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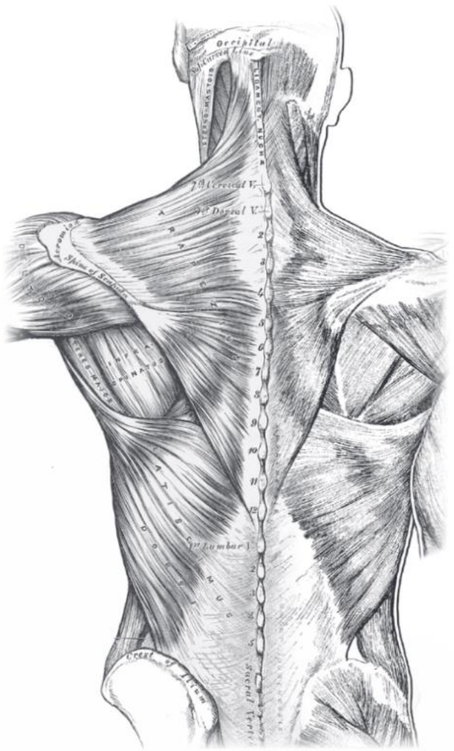
QUICK REFERENCE
EVIDENCE INFORMED

PHYSICAL ASSESSMENT

Integrated neurologic, orthopedics & physical exams
Free online resources, quizzes and video

Dr. Nikita A. Vizniak

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Congratulations on making the best investment of your life - your own education. To help support you - this text was created as the most up-to-date, functional and cost effective clinical text available. Countless hours of research & design were spent to develop the content & format. **This text bridges the gap between basic academic learning and practical clinical application.** Information sources include: thousands of original peer reviewed research articles with cutting-edge information, pathoanatomy & kinesiology texts, direct cadaver dissections & decades of evidence informed best practices & multidisciplinary clinical experience with a focus on **results based medicine**.

In order to get the most clinical utility from this text, it must be available at all times, as such the books size allows for easy transport & storage. The paper used is uncoated to allow you to write your own notes directly on the pages. Do not be fooled, this text contains more useful information than most full-size textbooks and is supported by numerous student, clinician & instructor **Apps, quizzes, video & patient handouts, and ProHealth® Continuing Education seminars.**

To help ensure gender equity, 'his' & 'her' are used interchangeable throughout the text. The ☺ symbol signifies a section containing humor, laughter is optional but recommended ☺.

'Clinical assessment is therapeutic - *your assessment skills help create a more accurate list of potential pathology and develope a relationship of trust and confidence in the patient's belief of your ability to help - establish yourself as an expert - **more accurate assessment = better clinical outcomes**'*

Nikita A Vizniak

Note From the Author

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As health care providers, our fundamental goal is to correctly & efficiently assess, differentially diagnosis & offer management options to our patients. Part of the pattern recognition process requires an understanding of the basic tissues injuries & the conditions required to promote optimal healing & health.

We must realize that our role is to help facilitate the bodies natural healing processes; **the most powerful therapeutic option any clinician has is the ability to give patient's the confidence to realize they can get better** & to not be limited by labels of a given condition or pathology - for basic quality of life the sooner a person returns to regular activity the better the outcome!

For most outpatient conditions, an assessment & treatment progression from least to most invasive is usually best, keep the principle of 'Minimum Effective Dose' throughout the management process (over treatment can also cause injury). Remember your basic anatomy & physiology education & try to ensure treatments are as simple & easy to follow. For guidance be directed by the basic principles below:

1. **First Do No Harm** (*Primum Non Nocere*) - choose treatment options that are safe & effective, to increase health & decrease harmful side effects (progress from least to most invasive)
2. **The Healing Power of Nature** (*Vis Medicatrix Naturae*) - work to restore & support the powerful & inherent healing abilities of the body, mind & spirit & to prevent further disease from occurring
3. **Identify & Treat the Causes** (*Tolle Causam*) - The primary goal to treat the underlying cause of disease, not treat or mask the symptoms of the dysfunction (avoid treatments that only treat symptoms, find the cause & treat the specific tissue damaged!)
4. **Doctor as Teacher** (*Docere*) - Educate & support patients on personal health management; empower patients to take responsibility for their own health & work together to find solutions
5. **Treat the Whole Person** - holistic treatment recognizes the body as an integrated whole, treat the patient, not the disease. Address the nutritional status, lifestyle, family history, physical, mental, emotional, genetic, environmental & social factors in a person's life. Also realize the limitation of your practice scope, ability & create a strong network of professionals you can refer to for co-management
6. **Disease Prevention & Health Promotion** - applies all of the principles in a proactive form of disease prevention & health promotion (optimal health maintenance & prevention are still the best medicine)

In the past ~150 years human behavior has change dramatically through technological & urban development. In the developed world, many live in a time of excessive consumption, lack of exercise, diabetes, obesity & cancer. It is our duty as a health care providers to be advocates & role models for preventative medicine, active living & social policies that help achieve these goals. Your choices change the world, choose to buy products and support businesses/countries with ethical, long term environmental, labor and foreign policy laws. I challenge you to become this role model; live a balanced life, stay healthy, become active in your community & volunteer your time with organizations you feel can benefit from your help.

I would like to thank all the individuals & organizations that have been involved with the creation & review of this text. In addition, I would also like to thank the readers of this book for making it such a huge success. I invite any & all suggestions to continue to improve this work.

Thank you for your time & I look forward to hearing from you,

Yours in health,

Dr. Nikita Vizniak - contact@prohealthsys.com

Procedure Ranking System

---------- Procedure Ranking System ----------

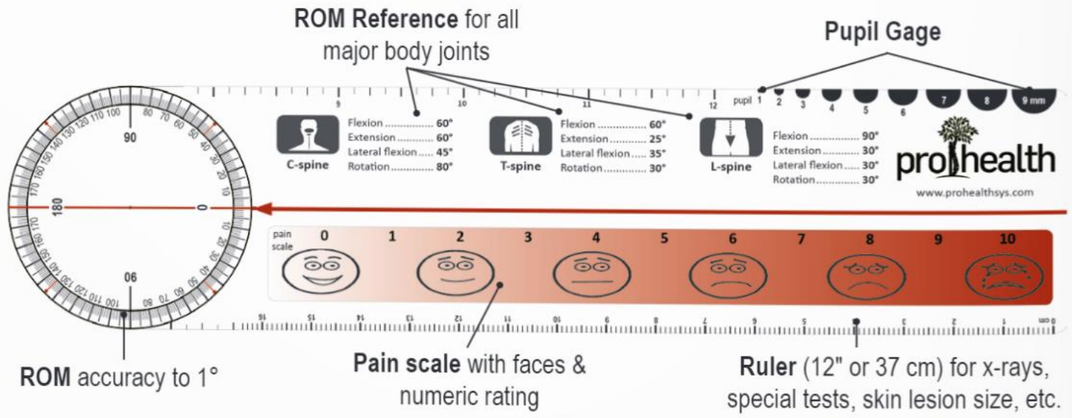
Special tests & procedures are ranked based on a 5 star ranking criteria to determine their clinical utility and recommendation for regular clinical use

- ★ Solid peer reviewed research on procedure interpretation
- ★ Follows current anatomical, kinesiology and pathology understanding
- ★ Procedure is easy to understand, perform & remember
- ★ Procedure is easy to interpret & create a differential diagnosis list
- ★ Procedure has low risk of injury or works well in conjunction with other findings or can be used as a outcome marker to monitor treatment progression

Rank	Meaning	Definition
★★★★★	**Excellent** (5/5)	Procedure is highly recommended to use when indicated - meets all ranking criteria
★★★★	**Good** (4/5)	Procedure is recommended to use when indicated - meets most ranking criteria
★★★	**Fair** (3/5)	Procedure may be useful in some cases - meets 3 of 5 ranking criteria
★★	**Marginal** (2/5)	Procedure may be useful but hard to perform correctly or lacks 3/5 ranking criteria
★	**Poor** (1/5)	May offer limited clinical use but is lacking in most required clinical measures

Pain Scale Goniometer ★★★★★

Uses reference ranges from the American Academy of Orthopaedic Surgeons, is easy to use, portable durable and low cost - use of this instrument allows the creation of quantifiable clinical outcomes that can be tracked over time to gage patient response to treatment or collect data for research.



Research Review Summary

Criteria professionals should use to evaluate research articles (besides who paid for or benefits from the study ☺)

Koch's & Hill's postulates of causality (do they exist in study?)

1. **Temporal order effect**: cause precedes effect
2. **Biological gradient** (dose response): larger exposure to cause will lead to greater effects
3. **Consistency/repeatability effect** (scientific replication): repeatedly observed by different people, in different circumstances & different times
4. **Interventions** (dechallenge/rechallenge) effect: association between cause & effect is reversible
5. **Biological plausibility**: makes sense, according to biological knowledge of the time

Study design parameters

Design type [strong or weak]: Survey? [weak] Retrospective? [weak] Prospective? [strong]

External validity: Q: Random sampling? Yes – generalizable No – not generalizable

- Defined cohort [inclusion/exclusion criteria?] Control group? Attrition rate (less than 10%)?
- Has the term "Normal" been defined/applied sensibly as it applies to this test or measure?
- Was there a [blind] comparison with a reference ('gold') standard of diagnosis?
- Are sensitivity, specificity, positive & negative predictive values, & likelihood ratios defined in the study?
- What is the prevalence of the health condition? Is the condition common/rare? Natural history?
- Valid (accurate) & reliable (consistent) clinical outcomes? Independent [blinded] assessors?
- Have tactics/operations for the measurement or test been described in enough detail to permit their exact replication? Will you perform that test in the exact manner on your patients?
- What is the utility of the test or treatment? Clinical applicability: Q: *Are they like your patients)?*
- Has the test resulted in increased knowledge that would lead to a change in case management?
- Will the results lead directly to selecting or avoiding a given test or therapy?
- Are the results useful for reassuring or counselling patients?
- Were the time-related categories of acute, subacute, recurrent-persistent &/or chronic defined?

Definitions

Prevalence: probability of disease in the entire population at any point in time (e.g. 2% the U.S. population has diabetes mellitus)

Incidence: probability that a patient without disease develops the disease during an interval (the incidence of diabetes mellitus is 0.2% per year, referring new cases only)

Inception cohort - a well described or defined sample group (or cohort) of patients assembled at a common early point [at 'inception' or time zero] in the course of the disorder(s)

Patient "follow-ups" - repeatedly spaced clinical outcomes that assess the patient's status over the entire length of the disorder, from the inception to its resolution

Retrospective: looking back in time

Prospective: looking forward in time

Reliability: reproducibility of test results, good reliability implies little random measurement error

Precision: magnitude of random measurement error (↑ precision implies ↓ measurement error)

Validity: ability of a procedure to yield a true value (are you measuring what you think you are)

Bias (general): unintentional, unwanted 'systematic error' **Experimental bias:** change attributed to investigator's expectations

Intra-examiner reliability: agreeing with one's self (self consistency)

Inter-examiner reliability: agreement between two or more examiners

Nominal Data: categorical data resulting in a set of attributes, rather than a numerical value (e.g. gender, eye color)

Ordinal Data: rank-ordered mutually exclusive categorical data (e.g.: totally disabled > severely disabled > moderately disabled > minimally disabled > etc.)

Interval Data: a scale of numerical data that does not have a true zero & differences between observed values have significance (e.g. temperature, mm on a VAS scale, dL of a blood biochemical assay)

Ratio Data: a scale of numerical data that does have a true zero & differentiates between observed values, ratios of value & values have significance (e.g. weight, chemical concentration, length)

Rating systems for assessing the quality of research
STARD - Standards for Reporting Diagnostic Accuracy
QUADAS - Quality Assessment of Diagnostic Accuracy Studies

Evidence Informed Practice

Evidence 'Informed' or 'Based' Medicine?

Evidence-Based Medicine (EBM) is the conscientious use of *current best evidence* in making decisions about the assessment & care of individual patients[1]. All healthcare providers must realize that EBM alone is not enough for effective utilization of best practices & must be integrated with the following fundamental abilities to make **evidence informed** clinical decisions:

- A detailed understanding of pathoanatomy & expertise in performing a history, examination & condition management (including referrals)
- Understanding of the patient's family, personal & social history & the community in which they live
- Developing a relationship with the patient formed by mutual respect & an understanding of their desires, beliefs & values to help create a functional context for therapeutic decision-making

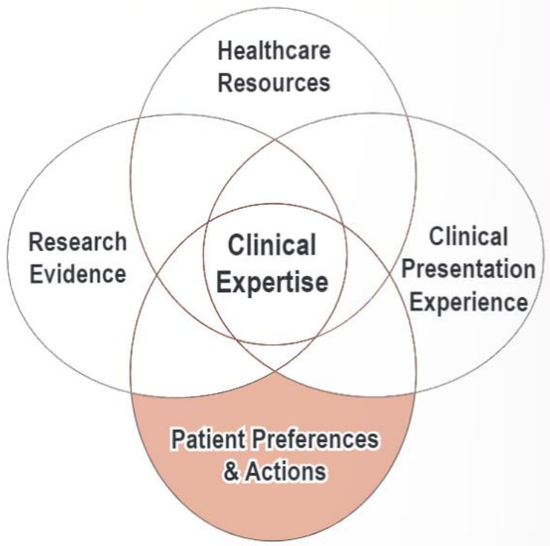
An evidence-informed medicine (EIM) approach helps to promote life-long learning & liberates clinicians from a reliance on tradition, which further permits the critical evaluation of both traditional & alternative therapies on an even playing field. EIM puts the patient at the center of care by emphasizing outcome markers that matter directly to patients such as pain, activities of daily living, quality of life & even cost (financial & personal).

Why use Evidence-Informed Medicine?

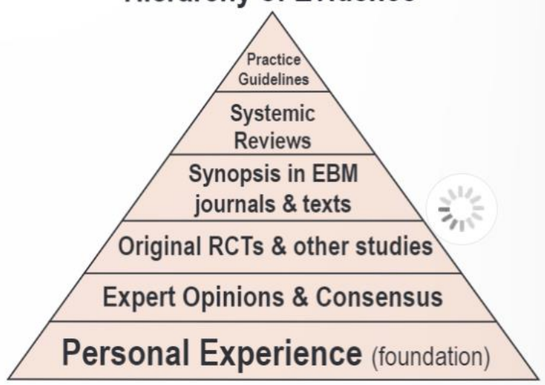
It provides a solid foundation for evaluation of new evidence from the literature, critical appraisal of existing practices, & the effective use of clinical information gathered from patients.

Perhaps the most direct change due to EIM is the potential improvement in clinical efficiency, which results in reduced healthcare costs by improving both assessment & treatment, as well as a net increase in earning potential for its providers as they are better able to competently see more patients in a given time period.

Evidence Informed Practice Model



Hierarchy of Evidence



Gathering information?

To be useful, *information must be relevant to everyday practice, valid, easy to obtain & low cost. Knowing where to look for answers to clinical questions is an important skill.* Most clinicians gather information from a wide variety of sources;

1. Straus SE, et al. Evidence Based Medicine. 4th Edition. Churchill Livingstone: Edinburgh, 2011.

Information source	Relevance	Validity	Work	Cost	Usefulness
Evidence-based textbook/website	High	High	Low	**Low**	**High**
Systematic review (evidence-based)	High	High	Low	**High**	**High**
Asking colleagues	High	Mod	Low	**Low**	**High-mod**
Practice guidelines (evidence-based)	Mod	High	Low	**Low**	**High-mod**
Practice guidelines (consensus)	Mod	Mod	Low	**Low**	**Mod**
Original journal articles	Low	High	Very High	**High**	**Low**

ProHealth resources are relevant to everyday practice, valid, easy to obtain & free or low cost!

Likelihood Ratios

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Introduction

When performing diagnostic tests, clinicians need to know which tests will best help *rule-in* or *rule-out* conditions. We need to assess the likelihood of disease ("pre-test probability"), perform a test to help shift our suspicion one way or the other, and then determine the likelihood of disease ("post-test probability"). Likelihood ratios tell us how much we should shift our suspicion for a particular test result.

Positive likelihood ratio (+LR) = ratio of positive test results in a patients *with* the pathology (true positives) compared to positive test results in patients *without* the pathology (false positives). **+LR corresponds to the concept of "ruling-in disease."**

Negative likelihood ratio (-LR) = ratio of negative test results in a patients *with* the pathology (false negatives) compared to negative test results in patients *without* the pathology (true negatives). **-LR corresponds to "ruling-out disease."**

- +LR and -LR don't change as the underlying probability of disease changes (predictive values do change)
- **LR's using multiple "levels" of positive (i.e. not just a simple yes/no or positive/negative result) which provide much better, more useful information to you as a clinician and help take into consideration the subtleties of interpreting many physical exam procedures**
- **+LR > 1 indicates an increased probability that disorder is present (bigger number is better)**
- **-LR < 1 indicates a decreased probability that disorder is present (smaller number is better)**
- The table below contains general guidelines, which must be correlated with each individual clinical scenario

+LR	Likelihood Ration Explanation	-LR
1 - 2	***Minimal* change to post test probability of diagnosis**	0.5 - 1
2 - 5	***Small* change to post test probability of diagnosis**	0.2 - 0.5
5 - 10	***Moderate* change to post test probability of diagnosis**	0.1 - 0.2
> 10	***Significant* (often conclusive) change to post test probability of diagnosis**	< 0.1

The decision to perform a test should be based on the initial assessment of the likelihood of the condition, and how important it is to rule-in or rule-out the condition.

When evaluating the likelihood ratios, sensitivity & specificity, do not get overly concerned with the statistical analysis of a given test; a statement that now accompanies almost every article in the literature is "further research is required." Many orthopedic and neurologic procedures have not been researched in any detail; this does NOT mean they are poor tests providing no valuable diagnostic information.

Among tests that have supporting research, keep in mind the limitations of many studies - do the meet research review requirements (page iv)? QUADAS? STARD? Does the test consider the influence of anatomical variation? Do physical tests take into account examiner size vs. patient size? Do they look at time of day or general mood of the patient when the test was performed? There are literally hundreds of variables that can affect the assessment accuracy of many physical tests.

Practitioners evaluating tests must realize their own limitations - specifically their understanding of the anatomy, skill level at performing the test, ability to interpret the results & population demographic on which the test is being performed - these variables, and many others, may substantially change the positive predictive value and overall validity of a given test or sign.

When performing physical exam procedures keep it simple (KIS), perform tests you understand & are able to perform well and efficiently, and improve your skill level on those your are not.

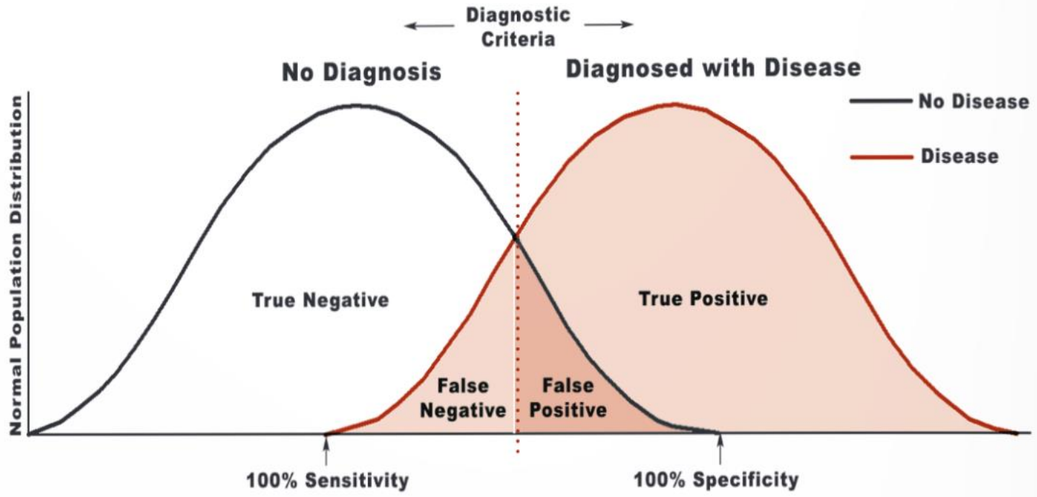
Research shows increased diagnostic accuracy when multiple clustered tests are performed in conjunction with a detailed patient history.

Test Diagnostic Accuracy - Remember the Basics

Sensitivity: high sensitivity helps the examiner ***rule out*** a disorder. **SnOut!**

Specificity: high specificity helps the examiner ***rule in*** a disorder. **SpIn!**

+LR > 1 helps rule in **(bigger number is better)**, **-LR** < 1 helps rule out **(smaller number is better)**



Sensitivity (SN) - 'SnOut' - rule out	Specificity (SP) 'SpIn' - rule in
Definition: probability of a positive test among patients with disease Highly Sensitive Tests are Best used to **Rule Out disease** Help to identify patients WITH disease (true positives)	Definition: probability of a negative test among patients without disease Highly Specific Tests are Best used to **Rule In disease** Help to identify patients WITHOUT disease (true negatives)

In general, as a test becomes more sensitive, it becomes less specific, and vice versa

	Patients **WITH** condition	Patients **WITHOUT** condition
Patients who test POSITIVE (*Positive Predictive Value*)	**True Positives (TP)**	**False Positive (FP)**
Patients who test NEGATIVE (*Negative Predictive Value*)	**False Negative (FN)**	**True Negative (TN)**

Negative Predictive Value (NPV)	Positive Predictive Value (PPV)
Percentage of patients who both test negative & do not have disease (true negatives)	Percentage of patients who both test positive & have the disease (true positives)

Sensitivity & specificity by themselves are only useful when they are very high (~95% or higher)

Predictive values help answer the question: "Given a positive or negative test result, what is the new probability of disease?" - realize that the predictive value varies with the pre-test probability of disease - the same test result may give one post-test probability on the playing field, and different one in your office, if the pre-test probabilities changes so does the predictive value.

A detailed history & physical exam in combination with critical thinking and past experience are your most useful diagnostic tools!

Learn by reading & attending a class, true understanding is gained through clinical experience

- **Epidemiology - Who gets this disease?**
  - Demographics (age, gender, race)
  - Risk factors (other conditions, environment, genetics, past medical history)
  - Exposure (drugs, exercise, travel, occupation, activities, hobby, sexual)
- **Time course - What is the typical timing?**
  - Onset (acute, subacute, chronic)
  - Pattern (constant, episodic)
- **Clinical presentation - What are the classic signs & symptoms?**
  - Classic signs & symptoms (key differential features from other similar syndromes)
  - Must have feature to be diagnosis (exclude past diagnosis unless it was unequivocally correct - avoid confirmation bias from prior inaccurate assessment)
  - Rejecting features (if present is not condition)
- **Mechanism - What are the biomedical causes of this condition?**
  - Pathophysiology (anatomy, physiology, immunology, biochemical pathway, genetics)
  - Environmental contributors (microbiology, toxin, medications, physical environment)
- Variants - master the classic rule before you learn exceptions (increase in experience will eventually give a clear picture of condition)

Prioritized Differential Diagnosis

Clinical Likelihood		Definition
High	Very likely (>90%) Likely (67-90%)	• Condition explains <u>all</u> of patient's major findings • Patient has all major manifestations of condition • No rejecting features, may have defining feature
Moderate	Uncertain (34-66%)	• Condition explains <u>most</u> of patient's major findings • Patient has some major manifestations of condition • No rejecting features
Low	Unlikely (10-33%) Very unlikely (<10%)	• Patient has single or few features of condition • Patient has rejecting feature of condition

- Special tests are usually not indicated if a condition is very likely or very unlikely, unless the condition is a high risk treatment or diagnosis (e.g. cancers)
- Good tests move the likelihood of a condition up or down one level (e.g. from moderate to high likelihood) - sensitivity & specificity from ~85-99% are considered good tests
- Special considerations
  - if you need to rule <u>out</u> a disease, use a test with >99% sensitivity
  - If you need to rule <u>in</u> a disease, find a test with >99% specificity
- **Establish a DDx, Choose correct tests, <u>Perform tests correctly</u>, Interpret tests correctly - give accurate diagnosis, treatment, co-management or referral**

Clinicians should cluster their special test to improve the accuracy of diagnosis - choose a minimum 3 tests of that you can perform & interpret well for a given condition.

Clinical Prediction Rules (CPRs) are designed to improve clinical decision making & assist practitioners in diagnosis, prognosis & treatment planning. CPRs provide practitioners with powerful diagnostic information from the history and physical examination that may serve as an accurate decision-making surrogate for more expensive diagnostic tests.[1] In many cases a good history & exam are more diagnostic than MRI!!! Combined multiple diagnostic tests with clinical understanding of disease process to improve accuracy & treatment effectiveness

1. Childs J and Cleland J. (2006). Development and Application of Clinical Prediction Rules to improve decision making in Physical Therapist Practice. PHYS THER. 2006 Jan;86(1):122-131. Web. 13 Aug 2014

Carpal Tunnel Syndrome

- *Purpose:* identify patients who likely have carpal tunnel syndrome based on specific patient characteristics
- *Rule:*
  - Shaking hands for symptom relief
  - Wrist-ratio index greater than .67
  - Symptom Severity Scale score greater than 1.9
  - Reduced median sensory field of digit 1
  - Age greater than 45 years
- *Sensitivity:* 0.98 (3+ variables), 0.77 (4+ variables), 0.18 (5 variables)
- *Specificity:* 0.54 (3+ variables), 0.83 (4+ variables), 0.99 (5 variables)
- *Positive Predictive Value:* 52% (3+ variables), 70% (4+ variables), 90% (5 variables)

Wainner RS, et al. Development of a clinical prediction rule for the diagnosis of carpal tunnel syndrome. Arch Phys Med Rehabil. 2005; 86(4): 609-18.

Cervical Radiculopathy

- *Purpose:* To diagnose patients with cervical radiculopathy so that patient's can be treated with the appropriate interventions
- *Rule:*
  - Positive Upper Limb Tension Test A
  - Involved cervical rotation less than 60°
  - Positive Distraction Test
  - Positive Cervical Compression Test
- *Sensitivity:* 0.39 (3 variables), 0.24 (4 variables)
- *Specificity:* 0.56 (2 variables), 0.94 (3 variables), 0.99 (4 variables)
- *Positive Likelihood Ratio:* 0.88 (2 variables), 6.10 (3 variables), 30.3 (4 variables)
- *Positive Predictive Value:* 21% (2 variables), 65% (3 variables), 90% (4 variables)

Wainner RS, et al. Reliability and diagnostic accuracy of the clinical examination and patient self-report measures for cervical radiculopathy. Spine. 2003; 28(1): 52-62.

Waldrop MA. Diagnosis and treatment of cervical radiculopathy using a clinical prediction rule and a multimodal intervention approach: a case series. J Orthop Sports Phys Ther. 2006; 36(3): 152-9.

Others available prohealthsys.com

- **Ottawa Ankle Rules, Ottawa Knee Rules**
- **Canadian Cervical Spine Rules**
- **Pittsburgh Knee Rules**
- **Subacromial Impingement**
- **Rotator Cuff Pathology**
- **Meniscal Pathology**
- **Deep Vein Thrombosis**

- **Use basic clinical prediction rules and cluster findings to help ensure appropriate assessment and diagnosis (including specific tissues damaged) must be done to ensure the correct management recommendations are given**
- **Follow HIP-MNRS with every patient encounter to avoid errors in differential diagnosis - History, Inspection, Palpation, Motion, Neurovascular, Referred pain & Special tests** (to help rule in or out conditions and better direct treatment)
- **Clinicians performing exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in context of other evidence based clustered findings, clinical prediction rules & the patient as a whole**
- **Visit our Website for more detailed information on all Clinical Prediction Rules (CRPs)**

Wound & Hemostasis (bleeding)

- If superficial wound consider topical antimicrobials - *Calendula*, polysporin
- Avoid medications, botanicals, vitamins & minerals that affect clotting & prolong bleeding time



1. Acute Inflammation (after injury, hematoma formation)

- Usually 1-2 days, may last up to 5 days (depends on tissue & severity of injury)
- Cardinal Signs (SHARP) - Swelling, Heat, A loss of function, Redness, & Pain (chemical irritation & nerve pressure) - may not reach peak until 5-7 days post injury
- Consider: Vitamin A, increase protein intake, bromelain
  - Vitamin C enhances neutrophil migration & lymphocyte transformation



Clinical Objectives: relieve pain; prevent further injury, initiate vasoconstriction; increase circulation; maintain muscle tone & PFROM; reduce effects of ischemia, address psychosocial issues



2. Post Acute Repair/ Proliferation (scar tissue formation)

- May last from 48 hours up to 6+ weeks
- Involves synthesis & deposition of collagen; macrophages/phagocytes remove cell debris, erythrocytes, & fibrin clot
- Collagen is not oriented in direction of tensile strength & quality is inferior to original
- Nutritional support (see specific tissues)
  - Increase vitamin C & *Centella asiatica* - promotes type 1 collagen synthesis
  - Glucosamine - for GAG synthesis & hyaluronic acid production
  - Zinc, Mn, Mg, Ca for protein synthesis, DNA synthesis & cell division

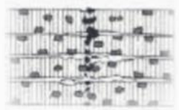


Clinical Objectives: prevent early adhesions; orient repair tissue along line of tension; relieve pain; maintain normal muscle tone; maintain normal ROM, reduce edema, PFROM & exercise to return to normal activity ASAP, address psychosocial issues to prevent transition to chronic condition

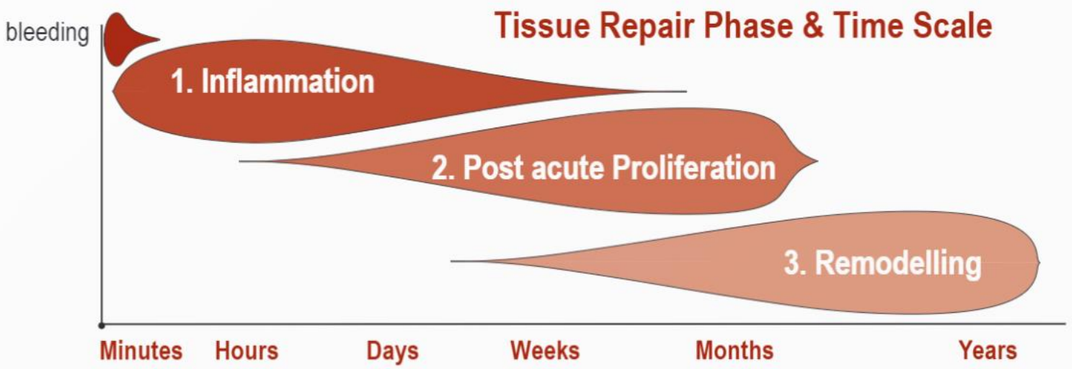


3. Remodelling (fibroblastic activity & fibrosis)

- May last from 3 weeks to 12+ months
- Collagen is remodeled to increase the functional capabilities of the tissue in the direction of stresses imposed upon it (PFROM/stretching help re-establish strength)
  - New collagen forms which increases tensile strength of wounds
  - Scar tissue is ~80% as strong as original tissue & residual fibrosis is common



Clinical Objectives: maintain nutrition, proper alignment of repair collagen; increase elasticity of scar tissue; reduce fibrotic adhesions; relieve muscle spasms; increase strength; increase range of motion; normalize joint & muscle activity, address psychosocial issues, prevent chronicity & permanent impairment



The most powerful therapeutic option any clinician has is the ability to give their patient's the confidence to realize they can get better. A positive mind set & the belief of future wellness is the single most important factor in healing for most out-patient health care encounters.

Phase	~Time Course	Clinical Objective
1 Acute*	2-3 days (up to ~7 days)	• **Reduce pain; PRICE (protect, rest, ice, compress, elevate)** • Emergency referral if required, prevent excess swelling/ischemia • Basic PFROM & activity as tolerated • Address psychosocial concerns (anxiety, depression)
2 Post Acute	2 days - 6 weeks	• Pain reduction, prevent early scar tissue adhesions • Begin orienting repair tissue along line of tension • Maintain normal muscle tone, ROM & functional capacity • Basic stretch, strength, functional & proprioceptive retraining
3 Chronic*	3 weeks - 12 month or more	• Proper alignment of repair collagen & myofascial tissue • Increase elasticity of scar tissue (increase ROM & strength) • Reduce fibrotic adhesions, relieve muscle spasms • Advanced stretch, strength, functional & proprioceptive retraining • Address psychosocial concerns (somatization, depression, etc.)

*Chronic recurrent episodes may be treated as acute during a flare-up; PFROM = Pain Free Range of Motion

Select Treatment Guidelines

Modality	Phase	~Duration
Cold therapy		
Cryotherapy	1, 2	5-20 min
Ice Massage	1, 2	2-5 min
Heat Superficial		
Infrared heat light	2, 3	10-20 min
Hot packs	2, 3	10-20 min
Paraffin	2, 3	7-10 dips (10 min)
Hydrotherapy	2, 3	10-30 min
Laser	1, 2, 3	sec - minutes
Heat Deep		
Continuous US	2, 3	5-10 min
Pulsed US	2, 3	2-8 min
Diathermy	2, 3	5-30 min
Electrical		
MENS (subsensory)	1, 2, 3	none established
IFC (sensory)	1, 2, 3	10-30 min
TENS	1, 2, 3	10-30 min
Muscle stimulator	2, 3	10-30 min
Motor stimulation	2, 3	2-10 min

Modality	Phase	~Duration
Mechanical		
Bed Rest	1	0-2 days
Massage or IASTM	1, 2, 3	5-45 min
Mobilization/manip.	1, 2, 3	1-20 min
Traction (in-office)	1, 2, 3	1-20 min
Flexion-distraction	1, 2, 3	1-15 min
Ext. compression	1, 2, 3	1-15 min
Exercise (in-office)		
Passive	1, 2, 3	5-30 min
Active (gym, yoga)	1, 2, 3	15-90 min
ADLs (back school)	1, 2, 3	10-30 min
PNF/CR	2, 3	5-10 min
Bracing	1, 2	short duration
Work Hardening	3	2-8 hours
Acupuncture/Prolo Dry needling/IMS	1, 2, 3	by technique
Nutrition/Herbal Medications	1, 2, 3 1	entire treatment short duration
Surgery	1, 3	emergency or last resort

Note: specific treatment régimes must be tailored to the individual patient presentation. In most cases, medication use should be short term (long-term use can result in chemical dependency & mask important signs & symptoms). Surgical intervention should be offered only in emergency injuries or as a last resort when conservative treatments have failed (surgery is not a guaranteed cure).

Basics

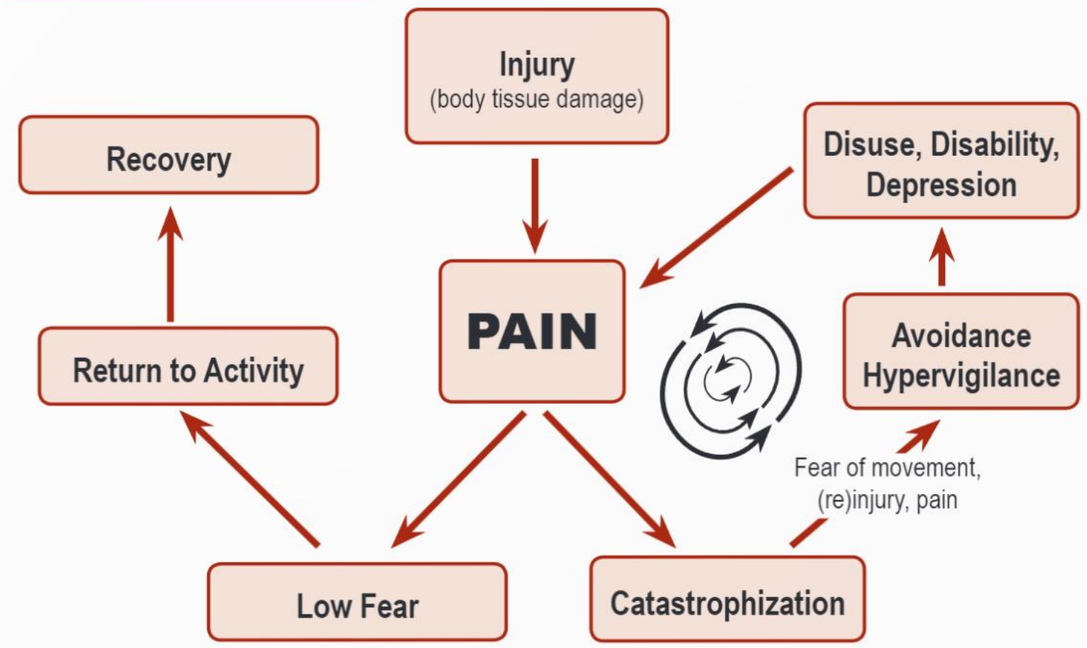
Psychosocial factors that predict worse outcome

- **Signs of depression**
- **Passive coping strategies**
  - Withdrawing or giving up in response to pain, fear, avoidance (restricting/canceling social activities, taking excess or long-term medications)
  - Active coping strategies - behavior required to manage pain (exercise, positive thinking, return to activity/social engagement)
- **Job dissatisfaction**
- **Higher disability levels**
- **Disputed compensation claims** (legal issues)
- **Fear avoidance beliefs**
- **Somatization -** a tendency to experience & communicate somatic distress in response to psychosocial stress & to seek medical help for it

Coping Statements

- **Diverting attention**
  - I try & think of something pleasant
  - I run a song through my mind or count numbers
- **Hoping or praying**
  - I believe that doctor's will find a cure for my pain
  - I pray to 'God' that it won't last long
- **Increasing behavioral activity**
  - I do something I enjoy like watching TV
  - I do something active like house chores or go for a walk
- **Ignoring or reinterpreting the pain**
  - I go on as if nothing happened
  - I don't pay attention to the pain
  - I think of it as a dull or warm feeling rather than pain
- **Catastrophization** (not good - negative coping)
  - I wonder if the pain will ever end
  - I cannot ever see myself getting better

Fear Avoidance Model



Catastrophization, avoidance & fear of future injury creates a cycle for the development of chronic pain
Research & personal experience show that the best chance for recovery is a return to normal ADLs
It is important to have this conversation with patients for their own understanding & healing

The **Fear-Avoidance Beliefs Questionnaire (FABQ)** is a useful diagnostic tool that can help show a biopsychosocial model of the cognitive, affective & behavioural influences in pain & disability

History & Records Contents

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ProTip: Practice Building

Call new patients on the evening of their 1st visit to check in and follow-up - most clinician's forget this basic step as a way to go the extra distance to better engagement of their patients and evaluate the effectiveness of care - in most cases the patient will already be feeling better and associate you with those positive outcomes and feelings.

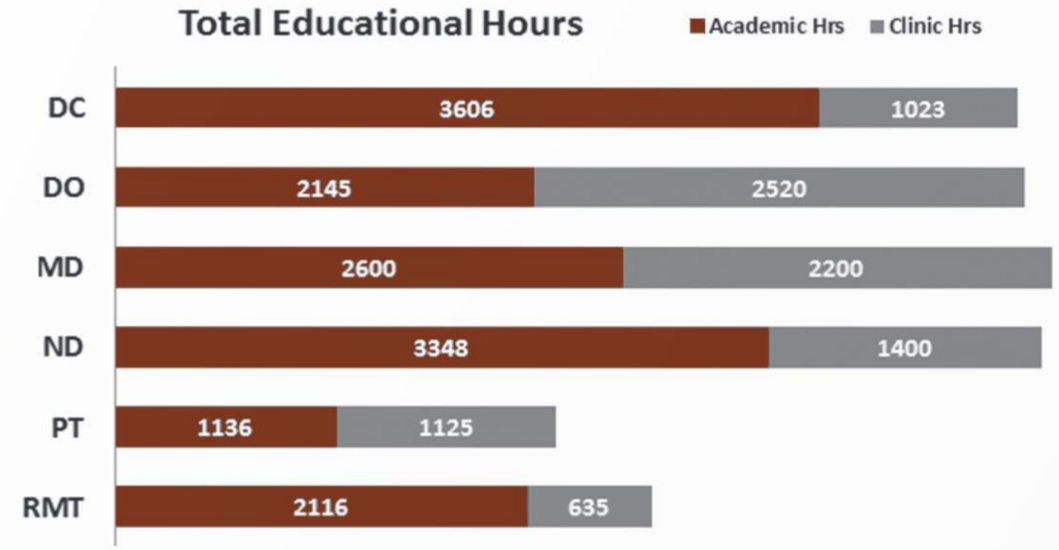
A detailed patient history is the most useful diagnostic tool available to any clinician. The main purpose of the patient history is to determine the patient's motives for seeking health care & how their specific ailment is interfering with their daily life. **Surveys suggest that over 80% of the diagnosis in general outpatient clinics are based on the interview**. The interview should continue through the entire duration of the interaction with the patient. The best general patient history technique is to start with open-ended questions (e.g. How are you doing today?) & eventual progress to close-ended questions for more specific details (e.g. Do you experienced pain when you exercise?). The accuracy of information collected from a patient during the interview & exam influence the precision of diagnosis & treatment. Chart notes are a written record of the patient's medical history from initial presentation on. Here are a few general rules for charting:

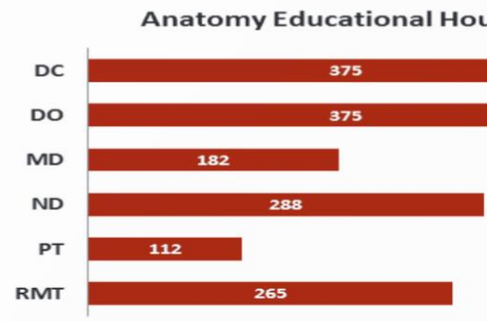
1. **If you saw it or did it, chart it (if you did not chart it, it did not happen)**
2. Charting must be clear & legible in order to be useful (a problem for many clinicians)
3. Do NOT erase mistakes or remove pages from the chart (draw a single line through errors & initial)
4. Charting should be done in black ink, labeled, dated & signed by the examining clinician
5. All written records must remain confidential

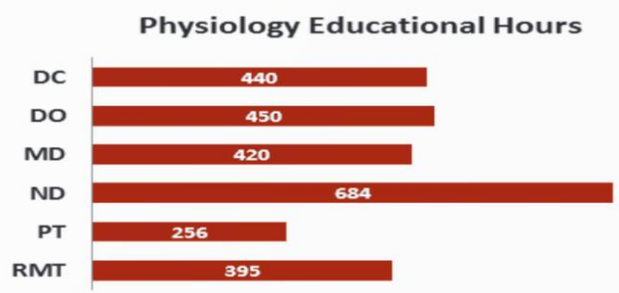
- **Appropriate assessment and diagnosis (including specific tissues damaged) must be done to ensure the correct management recommendations are given**
- **Follow HIP-MNRS* with every patient encounter to avoid errors in diagnosis**
- **Observation, History, Inspection, Palpation, Motion, Neurovascular, Referred & Special tests** (remember after a history the order of procedures can change based on clinical evaluation required)
- **Clinicians performing exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in context of other clustered findings & patient as a whole**
- **More information results in a more accurate understanding and patient specific treatment**

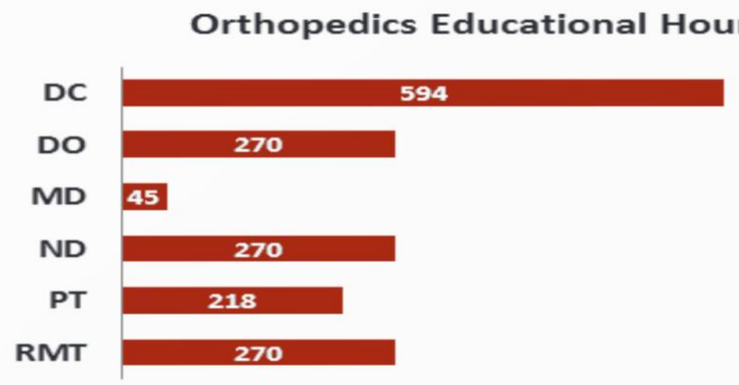
*During an emergency presentation a neurovascular & fracture screen should be performed in conjunction with the patient history

Educational Hours







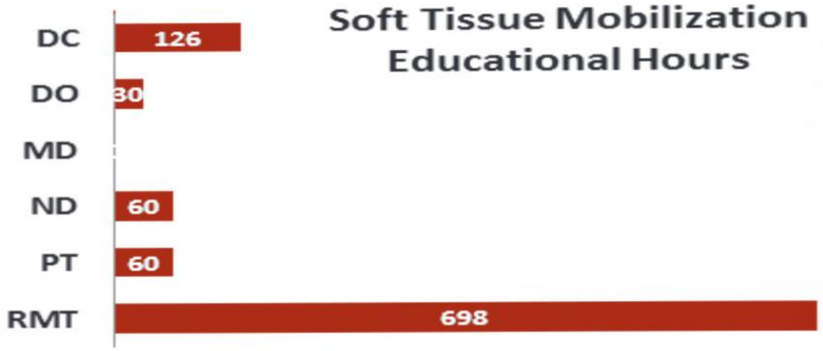


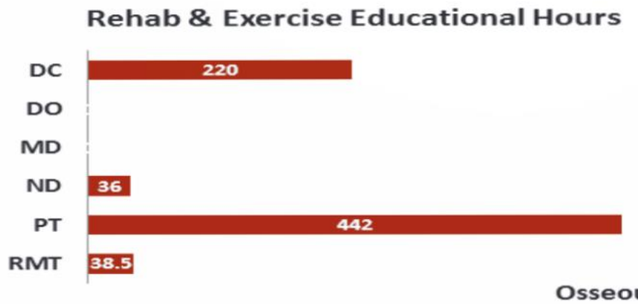
Comparison of DC, DO, MD, ND, PT, RMT. Professions are listed in alphabetical order. Data was collected from academic calendars among the top ranked programs in North America. DC – University of Western States, DO – Touro Osteopathic, MD – Yale Medical, ND - Boucher Institute, PT – Queens University, RMT Vancouver Career College - you can easily independently verify or compare this data by reading any institutions academic calendar

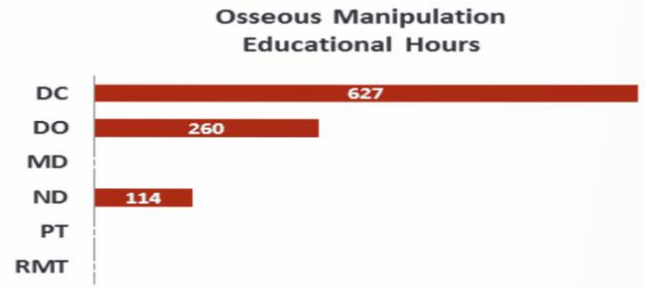
Educational Hours

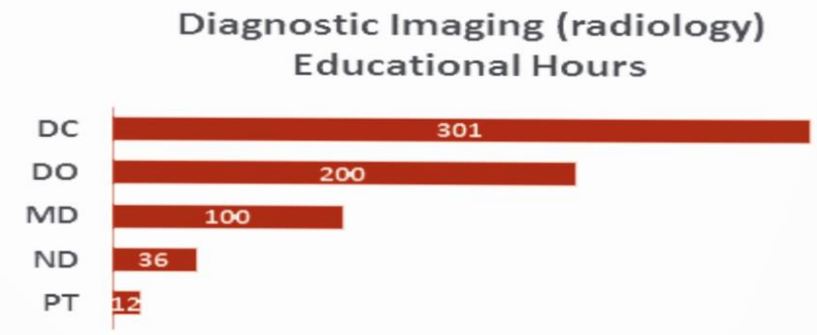
Caution: avoid having negative attitudes due to preconceived notions and prejudice based on ignorance and lack of understanding of other practice types and techniques.

If one specific technique was truly 'the best' then all practitioners would be using it.









Charts are provided for basic comparison and education priorities of each profession. Please recognize that while education plays a role in practice style, the charts below do not take into consideration post graduate education, practice preference, personal experience or clinical specialization. More details of specific hours hours are available at **prohealthsys.com/site/students/professional-comparison/**

Infection & Hygiene

Wash your hands & clean your table between every patient, visit to the bathroom or meal. If you have a transmittable condition, such as a cold or flu, use a mask to prevent or reduce the chances of spreading this disease to your patients, classmates & instructors. If you have an open wound on your hand, protect yourself from infection & spreading possible infection to your patient. If your condition is a concern do NOT offer treatment.

Performing manual medicine procedures can & will cause you to perspire heavily on occasion. In order to avoid dripping perspiration on your patient keep a towel or tissue nearby to wipe your brow. Strong breath odours resulting from some herbs & seasonings (e.g. garlic & onions) or cigarettes can also be offensive to others in close proximity. Either brush your teeth (and tongue) or use natural fresheners.

As manual medicine providers we also need to pay particular attention to the cleanliness & smoothness of our hands & finger nails. Finger nails must be cleaned, trimmed & filed regularly; callouses need to be filed. Longer nails can carry bacteria & along with exposed nails, unfiled nails or rough skin, can be uncomfortable for the patient when performing many techniques.

Before treatment: always wash hands, remove all jewellery & watch, ensure that your equipment is clean & ready, have a towel available to wipe your hands or wipe off perspiration.

After treatment: wipe tables down, especially the face piece (replace face paper), with viral/bacterial cidal solution; wash hands, first with warm or hot water, then finish with cool or cold, leave room neat & tidy!

Washing Hands



Have paper towel ready from dispenser



Remove jewelry & watches



Turn on water, make sure it is warm



Wet hands & forearms & apply soap



Rub hands together for **~20 seconds**; pay particular attention to your finger nails & webs of fingers



Rinse forearms down to fingertips



Dry forearms down to finger tips



Use paper towel to turn off water & dry sink area

Coughing & Sneezing

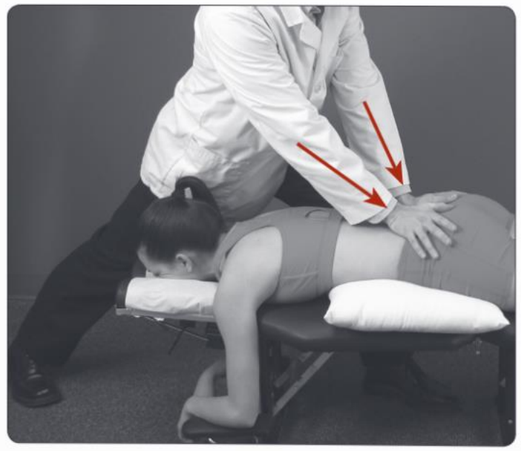
Cough into your elbow to help keep you hands bug free!!!

Do NOT cough into your hand (arrows denote location of bacteria - see image)



Biomechanics

- **Manual medicine providers must always be aware of their biomechanics**, especially your back, shoulders & hands
- Pick the correct table height (use an adjustable table in practice):
  - **Soft tissue mobilization** - STM (massage) - with arms relaxed at sides, fingers or knuckles should brush table top when standing
  - **Osseous mobilization** - base of patella should be level with table top when standing
  - With clinical skill, practitioners evolve specific styles based on body and table size that works best for them (always adapt & explore)
- Anticipate direction of movement & try not to finish in an awkward position
- Adjust posture & biomechanics according to the technique being applied & the body part being treated, to facilitate smooth transition from one body part to another, & from one technique to another
- **Keep shoulders relaxed**; there is a tendency to raise shoulders when trying too hard or when the therapist is fatigued Elbows are flexed & wrists are relaxed for all light & moderate techniques; be careful not to "whip" or "snap" wrists during rapid applications (hyper-radial/ulnar deviation)
- Stand with feet shoulder width apart, place feet in the direction of movement; knees & hips should be slightly flexed, back is straight, shoulders relaxed
- Lift heavy limbs close to your body; use other parts of your body (legs, arms), bolsters, pillows or the table to support whenever possible
- **Use your body weight whenever possible**



Passive Patient Movement

- Physical contact creates non-verbal communication that can be sensed by the patient; if you are nervous or not confident, patients can sense it & often react in a counter productive manner to the treatment
- Clinicians must overcome the patient's tendency to muscle guard or 'help' move the limb
- Support joints with your hands, another part of your body (arms, leg, etc.) or the table; this mainly refers to proximal joints (elbows or knees), which can become very unstable if not supported
- Distal joints (ankle & wrists) may not have to be supported at all times through the whole range, provided that there is no threat of compromising the joint
- **Other patient movement tips**:
  - **Practice:** continually refining your skills makes you more proficient ("perfect practice makes perfect")
  - Teach the patient to have **awareness of when they are guarding** or moving the limbs for you; the majority of the time patients do not even realize they're guarding or moving the limb for you
  - **Firm & solid hand contacts:** this will communicate to the patient that the limb is secure & that you have complete control of the limb
  - **Voice commands** to the patient are helpful. "Let me take the weight of your arm," "Let your body sink into the table," "Take a nice deep breath," "Close your eyes," "Rest your tongue on the roof of your mouth," - these phrases are all helpful cues that do **not** include the word **RELAX,** which may make it even more difficult for the patient to prevent guarding
  - **Smooth movements:** jerky movement will stimulate joint proprioceptors which results in the muscles contracting around that joint to stabilize it; this prevents smooth mobilization of the limb
  - **Always support injured joints:** prevents further injury & helps relax the patient
  - Slight **axial distraction (traction**) of the limb may help inhibit stimulation of joint receptors, which will in turn prevent muscle guarding

Below is a sample clinical exam flow that can be used as a framework for individuals to use as a foundation to develop their own specific exam style (detailed exams are covered in the Physical Assessment Texts)

Observation, history & inspection should be performed first; following steps may be done depending on patient's clinical presentation. With more acute & potentially serious injuries, vascular & neurological screens should be done earlier during the physical exam.

1. Observe

- □ Patient's general appearance, posture & mobility (how do they walk into office?)
- □ Emotional status (happy, sad, anxious) - are they comfortable?

2. History (basic considerations)

- □ Where is the problem? - point to it exactly, When did start?
- □ What make it better or worse? (self care) - Prior treatment or injuries?
- □ Quality of issue? (numbness, tingling, weakness, sharp, dull)
- □ Severity (scale from 0-10)? - Gradual or sudden onset?
- □ What are the patients goals for treatment?

3. Inspection

- □ **Posture (standing & seated), gait**, bony deformity, trouble with ADLs
- □ Obvious discomfort (painful expression, unable to sit comfortably, limp)
- □ Bony & soft tissues (deformity, bruising, swelling, color, sweat/dry, scars, calluses, bunions, atropy, ulcers)
- □ Foot wear (supportive, wear patterns on shoes, assisting devices such as orthotics or braces)

O - observe
H - history
I - inspection
P - palpation
M - motion
N - neurovascular
R - referred pain
S - special tests
Tx = treatment

4. Palpation (ask permission be for performing a hands on assessment)

- □ Temperature, Texture, Tone, Tenderness (4 Ts)
- □ **Anatomy review** (bone, tendons, muscle, ligaments, fascia, blood vessels, nerves, lymph, viscera)
- □ Swelling, pain, inflammation, myospasm, scar tissue

5. Motion

- □ Functional screen (ADLs & functional movements)
- □ **Active ROM** (provides baseline outcome marker)
- □ **Passive ROM** with over pressure (joint play)
- □ **RROM** = resisted ROM = isometric testing (break test)

Movement	Muscle	Ligament	Nerve
AROM	Pain	Pain	weak
PROM	-	Pain	-
RROM	Pain	-	weak

A more detailed tissue differential table is provided in the appendix (page 400)

Fracture screen

- Hx of significant ***trauma***? Older than 55? - Dark black bruising?
- ***Four step*** test (4 steps without pain or altered gait?)
- ***Resisted*** isometric contraction
- ***Percussion***, light palpation
- **Pain with squeeze** of bone
- 128 Hz tuning fork, ultrasound (many false negatives)
- Inability to move damaged area?

6. Neurovascular screen

- □ Dermatomes, reflexes (DTRs), cranial nerves, pathologic reflexes
- □ Muscle strength (myotomes), proprioception, coordination
- □ Pulses, nail bed or skin blanching, temperature

7. Referred pain (screen adjacent areas & spine)

- □ MFTPs referral, nerve root impingement, visceral origin, infection, psychogenic origin/overlay

8. Special tests

- □ Orthopedic tests or injection of local anesthesia in specific tissue (pain reduction shows damaged tissue)
- □ Diagnostic imaging: X-rays, U/S, CT, MRI, thermography
- □ Lab tests: blood, urinalysis, biopsy etc.

Assessment is Therapeutic!

Many assessment methods may be used as treatment techniques. Example - patient presents with pain between the shoulders and limited mid thoracic extension - passive ROM into assess extension restriction also stretches the tight soft tissues fibers

Clinical Encounter Records

Examiner must sign & date each entry, use ink, & perhaps most importantly - write legibly (difficult task for many doctors ☺). The purpose of the **SOAP** note is to provide a record of the patient's **subjective** concern, the examiner's **objective** findings & **assessment/actions**, the long-term management **plan**.

H **S**

Subjective - History (OPQRSTUVW or LOC-Q-SMAT)

- Record of information provided by the patient (direct quotes when possible)
- How has the patient responded since last treatment?
- You should have specific outcome markers to focus on (pain scale, ADL's, medication use, ROM, etc.)
- In patients with multiple conditions, address each condition separately
- If a patient has a new condition a new chief concern history is required

Create a **differential diagnosis list** to guide PE

I P M N R S **O**

Objective - clinician's PE findings

- General observations of patient's physical presentation
  - *Specific palpation/measurements:* blood pressure, vitals, AROM
  - *Functional tests:* ADLs, sport performance, functional movement patterns
  - *Orthopedic tests:* straight leg raise, valgus stress test, Phalen's
  - *Neurologic symptoms:* numbness, weakness, DTRs, electrical pain
  - *Tenderness or joint listings:* trigger points, myospasm, joint dysfunction

Narrow down **differential diagnosis**

A

Assessment create working DDx

- Decide what you are treating & give the condition(s) a name
  - **Stage** - acute, subacute, chronic, chronic recurrent
  - **Severity** - mild, moderate, sever, or grade 1, 2, 3
  - **Pathoanatomy** - location, type of tissue, named syndrome, ICD-10 code
  - Eg. ***subacute mild left lumbar multifidi strain with local trigger points***
- Record global statement of patient's current condition - **clinical impression**
- Indicate whether the patient is improving or not

Tx **P**

Plan - treatment plan & follow-up

- Discuss with patient **PAR-Q** (procedures, alternatives, risks & questions)
- Record treatment given during visit
  - Soft tissue mobilization (STM or IASTM) record region & type of technique
  - Joint mobilizations record region, listing & treatment
  - Electrotherapy treatment time, location & specific equipment settings
  - Therapeutic exercise frequency, intensity, time & type
  - Acupuncture points used, technique & outcomes (dry needling, prolo)
  - Nutrition, botanicals, meds - dose, frequency, timing, warning signs
- Record any patient self-care instructions (exercise, nutrition, activities)
- Record any future plans if there is something you wish to examine, treatment or test you wish to order on a future visit

Record response to treatment - **schedule follow-up visit**

General History Considerations

Red Flags* for More Serious Pathology

History of...

- Violent trauma
- Carcinoma
- Systemic steroid use
- Drug abuse
- HIV, Hepatitis
- Recent unexplained weight loss
- Constant, progressive non-mechanical pain
- Bowel and/or bladder dysfunction

Signs & symptoms

- Temperature > 100° F / 37.8° C
- Blood pressure > 160/95 mm Hg
- Resting pulse > 100 bpm
- Resting respiration > 25 bpm
- Auscultation of bruits - carotid, abdominal
- Widespread neurological deficits
- Saddle anesthesia

*Red flag = pathomneumonic sign or symptom that is very suggestive & almost always associated with a given condition (e.g. shooting or electrical pain radiating down the back of the leg into the heel is a "red flag" for lumbar radiculopathy)

The true clinical value of any patient history system is derived from the questions it contains & not the mnemonic used to recall it. It matters little what history format is used, so long as the clinician covers all of the pertinent points during the interview and physical exam. As most competent clinicians agree, more than 80% of your diagnosis can come from a well-rounded patient history.

Patient history mnemonics

LMNOPQRSTTUVW	OLDER SAAB
Location (where? point to it) **M**odifying factors (what makes it better/worse) **N**umbness, tingling or weakness **O**nset of pain/illness (time, duration) **P**alliative factors for pain **Q**uality of pain (throbbing, stabbing, dull, etc.) **R**adiation (how does pain spread) **S**everity of pain (usually scale of 1-10) **T**iming of pain (after exercise, in evening, etc.) **T**reatments tried **U**: How does it affect '**U**' in your daily life? (ADL's) Deja **V**u: Has this happened before? **W**orry: What do you think or fear that it is?	**O**nset **L**ocation **D**escription (what does it feel like) **E**xacerbating factors **R**adiation **S**everity **A**ssociated symptoms **A**lleviating factors **B**efore (ever experience this before)

I VINDICATE AIDS (DDx list)		LOST WAR
Idiopathic **V**ascular **I**nfectious **N**eoplastic **D**egenerative **I**nflammatory **C**ongenital	**A**utoimmune **T**raumatic **E**ndocrine/metabolic **A**llergic **I**atrogenic **D**rugs **S**ocial	**L**ocation **O**nset **S**everity **T**ime **W**orsening factors **A**lleviating factors **R**adiation

LOC-Q-SMAT

Review intake questionnaire

- Prior to beginning the patient history the patient intake questionnaire should be reviewed to help better point out specific areas on interest or coexisting conditions

Why are they seeking care
How can I help you today?

1. Location

- Where? Point to it
- Write as accurate a location as possible ("low back" is too general, "lumbosacral" is better, "shoulder" is too general, "anterior & lateral right shoulder" is better)
- Always indicate right or left
- Does it radiate? Where? How far? (elbow, wrist, hand, fingertips?)
- What aspect/surface? (lateral/medial/posterior)

2. Onset (what happened & when?)

- When did it happen? Gradual or sudden? What caused it?
- What is the mechanism of injury? - Look for specific actions, changes in activities, posture, work (worker's compensation)

3. Chronology/Timing (symptom patterns)

- Constant or intermittent (episodic)
- If constant, is it truly 24 hours a day? Does it prevent sleep?
- If intermittent: is it associated with specific circumstances? (e.g. eating certain foods? certain activities? Time of day?)
- Frequency & duration of the episodes
- Diurnal patterns (worse in morning? end of day?)
- Is there night pain (wake or prevent sleep?)
- Getting worse (progressive)? Getting better? Staying the same?
- Prior history: has this ever happened before? When? How long? What did you do about it?

4. Quality

- Ask patient to describe symptoms in their own words, use patient's words in quotations
- Describe pain or symptoms (sharp, dull, etc.)

5. Severity/effect on ADL

- Pain mild, moderate or severe?, Pain scale (0-10)

ADL: can you go to work? Affect performance? Affect hobbies? Sexual activity? Simple activities such as putting on a shirt? Get specific activities & how the patient is affected (excellent source of functional outcome markers)

6. Modifying factors

- What increases the symptoms or pain? Be specific
- What makes it better? Avoiding what? Changing posture? Rest? Medications, supplements, botanicals (dose & frequency?)

7. Associated symptoms

- Do you have any other symptoms or problems that you feel are related to this complaint?
- Additional specific questions are asked based on what the patient presents with & what the examiner thinks it could be; for example:
  - Neck or back complaint: is there numbness, tingling, or weakness in an extremity?
  - Low back: does your back ever catch or get locked? Change in bowel habits? Change in bladder habits? Change in sexual function? Change in menses?
  - Knees: any popping, clicking, snapping? Knee ever lock? Swell? Give way?

8. Treatment previous

- Who did they see? When? What tests done?
- What diagnosis? What treatment? Did it help?

9. Relevant injuries/x-rays

- When? What happened? Eventual outcome/ residual effects?
- Where x-rays taken? What were the results?

10. Review of Systems (if indicated)

- See page 6-7 for detailed review of systems

11. Goals

- What is patient's treatment goals?
- If long standing problem, why did they come in now?

Is there anything else you can tell me about your condition that I have not asked?

<u>Create a differential diagnosis</u> list to help direct physical exam, select special tests or referral for co-management

1. Serious Illness

- Have you ever had any serious illness(es)?
- Any other problems? Residual effects?

2. Hospitalizations/Surgeries

- Have you ever been hospitalized?
- Have you had any surgeries?

3. General Trauma, Accidents, Injury

- Have you experienced any physical trauma that required treatment or should have been treated?
- Have you had any accidents? MVA?
- Were there any residual problems or prolonged side effects?

4. Menses, Menopause

- When was the first day of your last menstrual period?
- Do you have any problems with your menstrual cycle?
- Have there been any changes in your menstrual cycle? Any abnormal bleeding?

Patients over 50:

- Are you still having menstrual periods? If yes, do you remember the first day of your last menstrual period?

Physiologic menopause:

- At what age did you experience menopause?
- Did you/are you taking hormone replacement?
- What? How is it administered?

Surgical menopause:

- Why did you have a hysterectomy? (Cancer?)
- Did they remove your ovaries?
- Are you taking hormone replacement?
- What medication? How is it administered?

5. Contraceptives, Pregnancies

- Contraceptives: Are you using any kind of hormonal contraceptive or an IUD? If yes, what & any problems?
- Pregnancies: Have you ever been pregnant? If yes, were there any complications?

6. Medications

- Do you take any prescribed medications?
- Do you take any over the counter medications?
- Do you take any vitamins?
- Have you ever taken medication for extended periods of time?
- E.g. Steroids, antidepressants, NSAIDs, antibiotics, hormones

7. Allergies

- Do you have any allergies? Food, meds, seasonal

8. Diagnostic Imaging (x-ray, MRI)

- Have you ever had any x-rays? If yes, why?
- Were there any problems identified on the x-ray?

9. Prior Care

- Have you ever received prior care?
- If yes; what for? Describe the care. Did it help?
- This will tell what has & has not worked previously (huge clinical value)

10. Last Physical Exam

- When was your last physical exam? Were you experiencing your chief complaint when you had the physical?
- What was it for?
- Were any problems identified?

Females:

- When was your last GYN exam & PAP smear?
- What were the results?

Females over 50:

- Have you had a mammogram? How often?
- What were the results?

Males 15-35:

- Do you perform self-testicular exam?
- Have you ever been taught how to?

Males over 40:

- Have you ever had a rectal exam or lab tests to evaluate your prostate?
- If yes, do you remember the results?

Family & Personal History

Family Health Problems

- Consider using a family tree in chart notes
- Are there any conditions that run in your family (diabetes, high blood pressure, stroke, heart disease, cancer)
- I'd like to start with your mother. Is she alive? Does she have any health problems?
- How about your mother's mother?
- How about your mother's father?
- Your father? Your father's mother? Your father's father? Brothers? Sisters?
- If there is a deceased relative, how old were they when they died? Cause of death?
- Any other health problems in family?

1. Living Situation

- Can you describe your living situation to me? (house/apt., relationships, children, etc.)

2. Occupation

- What is your occupation?
- Describe your activities at work. Hours?
- Do you like your job?

3. Exercise

- Describe your overall fitness level.
- Do you participate in regular exercise? (describe type, intensity & frequency)

4. Interests/Other Activities

- Do you have any other interests, hobbies or activities you enjoy?

5. Diet

- Rate your overall diet for me (good, fair, poor)
- What do you eat for … breakfast? Lunch? Dinner? Snacks?
- What do you drink throughout the day?
- How often do you eat … vegetables? Fruit? Sweets? Fast food?
- How much water do you drink a day?

6. Sleep Pattern

- How many hours do you sleep each night?
- Have there been any recent changes?
- Do you feel you get enough sleep?

7. Bowel Habits

- How often do you have a bowel movement? Any recent changes?

Patients over 50:

- Do you ever notice any rectal bleeding?

8. Urinary Habits

- Do you have any problems with urination? Any recent changes? (stopping or starting)

9. Habits

Alcohol: Do you drink alcohol? Type?

- How often do you drink? How much?

If you have concern about patient's drinking (CAGE):

- Have you ever felt the need to **C**ut down on drinking?
- Have you ever felt **A**nnoyed by criticism of drinking?
- Have you had **G**uilty feelings about drinking?
- Have you ever taken a morning "**E**ye opener?"

Smoking:

- Do you use or have you ever used tobacco products/smoke? What do you use?
- How much do you smoke? For how long? When did you stop?

Drugs: Do you use any recreational drugs? What? For how long? (reiterate patient confidentiality if needed)

10. Domestic Violence

- Are you currently or have you ever been in a relationship where you were physically hurt or made to feel threatened?

11. Stress factors/Support System

- Have there been any significant stresses in your life lately? (e.g. deaths, divorce, family, work)
- Have you noticed a change in your ability to handle stress?
- What resources do you have for support for…?

History & Records

Review of Systems

The following list shows the content of a systems review that can be incorporated into the patient history. A complete review of systems is not required for every patient.

1. General

- Weight - average, recent changes, minimum, maximum
- Weakness, fatigue, fever
- Sweats, chills
- Anorexia
- Insomnia (can't sleep)
- Hypersomnolence (sleep all the time)

2. Skin

- Lesions, lumps, growths, sores
- Moles, change in color/pigmentation, eruptions/rashes
- Pruritus (itching)
- Dryness, excessive sweating
- Easy bruising
- Changes in nails/hair
- Birthmarks
- Change in temperature

3. HEENT

- ***Head:*** headache, head injury, change in size, deformity, dizziness, syncope (lightheaded), vertigo (spinning)
- ***Eyes:*** use of glasses/contacts, pain, diplopia (double vision), glaucoma, cataracts, itching, spots, photophobia, color blindness, night blindness, blurry vision, ptosis (droopy eyelids), halos (rings around lights), scotomata (blind spot), redness, tearing, discharge (color, consistency), use of eye drops, last eye exam
- ***Ears:*** pain, hearing loss, deafness, discharge (color, consistency, bloody), infections, tinnitus (ringing), vertigo, pruritus (itching), use of hearing aid
- ***Nose/Sinuses:*** rhinorrhea (runny nose), stuffiness, discharge (color, consistency), pruritus (itching), epistaxis (nose bleeds), pain over sinuses, hay fever, frequent colds
- ***Throat/Mouth:*** sores, lesions, condition of teeth and gums, dental caries, loss of teeth, dentures, bleeding, sore throat, hoarseness, change in taste, bad taste, malodorous breath, dry mouth, last dental exam

4. Neck

- Pain, swelling
- Limits in range of motion or stiffness
- Lumps, swollen lymph nodes
- "Swollen glands"

5. Breast

- Lumps, pain, swelling
- Nipple discharge
- Use of self-exam, last mammogram

6. Respiratory

- Cough, sputum (color, quantity), hemoptysis (blood from lungs/bronchus)
- Wheezing, asthma, emphysema, bronchitis, pneumonia, tuberculosis, pleurisy
- Shortness of breath
- Last chest x-ray

7. Cardiovascular

- History of heart disease
- Chest pain (exertional/nonexertional, associated symptoms)
- Orthopnea (discomfort breathing by lying flat)
- PND (Paroxysmal Nocturnal Dyspena)
- Dyspnea on exertion (shortness of breath)
- Edema, cyanosis (blue skin)
- Palpitations (irregular heartbeats)
- Loss of consciousness
- Hypertension, heart murmur
- Claudication (limping/calf muscle weakness)
- Thrombophlebitis (inflamed veins)
- Varicosities (dilated veins)
- Raynaud's Phenomenon (bilateral cyanosis of digits)
- Rheumatic Fever

8. Gastrointestinal

- Change in appetite
- Abdominal pain, difficulty/pain with swallowing
- Heartburn, indigestion, bloating, belching, nausea, vomiting, hematemesis (vomiting blood), jaundice
- Food intolerance
- Frequency of bowel movements
- Change in bowel habits (frequency, consistency, caliber, constipation, diarrhea), melena (dark colored stools), hematochezia (bloody stools), clay-colored stools, mucus (passing mucus)
- Excessive belching or passing of gas
- Incontinence (inability to prevent discharge)
- Hemorrhoids, rectal itching/burning
- Rectal discharge/pain
- Laxative use
- Hepatitis, gall bladder disease

9. Genitourinary

- Frequency of urination
- Dysuria (difficulty/pain urination)
- Hematuria (blood in urine)
- Change in color of urine
- Polyuria (excess urine)
- Nocturia (pee a lot at night)
- Oliguria (not much urine), anuria (no urine)
- Flank/suprapubic pain
- Retention (can't fully void)
- Urgency (desire to void)
- Hesitancy (involuntary delay)
- Incontinence, change in force of stream
- Dribbling, passage of air/stone
- Enuresis (leakage of urine)
- Past infections

10. Female

- Menstrual history (onset, cycle, duration, amount of flow, change in cycle)
- LMP, amenorrhea (loss of cycle), menorrhagia (excessive menses), metrorrhagia (irregular menses), associated pain or PMS symptoms
- Contraceptive history
- Previous pregnancies (deliveries, abortions, complications, outcomes)
- Exposure to DES (diethylstilbestrol)
- Vaginal discharge, pruritus, abscess, sores, lesions, infections, STI's, PID (Pelvic Inflammatory Disease), RPR status (Rapid Plasma Reagin test – syphilis), HIV status,
- Previous PAPs
- Premenstrual symptoms
- Problem with intercourse (pain, satisfaction, libido), sexual orientation, number of partners
- Age at menopause
- Postmenopausal bleeding
- Menopausal symptoms (hot flashes, mood swings, changes in vaginal lubrication)

11. Male

- Hernias
- Penile discharge
- Sores
- Testicular pain or lumps
- STI's
- RPR (Rapid Plasma Reagin test – syphilis)
- HIV status
- Sexual orientation, number of partners
- Problems with intercourse (impotence, satisfaction, sex drive)
- Contraceptive use

12. Endocrine

- Goiter, exophthalmos (eyeballs protrude)
- Hot/cold intolerance, constipation/diarrhea
- Tremor, excessive sweating
- Palpitations, change in voice
- Skin changes, hair distribution
- Secondary sex characteristics
- Changes in body contour or weight
- Changes in hat/glove/shoe size
- Polyuria (increase urine), polydipsia (increase thirst), polyphagia (increase eating)
- Striae (stretch marks)
- Acne, pigmentation
- Infertility, diabetes, thyroid disorders

13. Musculoskeletal

- Pain in an extremity, joint pain
- Swelling, redness, stiffness, deformity, warmth
- Limited range of motion,
- Crepitation (cracking joints) - note location of each joint involved
- History of arthritis, muscle pain, gout, backache, neck pain, significant trauma

14. Neurologic

- Syncope, dizziness, seizures, vertigo
- Ataxia (uncoordinated movements),
- Frequent falls, tremor, involuntary movement
- Weakness, loss of muscle mass, paralysis
- Clumsiness, pain
- Numbness, paresthesia (abnormal sensation, burning, tickling), hyperesthesia (abnormal acuteness to touch), dysarthria (speech change)
- Changing in handwriting
- Incontinence (bowel or urine)

15. Hematologic

- Anemia, easy bruising
- Past transfusions and any reactions to them
- IV drug use, enlarged lymph nodes
- Hemoglobinopathies (abnormal hemoglobins e.g., sickle cell anemia)

16. Psychiatric

- Nervousness, anxiety, mood swings, depression, crying spells, panic attacks
- Change in memory, early awakening, problems sleeping, loss of energy
- Change in libido, suicidal thoughts
- Change in appetite, binge eating, purging
- Excessive exercising
- Paranoia, hallucinations, disturbing thoughts

Outcome markers are used to monitor patient treatment progression. Any parameter that has the ability to be proven valid & reliable & can be objectively measured has the potential to become a clinical outcome marker. Listed below are some commonly accepted outcome markers:

Pain (subjective) - see below
- **Visual analogue scale (VAS)**
- Verbal pain scale (0-10)
- **Medication or botanical use & dosage**
- Centralization of symptoms, duration, frequency

Activities of Daily Living (ADLs)
- The **best functional outcome measure**
- Walking, sitting, chewing food, range of motion
- Ability to perform specific tasks
- Playing sports, hobbies, intercourse
- Day of missed work in a set time frame

Orthopedic tests / Range of Motion
- Active & passive motion before symptoms, utilizing a goniometer, inclinometer
- Change in response to provocative testing

Strength
- Muscle grading (0-5)
- Dynamometer, grip strength
- Ability to lift weight (kg/ lbs & number of reps)

Endurance
- Walk/run set distance (meters, km)
- Back extension repetition, sit-ups
- Ability to maintain position

Flexibility (ROM)
- Global range of motion (AROM, PROM)
- Touch toes (measure finger distance from floor)
- Reach behind back (measure distance to C7)
- Inclinometer, goniometer

Neurological
- Normalization of DTR's, loss of pathologic reflexes
- Centralization of symptoms - decreased sensory deficits, muscle strength (dynamometer)
- Improvement on nerve conduction studies

Quality of Life
- Patients that report a lower quality of life may be predisposed to poor treatment outcomes
- Ask the patient "Think of the last week, how would you rate your quality of life?" - excellent, very good, moderate, bad, very bad

Outcome Assessment Questionnaires
- While Questionnaires show good reliability many patients find it time consuming & somewhat inconvenient to repeatedly fill out multipage forms prior to each treatment
- Oswestry Low Back Pain Disability Questionnaire
- Roland/Morris Disability Questionnaire
- Pain Disability Index, McGill Pain Questionnaire

Pain Parameters

- **Dermal Pain:** from superficial soft tissues, usually well localized (eg. cut in skin)
- **Sclerotomic Pain:** from deep somatic tissues typically deep, aching & somewhat localized (eg. muscle strain)
- **Visceral pain:** from internal organ capsule distension or ischemia, deep achy, cramping pain that may be sharp at times, often poorly localized and may be immobilizing in more severe cases (eg. intestinal cramps, heart attack, appendicitis)
- **Radicular Pain:** from nerve roots, often described as shooting, electrical and/or burning & in a dermatomal pattern (nerve root compression) - Nerve compression distal to the nerve roots may result in a peripheral nerve distribution pattern of pain
- **Phantom pain:** arises from direct changes in neural pathways & perception of the brain, felt by amputees in the area of the missing limb
- **Referred pain:** pain felt at a site other than where the cause is situated; pain in internal organs or myofascial trigger points (MFTP) is often referred to other locations (mechanisms of referred pain are complex - theories include convergent projection, convergent facilitation, axon reflex & hyper excitability)

Pain Duration
- **Acute Pain:** generally refers to pain associated with the acute stage of inflammation, however can be described as pain that is unbearable, usually first 48-72 hours.
- **Sub Acute:** pain after the acute stage but not yet chronic (> 72 hrs)
- **Chronic Pain:** refers to pain associated with the stages healing after the resolution of the inflammatory response. - is commonly used in reference to pain of long duration (> 3 months)

Pain Assessment

Definition of pain: **an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage**[15]

Pain is one of the best determinants of disability[8, 9] and low back pain (LBP) is predictive of work resumption within the year following related short-term absence.[10]

Three main methods are used to measure pain intensity: visual analogue scale (VAS), verbal rating scale (VRS), and numerical rating scale (NRS).[23,25,26] Pain scales have been demonstrated to be both a reliable & valid instrument for measuring the patient's sense of pain.[21, 29, 33, 34, 39] The faces pain scale is recommended for use with younger children & elderly in parallel with numerical self-rating scales (0-10).

Application: examiner asks the patient to "rate current pain on a scale from 0-10, 10 being the worst pain you can imagine." Patient states a number or points to corresponding pain level. Separate body regions should be rated individually; for example, in a patient with LBP & leg pain (which may or may not be related issues) there should be a pain rating for the LBP and a second rating for leg pain.

Other Consideration

1. **Tissue sensitivity to pain**

Most sensitive → Least sensitive			
• Skin • Fibrous capsule • Periosteum	• Tendons • Ligaments • Subchondral bone	• Cortical bone • Muscle • Fascia	• Fibrocartilage • Articular cartilage • Synovium

2. **Asking separate questions**
   - What is your current pain? What is the usual pain level?
   - What is the pain at its worst?
   - What is the pain at its least?

3. **Chronic pain cases**
   - Consider recording the "least pain" the patient has been experiencing (research suggests patients recall "least pain" more accurately than "usual or worst")

4. **Measuring symptoms other than pain**
   - ***The 0-10 scale can be applied to different symptoms (discomfort, nausea, fatigue, stress, etc.)***
   - ***Simply substitute the word "pain" with the given symptom you wish to measure***

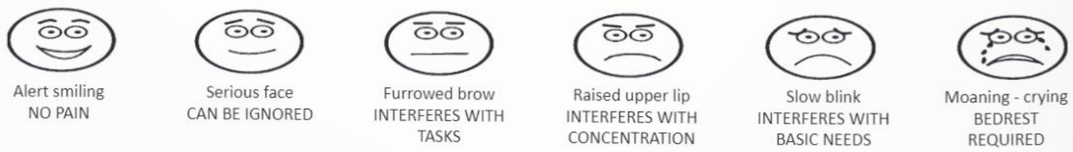
Numeric Rating Scale (NRS)



Visual Analog Scale (VAS)



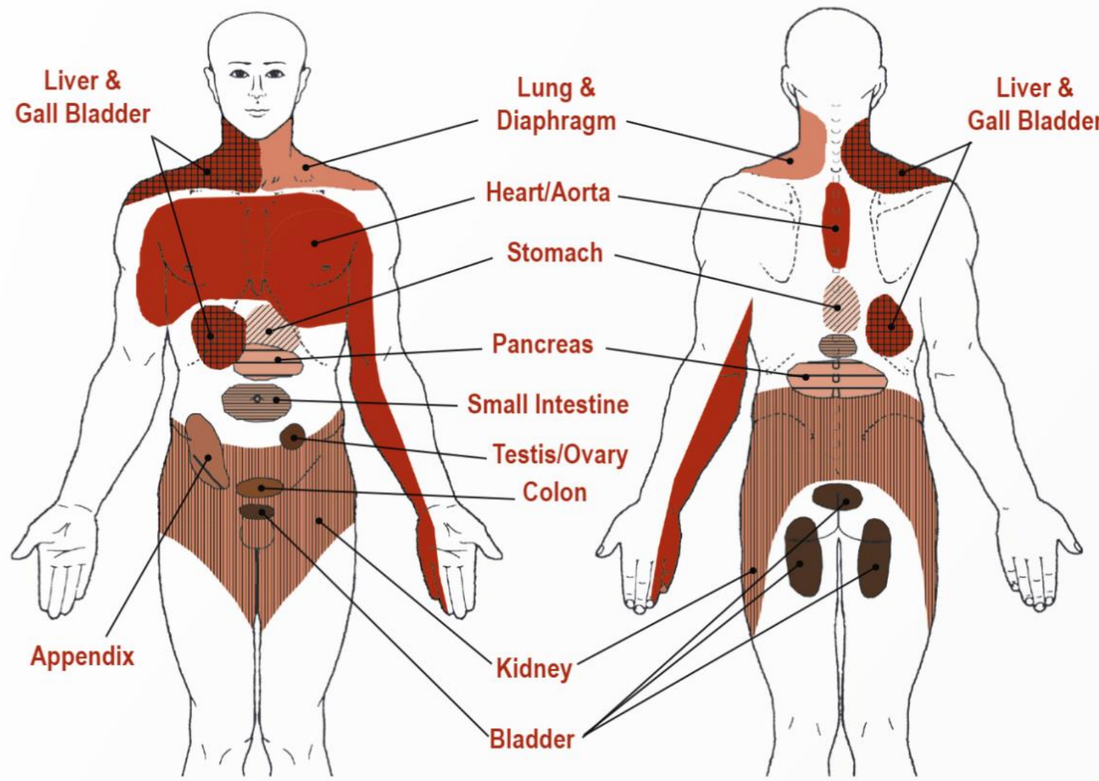
Faces Pain Scale (as used on ProHealth Goniometer & Posture wall chart)



History & Records

Visceral Pain Referral

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Pain Parameters

Pain Patterns

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Tissue Specific Differential

Condition	AROM	PROM	RROM	Comments
Muscle Injury (strain or tendinopathy)	↓ AROM (painful)	WNL (pain at end ROM)	Pain	• Dull ache - sharp pain when challenged • Pain with palpation of damaged tissue • Stretching or contraction of muscle causes a pain (possible weakness) • *Unidirectional* pain with motion in muscle fiber direction
Fascial Strain (adhesion or scaring)	↓ AROM (painful)	↓ PROM (painful)	WNL (painless)	• May have palpatory subcutaneous adhesions, limited ROM or non-dermatomal pain & posture changes
Ligament Injury (sprain)	↓ AROM (painful)	↓ PROM (painful)	WNL (painless)	• Pain with palpation of ligament • Stretching of the ligament, especially with over pressure, causes pain • **Instability** due to full ligament rupture may show an empty end feel, ↑ PROM or repeatable 'clunk' with motion
Capsulitis	↓ AROM (painful)	↓ PROM (painful)	WNL (painless)	• Pain with direct capsule palpation or *multidirectional* pain with motion - pain in a single direction indicates muscle or tendon damage
Joint Injury (arthropathy)	↓ AROM (painful)	↓ PROM (painful)	WNL (painless)	• Early may have no loss of ROM or pain • Scour tests may show crepitus • AROM may show repeatable 'snapping' & 'popping' • Pain may change with weather
Joint Dysfunction (subluxation)	WNL or limited in specific ROM	Limited in specific ROM	WNL or weak	• Pain or point tenderness • Asymmetry/misalignment • ROM abnormality - joint "feels stuck" • Myofascial tone changes
Bone Injury (fracture)	↓ AROM (painful)	↓ PROM (painful)	↓ RROM (painful)	• Hx of trauma - perform fracture screen • Pin point tenderness, dull ache but very sharp when challenged
Nerve Injury	↓ or WNL	WNL	Weak	• Numbness, tingling or muscle weakness & shooting electrical pain reproduced with stretch or compression of nerve
Visceral Injury	• Writhing or cramping pain secondary to internal organ capsule distension or vascular compromise, deep achy, often poorly localized & may be immobilizing in more severe cases (eg. intestinal cramps, PMS, appendicitis) - pain is often NOT changed by change in body position			

↑ = increase, ↓ = decrease, WNL = within normal limits, Hx = history, , Vascular injuries often present with bruising, throbbing pain, changes in local body temperature and altered capillary refill times (> ~2 sec). Cutaneous (skin) injuries are easy to locate and visualize. The table above is for common general presentations, patients often have ranges of presentation depending on the specific scope of their injury or condition.

History & Records

Differential Diagnosis

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A complete diagnosis should include: **Stage, Severity and Pathoanatomy**
(When, How bad and What/Where is the damage - why is the history & who is the patient ☺)

Stage:
- **Acute** (<72 hrs)
- **Subacute** (> 72hrs)
- **Chronic** (>3 wks - 3 months)
- **Chronic Recurrent**

Severity:
- **Mild (grade 1)**
- **Moderate (grade 2)**
- **Severe (grade 3)**

Pathoanatomical & Named Syndrome

Location: Cervical, Thoracic, Lumbar, SI…med/lat, ant/post, etc…

Type: Sprain/Strain (postural, traumatic, overuse), traction, hyperextension

Pathology: Disc herniation, stenosis, spondilolithesis, sacroiliitis, AS, bursitis, adhesive capsulitis

Named Syndrome: TOS, facet syndrome, Guillain Barré syndrome, T4 syndrome, Myofascial Pain syndrome (Piriformis syndrome, Rotator Cuff tear)

Diagnosis: Tension HA, Migraine HA, Cluster HA, etc.

…with…

Neurological & Radiating

General: numbness, tingling, weakness, sensory loss, atrophy, DTR asymmetry

Hyper-reflexia: UMNL, with or without clonus

Hypo-reflexia: LMNL, decreased or absent

Peripheral Neuropathy:

Symmetric Polyneuropathy: diabetic neuropathy, alcoholic neuropathy

Mononeuropathy: Carpal Tunnel Syndrome, median nerve neuropathy, etc…

Plexopathy: brachial/lumbar/sacral (eg. TOS)

Radiculopathy: disc lesion, SOL

Radiation: radicular, scleratogenous referral, etc…include right or left. How far? Past knee to foot/toes? Or past elbow to hand/fingers?

Surface: ant/post, med/lat, thigh/arm, etc.

…with associated…

Biomechanical & Soft Tissue

Type: joint dysfunction/subluxation/malposition/restriction

Location: cervical, thoracic, lumbar, pelvis, knee, wrist, etc…

Soft Tissue: myospasm, myofascial trigger point, myofascitis, hypertonicity, contracture

…complicated by…

Local Complications

Local: stenosis, ligamentous instability, DJD, transitional segment, spondylolisthesis, scoliosis, block vertebrae, muscle deconditioning, muscle imbalance, leg length inequality, avoidance behavior, etc…

Non-Local: (separate number on problem list), diabetes, smoking, alcohol, drugs, over-pronation, posture, stress, diet, exercise

Diagnosis Samples

Moderate acute L5 intervertebral disc herniation with associated right leg radicular symptoms down to the posterior calf & low back myospasm, further complicated by marked spinal canal stenosis at L4-S1.

Congenital leg length inequality with compensatory sacroiliac joint dysfunction & mild lumbar scoliosis & associated erector spinae hypertonicity.

ProTip - Typical Diagnosis vs. Professional Diagnosis?

Typical Dx: Ankle sprain (this is a very weak diagnosis & gives little useful information)

Professional Dx: Acute grade III right ankle inversion sprain with associated lateral ankle edema & bruising complicated by a history of similar chronic recurrent sprains & tarsal joint instability and over pronation

By writing a more accurate & complex diagnosis time is saved when dealing with other health care provides & an improved level of detail furthers your own reputation as an extremely competent practitioner

Problem List

A problem list can act as 'table of contents' in the patient file; it is a rapid way to assess the current & past health issues the patient has dealt with; in addition it provides the clinician with a list of items that may require particular attention.

- Once the history & physical examination are complete, decide which problems should be entered into the problem list
- Divide the list into active (requiring care) & inactive (resolved) conditions
- The problem list may include; diagnosis, physical exam signs, symptoms, laboratory tests, psychosocial history or risk factors (alcohol/smoking/obesity)
- The list provides chronological summary of all the patient's important health-related issues
- When the patient first noted the problem is written in brackets after each individual problem
- The problem list is designed to be a dynamic entry system & it is the clinician's responsibility to constantly review the problem list to ensure that the entries are accurate & up-to-date

Sample Problem List

Patient Name: Seymour Butz **File #** [redacted] **DOB:** 5 4 [redacted]

#	Active Problems	Date	Inactive Problems	Date
1	Thoracic Outlet Syn. (8/1/08)	8/1/16		
2	Obesity (since childhood)	8/1/16		
3	Smoking (since 1972)	8/1/16		
4	Hypercholesterolemia (4/8/05)	8/1/16		
5			GERD (7/29/04 last episode)	9/1/16
6	Unemployed (5/6/05)			
7			MI (3/5/82)	9/1/16
8	Diabetes Mellitus (9/2/05)	9/2/16		

Case Study

The patient above presented for his initial history & exam on 9/1/16 & that day's findings were included on the problem list. The day following the initial exam a fasting plasma glucose was taken showing elevated blood glucose; as such, diabetes mellitus was diagnosed for the first time & added to the problem list. While the gastroesophageal reflux disease (GERD) & myocardial infarction (MI) are not currently active they are of clinical significance & should be noted on the inactive problem list. Other issues such as smoking & unemployment are also of overall clinical significance to the well-being of this individual & should also be included on the list.

PhysMed Tx Parameters

The following treatment parameters are to be used only as guidelines for the development of a management plan. These are estimates of treatment and/or healing time for commonly encountered categories of neuromusculoskeletal conditions. Individual patients will vary in the amount of time required for their healing & rehabilitation depending upon their specific clinical presentation & dedication to treatment.

0-6 Weeks of Treatment

- Mild-moderate strain, mild sprain
- Mechanical/joint dysfunction (uncomplicated)
- Acute facet syndrome
- Contusion
- Mild-moderate tendinitis, capsulitis, bursitis, synovitis
- Mild sacroiliac syndrome
- Acute myofascial pain syndrome
- Mild symptomatic degenerative joint disease
- Headaches: vertebrogenic, muscle contraction, migraine, vascular
- Torticollis (acquired)

2-12 Weeks of Treatment

- Moderate-marked strain, moderate sprain
- Post traumatic mild-moderate myofibrosis
- Post traumatic periarticular fibrosis & joint dysfunction with marked tendinitis, bursitis, capsulitis
- Chronic tendinitis, bursitis, capsulitis
- Chronic facet syndrome
- Moderate sacroiliac syndrome
- Chronic SI syndrome with marked myofascial pain syndrome
- Chronic myofascial pain syndrome
- Mechanical/joint dysfunction (complicated)
- Mild inter-vertebral disc syndrome without myelopathy
- Chronic headaches: vertebrogenic, muscle contraction, migraine, vascular
- Mild temporomandibular joint dysfunction
- Symptomatic spondylolisthesis
- Mild clinical joint instability

1-6 Months of Treatment

- Chronic facet syndrome associated with clinical vertebral instability
- Marked strain associated with post traumatic myofibrosis and/or joint dysfunction
- Marked sprain w/ associated instability/dysfunction
- Thoracic outlet syndromes
- Moderate inter-vertebral disc syndrome w/o myelopathy
- Peripheral neurovascular entrapment syndromes
- Moderate to marked temporomandibular joint dysfunction
- Adhesive capsulitis (frozen joint)
- Partial or complete dislocation

2-12 Months of Treatment

- Marked inter-vertebral disc syndrome w/o myelopathy, with or without radiculopathy
- Lateral recess syndrome
- Intermittent neurogenic claudication
- Acceleration/deceleration injuries of the spine with myofascial complications (whiplash)
- Cervicobrachial sympathetic syndromes
- Sympathetic dystrophies
- Severe strain/sprain of cervical spine with myoligamentous complications

Prognosis

A prognosis is an educated estimate of the potential outcome of a given condition. There are a number of factors that can influence the accuracy of a prognosis on any given patient. A prognosis should include the following:

General information

1. Age, general health
2. Severity of injury or onset of disease
3. Natural history of condition (pathogenesis)
4. Complicating factors (e.g. diabetes, instability, DJD, stenosis, etc...)
5. Clinician's skill & experience with condition
6. 'Operant factors' - patient compliance, lifestyle & occupation, socioeconomic status

Vocabulary

"Prognosis is...

...excellent" = complete recovery expected
...good" = little doubt of complete or near complete recovery
...fair" = recovery may not reach 100% pre-injury status
...guarded" = unclear on degree of recovery based on current clinical information
...poor" = chance of recovery is limited at best
...pending" = waiting for further clinical information (imaging, blood tests, second opinion)

Attempt to

1. Discuss what your opinion is based upon
2. Differentiate cure from symptomatic relief
3. Indicate the likelihood of recurrence & residual effects
4. Indicate if symptomatic care is appropriate & would benefit patient
5. Remember that your prognosis can change

Prognosis examples

- *Prognosis is good for relief of the shoulder pain with continued care & patient compliance. The patient's condition is mechanical in nature without neurologic compromise & should resolve without residual dysfunction. This assessment is based on the biomechanical nature of the problem & the general good health & high aerobic activity level of the patient.*
- *Prognosis is poor, due to the general poor health of the patient, previous history of failed treatments, poor compliance with management plan, mental handicap & low socioeconomic status.*
- *Prognosis is guarded due to periodic, unavoidable exacerbations from occupational postures that suggest continued treatment will be necessary to maintain the patient's employability.*

Factors that IMPROVE healing	Factors that SLOW healing
• Laughter, positive mood & good sleep habits	**• Depression, poor sleep habits**
• Love, community & social support	• Increased age, malnourishment
• Younger age & adequate nutrition	• Low blood supply to damage tissue
• Good blood supply (nutrient/waste exchange)	• Poor aerobic level & lack of exercise
• Healthy aerobic fitness, activity & movement	• Smoking, alcoholism
• Vitamin A, D, E, K, Mg, Mn, Zn, Ca, water, antioxidants (free radicle elimination)	• Prolonged immobilization/rigid fixation
• Soft tissue/joint mobilization, massage & IASTM	• Corticosteroids/ NSAIDs
• Electrotherapeutics (microcurrent, ultrasound)	• Diabetes, high cholesterol
• Surgical gap closure & acupuncture/needling	• Excessive soft tissue gap (complete tear, lack of tissue approximation)
• Confidence in future wellness & health care provider's ability (positive expectations)	• Excessive motion or stress or repeat injury (chronic injury)

Clinical Impression

A clinical impression is not required for every patient. However their value is absolutely crucial when communicating with other physicians (patient referral or co-management), lawyers (legal proceedings, etc.) & insurance companies (justifying payment & reasons for continuing care). A clinical impression should include contributions from the list below:

1. Opening statement
- Patient's age, gender, race & occupation
- Mental status
- Complaint description, duration & pain level (0-10)

2. Resulting anatomical damage or syndrome
- Sprain/strain, dislocation, fracture
- Migraine, disc herniation, etc.

3. Mechanism of injury (as specific as possible)
- Trauma, repetitive stress
- Chronic, postural
- Size & speed of vehicles involved, etc.

4. Stage and/or grade of condition
- Acute, subacute, chronic
- Grade I, II, III strain, etc.

5. Neurological findings (if present)
- Absence of pathologic neurological signs
- DTR's, motor testing
- Nerve tension signs (SLR, well leg raise, etc.)

6. Orthopedic & biomechanical issues (and their relation to the anatomical injury)
- Results of diagnostic orthopedic tests
- Joint dysfunctions
- Soft tissue changes, myospasm, muscle contracture or hypertonicity

7. Complicating & contributing factors
- Instability, DJD, RA (secondary pathology)
- Poor general health, obesity, diabetes, hypertension, high cholesterol
- Poor flexibility, anatomical leg length inequality

8. Other information (you feel may be important to the case)
- Socioeconomic status
- Self rated quality of life
- Job satisfaction, social situation
- Support network

Sample Clinical Impression

Mrs. Back Hurt, a 45-year-old Caucasian secretary & mother of two, presented on 12/12/2015 alert & cooperative with moderate (3.5/10 VAS) dull, achy low back pain, located centrally at the thoracolumbar (TL) junction & inferiorly to L5-S1. The cause of this patient's pain seems to be the result of repetitive microtrauma during a vigorous 3 hour tennis match two weeks ago with her 16-year-old son. The pain was worse with serving, a movement involving strong contraction of the iliopsoas & quadratus lumborum muscles.

History & physical examination suggest that Mrs. Hurt is suffering from TL joint dysfunction secondary to an iliopsoas muscle strain. This diagnosis is consistent with the palpable, grade 2/4 tenderness of the right iliopsoas, reproduction of the TL pain & mild weakness with the iliopsoas length & strength testing. Mrs. Hurt's pain does not wake her up at night or affect her bowel & bladder control, & she is not suffering from any other noted neurological deficits or abnormalities. She also presented with lumbosacral (LS) pain, most likely a result of LS extension occurring as a compensation for the iliopsoas strain causing TL flexion. A major contributing factor to this injury was overall poor conditioning & lack of exercise before undertaking such a vigorous activity. The patient also exhibits signs & symptoms of chronic postural strain with associated cervicogenic headaches, which appear to be unrelated to her low back pain.

ProTip: Practice Building (Networking)

By taking the time to write a well-rounded complete clinical impression or narrative report when referring patients, you will quickly become recognized as an extremely competent professional within your local healthcare community. As such, other healthcare professionals in your region will recommend you as their first choice for referral. Conversely, a poor clinical impression suggests poor clinical competence which will result in fewer patient referrals.

Review of Findings

A review of findings is given to the patient after the history & physical exam are completed; it is an important part of any clinical encounter & gives you the opportunity to further establish the benefits of your care & yourself as an expert in its delivery or to suggest a referral to a more qualified professional.

Greeting
1. Greet patient by name
2. Inquire about current status
3. Orient patient to ROF
   a. Review of findings & what they mean
   b. Make treatment recommendations
   c. Give opportunity for questions
   d. Inform patient of expected duration (5-10 min)

Overview
1. Short summary of problem(s)
2. Establish your ability to help
3. Reassure patient about their condition

Describe condition(s)
1. Explain diagnosis in lay terms
2. What caused it (mechanism of injury)
3. Briefly review exam findings & how they correlate to diagnosis
4. What happened in the body (use models, diagrams, charts, etc.)
5. How it manifests (pain…)
6. How treatment will address the cause

Describe treatment
1. Type of therapy (office & home care)
2. Frequency & duration of treatments

Establish goals
1. Describe goals of treatment
2. Relate goals to problem(s) & outcome markers

Describe importance of compliance
1. Relate to cause of problem & complaint
2. Stress patient's role as an active participant in her/his own care
3. Identify & address barriers to compliance
4. Involve patient in addressing barriers

Describe expectations
1. Outcome measures
2. When to re-evaluate

PAR-Q (procedures, alternatives, risks)
- Legally required for every new procedure
- **Describe procedures, alternatives to treatment & risks**
- **Obtain written informed consent to proceed with treatment**
- **Does the patient have any QUESTIONS?**

Conclusion
1. Educational materials
2. Answer any patient questions?

ProTip: Practice Building Professionalism
1. Be professional, prepared & competent
2. Attend to patient's comfort
3. Voice should be clearly audible
4. Use language appropriate to patient's level of understanding
5. Communication between clinician & patient should flow easily
6. Use plastic models (and diagrams) for patient's education
7. Demonstrate good listening skills
8. Physical posture should relay openness & confidence
9. Appropriate eye contact to patient comfort
10. Have empathy to patient's concerns
11. Give patient opportunities to ask questions/verbalize concerns
12. **PAR-Q conference must meet Province/State requirements (informed consent)**

Treatment Plan

Treatment plans should include the following:

1. Additional diagnostic steps - x-ray, CT, MR, blood draw, nerve conduction studies...
2. Office procedures for acute & rehab. phases - OM, STM, electric modalities...
3. Home care for all phases - activity modification, supports, nutrition, exercise...

Also include treatment frequency & duration for acute & rehab. phases. In addition, discuss treatment goals & objective criteria (outcome markers) you will be using to monitor improvement.

Sample Treatment Plan

Patient Name: HarryR .M .Pitts **DOB:** 5 4 3 **DOI:** 2 2 6 x initial visit □ update

#	Diagnosis (same as problem list)	ICD-9
1	Carpal tunnel syndrome	8
2	Hypothyroidism	2
3	Acute right cervical myofascitis w/ associated cervical joint dysfunction	8
4	Chronic left sacroiliac joint dysfunction	9

Phase of care (use problem #):
123 Therapeutic 4 Palliative _____ Maintenance _____ Preventative _____ Elective

Dx #	Treatment	Rationale
34	Osseous Manipulation	Restore normal joint mobility & related neurophysiological function
B	Myofascial Release	Reduce myofascial adhesions, MFTP, ↓ hypertonicity, improve motion
34	Joint Mobilization	Restore normal joint mobility
1	NMS Re-education	Improve balance, coordination, posture, proprioception
3	Therapeutic Massage	Improve circulation; reduce muscle hypertonicity
	Manual Traction	Decompression, pain reduction
	Electric PT modality	Increase circulation, muscle tone, prevent disuse atrophy, pain relief
1	Ultrasound	Reduce pain, edema, MFTP, calcium deposition, increase circulation
	Hot Packs	Reduce pain, relieve congestion, reduce muscle hypertonicity
3	Ice	Reduce pain & swelling in acute injury
B	IASTM	Decrease local adhesion, improve local blood flow

Dx #	Treatment frequency
B	3 x/wk for 2 wks; 2 x/wk for 2 wks; 4 x/month for 3 months
4	2 x/wk for 2 wks; 1 x/wk for 4 wks; 1 x/month for 4 months

Free downloadable Chart Forms are available at

http://www.prohealthsys.com

Supplies
□ lumbar brace □ lumbar/cervical pillow □ cervical collar □ foot orthotics □ heel lift
X other: neutral night wrist splint for carpal tunnel

Supplements/OTC's: calcium, magnesium, vitamin B6, vitamin C, increase water intake

Home exercise
X stretching □ strengthening □ balance □ aerobic □ posture □ proprioceptive
Specific type, sets, reps: seated stretch 4x/day hold for 30 sec.
Area: upper traps, sub-occipitals & SI joint, wrists

Home instructions
X ice □ heat □ rest □ food diary □ other: _____
Comments: ice right suboccipitals 10 min. on 50 min. off for 2-3 cycles in evening

Electric modality
□ ultrasound □ IFC □ TENS □ MENS □ EMS □ LVG □ HVT □ LFAC □ diathermy
Settings (location, time, frequency):

Work restrictions
□ off work X light duty with no lifting over _____lbs for the next _____
Comments: avoid prolonged painting sessions & take frequent breaks

Follow-up Procedures
□ Diagnostic imaging:_____
X Lab: TSH, FT4 (free T4)
Purpose: check thyroid levels & monitor performance of medication

Referral
□ DC □ DO □ DMD □ MD □ ND □ OT □ PT □ RMT X Other: endocrinologist
Name: Dr. Ty Roidgland
Purpose: Secondary consultation on medication dosage & condition specifics

Treatment goals	Outcome markers
#1,3,4: ↓frequency/severity of symptoms	#1,3,4: mVAS, pain with provocation, degree of tenderness, duration of activity before symptoms return
#2: Elimination of hypothyroid symptoms	#3: ↑heart rate, weight loss, ↓fatigue

General comments: consider intermittent axial wrist traction for treatment of carpal tunnel syn.

Signature: Dr. Sue Permann Date: 05/07/16 PARQ Date: 05/07/16

DOB = date of birth, DOI = date of injury, OTC = over the counter (medication), PARQ = procedures alternatives & risks questions

YOUR LETTERHEAD

address - e-mail - web page - phone - fax

July 16, 2015 [date of report]

Re: Patient: [patient name]
Date of Injury: July 2nd, 2015
Employer: US Postal Service
File #: WC54362400-3342

Introductory statement
This narrative report details the patient's chief complaint, examinations performed, treatment received & other pertinent information regarding her case.

History
In a brief paragraph summarize the patient's history relative to his/her chief complaint. Giving particular attention to location/radiation of symptoms, mechanism of injury, pattern of symptoms, frequency & duration of symptoms, severity (0-10) & effects on activities of daily living (ADL's).

Past health history
Summarize potentially relevant or associated complicating factors from the patient's past: serious illnesses (diabetes, heart conditions, strokes, cancers, hepatitis, infections, etc.), recent hospitalizations/surgeries, general trauma, accidents, injuries, medication use (over-the-counter & prescription), allergies, previous x-rays & care & last physical exam.

Family history
Summarize potentially associated complicating and/or risk factors from the patient's genetic lineage: diabetes, heart conditions, strokes, cancers, hepatitis, infections, etc.

Social/Personal history
Summarize potentially associated complicating and/or risk factors from the patient's personal/social history: living situation, occupation, exercise, hobbies, diet, sleep pattern, bowel & bladder habits, alcohol consumption, smoking, recreational drug use, domestic violence, & major stresses in life.

Initial physical exam findings [Date: July 16th, 2015]
Summarize & include all observations, positive findings & pertinent negatives, may be broken down further into the more specific sub-headings (see below) depending on the level of detail performed during the exam.

Ranges of Motion	Ophthalmic Exam
Palpation	Otoscopic Exam
Radiographic Exam	Rhinoscopic Exam
Vascular Exam	Mental Status Exam
Neurological Exam	Special Imaging (X-ray, MRI, CT, diagnostic US)
Orthopedic Exam	Additional Exam Procedures (blood draw, ECG, NCV, etc)

YOUR LETTERHEAD

address - e-mail - web page - phone - fax

Follow-Up physical exam [date]

Reevaluate & summarize changes in all original observations, positive findings & pertinent negatives, to confirm effectiveness of care over time (evaluate your outcome markers), once again using the same sub-headings as the initial physical exam.

Working diagnosis

Give a diagnostic summary in one or two lines. Diagnosis should include anatomical lesion, neurological involvement, biomechanical evaluation, complications & ICD-10 codes (standard four part diagnosis). Refer to pages on diagnosis.

Clinical impression

Discussion of clinical issues surrounding the patient's case. Refer to pages on clinical impression.

Treatment plan

A thorough treatment plan should include the following:

1. Additional diagnostic steps - x-ray, CT, MR, blood draw, nerve conduction studies...
2. Office procedures for acute & rehab. phases - CMT, STM, PT modalities...
3. Home care for both phases - activity modification, supports, nutrition, exercise...

Also include treatment frequency & duration for acute & rehab. phases. In addition, discuss treatment goals & objective criteria (outcome markers) you will be using to monitor improvement.

Prognosis

Summarize your predicted outcome for this patient. Discuss in terms of excellent, good, fair, guarded & poor. Always provide a brief explanation for your choice (see prognosis page).

Comments

Keep this portion of your narrative to a minimum; reserve it only for relevant personal conjecture. Here is a sample comment:

"Based on the patient's subjective complaints, physical exam findings & treatment response, it is my professional opinion that [patient's name] complaints are consistent with the type of repetitive trauma she reported."

Closing statement

If we can provide additional information or be of further assistance regarding this case, please contact our clinic.

Sincerely,

_____

Your name, DC, DPT, DO, MD, ND, OT, PT, RMT, RN

S

Chief concern:
#1 – Mid-Back pain
#2 - Right mild subacute gastrosoleus strain (ddx from prior visit) "getting better"

O: Yesterday
Prog: Was blow-drying my hair, and all of a sudden it hurt to breath, experienced a sharp pain in her left upper back
Pa: Moving slowly
Prov: Deep breathing, coughing, sneezing
Q: Dull and achy just sitting, and sharp with the things that cause pain
R: None
S: 4/10, and 7/10 with deep breathing
T: No timing noted

O

Patient points to area just below scapula on left side to indicate area of pain
AROM: decrease left lateral flexion of thoracic spine with mild discomfort, sharp local pain with inspiration
Cardiac auscultation WNL, no shortness of breath, diaphoresis, no NTW in arms or chest
(-) Sternal compression, rib expansion: equal bilaterally
Prone rib palpation: 7th left rib sits more posterior, pt indicated pain with 7th rib palpation associated local myospasm and tenderness
Palp of right gastrosoleus shows focal tenderness & trigger points over injury

A

A// CC#1 Back Pain
WDx: L 7th rib subluxation
Pert (+): left 7th rib sits more posterior, localized pain over left 7th rib, decreased left lateral flexion, pain with inspiration
Pert (-): sternal compression –ve, rib expansion bilaterally, no provocation of pain after meals, no hx of pancreatitis, no signs of cardiovascular dysfunction

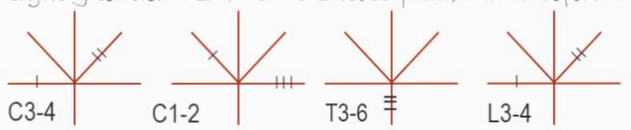
P

P//
1. *Hydroculator application over thoracic spine for 10 minutes prior to adjustment*
2. *Supine Rib Adjustment over L 7th rib, cavitation noted, well tolerated - patient noted significant pain reduction after adjustment "I can take a deep breath again"*
3. *Provided patient with home care instructions (hydrotherapy, light stretching)*
4. *Continue IASTM and acupuncture over lateral right gastrosoleus*

Sample SOAP note #2

S "neck is feeling much better", ↓ HA frequency (1 in 2 weeks), pain scale = 1/10

O tight & tender +1/4 R >L suboccipital, MFTP referral over right eye



PI right ilium
Superior left navicular

A hot pack (15 min) posterior cervical spine & upper shoulders, iSTM of suboccipitals region, stretch of upper trapezius & splenius, osseous manipulation of above motion restrictions

P ↓ Pain following Tx, continue home stretching, ↑ H_2O intake. return: 1 wk

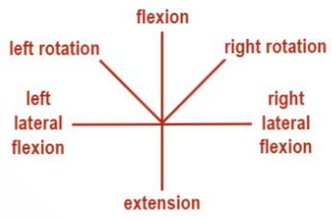
Signature: Dr. Emma Wroids Date: 2015/12/15

Free sample charts for all body region can be downloaded from www.prohealthsys.com

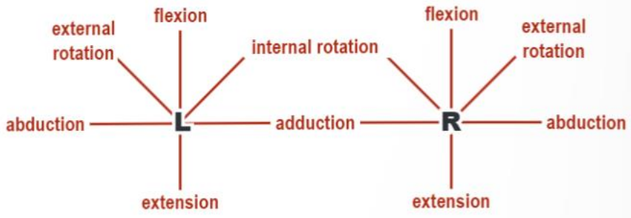
Charting ROM Findings

Star Diagram: used to record AROM & PROM information in an efficient format

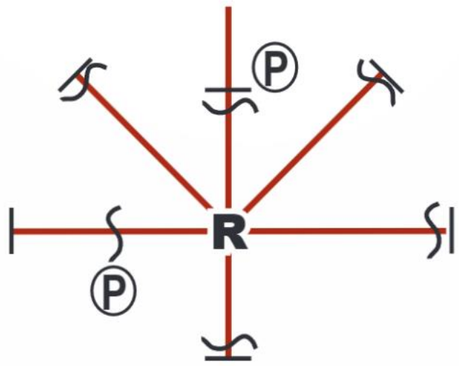
Spinal Joint



Peripheral Joint



Example Right Shoulder Joint



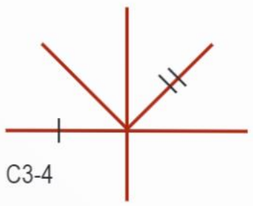
Text version equivalent

- Shoulder flexion both active & passive is limited to ~50% (~90°) into flexion
- Shoulder active adduction is limited to ~50% (~15°) into adduction
- All other ROM is WNL (AROM < PROM)

Ⓟ= pain
⟆= AROM
| = PROM

- Each line represents 100% motion in that direction, therefore a mark half way on a line indicates 50% ROM ability; examiner should record any pain, abnormal movements or clunks & location within ROM
- Hypermobility would be noted as greater than 100% ROM (off the end of the line representing motion)

Charting Spinal Listings



- **The star diagram may be modified to show spinal joint listings (restriction or malposition depending on clinician preference)**
- **| = mild, || = moderated, ||| = marked**
- **Example demonstrates a C3-4 moderate right rotation, mild left lateral flexion restriction**

Sample Chart Verbiage

Eyes, Ears, Nose & Throat

Eyes: Distance vision: 20/20; no correction. Visual fields intact. Parallel corneal light reflex no nystagmus. Eyes symmetrical, brows, lids & lashes intact without deformity, ptosis or lesions. Conjunctiva clear, no discharge. Cornea smooth & clear. Pupils equal, round, reactive to light & accommodating (PERRLA). Fundoscopic: full bilateral red light reflex, discs round, cream colored, well-defined margins, slightly excavated (as a normal variant). Arteries light red with narrow light reflex & even caliber. Retina uniform red-orange without exudates or lesions.

Ears: Ear positioning bilaterally symmetrical; smooth auricles without lesions or discharge. Small amount of light cerumen noted in both external canals. Tympanic membrane intact with slight scarring in the left one; all landmarks clearly identified. Auditory: watch test equal bilaterally. Rinne: air conduction greater than bone conduction; Weber L= R.

Nose: Appears straight with slight deviation of the nasal septum towards the right vestibule, decreasing its opening slightly. Both nostrils patent. Odors properly identified. Nasal mucosa pink, moist with slight clear discharge. No lesions. Sinuses non-tender.

Mouth & pharynx: Lips pink, moist, without lesions. Buccal mucosa gingivae, hard & soft palates pink, with no lesions, inflammation, patches or swelling.

Teeth: Twenty eight. Firmly seated, with two fillings in the right upper second molar. No debris, staining, or obvious caries. No inflammation at gingivae.

Tongue: Midline, symmetrical. No lesions or fasciculations. Floor of mouth without lesions. Uvula slightly left deviated, no swelling or exudates of tonsils. Pharyngeal wall pink, no lesions or swelling. Mouth odor normal.

Thorax & Lungs

Inspection: Thorax is symmetrical in appearance & expansion. AP diameter is not increased.

Palpation: Fremitus is normal. Expansion of the chest is symmetric.There are no lesions, auxiliary adenopathy or other lumps. There is no palpatory tenderness.

Percussion: Diaphragmatic excursion is 5 cm bilaterally. Lung fields are resonant throughout.

Auscultation: Breath & voice sounds are normal. There are no rales, rhonchi or rubs noted.

Heart

Inspection: No abnormal heaves observed.

Palpation: No thrills detected. API palpable in 5th left intercostal space medial to mid-clavicular line.

Auscultation: Rate is 80 bpm & regular. Sounds are normal with S1 aortic > S2 pulmonic. No murmurs, gallops or rubs are noted.

Abdomen

Inspection: Abdomen is flat & symmetric. Skin exhibits no lesions, striations or scars. No hernias or abnormal pulsations are present.

Auscultation: Bowel sounds are present in all quadrants. No bruits are detected.

Percussion: Normal abdominal tympany is present. Liver span is 7 cm at right clavicular line. Splenic dullness is present at the 10th intercostals space at the left midaxillary line.

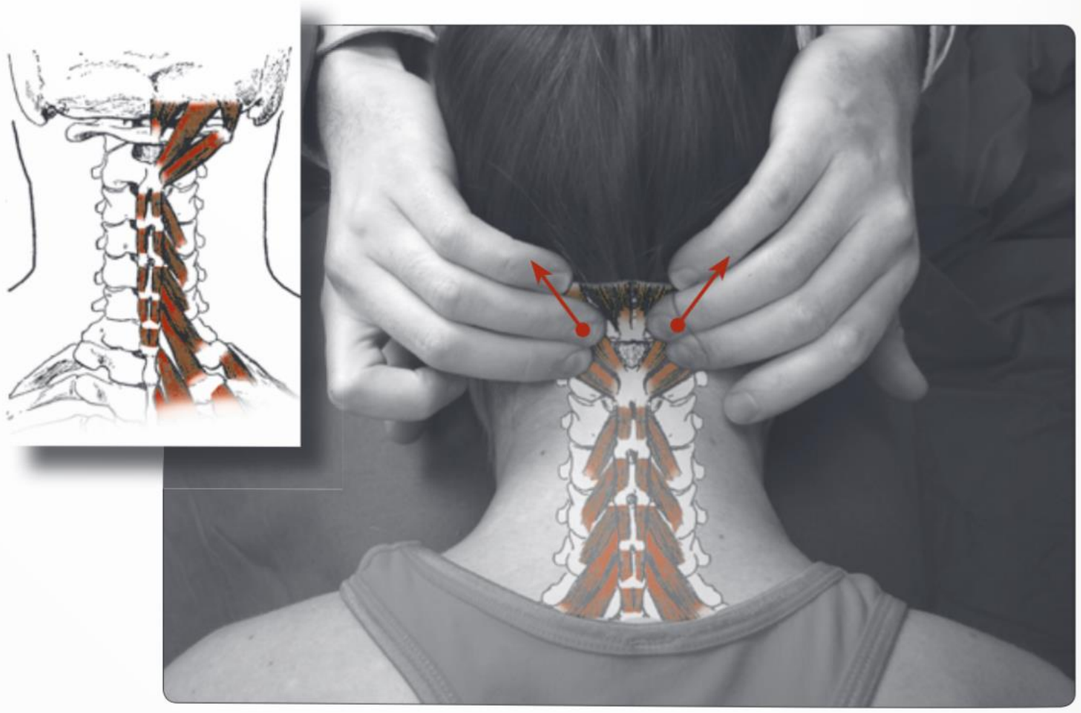
Palpation: No tenderness or masses are noted. Abdomen is soft. Spleen & kidneys are non palpable. Liver edge is located at the costal margin. Murphy's Punch Sign is negative.

☺ Below are some quotes, allegedly taken verbatim from the medical records of a general hospital in a large metropolitan area, try to avoid these statements in your own chart notes:

- Patient has been married twice, but denies any other serious illnesses
- Skin somewhat pale but present
- On the second day the knee was better & on the third day it had completely disappeared
- Patient has chest pain if she lies on her side for over a year
- She has had no rigors or shaking chills, but her husband states she was very hot in bed last night
- The patient has been depressed ever since she began seeing me in 1993 *(consider a referral ☺)*
- Patient's past medical history has been remarkably insignificant with only a 40 pound weight gain in the past three days
- Occasional, constant, infrequent headaches
- Both breasts are equal & reactive to light & accommodating
- Rectal exam revealed a normal size thyroid
- Exam of genitalia reveals that he is circus sized

Physical Exam Contents

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Diagnostic Physical Exam

The goal of physical diagnosis is the detection of abnormalities associated with disease, as it is critical to current & future decisions related to patient treatment & condition management. The techniques & skills required for a competent clinical examination are best learned through experience. However, before clinicians can deliver an intelligent clinical examination they must have a detailed understanding of normal & abnormal anatomy & physiology as well as "pattern recognition" of disease.

Clinicians performing physical exam procedures must realize that in most cases no one sign is of absolute significance in isolation, & each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important in diagnostic procedures that may result in so-called "soft" signs which are difficult to reproduce & have a large subjective bias in their interpretation. It is important to remember that there is a purpose to the physical exam & that most conditions can be solved by a careful history & examination.

The greater a clinician's knowledge base & understanding, the more likely the correct diagnosis will be made & appropriate care will be delivered. As human beings, clinicians have the greatest diagnostic tool available, the human body. Examining a patient uses the senses of sight (observation & inspection), touch (palpation), hearing (percussion & auscultation), smell & most importantly of all - thought (critical thinking).

During the examination here are some basic items to keep in mind:

- Be professional, prepared & competent
- Your voice should be clearly audible
- Use language appropriate to patient's level of understanding
- Communication between examiner & patient should flow easily
- Attend to patient comfort (always ask if they are comfortable or doing well)
- Try and have the patient change position as few times as possible (improves clinical efficiency)
- When possible, progress through the following patient positioning sequence, to avoid patient discomfort & improve examination efficiency:
  - **Standing**
  - **Seated**
  - **Supine**
  - **Sidelying**
  - **Prone**
- Rule out other pathologies in adjacent joints above & below or other areas that may refer symptoms

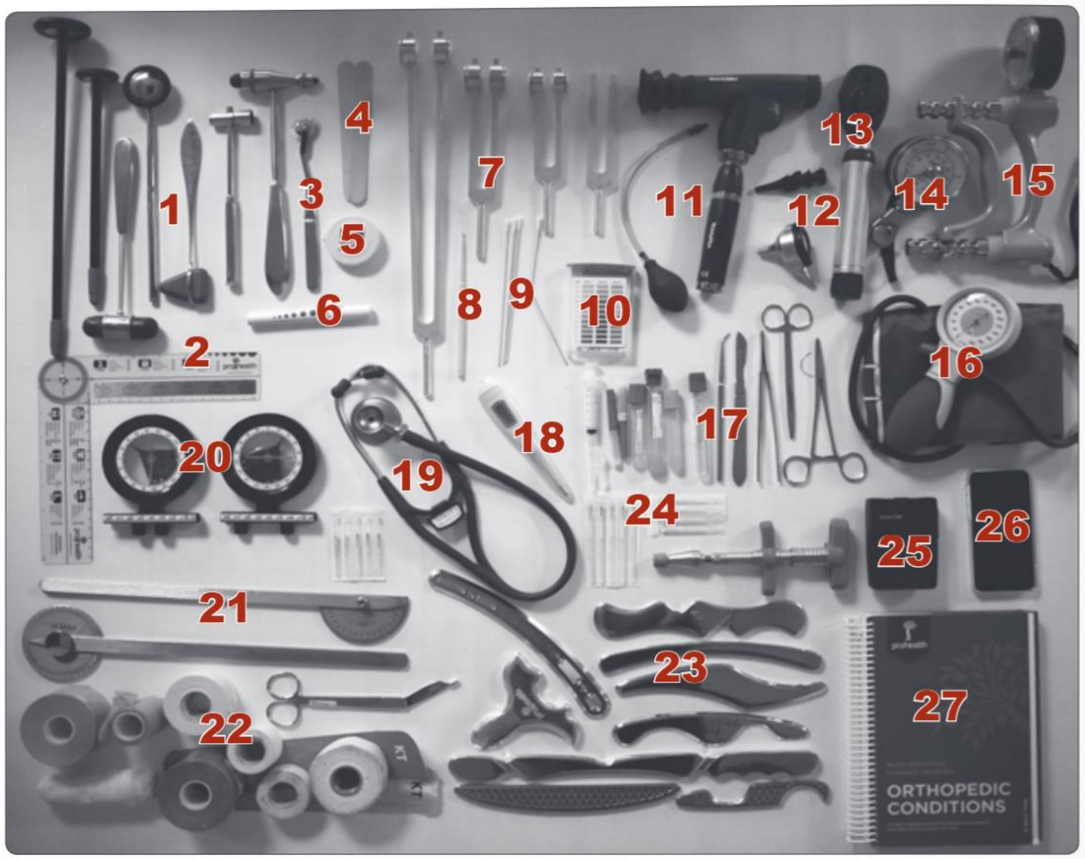
ProTip: Practice Building (patient education)

Unless a patient directly states they are not interested, their examiner should explain what procedures are being performed & why. Not only does this further establish the examiner as an expert in their field, but also helps to educate the patient with the specifics of their condition & gives them the potential to have a much more active role in their treatment plan.

This interaction will result in mutual respect & the formation of long term patient-clinician relationships.

All clinicians must realize that education & understanding are fundamental parts of healing. The word doctor is derived from the latin 'docēre' meaning 'to teach'

Diagnostic Equipment



Standard Clinical Examination Diagnostic Equipment

1. Reflex hammers (DTRs, Babinski)
2. Pain scale goniometer (with pupil gauge)
3. Safety pins (sharp/dull sensory exam)
4. Tongue depressors
5. Measuring tape (leg length, height, girth)
6. Pen light
7. Tuning forks (hearing & fracture screen)
8. Ear picks (removal of cerumen & debris)
9. Wooden Q-tips (corneal reflex, sharp dull)
10. pH strips (urinalysis)
11. Ophthalmoscope (fundiscopic exam)
12. Otoscope (with insufflation bulb)
13. Rhinoscope (nasal & throat exam)
14. Pinch gauge (pinch force measure)
15. Dynamometer (grip strength)
16. Sphygmomanometer (blood pressure cuff)
17. Minor surgery / blood draw kit
18. Thermometer
19. Stethoscope (heart, lung, abdomen exam)
20. Inclinometers (measure ROM)
21. Goniometers (peripheral joint ROM)
22. Assorted athletic tape & scissors
23. IASTM tools (myofascial, activator, etc.)
24. Acupuncture needles (TCM & dry needling)
25. TENS unit (electrostim. pain reduction)
26. Smart Phone (pre & post treatment posture changes, documentation of skin lesions, abuse, tissue damage, healing, etc.)
27. Any book, ebook, App or CE seminars written by Dr. Vizniak (absolutely crucial for any competent clinical practitioner ☺)

The picture & table above are an exact inventory of the contents of Dr. Vizniak's physical exam bag
(you do not need 7 reflex hammers - I just like hammers ☺)

Realize that prior education used in conjunction with a detailed history, inspection & palpation are your most useful diagnostic tools

General Physical Exam Flow

Below is a sample physical exam flow that can be used as a framework for individual clinicians to follow & develop their own specific exam. Detailed regional exam procedures are given through-out this chapter.

Vitals
- **Temperature (37° C / 98.6° F)**
- **Pulse (60-100 bpm)**
- **Respiration (12-20 bpm)**
- **BP bilaterally (<120/80 mmHg)**
- **Observe skin throughout exam**

Standing
- Height, weight, BMI
- Snellen chart (use back of this text)
- Observe posture & gait, heel walk, toe walk
- Spinal ROM (Adam's sign? pain? where?)

Seated (standing in front of patient)
- Inspection & palpate of head & neck

Cranial nerve exam:
1. Smell (I)
2. Peripheral vision (II)
3. Cardinal fields of gaze (III, IV, VI)
4. Accommodation (III)
5. Facial expression (VII)
6. Stick out tongue (XII)
7. Trapezius/SCM muscle test (XI)
8. Hearing (VIII) if (+): Webber, Rinne
9. Consensual light reflex (II, III)
10. Examine mouth & teeth
11. Say "ahhhh" (IX, X)
12. Bite (V)

- Otoscopic & rhinoscopic exam
- Ophthalmic exam

Neurologic exam upper extremity
Sensory:
- Light touch, sharp/dull (face/arms)
- Vibration (DIP, 3rd digit)

DTR
- Biceps (C5), brachioradialis (C6), triceps (C7)

Motor:
- Deltoid (C5, C6)(axillary)
- Brachioradialis (C5, C6) (radial)
- Biceps (C5, C6) (musculocutaneous)
- Triceps (C6, C7, C8, T1) (radial)
- Wrist extensors (C6, C7, C8) (radial)
- Wrist flexors (C6, C7) (median/ulnar)
- Finger flexors (C7, C8, T1) (ulnar/median)
- Interossei (C7, C8, T1) (ulnar)

Cervical orthopedics
- VBI screening test (Vizniak VBI)
- Muscle test neck (flex/ext. lat. flexion, rotation)
- Cervical compression/distraction
- TOS tests (if arm/hand symptoms present):

Thorax
- Percuss lung fields, check respiratory excursion
- Auscultate lungs, heart & carotid arteries
- Spinal percussion, Kemp's test
- Lumbar/thoracic/rib motion palpation

Supine (examiner stands/sits at side of table)
Abdominal exam: inspect, auscultate, percuss, palpate, abdominal strength, palpate inguinal lymph nodes

Supine (examiner stands at foot of table)
- Inspect feet, palpate temperature of feet
- Dorsal pedis & posterior tibial pulses
- Leg length evaluation
- Internal/external rotator muscle test

Neurologic exam lower extremity
Sensory
- Light touch, sharp/dull or pinwheel
- Vibration (DIP, 3rd digit), Babinski (L1 & above)

DTR
- Patella (L4), Hamstring (L5), Achilles (S1)

Motor
- Tibialis anterior (L4, L5) (deep peroneal)
- Extensor hallicus longus (L4-S1) (deep per.)
- Peroneus longus (L5, S1) (superficial peroneal)

Supine (examiner stands at side of table)
Low back/pelvis orthopedics
- Active SLR, double SLR, passive SLR
- Braggard, Goldthwaite (if there is back pain)
- Patrick FABER, Hip circumduction
- Thomas (with leg off the table)

Side Posture
- Active hip abduction, Ober's Test
- SI compression

Prone (examiner stands at foot of table)
- Internal/external rotation with knees bent
- Palpate for calf tenderness

Prone (examiner stands at side of table)
Palpate: hamstrings, TFL, glut max, glut medius, erector spinae, quadratus lumborum
- SI joint, PSIS/crest height
- Lumbar, thoracic spine & ribs

Follow-up procedures
- Urinalysis
- Blood draw/CBC
- Diagnostic imaging
- Genitourinary exam

General Physical Examination

Name:

Vital Signs: ☑ Check normal, circle & describe abnormal.

Pulse: L _____ R _____, Blood Pressure: L _____/_____, R _____/_____, Temp: _____, VBI: L _____ R _____,
Resp: _____/min, Visual acuity: L _____/_____, R _____/_____, Height: _____, Weight: _____

Observation: □ WNL

Development: □ good, □ fair, □ poor

- □ Posture: _____
- □ Gait: _____
- □ Skin (bruising, scars): _____
- □ Asymmetry: _____
- □ Other: _____

Range of motion: □ WNL

Cervical Spine	L	R
Flexion (45°)		
Extension (55°)		
Lateral flexion (45°)		
Rotation (70°)		

Lumbar Spine	L	R
Flexion (90°)		
Extension (30°)		
Lateral flexion (20°)		
Rotation (30°)		

Neurologic exam: □ WNL

Sensation □ WNL	L	R
Light touch		
Sharp/dull		
Vibration		

Reflexes (0-5) □ WNL	L	R
Biceps (C5)(musculocut.)		
Brachioradialis(C6)(radial)		
Triceps (C7)(radial)		
Patellar (L4)(femoral)		
Medial hamstring (L5)(sciatic)		
Achilles (S1)(tibial)		
Babinski		
Other:		

Motor (0-5) □ WNL	L	R
Resisted neck ROM (C1-C4)		
Shoulder elevation (CN XI, C3-C6)		
Shoulder abduction (C4-C6)		
Elbow flexion (C5-C6)		
Elbow extension (C6-C8)		
Wrist/finger flexion (C7-T1)		
Wrist/finger extension (C6-C8)		
Hip flexion (L1-L3)		
Knee extension (L2-L4)		
Knee flexion (L4-S1)		
Plantar flexion (L5-S2)		
Dorsiflexion (L4-L5)		
Other:		

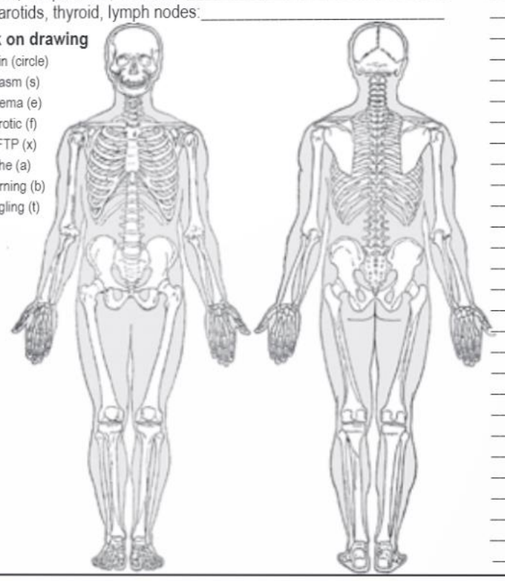
Cranial nerves □ WNL	
□ I (smell)	□ VII (facial expres)
□ II (light, vision)	□ VIII (Weber, Rinne)
□ III, IV, VI (gaze)	□ IX, X (ahhh)
□ V (bite, sensation)	□ XI (trap/SCM)
□ V, VII (corneal ref.)	□ XII (tongue)

Palpation: □ WNL

- □ Skin, temperature, moisture: _____
- □ Parotids, thyroid, lymph nodes: _____

Mark on drawing

- □ pain (circle)
- □ spasm (s)
- □ edema (e)
- □ fibrotic (f)
- □ MFTP (x)
- □ ache (a)
- □ burning (b)
- □ tingling (t)



Spinal Palpation

_____C0_____
_____C1_____
_____C2_____
_____C3_____
_____C4_____
_____C5_____
_____C6_____
_____C7_____
_____T1_____
_____T2_____
_____T3_____
_____T4_____
_____T5_____
_____T6_____
_____T7_____
_____T8_____
_____T9_____
_____T10_____
_____T11_____
_____T12_____
_____L1_____
_____L2_____
_____L3_____
_____L4_____
_____L5_____
_____S1_____
_____Co_____
_____SI_____

Orthopedic exam: □ WNL, □ other: _____

Functional □ WNL	L	R
Heel walk (L3, L4, L5)		
Toe walk (S1)		
Squat & rise		
Tandem Romberg		
Romberg		
Adam's Sign		
Other:		

Cervical □ WNL	L	R
Resisted muscle test		
Compression		
Maximal compression		
Distraction		
PROM		
Jull's (active flexion)		
Soto Hall/Brudinski		

Lumbar □ WNL	L	R
Kemp's test		
SLR passive, active		
Braggard's		
Patrick's (FABERE)		
Thomas/Gaenslen's		
Hip circumduction		
SI distraction/compression		

Additional exam procedures: □ WNL

- □ Auscultation (heart, lungs):
- □ Other:

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2015 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

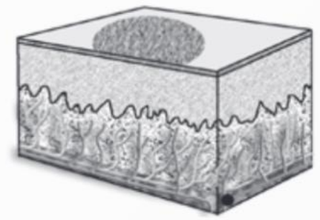
Signature: **Date:**

Free on-line Clinic Forms & Video of FULL PE available at **prohealthsys.com**

Inspection & palpation

- **Generalized changes:** pallor, cyanosis, rubor, jaundice, rashes, sores, texture, abrasions
- Danger signs with pigmented lesions (ABCD)
  - **A**symmetry, **B**order irregularity, **C**olor variation, **D**iameter > 6 mm
  - Skin cancer risk factors
    - History of childhood sunburns or excessive exposure to sun
    - Age > 50, fair skin, light hair (Irish & Scottish descent)
    - Presence of > 50 moles,
    - Family history of skin cancer
- **Symptoms:** pain, itching, bleeding, irritation, pruitis
- **Associated symptoms:** systemic disease, high fever, relation to stress, allergies
- **Location:** localized, generalized, skin folds, flexor or extensor surfaces
- **Apparent cause:** medication, contact dermatitis, contact with other individual with condition
- **Palpation:** tone, moisture, temperature, texture, mobility & turgor

Macule

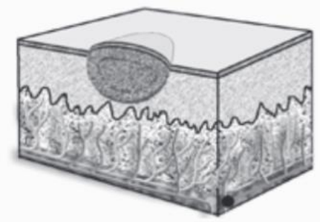


- Flat, circumscribed discoloration (only color change)
- Less than 1 cm diameter (> 1 cm = patch)
- Discoloration may be brown, blue, red or hypopigmented

Potential causes

- Brown - freckles, café-au-lait spot, lentigo, flat nevi
- Blue - tattoo, Mongolian spot, ochronosis
- Red - Still's disease (juvenile RA), rheumatic fever

Papule

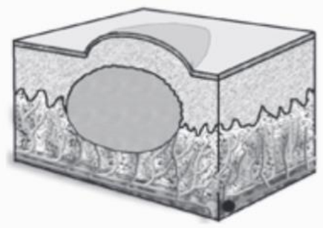


- Solid, elevated, circumscribed, superficial thickening of dermis
- Less than 1 cm diameter (> 1 cm = patch)
- May become continuous (plaque), color varies

Potential causes

- Brown - dermatofibroma, melanoma, nevi, seborrheic keratosis, warts (verruca), urticaria pigmentosum
- Red - acne, atopic dermatitis, cherry angioma, molluscum contagiosum, lichen planus

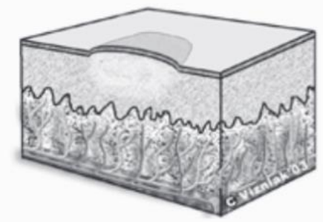
Nodule



- Solid, elevated, circumscribed lesion
- Less than 1 cm diameter (> 1 cm = tumor)
- May extend deeper into dermis, large nodule is referred to as a tumor

Potential causes: xanthoma, fibroma, interdermal nevi, basal cell carcinoma, hemangioma, lymphoma, squamous cell carcinoma, warts

Wheal/Urticaria

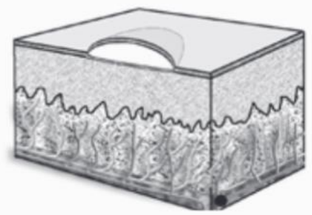


- Superficial, transient edematous (not free fluid)
- Synonyms: hive

Potential causes

- Mosquito bite, allergic reaction, dermographism, angioedema, hives, urticaria pigmentosa

Vesicle



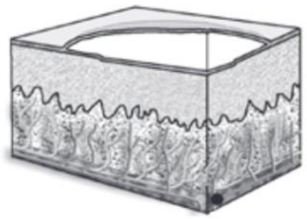
- Elevated, circumscribed, fluid-filled cavity
- < 1 cm diameter

Potential causes

- Pemphigus, contact dermatitis, scabies
- Early chicken-pox (vericella)
- Herpes simplex, herpes zoster (shingles)

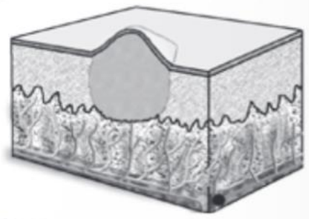
Bulla
- Large elevated, circumscribed, fluid-filled cavity
- > 1 cm diameter

Potential causes: friction blister, burns
- Contact dermatitis, pemphigus
- Lupus erythematosus



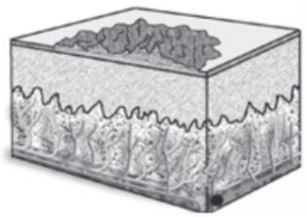
Pustule
- Elevated, turbid fluid (pus) filled
- Circumscribed lesion, vary in size

Potential causes: bacteria purulent infections
- Acne, candidiasis, chicken pox, folliculitis
- Herpes simplex, impetigo, scabies, herpes zoster



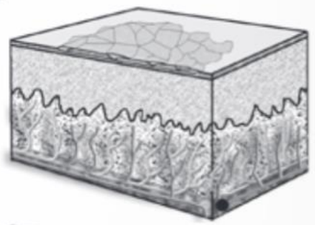
Crust (scab)
- Collection of serum & dried cellular debris
- Vary in color from red-brown, honey to yellow

Potential causes: scab following abrasion
- Impetigo, eczematous inflammation
- Pemphigus foliaceus



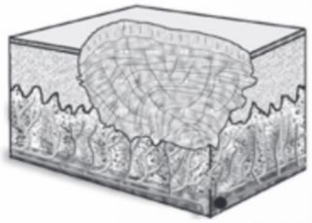
Scales
- Excess abnormal dried epidermal cells produced by abnormal keratinization & shedding

Potential causes
- Fine to stratified - psoriasis, ichthyosis, lupus, pityriasis, scarlet fever, tinea versicolor, xerosis
- Scaling in sheets - Kawasaki syndrome, toxic shock syndrome, Staph. scalded skin syndrome, eczema



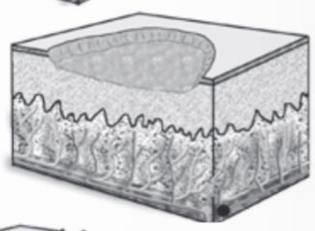
Ulcer
- Deep, scooped out lesion, involves dermis & epidermis
- Heal with scarring

Potential causes: stasis ulcer, chancre (syphilis), pressure sor
neoplasm, chancroid, ischemia, diabetes mellitus



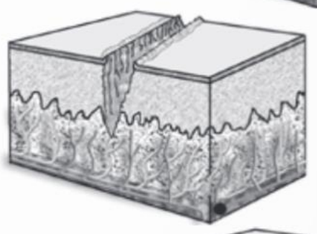
Erosion
- Shallow, scooped out lesion, restricted to epidermis
- Heal without scarring

Potential causes
- Superficial injuries (abrasion)
- Candidiasis, dermatophyte infection, eczema, herpes simplex, interigo
- Excoriations (self induced abrasion), insect bites, dermatitis



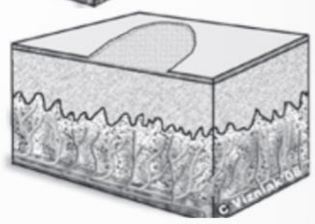
Fissure
- Linear crack with abrupt edges into dermis

Potential causes: chapping, interigo
- Cheilosis (vitamin B2 deficiency)
- Eczema, perteche



Atrophy
- Depression in skin due to thinning of epidermis

Potential causes: aging (elderly patients have thinner skin)
- Striae, dermatomyositis
- Lichen sclerosis et atrophicus
- Morphea, topical & intralesional steroids



Definition: evaluation of a person's body position and/or structure **standing & seated**; assessed in 4 positions. It is used for overall observation, gathering assessment information, monitor patient progress, noting positional changes. It may also be useful to observe a patient in a seated or work positions (especially office workers) or in the stance they spend most of their day (cashiers, machinist)

Procedure (patient is examined in their habitual, relaxed standing posture):
- ☐ Explain procedure to the patient - but do NOT use the word posture! - "I would like to observe how you normally stand" - "try and stand as relaxed as possible." - have them "shake it out" and stand
  - ☐ Observe body in 4 different positions (anterior, right lateral, left lateral, & posterior view)
- ☐ **Performed from the feet up to the head -** plumb line is suspended from the ceiling
  - ☐ Patient is best observed in shorts, underwear, swim suit or unitard ☺
  - ☐ Patients using orthotics should first be viewed with corrective devices in place, and then without (be sure to record type of device)

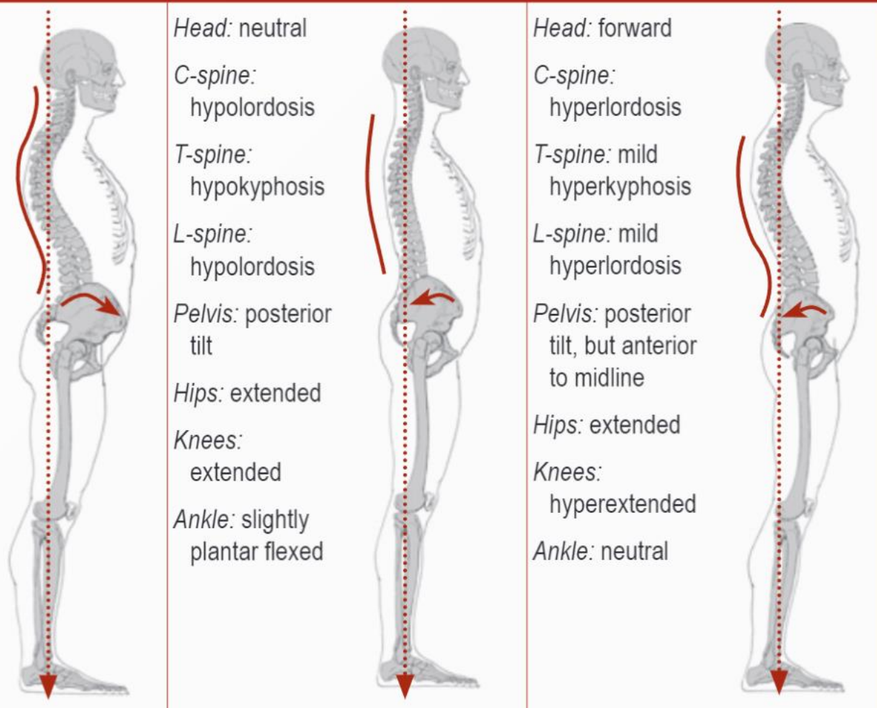
Common factors affecting posture:

Structural (bone)	Functional (myofascial)	
• Anatomical variation • Leg length discrepancy • Scoliosis • Age (osteoporosis) • Respiratory conditions	• Pain (pain avoidance) • Muscle spasm or weakness • Muscle imbalance • Ligament laxity or contracture • Fascial adhesion & scar tissue	• Joint subluxation or dysfunction • Neurovascular inhibition • Poor habits & excess weight • Shoes (heels, abnormal wear) • Peer pressure

Structural changes can cause functional compensation (myospasm, hypomobility or hypermoblilty)
Functional changes can lead to structural problems (instability & degeneration)

Common Posture Variations

Kyphotic-Lordotic	Flat Back (military spine)	Sway Back
Head: forward *C-spine:* hyperlordosis *T-spine:* hyperkyphosis *L-spine:* hyperlordosis *Pelvis:* anterior tilt *Hips:* flexed *Knees:* hyperextended *Ankle:* plantar flexed, legs are behind midline	*Head:* neutral *C-spine:* hypolordosis *T-spine:* hypokyphosis *L-spine:* hypolordosis *Pelvis:* posterior tilt *Hips:* extended *Knees:* extended *Ankle:* slightly plantar flexed	*Head:* forward *C-spine:* hyperlordosis *T-spine:* mild hyperkyphosis *L-spine:* mild hyperlordosis *Pelvis:* posterior tilt, but anterior to midline *Hips:* extended *Knees:* hyperextended *Ankle:* neutral



Clinical Tip: Use the prohealth posture/ROM poster grid for more accurate postural and AROM assessment - posture exam form and wall poster available at prohealthsys.com

Posture Assessment

Anterior View

Vertical Landmarks: pubic symphysis, umbilicus, xiphoid, suprasternal notch, nasal bones

Horizontal Landmarks

- ☐ Foot angle, arches, malleoli
- ☐ Fibular heads level
- ☐ Knees straight (varum/valgum)
- ☐ Patellae point straight ahead
- ☐ Level at symphysis pubis
- ☐ ASIS level
- ☐ Iliac crest level
- ☐ Palms (hands) face body in relaxed position
- ☐ Elbows carrying angle (5°-15°)
- ☐ Waist angles (equal, arms equal distance to waist, IR/ER)
- ☐ Ribs/sternum, clavicles/ AC Joint (level & symmetrical)
- ☐ Shoulders (level, normal for dominant side to be lower)
- ☐ Trapezius neck (slope on dominant may be greater)
- ☐ Nose (midline)
- ☐ Jaw (in resting position)
- ☐ Head (straight at midline, tilting, rotation)

Lateral View x 2

Vertical Landmarks:

- ☐ Anterior to lateral malleolus
- ☐ Fibular head
- ☐ Greater trochanter
- ☐ Acromium
- ☐ Bodies of cervical vertebra
- ☐ External auditory meatus/ tragus

Horizontal Landmarks

- ☐ Knees (slightly flexed 0-5°)
- ☐ Pelvic angle (normal male 0-10°, female 15-30°)
- ☐ Chest (pectus excavatum/ pectus carinatum)
- ☐ Muscles of abdomen
- ☐ Chest and back
- ☐ Shoulders (anterior rotation or military stance)
- ☐ Spine (normal spinal curvatures)
- ☐ Ear lobe - align with acromion and iliac crest other vertical landmarks

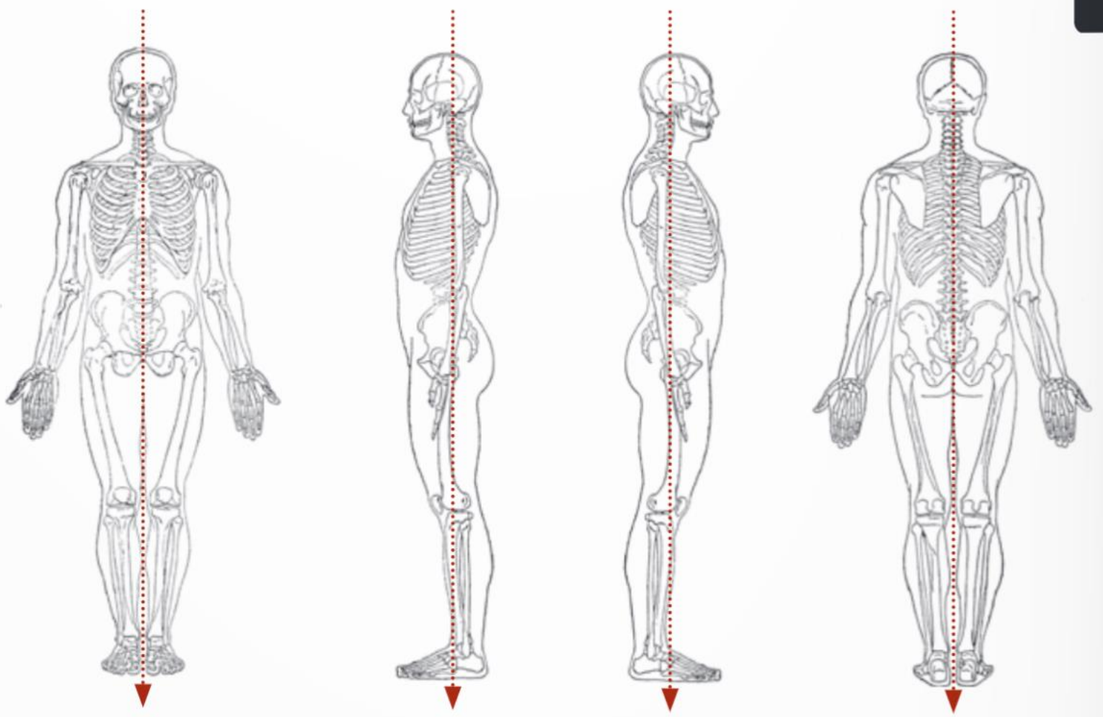
Posterior View

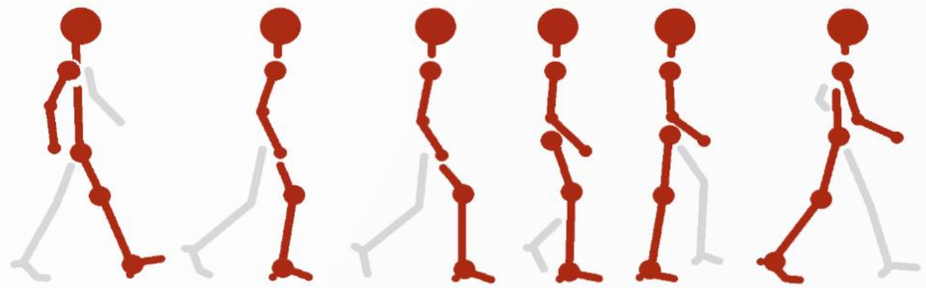
Vertical Landmarks:

- ☐ S2
- ☐ C7
- ☐ Inion (EOP)

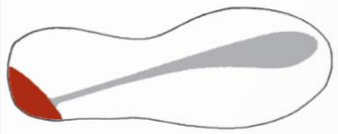
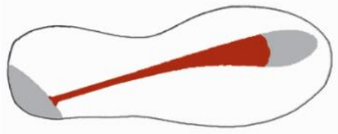
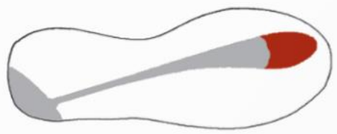
Horizontal Landmarks

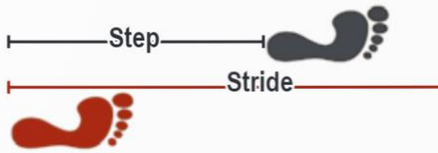
- ☐ Heels (straight, angled in/out)
- ☐ Achilles tendon (straight, angled in/out)
- ☐ Popliteal fossa levels
- ☐ Gluteal folds (level, symmetry)
- ☐ PSIS level
- ☐ Arms (equal distance from body)
- ☐ Waist angles (equal/level, equal distance from body)
- ☐ Ribs (protruding)
- ☐ Spine (straight, curved laterally)
- ☐ Scapulae (inferior angles level)
- ☐ Shoulders level
- ☐ Head (midline)





Stance Phase (60%)

Heel strike (~27%)	Midstance (~40%)	Take-off (~33%)
		
Initial contact: foot lands ~2° supinated & neutral to slightly dorsiflexed. Rapid ankle plantar flexion is controlled by leg muscles, especially tib. anterior	Begins with contralateral toe off & ends when the center of gravity is directly over the reference foot	Begins at contralateral initial contact & ends at toe off
Foot adapts to ground by pronating & collapsing of arches to absorb shock	**Momentum** carries body over fixed foot. COG over a single stance limb	COG anterior to stance limb
Forefoot strike: followed by rapid ankle dorsiflexion & pronation. Tibialis anterior eccentrically controls pronation, gastrosoleus controls dorsiflexion & absorbs shock	**Foot starts** fully pronated. It supinates through neutral & ends slightly supinated	**Preswing,** knee flexes ~35° & ankle plantar flexes ~20°
Loading response: knee flexes 15° while ankle plantar flexes ~15° (energy-conserving)	**Mid-foot:** with mid-foot pronation the ankle dorsiflexes	**Gastrosoleus** lift (plantar flexes) heel
Hamstrings & ankle dorsiflexors remain active; quads & glutes act during loading & midstance to maintain hip & knee stability	**Supination:** foot inverts, adducts & ankle dorsiflexes at mid tarsal & subtalar joints	**Tibialis posterior** rapidly inverts heel at start
Lower limb rotates internally, same hip adducts slightly & pelvis drops to opposite side. Controlled by gluteus med/min	**Concentric contractions** of gluteus maximus & quadriceps only with resistance (ie. hills/ wind)	**Supination** of foot is complete (rigid foot) - subtalar locks mid tarsals
	Terminal stance: begins when the center of gravity is over the supporting foot & ends when the contralateral foot contacts the ground	**Toes** passively extend (foot rolls like a wheel)
		Increase weight on larger 1st ray. Metatarsal break helps distribute weight to other toes
		Toe flexors eccentrically control toe extension aided by tension of the plantar fascia (Windlass effect)
		Fibularis longus & big toe flexors stabilizes 1st ray & transverse arch & plantar flex 1st metatarsal
		Thigh & leg extend & externally rotate

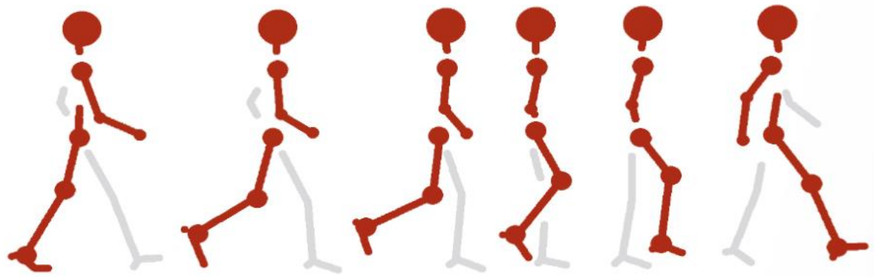


Gait analysis is simply the observation of moving posture

video of gaits at prohealthsys.com

Step = advancement of a single foot; **Stride** = advancement of both feet (one step by each side of your body)
Step length = longitudinal distance between 2 feet; **Stride length** = distance covered during 1 cycle = 2 step lengths
Velocity = stride length/cycle time (m/s); **Cadence** = steps /minute; **Double support** = both feet on ground
Float phase = neither foot is on the ground, COG = centre of gravity

Gait Cycle



Swing Phase (40%)

Initial swing	Mid swing	Terminal swing
Starts with toe off & continues until maximum knee flexion (~60°) occurs **Knee flexe**s, hip extends Completion of leg & thigh external rotation **Anterior thigh** (hip flexors) decelerate/ stop (eccentric contraction) Very little initial swing in walking, increases with increased speed	Change in direction, from maximum knee flexion until the tibia is vertical or perpendicular to the ground **Early:** hip flexors & quads 'whip' limb forward ('bowling ball effect') - concentric contraction **Late** (after swing limb crosses stance limb): hip extensors & knee flexors (glut max. & hamstrings) decelerate/ stop forward motion (eccentric contraction) **Dorsiflexors/ toe extensors:** hold foot dorsiflexed/ toes extended; otherwise accentuated hip/ knee flexion or toes drag on ground: 'foot drop' may also occur during foot strike **Internal hip rotators** (adductors) & hip capsule internally rotate hip	Change in direction, begins where the tibia is vertical & ends at initial contact **Hip & knee** extensors rapidly concentrically pull limb back to ground speed Amount of rotation affects foot orientation (toe-in or toe-out) during foot strike of next stance phase **Foot strike** = heel strike = end of swing phase

Note: during running stance phase decreases (~40%) & swing phase increases (~60%); the two periods of double support are replaced by periods of double float & stance time less than swing time

Selected Gaits	Description	Potential causes
Antalgic Limp	Stance phase shortened Very gentle foot contact in painful limb	Secondary to lower extremity injury/ pain avoidance
Knee Back Gait	Knee locked in hypertension during stance phase, places hand on thigh to assist	Quadriceps &/or gluteus maximus weakness
Hemiplegic	Swinging/circumduction of affected leg	Stroke; hip or knee disease, immobility, sacroiliac fusion
Scissors	Knees are pulling together & body swings laterally from the stepping limb	Cerebral palsy
Short Leg Limp	Limp may be disguised by pelvic tilt (try walking with one shoe on to simulate)	Congenital, post traumatic bone healing (especially femur)
Steppage/Foot Drop	Toe drop (slap): has to raise thigh of affected side excessively high to compensate	Disc herniation, compartment syndrome, peroneal neuritis
Trendelenberg Gait	Lurching gait with the pelvis tilting dramatically down during swing phase	Gluteus medius &/or minimus weakness or paralysis

Weight Gain & Loss DDx

Weight Gain

"Excess Fat is the new Smoking"

Weight gain of excess caloric intake
- Familial obesity
- Learned disorder
- Emotional hyperphagia: stress, depression, anxiety

Weight gain of fluid retention
- Nephritic syndrome
- Congestive heart failure
- Cirrhosis of liver
- Premenstrual edema
- Salt retaining medications: steroids, NSAIDS, lithium compounds

Weight gain of endocrine disorders
- Cushing's syndrome
- Hypothyroidism

Weight gain of pregnancy: normal physiological response

Obesity in children
- Consider endocrine & genetic disorders
- Familial obesity: learned disorder/patterning after parents
- Increasing rapidly (children, developing adult diseases, eg. Type II diabetes)

Physical findings
- "Normal" obesity usually evenly distributed
- Endocrine obesity usually has a pattern
- Cushing's - truncal obesity & buffalo hump
- Hypothyroidism - Increased weight, dry hair, decreased heart rate

Diagnosis
- Body fat distribution, BMI, waist circumference
- Biochemical profile with lipoproteins
- Thyroid function (TSH & Free T4)
- 24 hour Urine Free Cortisol (UFC)

Treatment
- Exercise & diet modification
- Counselling & lifestyle coaching
- Rule out other causes
- Medications or surgery in severe cases (many side effects)

Weight Loss

"Clinically, there is cause for concern when changes in body weight are not deliberate"

Non-deliberate weight loss: may indicate serious disease (carcinoma)

Mechanisms of weight loss
- Decreased caloric intake
- Accelerated metabolism (↑ calorie demand)
- Loss of calories in urine or stool

Endocrinological weight loss

Diabetes mellitus
- Initial weight loss due to osmotic diuresis
- Later weight loss due to tissue loss
- Loss of hormonal control & glucose through urine (losing calories)

Thyrotoxicosis: weight loss due to ↑ metabolic rate & ↑ motor activities

Addison's disease: ↓ cortisol resulting in decreased appetite

Gastrointestinal weight loss
- Fat malabsorption: sprue, chronic pancreatitis, cystic fibrosis
- Inflammatory bowel disease (IBS)
- Parasites, obstructive disorders

Infection associated weight loss (usually occult infection)
- Tuberculosis, systemic mycoses, parasitic infestation, AIDS

Malignancy associated weight loss

Most common cause of weight loss in the absence of major signs & symptoms

Mechanism of malignancy induced weight loss
- Anorexia, increased metabolic demand of cancer
- Side-effects of cancer therapy

Psychological associated weight loss
- Anorexia nervosa, Schizophrenia, conversion disorders, depression, severe addictions

Diagnostic tests
- CBC, urinalysis, ESR
- Biochemical profile
- Two-hour post-prandial glucose
- Thyroid function tests (TSH, free T4)
- Amylase & lipase (pancreas)
- Stool analysis

Overweight & Under Weight Health Issues

Over Weight	Under Weight
• Type 2 diabetes, insulin resistance • Dyslipidemia • Gall bladder disease • Obstructive sleep apnea & respiratory problems • Cardiovascular disease (e.g. coronary heart disease & ischemic stroke) • Hypertension • Osteoarthritis (↑ weight = ↑ stress on joints) • Certain cancers (breast, endometrial, colon, prostate & kidney) • Psychosocial problems (depression) • Functional limitations • Impaired fertility	• Under nutrition • Osteoporosis • Impaired fertility • Impaired immune function ** Underweight may be an indication of an eating disorder/ mental illness or other underlying illness*

Obesity Statistics

- Almost 50% of Canadians & ~70% of Americans over the age of 18 are overweight
- Inactivity in Canada is estimated to result in $1.45 billion/year in health-care costs (~15 billion in US)
- High blood pressure & stoke are twice as common in obese people
- Evidence is strong that obesity ↑ the risk of breast cancer (after menopause), uterine cancer & kidney cancer, & may also ↑ the risk of colon cancer
- Gall bladder disease is three times as likely to occur in middle-aged obese women
- Diabetes is four times more common in middle-aged obese people than in middle-aged people ~~mal~~ weight
- Coronary heart disease is twice as common in obese men under 45

Body Fat Content for Women & Men

Body Type	Female	Male
Athlete	<17%	<10%
Lean	17-22%	10-15%
Normal	22-25%	15-18%
Above Average	25-29%	18-20%
Over fat	29-35%	20-25%
Obese	35+%	25+%

Classification	Female	Male
Essential Fat	10-12%	2-4%
Athletes	14-20%	6-13%
Fitness	21-24%	14-17%
Acceptable	25-31%	18-25%
Obese	32+%	25+%

Table on the left are standard classifications from the WHO; table on the right is adapted from the American Council on Exercise

It is not the amount of fat a person has that matters, it is the amount of lean body mass they have in comparison to the fat!

Some very muscular people (body builder typically) fall outside of the BMI rating system, however for the general population it remains an excellent reference for risk associated with weight

The Body Mass Index is an index of weight to height (kg/m²) & is considered to be the most useful indicator of health risks associated with both overweight & underweight. However, the BMI does not provide an indication of the *distribution* of fat in the body & research has shown that excess fat in the abdominal area is associated with an increased risk to health.

WHO Health Risk Classification According to Body Mass Index (BMI)

BMI Category (kg/m²)	Classification	Risk of developing health problems
<18.5	Underweight	Increased
18.5 - 24.9	Normal Weight	Least
25.0 - 29.9	Overweight	Increased
30.0 - 34.9	Obese Class I	High
35.0 - 39.9	Obese Class II	Very high
≥40.0	Obese Class III	Extremely high

For use with adults age 18 & older. Not for use with pregnant & lactating women. *For persons 65 years & older the 'normal' range may begin slightly above BMI 18.5 & extend into the 'overweight' range.* In general, the higher the BMI the greater the risk to health. Adapted from: World Health Organization. *Obesity: Preventing & Managing the Global Epidemic: Report of a WHO Consultation on Obesity*. Geneva: WHO, 2008.

BMI less than 18.5 - Underweight

- Indication of increased health risk (under nutrition, osteoporosis, eating disorders)
- Underweight may also be due to the effects of unrecognized underlying disease
- Seniors (age 65 & over), a BMI in the low 20's suggests need for further health assessment
- For young adults who have not reached full growth or for adults who naturally have a very lean body build, a BMI somewhat less than 18.5 is not necessarily an indication of health problems

BMI 18.5 to 24.9 - Normal weight

- Population-wide studies have shown a "normal" BMI to be associated with the lowest relative risk of morbidity & mortality
- It should be noted that the entire range of BMIs in the "normal weight" category are indicative of low risk & the lower end of the range should not be viewed as the target weight

BMI 25.0 to 29.9 - Overweight

- Evidence from population-wide studies show that the relative risk of mortality begins to ↑ at a BMI of 25.0
- Risk ↑ gradually as BMIs ↑ from 25 to 29.9
- BMI does not distinguish fat vs. lean mass (individuals with a very muscular body build may have BMIs in this range but without a body fat level associated with health risk)
- Seniors (age 65 & over), evidence suggests that their relative risk of mortality begins to ↑ only in the upper levels of the overweight range

BMI 30 & over - Obese

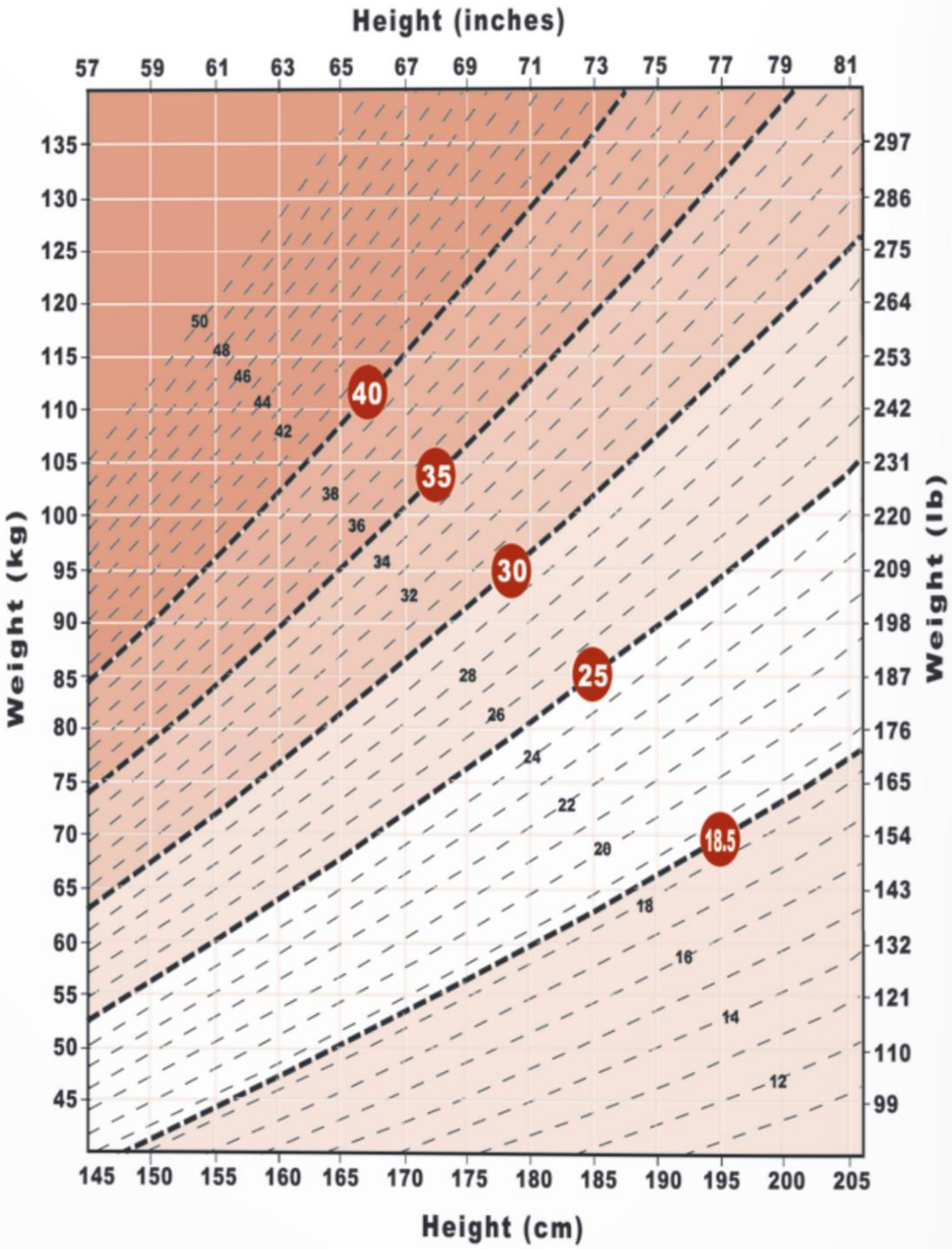
- The relative risk of mortality begins to rise more sharply at a BMI of 30
- See table for classifications of obesity (Class I, II, III)

Body Mass Index

$$BMI = \frac{\text{Weight in Kilograms}}{(\text{Height in Meters}) \times (\text{Height in Meters})}$$

$$BMI = \frac{\text{Weight in Kilograms}}{(\text{Height in centimeters}) \times (\text{Height in centimeters})} \times 10{,}000$$

$$BMI = \frac{\text{Weight in Pounds}}{(\text{Height in inches}) \times (\text{Height in inches})} \times 703$$



Waist Circumference

The measurement of waist circumference (WC) provides a simple & practical method for estimating abdominal fat & is an independent indicator of health problems associated with abdominal obesity. WC is measured at the part of the trunk located midway between the lower costal margin (bottom of lower rib) & the iliac crest (top of pelvic bone) while the person is standing, with feet about 25-30 cm apart (10-12 in). The examiner should stand beside the individual & fit the tape snugly, without compressing any underlying soft tissues. The circumference should be measured to the nearest 0.5 cm (1/4 in), at the end of a normal expiration. Examiner may also choose to do a hip to waist ratio measurement to check fat distribution.

Health Risk Classification According to Waist Circumference (WC)

WC Cut-Off Points	Health Risk (relative to WC below cut-off point)
Men ≥ 102 cm (40 in.) **Women ≥ 88 cm (35 in.)**	Increased risk of developing disorders such as type 2 diabetes, coronary heart disease & hypertension

For BMIs in the 18.5 - 34.9 range, use WC as an additional indicator of health risk. For BMIs ≥35, WC measurement does not provide additional information regarding level of risk. For use among adults age 18 & older. Not for use with pregnant & lactating women. Adapted from: World Health Organization. (2000). Obesity: Preventing & Managing the Global Epidemic: Report of a WHO Consultation on Obesity. Geneva: WHO, page 9

Waist To Hip Ratio

- Distribution of fat around the body differs for both men & women
- Men tend to store fat in the upper body i.e. the abdomen (android obesity or “apple shaped”)
- Women tend to store fat around the lower regions i.e. the hips (gynoid type or “pear shaped”)
- Waist to hip ratio (WHR) is used as an indicator of obesity & the risk associated with it
- Measure patient’s waist at the point of the navel while the measurement of the hips is done at the broadest part (see picture below)

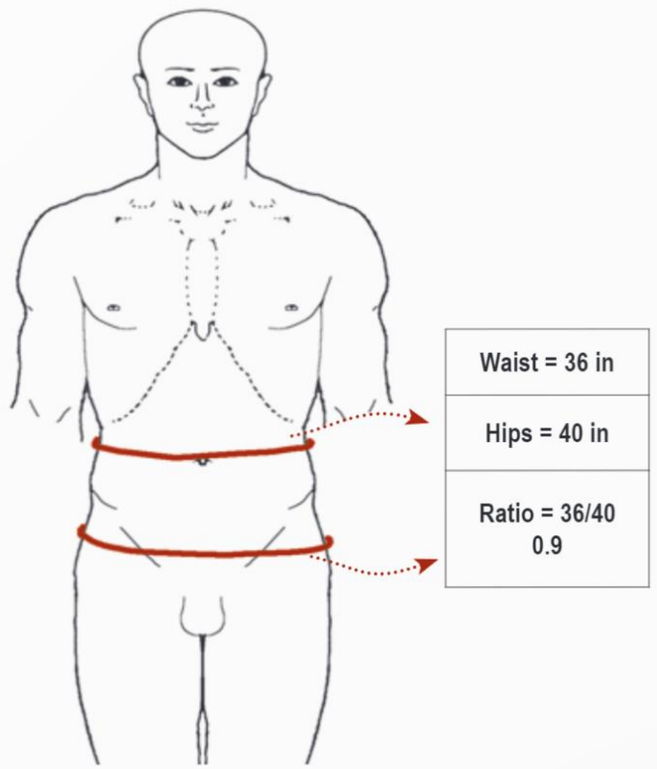
Measurement of Waist ÷ Hips

Indicate obesity & risk of disorders such as diabetes, hypertension & heart diseases

Waist to Hip Ratio =

≥ 0.9 men

≥ 0.85 women



Waist = 36 in
Hips = 40 in
Ratio = 36/40 **0.9**

Health risk* classification according to Body Mass Index (BMI) & Waist Circumference (WC)

		Body Mass Index (BMI)		
		Normal	Overweight	Obese Class I
Waist Circumference (WC)	< 102 cm (Males) < 88 cm (Females)	Least risk	Increased risk	High risk
	≥ 102 cm (Males) ≥ 88 cm (Females)	Increased risk	High risk	Very high risk

*Risk is relative to normal BMI & a waist circumference of < 102 cm (40 in.) for males & < 88 cm (35 in.) for females. Level of health risk refers to *relative* risk, that is, the risk of developing health problems in those with abnormal levels or distribution of body fat, as measured by BMI or WC, compared to those in a normal range. It is important to note that the risk for an individual will be influenced by a unique combination of factors that must be considered in addition to BMI and/or WC. It is also important to note that BMI does not reflect weight history. Recent weight gains or weight losses may be associated with health risks independent of BMI categorization & require assessment in individuals.

Adapted from: National Institutes of Health, National Heart, Lung, & Blood Institute. (1998). Clinical Guidelines on the Identification, Evaluation, & Treatment of Overweight & Obesity in Adults: The Evidence Report. Washington, DC: NIH, page 17

WHO Classification of Overweight & Obesity in Adults According to BMI*

BMI	Classification	Risk of Health Issues
< 18.50	Underweight	Low (but risk of other clinical problems Increased)
18.50-24.99	Normal range	Average
25.00-29.99	Pre obese	Increased
30.00-34.99	Obese class I	Moderate
35.00-39.99	Obese class II	Severe
≥ 40.00	Obese class III	Very severe

*These BMI values are age-independent & the same for both sexes. However, BMI may not correspond to the same degree of fatness in different populations due to differences in body proportions. The table shows a simplistic relationship between BMI & the risk of comorbidity, which can be affected by a range of factors, including the nature of the diet, ethnic group & activity level. The risks associated with increasing BMI are continuous & graded & begin at a BMI below 25. The interpretation of BMI grade in relation to risk may differ for different populations. Both BMI & a measure of fat distribution (waist circumference or waist:hip ratio (WHR)) are important in calculating the risk of obesity comorbidities.

Source: Canadian Guidelines for Body Weight Classification in Adults, Health Canada, 2003 Reproduced with the permission of the Minister of Public Works & Government Services Canada, 2008.

Body Frame Size Calculation

- □ Flex patient's arm in front of body (shoulder flexed 90º), flex patient's elbow 90º, with forearm supinated (palm of hand facing patient)
- □ Place thumb & index finger on the medial & lateral epicondyles of the humerus, then measure the distance between the bones with a tape measure or calipers (recommended)
- □ Compare to the charts below for a medium frame
  1. If patient's elbow measurement for their height is less than the number of inches listed, patient has a small frame
  2. If patient's elbow measurement for their height is more than the number of inches listed, patient has a large frame

Female: Elbow Measurements for a Medium Frame

Height	Elbow Breadth
4'10"-4'11"	2¼"-2½"
5'0"-5'3"	2¼"-2½"
5'4"-5'7"	2⅜"-2⅝"
5'8"-5'11"	2⅜"-2⅝"
6'0"	2½"-2¾"

Male: Elbow Measurements for a Medium Frame

Height	Elbow Breadth
5'2"-5'3"	2½"-2⅞"
5'4"-5'7"	2⅝"-2⅞"
5'8"-5'11"	2¾"-3"
6'0"-6'3"	2¾"-3⅛"
6'4"	2⅞"-3¼"

Conversions - 1" = 2.54 cm; 1 lbs = 0.45 kg

Height Weight Chart for Seniors

Height feet / inches	Weight in Pounds
4' 8"	84 - 124
4' 9"	87 - 129
4' 10"	90 - 133
4' 11"	93 - 138
5' 0"	96 - 143
5' 1"	99 - 147
5' 2"	102 - 152
5' 3"	106 - 157
5' 4"	109 - 162
5' 5"	113 - 167
5' 6"	116 - 172
5' 7"	120 - 178
5' 8"	123 - 183
5' 9"	127 - 188
5' 10"	130 - 194
5' 11"	134 - 200
6' 0"	138 - 205
6' 1"	142 - 211
6' 2"	146 - 216
6' 3"	150 - 222
6' 4"	154 - 229
6' 5"	158 - 235
6' 6"	162 - 241
6' 7"	166 - 247
6' 8"	170 - 254

Research studies show it is much better to be *slightly* overweight & healthy through exercise, than it is to be an "ideal" weight but sedentary; the best option is to have an active lifestyle & eat a balanced healthy diet.

'Ideal' Height Weight Tables

Height		Men		Women	
Feet & Inches	Metres	Kilograms (kg)	Pounds (lbs)	Kilograms (kg)	Pounds (lbs)
4'7"	1.40	...	...	40 - 57	88 - 126
4'9"	1.45	...	...	42 - 58	92 - 129
4'10"	1.50	...	...	43 - 59	94 - 131
4'11"	1.52	48 - 65	105 - 144	44 - 60	97 - 133
5'0"	1.54	49 - 66	108 - 147	44 - 61	97 - 135
5'1"	1.56	50 - 67	110 - 149	45 - 62	99 - 137
5'2"	1.58	51 - 68	112 - 151	46 - 64	101 - 140
5'3"	1.60	52 - 69	114 - 153	48 - 66	105 - 144
5'3½"	1.61	53 - 70	116 - 155	49 - 67	108 - 146
5'4"	1.64	54 - 71	119 - 157	50 - 69	110 - 151
5'5"	1.66	55 - 73	121 - 162	51 - 70	112 - 153
5'6"	1.68	56 - 75	123 - 166	52 - 71	114 - 155
5'7"	1.70	58 - 78	127 - 170	53 - 72	116 - 157
5'7½"	1.71	59 - 79	130 - 173	55 - 74	121 - 162
5'8"	1.74	60 - 80	132 - 175	56 - 75	123 - 164
5'9"	1.76	62 - 82	136 - 179	58 - 76	127 - 168
5'10"	1.78	64 - 84	141 - 184	59 - 78	130 - 173
5'10½"	1.79	65 - 85	143 - 186	60 - 79	132 - 174
5'11"	1.82	66 - 87	145 - 190	61 - 80	135 - 176
6'0"	1.84	67 - 89	147 - 195	63 - 82	138 - 181
6'1"	1.86	69 - 91	152 - 199	65 - 85	143 - 188
6'2"	1.88	71 - 93	156 - 204	68 - 87	149 - 192
6'2½"	1.90	73 - 95	160 - 208	...	...
6'3"	1.91	75 - 97	165 - 212	...	...
6'4"	1.93	77 - 100	169 - 220	...	...

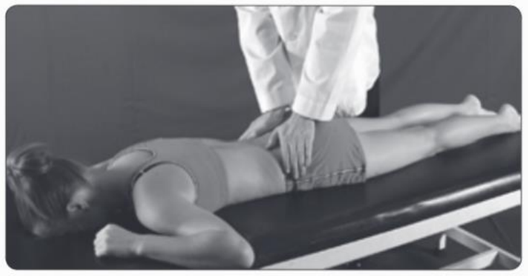
Weights at ages 25-59 **based on lowest mortality**, weight in pounds according to frame (calculation shown on next page - small frame should be at the lower end of the range & large frame should be at the upper end of the range for a given height), wearing indoor clothing weighing 5 lbs.; shoes with 1" heels. Adapted from: Met Life Insurance. Harrison GG, Height-weight tables. Ann Intern Med 1985; 103:489-94. Pai MP, Paloucek FP, The origin of the "Ideal" body weight equations. Ann Pharmacol 2000; 34:1066-69

Palpation

Specific palpation techniques for individual joints & regions are discussed in their respective chapter; always compare bilateral structures during palpation

General Palpation

- ***Definition:*** application of manual pressure to determine abnormalities (tenderness, tone, texture, pain, shape, size, pulsations, masses, position, tissue mobility & temperature)
- Excellent physical palpation skills demand hours of practice & direct mental concentration (do not palpate casually)
- Use the least amount of pressure possible (touch receptors respond best to light touch)
- Use a broad or flat contact whenever possible
- Closing your eyes may increase your palpatory sense
- Develop a palpation routine that is standard for you & apply it to all patients
- Numerous studies show excellent interexaminer reliability for the palpation of bony & soft tissue tenderness (palpation is one of the best tools a clinician can use)



Soft Tissue Palpation

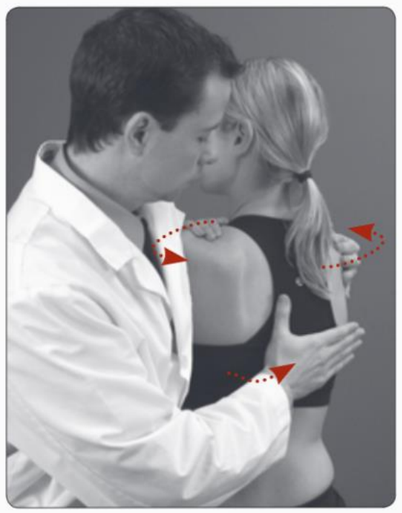
- Dermal layer (skin): palpation & assessment of temperature, texture, motility, tissue sensitivity (temperature assessment use back of hand - more sensitive to heat)
- Subcutaneous & deeper layers (muscle): palpation & assessment of texture, motility, tissue sensitivity, flexibility, muscle tenderness, trigger points, lymph nodes, myospasm, guarding or splinting, edema, asymmetry & muscle imbalance from side to side

Bony Palpation

- **Purpose:** location of landmarks, assess contours for tenderness or anomalies
- Procedure: generally palmar surface of fingers (most sensitive to touch)
- Bony tenderness may result from: joint dysfunction, direct trauma, fractures, bone infection, neoplasms, or osteoporosis

Motion Palpation

- ***Definition:*** use of hands to assess joint motion (may be active or passive)
- Requires detailed understanding of functional anatomy, biomechanics, pathomechanics
- Each joint has unique patterns & ROM
- Purpose: assessment of motion quality, quantity, end feel, joint play & symptoms that may occur
- Motion should be performed slowly & smoothly; compare results bilaterally
- Be sure to palpate both bones on either side of the joint & joint space if possible
- Ensure the patient is comfortable & relaxed



It is important to always use a well understood pain scale during any physical assessment or treatment (palpation, massage, stretching, muscle energy technique, myofascial release, etc). The pain scale should be established at the beginning of each treatment (even if you have treated the patient, they may not always remember).

Keep in mind that telling the patient the pain scale doesn't mean that they will use it. Sometimes people feel like they should be able to deal with the pain, or they are too modest to tell you that they are in pain. Therefore, it is imperative that you not only use the pain scale and always check in with them but also watch their body language and facial expressions.

Subjective Pain Scale (verbal pain scale rating from 0-10)

Descriptive Pain Intensity Scale



Subjective Tenderness/Pain Scale for use with Palpation/Massage

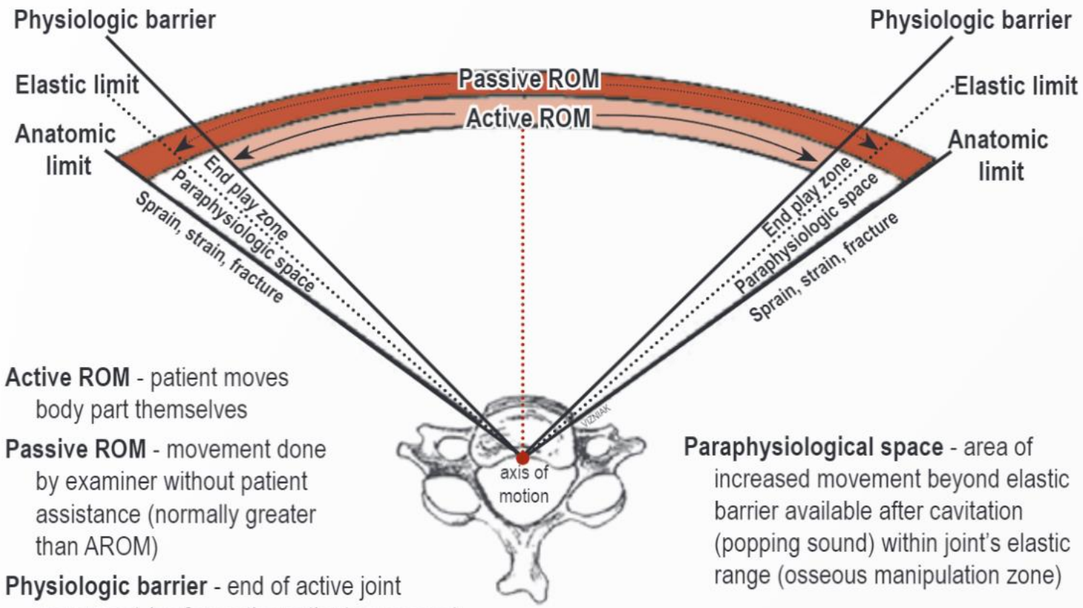
Grade	Description
1	"Feel the pressure of my hand"
2	"A little pressure, but feels comfortable"
3	"Pressure, but is a good pain"
4	"Considerable pressure that is painful but you can breathe through it"
5	"STOP" - the pressure is too much & no longer tolerable beyond

Objective Soft Tissue Tenderness/Pain Scale

Grade	Description
0	No tenderness
1	Tenderness with no physical response
2	Tenderness with grimace and/or flinch
3	Tenderness with withdrawal (= jump sign)
4	Withdrawal from non-noxious stimuli (eg. light palpation)

Consistent pressure needs to be applied by the clinician - pressure should be just enough to blanch fingernail capillary bed - chart as a rating out of 4; e.g.; 0/4, 3/4, 2/4, 1/4, 0/4

The purpose of ROM assessment is to establish a patient baseline of ability (outcome marker) & locate potential dysfunction generators (muscles activated, tissue stretched, joint malposition)



Active ROM - patient moves body part themselves

Passive ROM - movement done by examiner without patient assistance (normally greater than AROM)

Physiologic barrier - end of active joint movement (as far as the patient can move)

Paraphysiological space - area of increased movement beyond elastic barrier available after cavitation (popping sound) within joint's elastic range (osseous manipulation zone)

Elastic limit - elastic resistance that is felt at end of passive range of movement; further motion towards anatomic barrier may be induced passively by examiner

Anatomic limit - limit of anatomical integrity; limit of motion imposed by anatomic structures; forcing movement beyond this barrier will produce tissue damage (sprain/strain/fracture)

Joint play - discrete, short-range movements of a joint independent of action of voluntary muscles, determined by springing each joint in neutral position

End Play (end feel) or Passive Over Pressure (POP) - discrete, short-range movements of a joint independent of action of voluntary muscles ***at the end or start of PROM***

- **Full ROM without pain → normal finding**
- **Full ROM with pain → minor sprain**
- **Hypomobility without pain → tissue contracture, adhesions or joint dysfunction**
- **Hypomobility with pain → acute sprain with possible muscle guarding or joint dysfunction**
- **Hypermobility without pain → complete ligament rupture**
- **Hypermobility with pain → partial ligament tear or sprain (intact fibers are being stressed)**

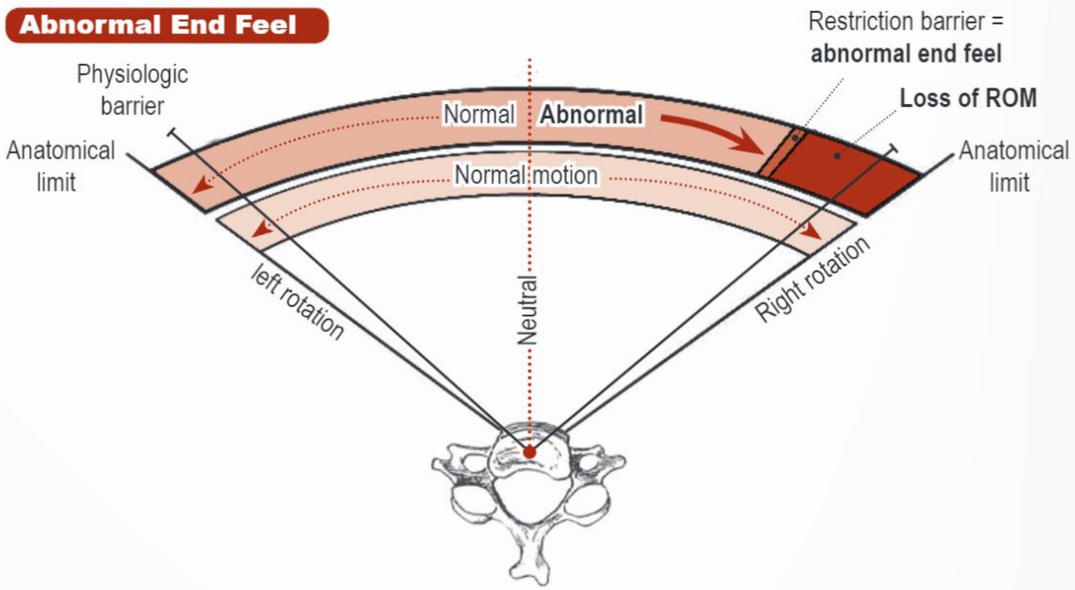
Types of Hypermobility (instability)				
Generalized	**Segmental**	**Functional**	**Structural**	**Surgical**
Multiple joints	"Dysfunction"	Programming	Ligamentous damage	
May be genetic	Compensatory	Unstable mid-range	Unstable end-range	Very unstable
Significance? May be normal anatomical variation	***Reversible*** Hypomobile segments around hypermobile segments respond well to manipulation	***Chronic/recurrent,*** Muscle imbalance - requires conditioning & proprioceptive retraining	***Difficult to reverse*** (require long term therapy & rehab.)	***Surgery*** e.g. Grade III sprain, spondylolisthesis
No major structural damage →	mild damage →	moderate damage →	serious damage	

With the exceptions of anatomical variation, trauma & inflammatory arthropathies, joint motion pathologies are most commonly a function of soft tissue changes & compensations resulting in alterations of normal biomechanical function

End Play (end feel) Types

	End Play	Definition (example)
Normal	Tissue stretch	Near end ROM hard/firm type of movement limited by tension in muscles & fascia (e.g. cervical lateral flexion)
	Soft tissue approximation	Squeezing quality, near end ROM where soft tissue compression prevents further motion (e.g. elbow flexion)
	Ligamentous	Hard, firm, painless end ROM, limited by tension in ligaments (e.g. normal knee extension)
	Bone to bone	Hard, non-giving, painless end ROM (e.g. elbow extension)
Abnormal (Pathologic)	Bone to bone	Painful, hard end feel (osteophyte formation, ankylosis - fusion)
	Muscle spasm	Guarded or splinting feel caused by movement reduction secondary to reactive myospasm to protect the injured tissue (instability or trauma)
	Capsular	Firm, decreased ROM accompanied with pain, but not myospasm, synonym: "boggy" end feel (edema, adhesions, synovitis, adhesive capsulitis)
	Springy block	Bouncing or springy, seen in joints with menisci (knee mainly), associated rebound effect (internal derangement, meniscal tears)
	Empty	Lack of normal end ROM resistance, usually associated with an increase ROM (instability, hypermobility, ligament rupture)

Abnormal End Feel



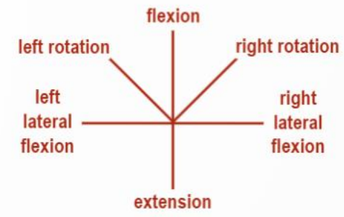
Schematic showing direction a joint or surrounding muscles & soft tissue can move towards a restriction barrier (abnormal end-feel) or towards a position of relative ease (normal). Osseous manipulation and/or soft tissue techniques may be applied to correct this fault.

Free sample charts for all body region can be downloaded from www.prohealthsys.com

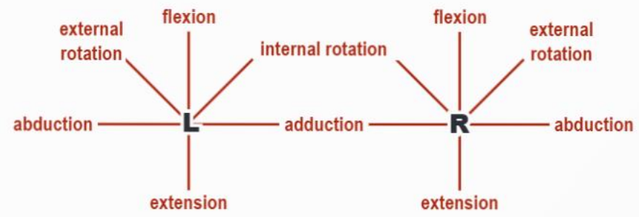
Charting ROM Findings

Star Diagram: used to record AROM & PROM information in an efficient format

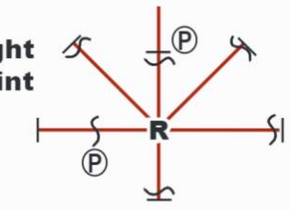
Spinal Joint



Peripheral Joint



Example Right Shoulder Joint



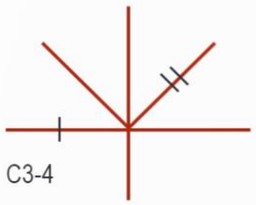
Ⓟ= pain
⟆= AROM
| = PROM

Text version equivalent

- Shoulder flexion both active & passive is limited to ~50% (~90°) into flexion
- Shoulder active adduction is limited to ~50% (~15°) into adduction
- All other ROM is WNL (AROM < PROM)

- Each line represents 100% motion in that direction, therefore a mark half way on a line indicates 50% ROM ability; examiner should record any pain, abnormal movements or clunks & location within ROM
- Hypermobility would be noted as greater than 100% ROM (off the end of the line representing motion)

Charting Spinal Listings

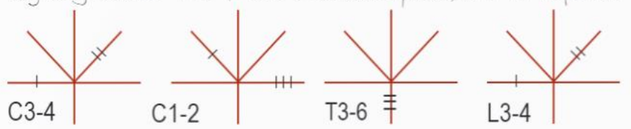


- **The star diagram may be modified to show spinal joint listings (restriction or malposition depending on clinician preference)**
- **| = mild, || = moderated, ||| = marked**
- **Example demonstrates a C3-4 moderate right rotation, mild left lateral flexion restriction**

Sample SOAP note

S "neck is feeling much better", ↓ HA frequency (1 in 2 weeks), pain scale = 1/10

O tight & tender +1/4 R >L suboccipital, MFTP referral over right eye



PI right ilium
Superior left navicular

A hot pack (15 min) posterior cervical spine & upper shoulders, myofascial release of sub-occipitals region, stretch of upper trapezius & splenius, osseous manipulation of above motion restrictions

P ↓ Pain following Tx, continue home stretching, ↑ H_2O intake. return: 1 wk

Signature: Dr. Emma Wroids Date: 05/07/16

Muscle Testing

An accurate & objective measurement of muscle strength is useful for many reasons:

- **Neurologic screen** - assessment of muscle strength also assesses motor nerve function
- **Diagnostic aid** - helps clinician identify specific muscles that are weak or damaged
- **Therapeutic aid** - creates an objective measure of progress through a treatment plan & allows the patient to witness the effect & necessity of treatment

Manual Muscle Testing

Static Manual Muscle Tests (MMT or RROM) or 'Break Tests' are isometric contraction tests designed for specific muscle; they are easy to quantify & much more efficient to perform clinically

- Patient is positioned in optimum posture (attempt to eliminate action of other synergistic muscles)
- **Clinician states '*Don't let me move you*' or '*resist my force*' & demonstrates motion to be resisted**
- Ask patient to hold position & relax when test is done ("hold, hold, hold, & relax")
  - Typically patient holds position for 3-5 seconds
  - **If there is a high index of suspicion of muscle damage or neurologic compromise then...**
    - Hold for 5-10 seconds or,
    - Repeat for up to 10 repetitions (e.g. chart as 3/5 at 8x) or,
    - Test at multiple angles through ROM, and through eccentric, concentric, isometric contractions
- Joint should only be moved ~5° or through ~5% of range of motion at most - little or no motion is better
  - Common error is to move joint too much, thereby testing many different muscles & joint capsule
  - Consider testing in positions or actions that cause patient mild discomfort to help get a true sense of specific limitations & actual muscle damage
  - Compare results bilaterally & keep in mind dominant vs. non-dominant extremity
- Examiner must remember to use good ergonomics & biomechanics

Muscle Testing Scale

Grade		%	Definition
5	Normal	100%	Patient can maintain position against gravity & against *full* examiner-applied resistance
4	Good*	75%	Patient can maintain position against gravity & against *minimal* examiner-applied resistance
3	Fair*	50%	Movement against gravity but not against examiner's resistance
2	Poor*	25%	Movement possible, not against gravity
1	Trace	~5%	Evidence of slight contractility; *little* or *no joint motion*
0	Zero	0%	No palpable or perceivable evidence of contractility (*flaccid*)

% = % normal strength, ROM = range of motion, *Pain, muscle spasm or contracture may limit strength or ROM
Chart as a rating out of 5; e.g.; 5/5, 4/5, 3/5, 2/5, 1/5, 0/5

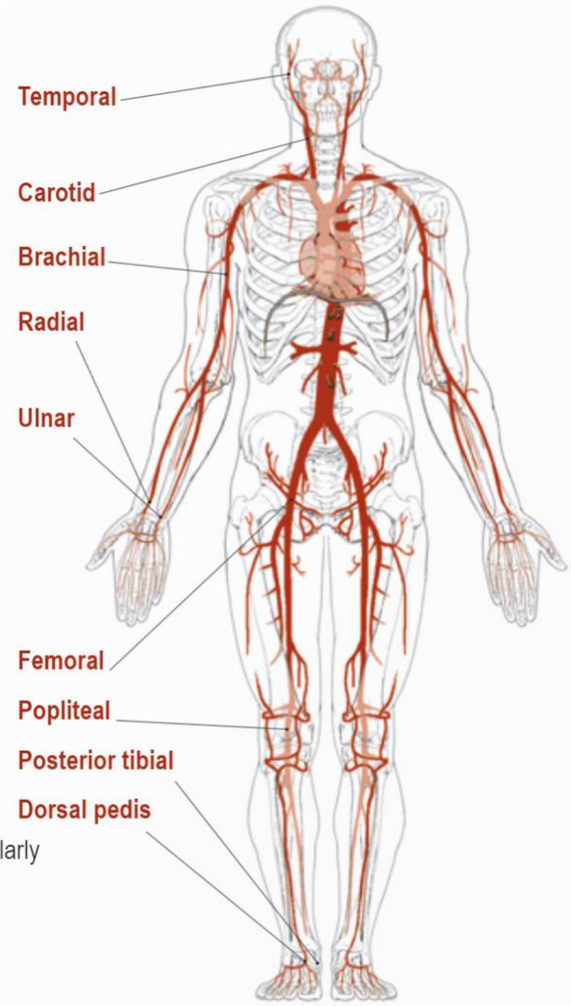
Common Muscle Testing Findings

- Strong painless resistance indicates normal tissue integrity
- Weak & painless resistance indicates a loss of motor nerve supply or complete rupture of musculotendinous structure
- Painful resistance indicates partial tear or rupture of musculoskeletal structure

Peripheral Pulses

Peripheral pulse locations

- Head & neck
  - Superficial temporal
  - Carotid
- Upper extremity
  - Brachial
  - Radial
  - Ulnar
- Lower extremity
  - Femoral
  - Popliteal
  - Posterior tibial (behind medial malleolus)
  - Dorsal pedis



Pulse parameters

1. Beats per minute (bpm)
   - **Normal**
     - **Children 90-110 bpm**
     - **Adult 70-80 bpm**
   - **Bradycardia < 60 bpm**
   - **Tachycardia > 100 bpm**
2. Quality - strong, weak, good, thready
3. Regularity - regular, regularly irregular, irregularly irregular (monitor for 1 min. if irregular)

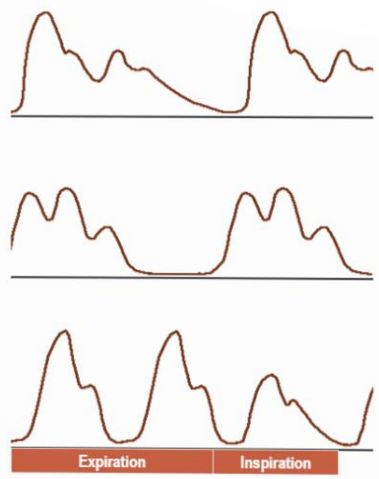
Pulse grading (amplitude/strength)

Grade	Description
4	Hyperkinetic or bounding: pulsus magnus (↑ cardiac output) may be noted during strenuous activity or cardiovascular pathologies
3	Increased or full
2	Normal: pulse is as expected
1	Barely palpable: pulsus parvus (low pulse pressure)
0	Absent: not palpable

Pulses should be compared bilaterally & between upper extremity to lower extremities.
Chart notes should be recorded as grading out of 4: 1/4, 2/4, 3/4, 4/4.

Peripheral Pulse DDx

Name	Clinical notes
Normal	Seen in healthy individuals Normal heart rate: 70-80 bpm (adult)
Pulsus magnus	'Bounding' or 'hyperdynamic' pulse (3-4/4) ↑ Cardiac output (wide pulse pressure) DDx: exercise, anxiety, fever, hyperthyroidism, atherosclerosis, anemia, drug use
Pulsus parvus	Weak or 'thready' pulse (1/4) ↓ Stroke volume (narrow pulse pressure) DDx: hypovolemia, aortic stenosis, congestive heart failure
Pulsus alterans	Alternates in amplitude, normal beat frequency DDx: left ventricular failure, more significance if pulse is slow (bradycardia)
Pulsus celer	Sharp rise & quick collapse (3/4 or 4/4) Synonym: 'water hammer' pulse DDx: aortic regurgitation (aortic insufficiency), patent ductus arteriosus
Pulsus tardus	Slow rising & weak (1/4) Synonym: 'plateau pulse' DDx: aortic stenosis, hypovolemia, congestive heart failure
Pulsus bigeminus	Two rapid beats followed by longer interval May be confused with pulsus alterans DDx: premature ventricular beats
Pulsus bisferiens	Two strong systolic peaks separated by mid systolic dip (best felt at carotid artery) DDx: aortic regurgitation, aortic stenosis
Pulsus paradoxus	↓ Pulse amplitude inspiration, ↑ with expiration > 10 mm Hg amplitude change DDx: COPD, bronchial asthma, emphysema, pericardial effusion, constrictive pericarditis



↑ = increase, ↓ = decrease, DDx = differential diagnosis list

Blood Pressure Exam

High blood pressure (hypertension) is extremely important to evaluate regularly; it usually causes no symptoms but may cause serious complications and disease (heart disease, heart attack, stroke)

High blood pressure is the second most common reason for visits to a doctor in the United States

Proper technique

1. Blood pressure (BP) measurement must be done in a repeated systematic manner to ensure accuracy
2. No smoking or coffee intake for previous ½ hour
3. Sit on chair with ***back supported***, resting for 5 min
4. Support arm at heart level
5. Use proper cuff with midpoint over brachial artery
   - 80% of arm should be covered by cuff bladder
   - Do not place over clothing
   - Use appropriate cuff size for patient (undersized cuff artificially raises blood pressure; oversized cuff artificially lowers blood pressure)
6. Place stethoscope at ante-cubital fossa & palpate radial pulse to assess pulse pressure
7. Rapidly & steadily inflate the bladder until radial pulse stops, note pressure (palpatory systolic)
8. Inflate cuff approximately 20 mm Hg above noted pressure & take blood pressure
   - Lower pressure approx 5-10 mm Hg/sec
9. Take a minimum of 2 readings spaced 3-5 min apart
10. Record in chart as systolic/diastolic (e.g. 120/80)



Proper patient position
Arrows denote patient's back supported, patient's sleeve rolled up not inhibiting BP cuff & examiner taking pulse pressure

Hypertension classification

Blood Pressure Level	Systolic	Diastolic	Follow-up
Normal	< 120	< 80	2 years
Pre-hypertension	120-139	80-89	1 year (provide lifestyle advice)
Hypertension	>140	>90	
Stage 1	140-159	90-99	2 months
Stage 2	160-179	100-109	1 month (consider referral)
	> 180	> 110	1 week (refer immediately)

Potential follow-up tests to help determine cause

- **Blood test:** lipid profile, electrolytes, blood urea, and creatinine levels (to assess kidney involvement)
- **Endocrine tests:** adrenal gland, thyroid gland
- **Eye examine:** look for ocular damage or signs of papilledema
- **Diagnostic imaging:** ultrasound of kidney, or CT scan of abdomen, pituitary or adrenal glands
- **Urinalysis:** electrolytes & hormones
- **Electrocardiogram (ECG)**
- **Echocardiogram**
- **Treadmill or pharmacologic stress test**
- **Ultrasound** check of pulses in arms, legs, hands & feet

Common sources of error during BP exam

Examiner error	Systolic BP change	Diastolic BP change
Cuff too narrow	-8 to +10 mmHg	+2 to +8 mmHg
Patient elbow too low	+4 mmHg	
Cuff over clothing	+5 to +50 mmHg	
Back unsupported	+6 to +10 mmHg	
Arm unsupported	+1 to +7 mmHg	+5 to +11 mmHg
Examinee error	**Systolic BP change**	**Diastolic BP change**
'White coat' reaction	+11 to +18 mmHg	+3 to +15 mmHg
Recent tobacco use	+6 mmHg	+5 mmHg
Recent caffeine use	+11 mmHg	+5 mmHg
Distended bladder	+15 mmHg	+10 mmHg

Auscultatory gap

- Rare phenomenon - at some pressure below the systolic pressure, the Korotkoff sounds fade in & out as you are taking auscultatory BP, making it possible to underestimate systolic BP and/or overestimate diastolic BP
- Determining palpatory systolic on initial visit can avoid problems with "auscultatory gap"

Significant difference arm to arm

- Normal to have difference of up to ~10 mmHg between two arms
- If difference is greater than 10-20 mmHg, there may be some type of occlusion in the arteries of the arm with the lower reading or the reading was performed incorrectly

Record key historical findings

- Risk factors or associated disorders for CVD (poor diet, diabetes, obesity, smoking)
- Causes of secondary hypertension (uncommon, 10% of cases)
- End organ damage (see below)

Hypertensive end organ symptoms

Retinal	CNS
• Blurred vision, diplopia • Retinal arteriolar constriction • Papilledema • Retinal exudates & hemorrhages • Dot & flame hemorrhages	• Headache (often occipital), nausea • Focal weakness or paresthesia • Generalized weakness • Disorientation • Focal neurological deficits
Cardiovascular	**Renal/Kidney**
• Left ventricular hypertrophy • Chest, back or abdominal pain • Palpitations, abnormal peripheral pulses • Dyspnea (difficulty breathing) • Orthopnea - dyspnea that occurs soon after assuming a recumbent position • Wheezes/rales and/or abdominal bruits **Lab tests** • MI enzymes, CKMB for 1st 24 hours • SGOT (AST) at 48 hrs, LDH at 72 hrs.	• Nocturia, hematuria • Oliguria • Urinary frequency • Flank pain, flank tenderness • Renal enlargement • Peripheral edema • Fatigue and/or weakness **Lab tests** • ↑ BUN, creatinine & protein • Also check ECG

Eye, Ear, Nose & Throat Exam

☑ Check normal, circle & describe abnormal

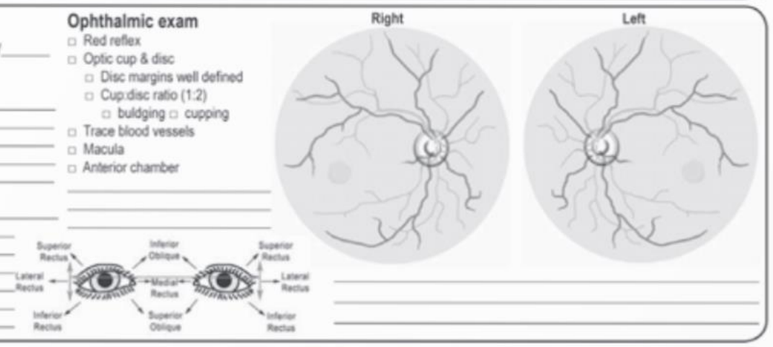
CC & significant history: _____

Patient: _____
Date: _____ Date of birth: _____ M/F

Temp: _____, Pulse: _____, Resp: _____, BP: L: ____/____, R: ____/____

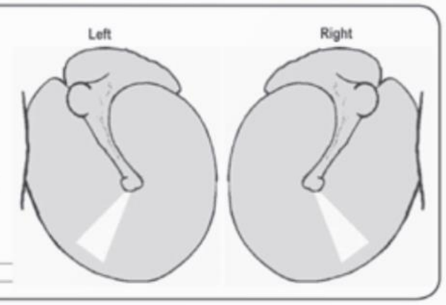
Eye: □ WNL
□ Visual acuity: L: ____/____ R: ____/____
□ corrected, □ uncorrected
External inspection
□ Size, shape symmetry: _____
□ Lids, lashes: _____
□ Conjunctiva (pallor): _____
□ Iris, sclera, cornea: _____
□ Palpation: _____
Examination
□ Ocular movements: _____
□ Visual fields: _____
□ PERRLA: _____
□ Corneal reflex: _____
□ Cover/uncover test: _____

Ophthalmic exam
□ Red reflex
□ Optic cup & disc
□ Disc margins well defined
□ Cup:disc ratio (1:2)
□ bulging □ cupping
□ Trace blood vessels
□ Macula
□ Anterior chamber

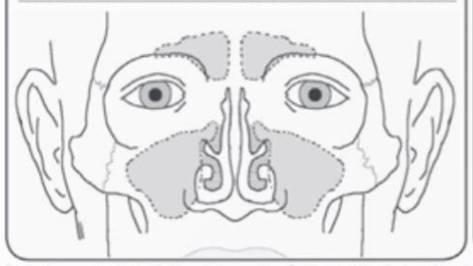


Ear: □ WNL
□ Uncorrected, □ hearing aid
External inspection
□ Size, shape symmetry: _____
□ Position & alignment of head: _____
□ Skin condition (color, lumps, lesions): _____
□ Auricular & tragus movement: _____
□ External auditory meatus: _____
□ swelling, □ redness, □ discharge, □ cerumen
Examination
□ Watch test: L > = < R _____
□ Weber: =, lateralize L/R _____
□ Rinne: AC > = < BC _____
□ Vestibular function: _____
□ Swivel chair test: _____

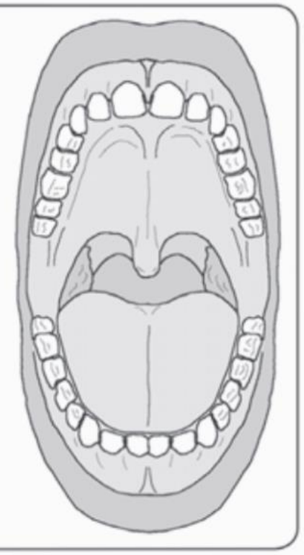
Otoscopic exam
□ Auditory canal
□ Tympanic membrane
□ Irritation
□ Scarring
□ Perforation
□ Cone of light
□ Red reflex
□ Fluid level: _____
□ Discharge: _____
Pneumatic otoscopy
□ Brisk movement
□ Slow/absent movement



Nose: □ WNL
External inspection
□ Size, shape symmetry: _____
□ Skin condition : _____
□ Deviated septum: _____
□ Congestion: _____
Rhinoscopic examination
□ Color: _____
□ Discharge: _____
□ Ployps: _____
Sinus examination
□ Percussion: _____
□ Transillumination: _____



Throat: □ WNL
□ Size, shape symmetry: _____
□ Lips: _____
□ Mucosa
□ Buccal: _____
□ Labial : _____
□ Teeth: _____
□ Tonsils: _____
□ Pharynx: _____
□ Tongue: _____
□ Uvula: _____
□ Hard palate: _____
□ Gingiva: _____
□ Cervical lymph nodes: _____
Other: _____



This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

Signature: _____ Date: _____

On-line videos demonstrations & clinical chart forms are available at
http://www.prohealthsys.com

Heart-Lung & Abdominal Exam

☑ Check normal, circle & describe abnormal

CC & significant history: _____

Patient: _____ date: _____
Insurance: _____ (abbrev/yr)
Date of birth: _____ M/F

Temp: _____, Pulse: _____, Resp: _____, BP: L: ____/____, R: ____/____

Heart-Lung: ☐ WNL

Observation
- ☐ Shape & symmetry, bony markings
- ☐ Spinal shape & curvature (kyphosis, lordosis, scoliosis)
- ☐ Skin: _____
- ☐ Effort of respiration (use of accessory muscles): _____
- ☐ Extremities: _____
  - ☐ Digital clubbing: _____
  - ☐ Edema: _____
  - ☐ Cyanosis: _____
  - ☐ Trophic changes: _____

Lung Auscultation
- ☐ Wheeze (rhonchi): _____
- ☐ Crackles (rales): _____
- ☐ Basilar crackles: _____
- ☐ Crepitus: _____
- ☐ Stridor: _____

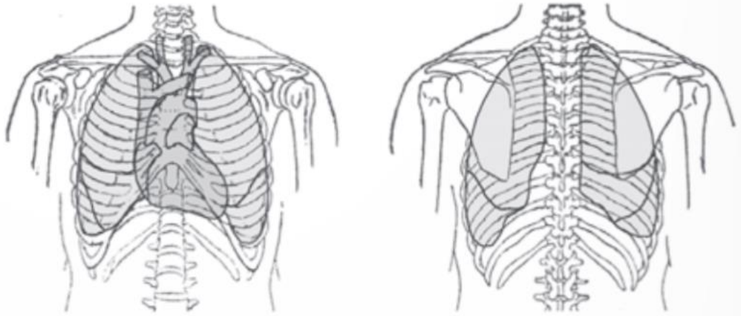
Heart Auscultation
- ☐ Point of maximal impulse: _____
- ☐ Carotid arteries: _____
- ☐ Abdominal aorta: _____

Specific valves
- ☐ Aortic: _____
- ☐ Pulmonic: _____
- ☐ Erb's point: _____
- ☐ Tricuspid: _____
- ☐ Mitral: _____

Sounds
- ☐ S1 ('lub'): _____
- ☐ S2 ('dup'): _____
- ☐ Bruit: _____
- ☐ Click: _____
- ☐ Other: _____

Percussion
- ☐ Resonant: _____
- ☐ Flat: _____
- ☐ Dull: _____
- ☐ Hyperresonant: _____

Palpation
- ☐ Spine/rib tenderness: _____
- ☐ Anterior chest wall: _____
- ☐ Thoracic excursion: _____
- ☐ Fremitus: _____
- ☐ Diaphramatic excursion: _____
- ☐ Tracheal palpation/deviation: _____
- ☐ Abdominal aorta: _____



Abdomen: ☐ WNL

Observation
- ☐ Skin: _____
- ☐ Symmetry/contour: _____
- ☐ Visible peristalsis: _____

Auscultation
- ☐ Upper left: _____
- ☐ Upper right: _____
- ☐ Lower right: _____
- ☐ Lower left: _____
- ☐ Vascular: _____
  - ☐ Aorta: _____
  - ☐ Renal: _____
  - ☐ Iliac: _____
  - ☐ Femoral: _____
- ☐ Bowel sounds: _____

Percussion
- ☐ Liver: _____
- ☐ Spleen: _____
- ☐ Murphy's punch: _____
- ☐ Percussion note: _____

Palpation (light then deep)
- ☐ Abdominal tone: _____
- ☐ Cutaneous hypersentitivity: _____
- ☐ Light palpation: _____
- ☐ Deep palpation: _____
- ☐ Inguinal lymphnodes: _____
- ☐ Other: _____

Hernia evaluation
- ☐ Umbilical: _____
- ☐ Inguinal direct: _____
- ☐ Inguinal indirect: _____
- ☐ Femoral: _____

Strength
- ☐ Resisted flexion: _____
- ☐ Reisisted L/R rotation: _____

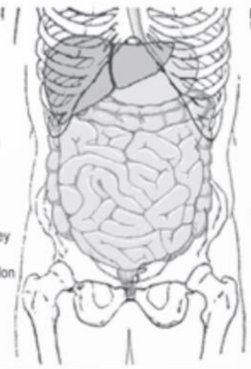
Acute abdomen special tests
- ☐ Rigid abdomen: _____
- ☐ Rebound tenderness: _____
- ☐ Valsalva: _____
- ☐ Murphy's sign (GB): _____
- ☐ Murphy's punch (kidney): _____
- ☐ Carnett's test: _____
- ☐ Other: _____

Right Upper Quadrant
Liver
Gall bladder
Duodenum
Head of pancreas
Right adrenal gland
Portion of right kidney
Hepatic flexure of colon
Ascending colon
Transverse colon

Left Upper Quadrant
Left lobe of liver
Spleen
Stomach
Body or pancreas
Left adrenal gland
Portion of left kidney
Splenic flexure of colon
Transverse colon
Descending colon

Right Lower Quadrant
Lower pole of right kidney
Cecum & appendix
Portion of ascending colon
Ovary & salpinx
Uterus
Right spermatic cord
Right ureter

Left Lower Quadrant
Lower pole of left kidney
Sigmoid colon
Portion of descending colon
Ovary & salpinx
Uterus
Left spermatic cord
Left ureter



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Signature: Date:

Specific exam procedures are discussed on the following pages

Inspection & palpation

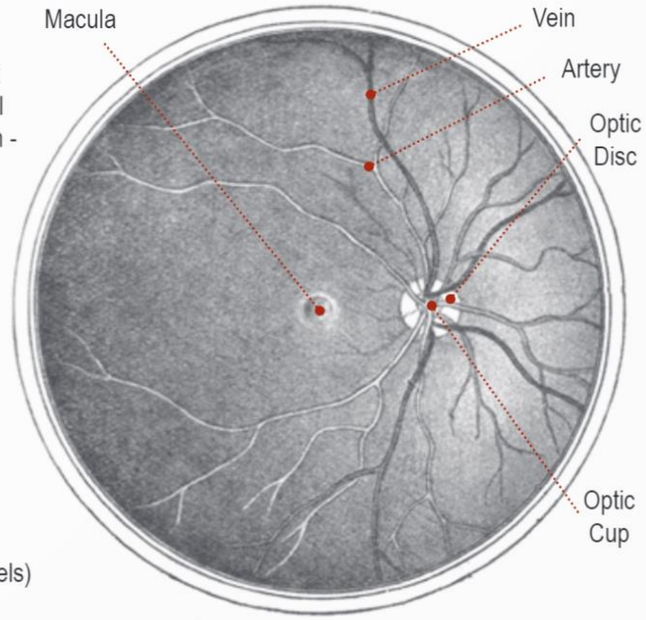
- Size, shape & symmetry
- Lids, lashes
- Conjunctiva (pallor → anemia)
- Iris, sclera, cornea
- Pupils - size equal bilaterally? Light reflection in same area of pupil?
- Patient close eyes - light palpation pressure on eye balls (quick check of eye pressure)



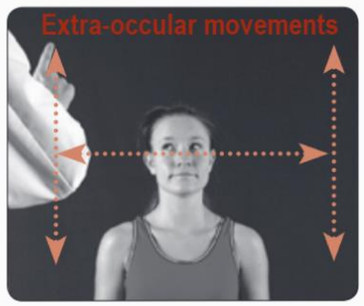
Examination

1. **Corneal reflex** - touch cornea with tissue & eye closes (CN III afferent, CN V efferent)
2. **Pupilary light reflex (swinging light test)** - allow time to readjust - observe ipsilateral & consensual reflexes; light in eyes back & forth - (+) afferent pupilary light defect
3. **Ophthalmic exam**
   1. ***Red reflex***
   2. ***Optic cup & disc***
      - Disc margins well defined
      - Cup:disc ratio = 1:2
      - Disc bulging = papilledema
      - Disc cupping = glaucoma
   3. ***Trace blood vessels***
      - Arteries are smaller & lighter
   4. ***Macula***
      - Have patient look into light
      - Darker area of retina (no vessels)
   5. ***Dial out*** (anterior chamber)

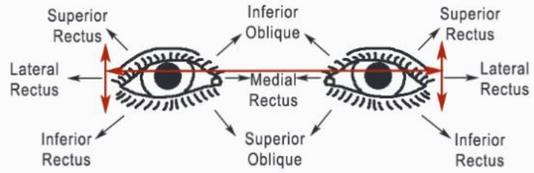
Right Eye Fundus



4. **Extra-occular movements** (H-pattern)
   - Note: nystagmus
   - Ask: did you note any double vision?



5. **Visual acuity** (one eye at a time - Snellen Chart)
   - Ask if patient uses corrective lenses
   - Patient should hold card about 35 cm (14 inches) from eyes
   - Read line forward, read line backwards
6. **Visual fields** (each eye individually)
   - Screen visual fields by confrontation
   - Use finger motion or finger number as objective measure
   - Scotoma test (blind spots in field of view)
7. **Cover uncover test** ('lazy eye')

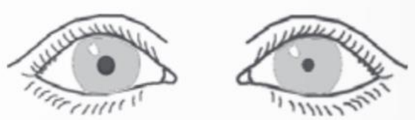


On-line videos demonstrations & clinical chart forms are available at **prohealthsys.com**

Common external eye abnormalities

Condition	Clinical notes
Blepharitis	Red, greasy crusted lid margins due to staphlococcal infection
Cataract	Opacities in the lens (common in elderly)
Chalazion	Nodule on lid due to infection of meibomian gland
Conjunctivitis	Infection of conjunctiva, "pink eye"
Dacryocystitis	Inflammation of the lacrimal sac (pain, warmth & swelling)
Ectropion	Loose lower lid rolls out, excessive tearing, may result from trauma
Exopthalmos	Forward eye displacement (associated with thyrotoxicosis)
Hordeolum (sty)	Infection of hair follicle at lid margin (painful, red, swollen)
Iritis	Deep dull red halo around iris & cornea
Ptosis	Drooping upper eyelid (Horner's, myasthenia gravis, CN III damage)

Common pupil abnormalities

Condition	Clinical notes	Picture
Adie's (tonic) pupil	• Sluggish reaction to light • Usually unilateral • Questionable clinical significance	
Argyll-Robertson	• No reaction to light, irregular shape • Associated with brain tumors, meningitis & chronic alcoholism	
Horner's syndrome	• Unilateral small pupil; ptosis • Sympathetic nerve interruption • Tumor, operative trauma, congenital	
Miosis (constricted pupils)	• Associated with pilocarpine (medication), narcotic use, iritis, damage to pons	
Mydriasis (dilated pupils)	• Associated with sympathomimetic medications, dilating drops, acute glaucoma, CNS injuries	
Oculomotor nerve damage	• Unilateral dilated pupil; ptosis • Eye turned lateral & downward	
Unequal size (Anisocoria)	• Normal in 5-20% of population • May be indicative of CNS disease	

Inspection & palpation

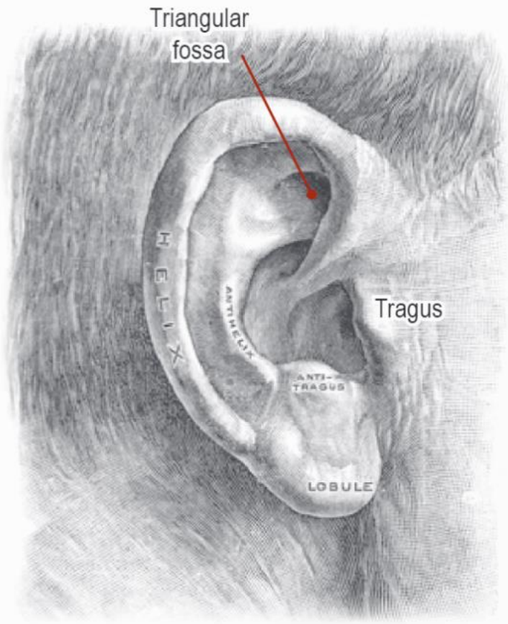
1. Size, shape of auricle
2. Position & alignment of head
3. Skin condition (color, lumps, lesions)
4. Auricular & tragus movement
5. Evaluate external auditory meatus (size, swelling, redness, discharge, cerumen)

Otoscopic examination

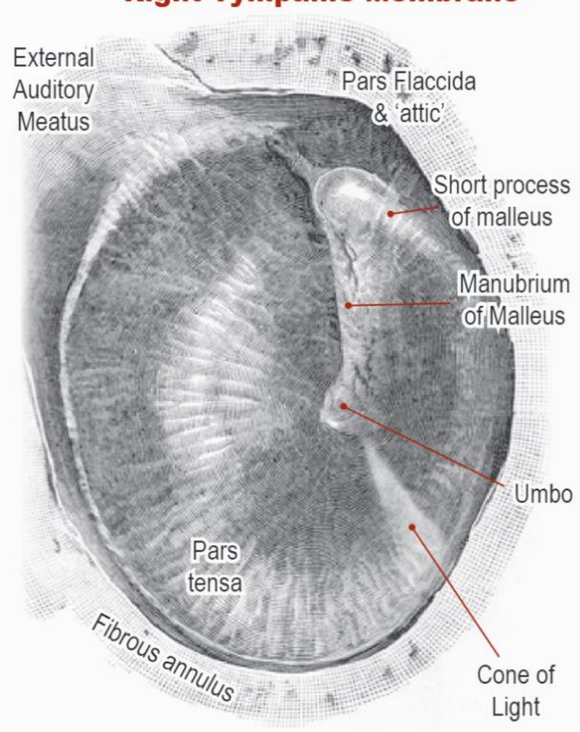
To help align external auditory meatus to slope of ear canal, apply traction to the pinna:
Adult: traction pinna posteriorly & superiorly
Infant: traction ear inferiorly (perhaps posteriorly)

1. **Inspect external canal**
2. **Note cerumen, discharge, lesions, foreign bodies**
3. **Redness & swelling of canal wall**
4. **Inspect tympanic membrane**
   - Membrane integrity
   - Short process of malleus (lateral process)
   - Manubrium of malleus ('handle')
   - Umbo
   - Cone of light (light reflex)
   - Red reflex (vascular strip that supplies tympanic membrane)
5. **Pneumatic otoscopy**
   - Use insufflation bulb, brisk puff of air to observe tympanic motion
   - ***Normal:*** membrane moves briskly in & out with ease, ↑ motion normal in infants younger than 7 months
   - ***Abnormal:*** sluggish or absent response may indicate presence of fluid or pressure behind membrane
6. **Hearing acuity**
   - Weber, Rinne (tuning fork)
   - Voice test, ticking watch test
7. **Vestibular function**
   - Swivel chair test, Dix-Halpike maneuver

External Right Ear



Right Tympanic Membrane



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Condition	Clinical notes
Bulbus myringitis	• Tympanic membrane infection (mycoplasma pneumonia, herpes zoster) • SSx: otalgia (ear pain), conductive hearing loss, swollen tympanic membrane, self limiting resolves in ~3 weeks
Cholestoma	• Malignant growth of epidermal tissue • SSx: blue/red color behind membrane, otorrhea (discharge), conductive hearing loss, apparent perforation, epithelial debris in ear canal
Exostosis	• Hypertrophic bony nodules in canal (may cause cerumen build up)
Labrinthitis	• Inflammation of labyrinthine canal, complication of upper respiratory tract infection • SSx: vertigo, nystagmus, increased severity with head movement
Ménière disease	• Vestibular labyrinth affected • SSx: tinnitus, vertigo, hearing loss
Otitis externa	• "Swimmer's ear," infection of outer ear, pain with tragus movement • Severe swelling of canal, tender, inflammation
Otitis media (secretory)	• Serous fluid build up in middle ear; due to allergies, residual otitis media • SSx: retracted tympanic membrane, air-fluid level, transient hearing loss
Otitis media (bacterial)	• Bacterial infection of tympanic membrane or inner ear • SSx: bulging, red membrane, fever, ear ache, conductive hearing loss
Otosclerosis	• Hereditary condition of irregular ossification of stapes • SSx: tinnitus, conductive hearing loss (usually noted between 11-30 yrs)
Perforation	• 'Central' - involves pars tensa, heal more easily (unless very severe) • 'Marginal' - involves fibrous annulus (poor healing) • 'Attic' - involves pars flaccida (poor healing)
Ramsey-Hunt syndrome	• Herpetic lesion of pinna, external canal, tympanic membrane, middle & inner ear • SSx: excruciating ear pain, sensory neural hearing loss (CN VIII), facial nerve palsy (CN VII)
Scarring	• Collagen scar formation (white & chalky) • Myringosclerosis - often late result of acute otitis media • Tympanosclerosis - deposition of hyaline within middle ear

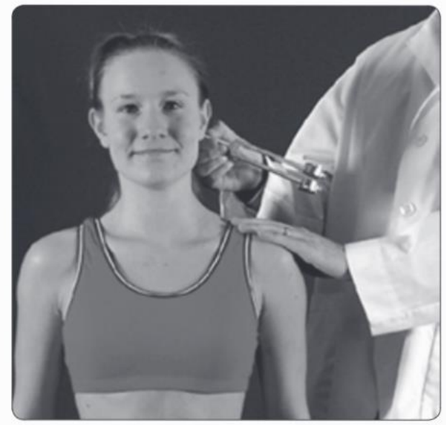
Ear drum appearance	Clinical notes
Yellow-amber	• Serum/pus (otitis media - serous or chronic)
Bright red	• Middle ear infection (otitis media - acute, purulent)
Blue or dark red	• Blood behind drum (trauma, skull fracture)
White dense areas	• Scarring (prior damage, sequella of infections)
Black or white dots	• Colony of growth (fungal infection)

Rinne Test

Procedure

Patient seated, examiner places the base of a vibrating tuning fork against the patient's mastoid process; the patient is instructed to verbalize when the sound is no longer heard; examiner notes time taken

Examiner then rapidly moves the vibrating tuning fork just outside of the patient's external auditory canal; the patient is again instructed to verbalize when the sound is no longer heard; examiner notes time taken



Interpretation

(+) Bone Conduction (BC) > Air Conduction (AC) → Conductive hearing loss

Normal: AC>BC



Clinical notes

This test compares bone conduction to air conduction of sound

Typically, air conduction should be heard twice the duration of time bone conduction is heard

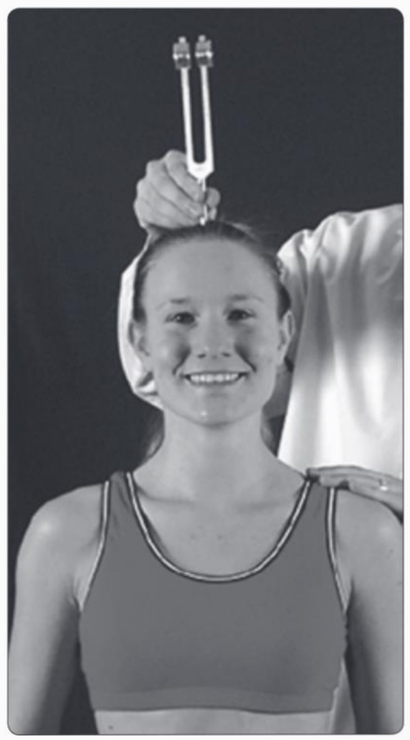
Example: if a bone conduction = 10 seconds, then air conduction should be ~20 seconds

Chart notes: recorded as *Rinne: AC>BC*

Weber Test

Procedure

Patient seated, examiner places the base of vibrating tuning fork at midline on the patient's head, examiner then asks the patient "is the sound heard the same in both ears, or better in one ear?"



Interpretation

(+) Lateralization of sound towards one ear → hearing impairment

Normal: sound should be heard equally in both ears

Clinical notes

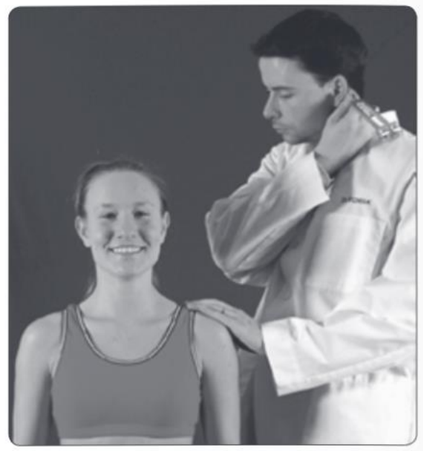
The examiner can test the patient's response reliability by asking the patient to cover one ear & repeating the test; the patient should hear the sound louder in the covered ear

Auditory Acuity Tests

Schwabach Test

Procedure

Patient seated, examiner alternately places the vibrating tuning fork against the patient's mastoid process & the examiner's mastoid process until sound is no longer heard



Interpretation

(+) Examiner hears sound long after patient does not → Hearing impairment

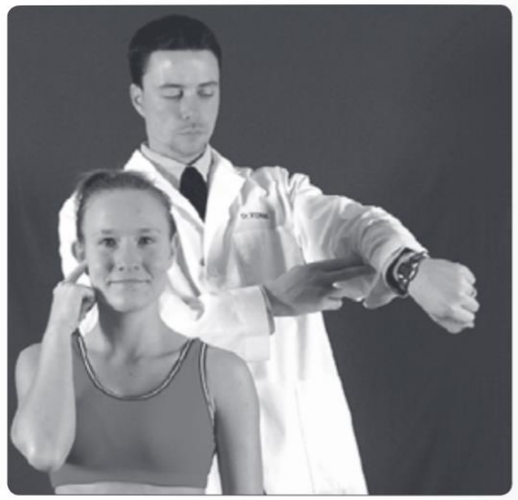
Clinical notes

Examiner & patient should hear sound for approximately the same amount of time

Ticking Watch Test

Procedure

Seated patient is instructed to cover one ear; examiner positions a ticking watch or device approximately 30 cm (12 in.) from the uncovered ear; the examiner then slowly proceeds to move toward the patient's ear & instructs the patient to verbalize when the ticking is heard; results are compared bilaterally



Interpretation

(+) Inability to hear ticking → hearing impairment

Clinical notes

For an objective measure, the distance can be measured at which the patient first hears the sound (Test does not work well with a digital watch ☺)

Whispered Voice Test

Procedure

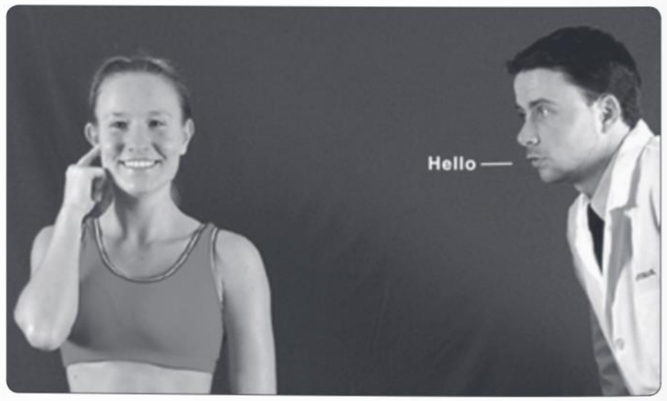
Seated patient is instructed to cover one ear; examiner stands approximately 60 cm (24 in.) from the uncovered ear & whispers two syllable words very softly; the patient is instructed to repeat the whispered words; if the patient has difficulty the examiner then gradually increases the volume of the whisper until the patient has an appropriate response; procedure is repeated with the opposite ear

Interpretation

(+) Inability to hear voice → hearing impairment

Clinical notes

At a distance of 60 cm most patients without hearing loss should be able to hear the examiner's whisper



A detailed history will reveal the type of dizziness in most cases.

Vertigo

Patient complaint
"My head is spinning...the room is whirling..."

Usual cause: vestibular disorders

DDx:
- Benign Positional Vertigo (BPV)
- Otitis media
- Meniere's syndrome
- Labrinthitis
- Acoustic neuroma
- Ototoxic & salt-retaining medications
- Brainstem dysfunction

Disequilibrium

Patient complaint (common in elderly)
"My balance is off...I might fall..."

Usual cause: sensory/neurologic dysfunction

DDx:
- Multiple sensory deficits
- Hyperventilation/anxiety disorders
- Vestibular disorders
- Drug induced
- Parkinsonism
- Alcoholic
- Senile gait

(pre) Syncope

Patient complaint
"...I might pass out...I feel faint..."

Usual cause: decreased cerebral profusion

DDx:
- Orthostatic hypotension
- Vasovagal
- Unknown (25%)
- Cardiac
- Neurological
- Situational
- Psychogenic (hyperventilation, hysteria)
- Metabolic & drug

Light-headedness

Patient complaint
"...I'm just dizzy..."

Usual cause: anxiety/depression

DDx:
- Acute hyperventilation
- Panic disorder
- Hypoglycemia
- Pheochromocytoma
- Drug withdrawal/induced
- Epilepsy (temporal lobe)
- Mitral valve prolapse
- Cardiac arrhythmia

Common vertigo differential tests

Test	Clinical comment
Orthostatic Blood Pressure	Measure of blood flow during postural change (supine, seated, standing)
Hyperventilation - 3 min	Determine if hyperventilation is cause of dizziness
Epley Maneuver (Hallpike)	Maneuver to help reduce inner ear caused dizziness
Gait observation (esp. turning)	Vestibular cause
Caloric Test (COWS)	Water in ear observe nystagmus (Cold Opposite side, Warm Same side)
Swivel Chair Test	Differentiate cervical spine from other source
Carotid Sinus Stimulation	Blood pressure measure

Dix-Hallpike Maneuver

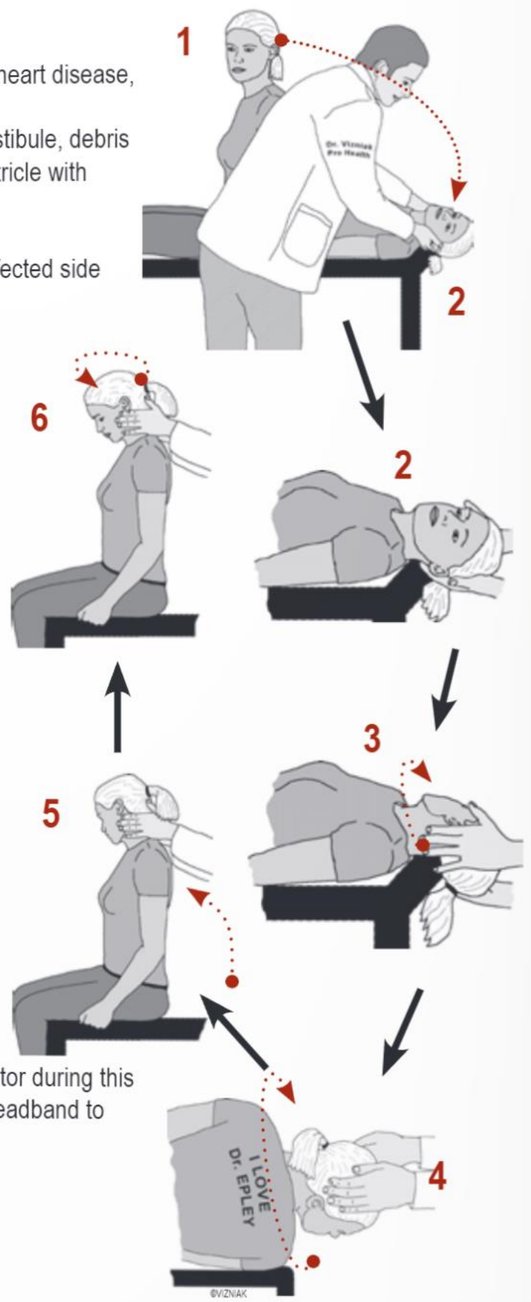
Procedure

- Rapidly move patient from sitting position to supine position with head turned 45° to the left
- Wait 20-30 seconds
- Return patient to the sitting position
- If nystagmus is observed, repeat procedure right side
- Vertigo symptoms may fatigue if patient is held in position (either seated or supine)

Interpretation: (+) Vertigo, nystagmus, nausea → Vestibular lesion

Epley Maneuver

Synonym: Canalith Repositioning Procedure
Indication: Benign Positional Vertigo (BPV)
Contraindications: severe carotid stenosis,, unstable heart disease, cervical spondylosis with myelopathy
Mechanism: reposition debris in labyrinth back into vestibule, debris starts in posterior semicircular canal & moves into utricle with procedure



Starting position 1: sitting, head turned 45° toward affected side (Dix-Hallpike Maneuver)

Position 2: clinician slowly reclines patient to supine position of affected side; the rate is guided by no nystagmus & no symptoms during movement (usually takes ~ 30 seconds); end position with the affected ear down

Position 3: clinician slowly turns supine patient's head toward the opposite side

Position 4: clinician & patient roll body so shoulders are aligned perpendicularly to the floor; affected ear up (keep head turned 45° nose points 45° below the plane of the horizon) - usually takes ~40 seconds

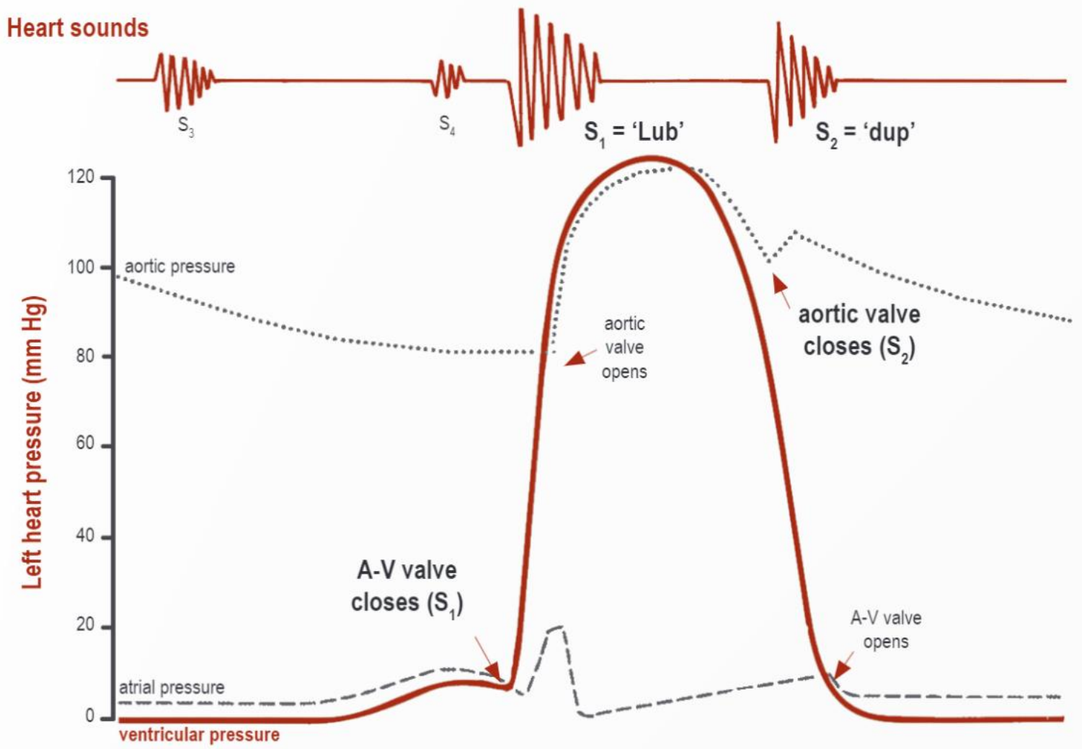
Position 5: patient is raised back to the sitting position (head turned at least 90°-135° toward contralateral side)

Ending position 6: turn head midline with 20° forward flexion of neck

- Some clinicians suggest the use of a mastoid oscillator during this procedure (held in position behind affected ear by headband to help agitate the particles so they move more easily)

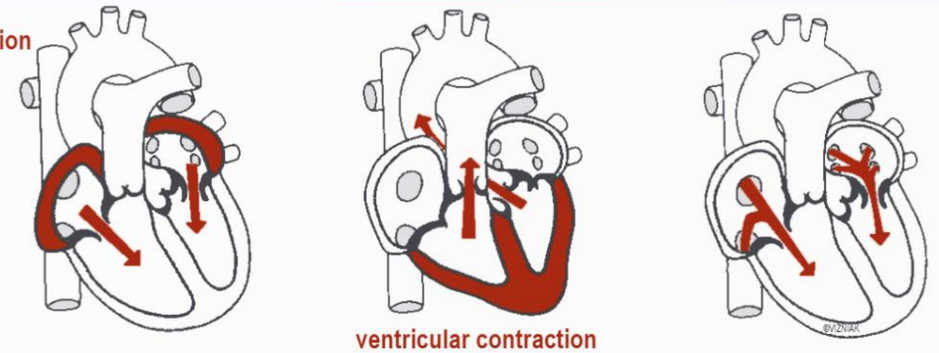
Post-Epley's Maneuver Instructions

- Turn head and neck as one unit for first week
- Sleep reclined at 45° for first 2 nights
- Do not sleep on affected side for the next 5 nights
- Return & repeat if symptoms reoccur



Diastole	Systole	Diastole

Heart action

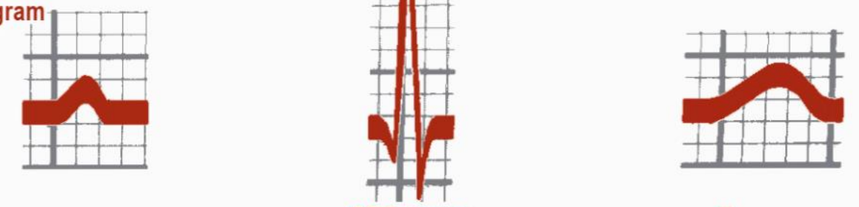


atrial contraction

ventricular contraction

ventricular relaxation
(passive ventricular filling)

Electrocardiogram



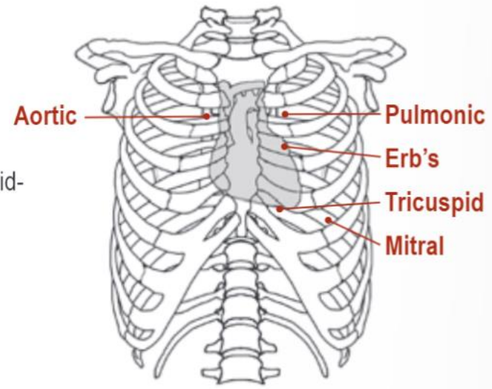
P-wave
atrial depolarization

QRS-waves
ventricular depolarization
atrial repolarization

T-wave
ventricular repolarization

A PET Monkey (mnemonic)

- **Aortic** - right 2nd intercostal space
- **Pulmonic** - left 2nd intercostal space
- **Erb's point** - left 3rd intercostal space
- **Tricuspid** - left 4th or 5th intercostal space
- **Mitral** - left 4th or 5th intercostal space, along the mid-clavicular line



Heart sounds ('Lub-dup')

S1 (1st heart sound) 'Lub'

- Closure of mitral & tricuspid valves (A-V valves)

S2 (2nd heart sound) 'dup'

- Closure of aortic & pulmonic valves (semilunar valves)
- Physiologic splitting of S2 may occur because of decreased intrathoracic pressure delaying closure of pulmonic valve; therefore, S2 may sound may be split during inspiration

S3 & S4 (3rd & 4th heart sounds) - usually absent, due to vibrations caused by ventricular filling

- In adults it may indicate decreased compliance of ventricles (early sign of heart failure)

PMI (point of maximum impulse)

- 5th left intercostal space at mid-clavicular line
- Normal for 50% of population to have a PMI, but brief & smaller than 2 cm in diameter
- If PMI larger or sustained, may indicate left ventricular hypertrophy
- If apical beat is displaced beyond left mid-clavicular line, may indicate left ventricular dilation

Selected 'common' murmurs

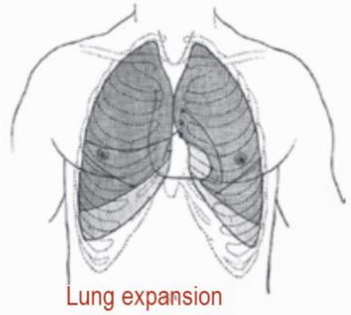
Murmur	Clinical notes
Aortic regurgitation	• 'Blowing' type of diastolic murmur • Aortic valve does not completely close resulting in blood flowing from aorta back into left ventricle during diastole • Left ventricular hypertrophy
Aortic stenosis	• 'Harsh' sounding systolic murmur • 'Jet-like' ejection of blood intensely vibrates aortic wall • Left ventricular hypertrophy • Chronic increase in blood volume
Mitral stenosis	• 'Weak' sounding diastolic murmur, best heard during late diastole • Blood has difficulty going from left atrium to left ventricle • May get left ventricular hypertrophy
Mitral valve prolapse	• "Mid systolic click" (between S1 & S2) • Defective mitral valve results in "click"
Patent ductus arteriosus	• Murmur heard during both systole & diastole • Shunting of blood from pulmonary artery to aorta & back

History

- □ Recent cough? (onset, duration, phlegm, blood, color)
- □ Pattern of cough: occasional, paroxysmal, change over time
- □ Associated symptoms: shortness of breath, chest pain, fever, choking, fatigue
- □ Past history of respiratory conditions? Smoking? Environmental exposure?

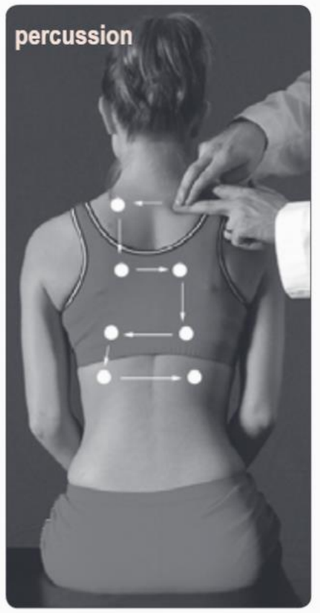
Inspection (patient should be gowned with the back exposed)

- □ Shape & symmetry of chest, bony markings
- □ Observe spinal shape & curvature (kyphosis, lordosis, scoliosis)
- □ Inspect skin
- □ Determine respiratory rate
  - 12-20 breaths per minute or 1:4 breaths:heart beat
- □ Note breathing pattern (bilaterally symmetrical without distress)
  - Dyspnea? (difficult/labored breathing)
  - Orthopenia? (difficult/labored breathing with recumbency)
  - Platypnea? (difficult/labored breathing with upright posture)
  - Tachypnea? (rapid breathing)


Lung expansion

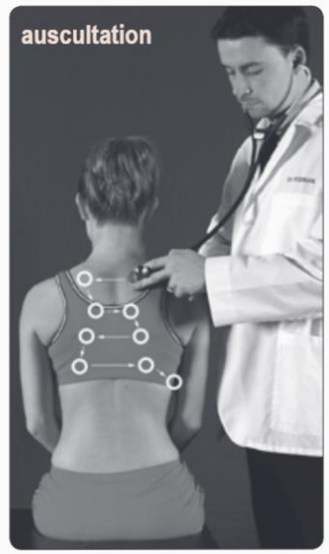
Palpation

- □ Thoracic muscles, bones (look for tenderness, unusual movement)
- □ Confirm symmetrical expansion (hands over posterior ribs & have patient take a deep breath)
  - Tactile (vocal) fremitus - palpable vibration (have patient say "blue moon" or "99")
  - Crepitus - 'crackly' or 'crinkly' sensation may be both palpated & heard (abnormal)
  - Grating vibration with inspiration (may indicate pleural friction rub)
- □ Tracheal palpation, position & mobility (should be midline; deviation suggests pathology)



Percussion (tap upon finger)

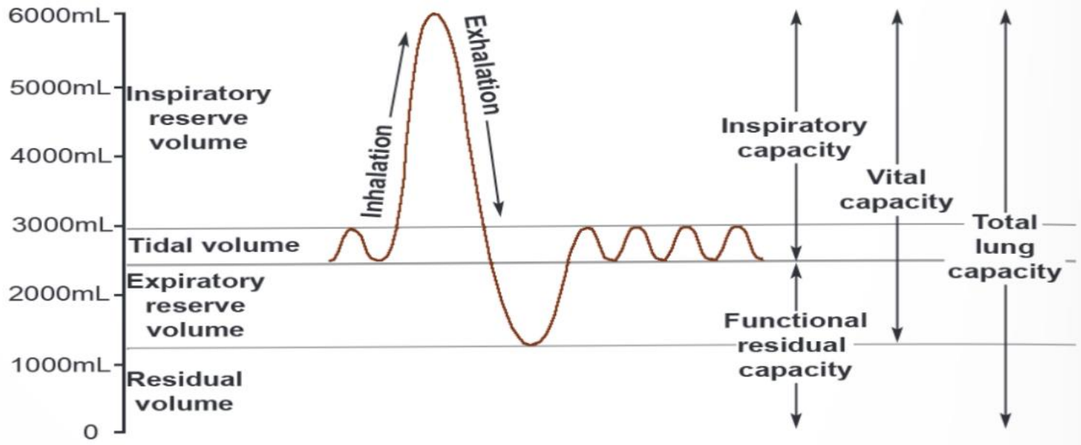
- □ Compare areas bilaterally
- □ Note tone
  - ***Resonant*** - normal sound over lung tissue
  - ***Flat*** - normal sound over thick muscle, scapula or spine
  - ***Dull*** - normal sound heard over liver
  - ***Hyperresonant*** - pathologic (may indicate obstructive lung condition or emphysema)
- □ Diaphragmatic excursion (normal = 3-5 cm)



Auscultation (follow same pattern as percussion)

- □ Compare areas bilaterally (do not auscultate over the scapulae)
- □ See Lung Auscultation Phonics (see page 70)
  - □ Note normal sounds
    - Bronchial or Tracheal
    - Bronchiovesicular
    - Vesicular or Alveolar
  - □ Abnormal Sounds
    - Crackles, rales
    - Friction rub
    - Wheezes, stridor

Respiration Patterns

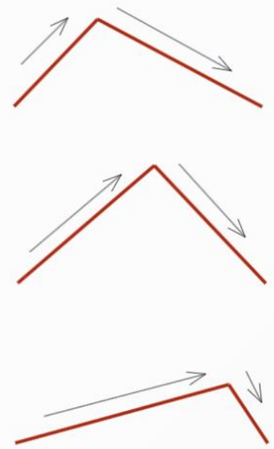


Type	Clinical notes
Normal	Rate: 10-20 breaths per minute Depth: 500-800 mL (tidal volume) Ratio: 4:1 pulse to respirations
Sigh	Occasional sighs are normal Frequent sighing may indicate emotional dysfunction
Tachypnea	Rapid, shallow breathing (> 24 per minute) DDx: fever, fear, exercise, pneumonia, pleurisy, alkalosis, lesions of the pons
Bradypnea	Slow breathing (< 10 breaths per minute) DDx: medication induced (depression of medulla), ↑ intracranial pressure, diabetic coma
Hyperventilation	Increased rate & depth of breathing DDx: fever, fear, exercise, diabetic ketoacidosis (Kussmaul's respirations), hepatic coma, salicylate overdose, lesions of mid-brain
Hypoventilation	Irregular shallow breathing DDx: narcotic or anesthetic overdose, muscle splinting to avoid pain associated with respiration
Cheyne-Stokes respirations	*Regular* cycle of waxing & waning increasing then decreasing breath depth DDx: severe congestive heart failure, renal failure, meningitis, stroke
Biot's respirations	*Irregular* cycle of waxing & waning increasing then decreasing breath depth DDx: head trauma, brain abscess, heat stroke, meningitis, encephalitis
Chronic obstructive breathing	Normal inspiration, prolonged expiration to overcome air way resistance DDx: COPD, "air trapping" - small shallow breaths as obstruction gets worse

↑ = increase, ↓ = decrease, COPD = Chronic Obstructive Pulmonary Disease

Lung Phonics

Normal auscultation lung phonics (see below)



Bronchial or Tracheal
- 1:2 = inspiration: expiration (harsh)
- Harsh & loud, heard best on expiration over central major airways
- Originate from trachea & primary bronchi

Bronchiovesicular
- 1:1 inspiration: expiration (medium) - medium pitch & intensity
- Heard equally in inspiration & expiration
- Originate from larger bronchi

Vesicular or Alveolar
- 5:2 inspiration: expiration (rustle) - soft, low-pitched , breezy sounds
- More pronounced during inspiration
- Most noticeable in peripheral lung, away from trachea & larger bronchi
- Originate from lung parenchyma, terminal respiratory bronchioles, alveoli

Pathologic Lung Phonics

	Name	Clinical notes
Discontinuous sounds (discrete)	**Crackles (fine) or rales**	Short, crackling & popping sounds Heard during inspiration, not cleared by cough Due to air passing through accumulated moisture DDx: *late insp. crackles* - pneumonia, heart failure; *early insp. crackles* - bronchitis, asthma, emphysema
	Crackles (coarse) / coarse rales	Loud, bubbling or gurgling sounds Start in inspiration may continue in expiration May be decreased by cough or suction DDx: pulmonary edema, pneumonia, terminally ill patients with a depressed cough reflex
	Atelectic crackles or rales	Similar to fine crackles, but disappear after first few deep breaths Not considered pathologic & may be seen in aging adults & bedridden patients
	Pleural friction rub	Low pitched, grating sound Heard in both inspiration & expiration Due to inflamed pleura having increased friction DDx: Pleuritis (pain with breathing that usually passes in a few days)
Continuous sounds	**Wheeze (high pitch)**	Synonym: sibilant rhonchi (polyphonic) High pitched, musical squeaking sounds Usually heard during expiration DDx: airway obstruction from acute asthma or chronic emphysema
	Wheeze (low pitch)	Synonym: sonorous rhonchi Low pitch, monophonic musical sound Usually heard during expiration DDx: bronchitis, single bronchial obstruction from bronchial tumor
	Stridor	High pitch, monophonic musical sound Heard during inspiration, louder in neck than chest wall DDx: croup, foreign body aspiration, airway obstruction (may be life threatening)

↑ = increase, ↓ = decrease, DDx = differential diagnosis, insp. = inspiration

Selected Lung DDx

	Condition	Clinical notes
	Asthma	Hx: allergic hypersensitivity to pollen, irritants, stress, exercise SSx: tachycardia, tachypnea, labored breathing, normal to hyperresonant percussion note, decreased breath sounds, wheezing with expiration DDx: bronchospasm constricting airways
	Atelectasis	SSx: commonly asymptomatic (depends on size of collapse), tachypnea, cough, dullness to percussion, absent breath sound DDx: lung collapse, airway obstruction, lung compression, lack of surfactant
	Bronchitis	SSx: rales, rhonchi, wheezes, fatigue, fever, hacking, rasping cough, resonant percussion note, crackles over deflated areas, tachypnea ("blue bloater" in chronic cases) DDx: excess mucous secretion resulting in partial obstruction
	Congestive heart failure	SSx: basilar rales, faint S3 gallop, ↓ exercise capacity, fatigue, tachypnea with exertion, orthopnea, ankle edema, crackles at lung bases DDx: pulmonary congestion from heart pump failure
COPD	**Chronic Bronchitis**	SSx: rales, rhonchi, wheezes, fatigue, fever, hacking, rasping cough, resonant percussion note, crackles over deflated areas, tachypnea ("blue bloater" in chronic cases)
COPD	**Emphysema**	SSx: "pink puffer," minimal cough, dyspnea, tachypnea, barrel chest, hyperresonant percussion note DDx: permanent enlargement of air sacs (connective tissue destruction); 80%-90% of cases are secondary to smoking
	Lobar pneumonia	SSx: cough, fever, chest pain, dark, thick or bloody sputum, rales/crackles DDx: progressive filling of alveoli with fluid, bacteria, RBCs & WBCs
	Pleural effusion	SSx: dyspnea, tachypnea, tachycardia, decreased chest expansion on affected side, dull percussion note DDx: fluid accumulation in intrapleural space resulting in lung collapse
	Pneumothorax	SSx: chest pain, dyspnea, moderate to severe respiratory distress, asymmetrical chest expansion, hyperresonant percussion note, decreased breath sounds, tracheal deviation to unaffected side DDx: air in pleural space (lung rupture or leak in chest wall)
	Tuberculosis	SSx: cough, hemoptysis, weight loss, pleuritic chest pain, yellow-green sputum, dyspnea, fatigue, crackles over upper lobes, calcific lesions on x-ray DDx: Mycobacterium tuberculosis causing inflammation, scar tissue

↑ = increase, ↓ = decrease, SSx = signs & symptoms, DDx = due to/cause, COPD = chronic bronchitis + emphysema

Chest Pain Rapid DDx

	Condition	History	Physical exam	Diagnostic tests
Cardiovascular disorders	**Angina pectoris**	Substernal pressure Lasts 2-3 min Exertion/emotional Relieved: rest/nitroglycerine	Usually transient SSx Tachycardia, hypertension Systolic murmur	Stress ECG, Coronary arteriogram
Cardiovascular disorders	**Mycardial infarction**	Substernal pain or pressure on chest, lasts a few seconds Radiates left neck & arm	Patient may be pale, sweating or anxious Increased or irregular heart rate	ECG exercise stress test Ultrasound PET scan
Cardiovascular disorders	**Mitral valve prolapse**	Young F>M, non-exertional Unpredictable	Mid-systolic click Late systolic murmur	ECG
Chest wall disorders	**Rib fracture**	Sharp, local pain following trauma or prolonged cough	Palpable crepitus Possible edema & or discoloration Pain with chest motion	x-ray
Chest wall disorders	**Rib subluxation**	Sharp local pain on near spine with inspiration	Palpatory tenderness & local myospasm	Joint play & passive ROM
Chest wall disorders	**Breast disorder**	Tender mass Family history breast CA Large breasts Vague chest wall pain	Palpable, unilateral mass Non-supportive bra	Mammogram, biopsy
Abdominal disorders	**Esophagitis**	Burning, substernal pain ↑ by lying & eating ↓ by antacids	Usually WNL Possible: thrush or herpetic lesions	CBC, endoscope, barium swallow
Abdominal disorders	**Peptic ulcer**	Burning, epigastric pain, Dietary indiscretions ↑ by fasting, stress ↓ by food & antacids	Usually WNL	Barium swallow
Abdominal disorders	**Biliary colic**	Epigastric ache, nausea, vomiting, restlessness ↑ by fatty meals	Usually WNL	Oral cholecysto-gram, ultrasound
Respiratory	**Pleuritis**	Sharp, lateral chest pain, Increased inspiratory effort Precipitated by cough Relieved by analgesics	Possible: fever, dull percussion, bronchial breath sounds, friction rub	Chest x-ray, CBC
Respiratory	**Bronchitis/ Asthma/ COPD**	Vague recurrent chest pain Prolonged coughing Asthma/infection	Possible: rales, rhonchi, wheezing, ↑ with chest motion, cough, respiration	Chest x-ray
Other	**Herpes Zoster** (Hx: dermatomal pain, prolonged duration, PE: rash) **Biomechanical, Myofascial Trigger Points, Thoracic outlet syndrome**			

↑ = increase pain, ↓ = decrease pain

Abdominal Rapid DDx

Condition	History	Physical exam	Diagnostic tests
Aortic aneurysm	Severe pain radiating to low back	Pulsatile tender mass Possible hypotension, shock & oligourea	Abdominal x-ray Diagnostic ultrasound Angiography
Acute appendicitis	Dull periumbilical pain that becomes severe & localizes to RLQ	Increased pain with hip extension Nausea, vomiting Fever	Rebound tenderness over McBurney's point (Rovsing's sign) Diagnostic Ultrasound
Acute pancreatitis	Severe, constant pain around abdomen & back Possible alcohol abuse	Nausea, vomiting Tachycardia, shock Tender to palpation	↑ serum & urinary amylase
Cholecystitis/ Cholelithiasis	Colicky epigastric pain that may radiate to right shoulder ↑ Pain following meals (especially fat & eggs)	Nausea, vomiting Patient writhes (+) Murphy's Sign May be jaundiced	Bilary tract ultrasound
Ectopic pregnancy	Sudden severe lower abdominal pain	↑ Pain with movement Tachycardia, shock Tender to palpation Rebound tenderness	Positive pregnancy test Diagnostic ultrasound
G.E.R.D.	"Heart burn" sensation following meals	↑ Pain with recumbency or after meal	Chest x-ray may show hiatal hernia
Intestinal obstruction	Colicky periumbilical or lower abdominal pain	↑ Pain with ingestion of food or drink Abdominal distension	Abdominal x-ray (air fluid levels in bowel)
Ureteral stones	Extremely intense pain Radiates from low back & progresses to groin & scrotum	Patient writhes Hematurea	Abdominal x-ray (90% of stones visible) Diagnostic ultrasound Urogram, Helical CT
Pelvic inflammatory disease	Lower abdominal pain Dyspareunia (painful intercourse)	Fever, chills Vaginal discharge	Urine based ligase chain reaction Laparoscopy
Peptic ulcer	Sudden onset of severe epigastric pain May wake patient from sleep	Duodenal ulcer: ↓ pain with eating, NSAIDs Gastric ulcer: ↑ pain with eating Nausea, fever, shock Rebound tenderness	Abdominal or chest x-ray (air under diaphragm) Endoscopy with biopsy (*H. pylori*) may be found anywhere in GI

↑ = increase, ↓ = decrease, RLQ = right lower quadrant, patients writhe in search of a comfortable position to help relieve their pain

Abdominal Exam

Sequence of an Abdominal Exam

- Ensure patient is relaxed & comfortable
- Patient position - lying down, knees bent, head raised (use pillows)

1. Observation

- Skin, symmetry, contour, visible peristalsis, respiratory movement

2. Auscultation

- 4 quadrants for 15-30 seconds each
- Bowel sounds, vascular sounds, friction rubs, muscle hums

3. Percussion

- Sizing of liver & spleen, detection of ascites, Murphy's punch (pyelonephritis)

4. Light Palpation

- Muscle tone, masses

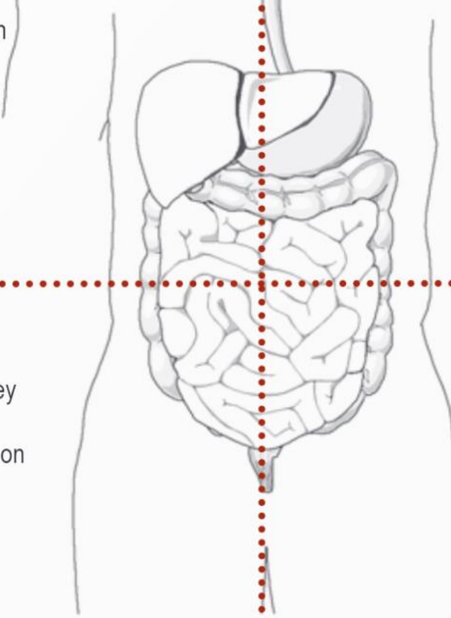
5. Deep Palpation

- Abdominal aorta, spleen, liver, gall bladder, kidneys, rebound tenderness
- Bimanual palpation where possible (below ribs & above iliac crest)
- Abdominal aorta should be 2.5-4.0 cm in diameter

6. Strength (sit-up, Beevor's sign)

Right Upper Quadrant
- Liver
- Gall bladder
- Duodenum
- Head of pancreas
- Right adrenal gland
- Portion of right kidney
- Hepatic flexure of colon
- Portions of ascending & transverse colon

Left Upper Quadrant
- Left lobe of liver
- Spleen
- Stomach
- Body or pancreas
- Left adrenal gland
- Portion of left kidney
- Splenic flexure of colon
- Portions of transverse & descending colon



Right Lower Quadrant
- Lower pole of right kidney
- Cecum & appendix
- Portion of ascending colon
- Ovary & salpinx
- Uterus
- Right spermatic cord
- Right ureter

Left Lower Quadrant
- Lower pole of left kidney
- Sigmoid colon
- Portion of descending colon
- Ovary & salpinx
- Uterus
- Left spermatic cord
- Left ureter

Abdominal Pain DDx

'Abdominal pain is one of the most common complaint that brings a patient to a physician's office'

- Repeated examinations over time are diagnostically valuable
- 40% of acute cases have no definitive Dx

Causes of Abdominal Pain

1. Hemorrhage - can occur w/ or w/o rupture
2. Rupture - tearing pain of rapid onset
3. Perforation - usually sudden sharp pain
4. Inflammation or infection
   - Slow, gradual onset of pain
5. Obstruction

Timing of Pain/Duration

- Very abrupt onset or suddenly worse → rupture, perforation, obstruction, hemorrhage
- Gradual onset or progressive worsening → inflammatory process or obstruction

Associated Symptoms

- Diarrhea - gastroenteritis
- Constipation - structural obstruction, neurologic disease, iatrogenic, metabolic
- Urinary symptoms - UTI
- Pelvic symptoms - PID, pregnancy
- Vomiting, anorexia
- High fevers & chills - infection

Visceral/Organ Pain (midline & deeper)

- Diffuse, deep, dull
- Colicky, intermittent
- Not affected by movement/palpation

Location

- Epigastric - thorax, stomach, duodenum, pancreas, liver, gallbladder
- Periumbilical - small intestine, cecum
- Hypogastric - large intestine, pelvic organs, urinary system

Parietal Pain (superficial)

- Sharp, constant
- Lateralizes to a quadrant
- Worse with movement, palpation & increases in abdominal pressure
- Localized within a quadrant (see below)

Patient Management

- 'Shock' - stabilize & call 911
- Peritoneal signs - refer for emergency care
- Obstruction - immediate emergency care
- Severe pain but unimpressive examination
- Manage, carefully monitor & re-exam

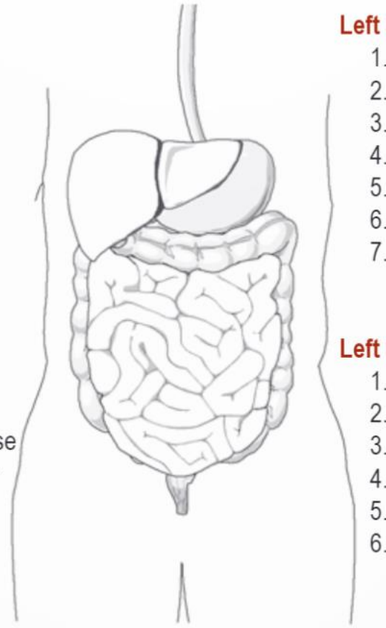
Differential Diagnosis by Location of Pain

Right Upper Quadrant

1. Pleurisy
2. Hepatitis
3. Cholecystitis
4. Perforated duodenal ulcer
5. Appendicitis
6. Perforated colon
7. Fallopian tube (rupture)

Left Upper Quadrant

1. Pleurisy
2. Splenic rupture or infarct
3. Perforated gastric ulcer
4. Pancreatitis
5. Diverticulitis
6. Perforated colon (cancer)
7. Fallopian tube (pregnancy, abscess)



Right Lower Quadrant

1. Appendicitis
2. Acute Crohn's disease
3. Pelvic inflammatory disease
4. Perforated duodenal ulcer
5. Acute cholecystitis
6. Inguinal hernia
7. Leaking aortic aneurysm

Left Lower Quadrant

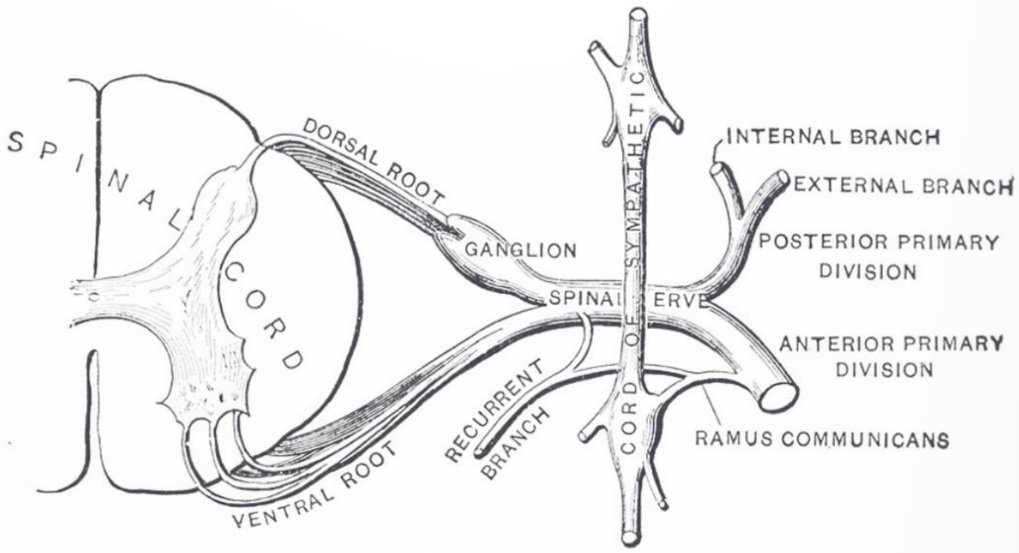
1. Sigmoid diverticulitis
2. Pelvic inflammatory disease
3. Sigmoid carcinoma
4. Gastric ulcer
5. Inguinal hernia
6. Leaking aortic aneurysm

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Neurologic Exam Contents

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Clinicians performing neurologic exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large bias in their interpretation.

When recording test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Free exam forms, online video of neurologic procedures & pathologies available at

http://www.prohealthsys.com

Neurologic Exam Flow

Red flags for more serious pathology
- Headache (sudden & severe) or head injury
- Dizziness/vertigo, nausea and/or vomiting
- Seizures or Tremors
- Weakness and/or incoordination
- Numbness or tingling
- Difficulty swallowing or speaking
- Significant past history
- Nystagmus
- Loss of consciousness (LOC)

Examination tips
- Explain the exam & give the patient appropriate instructions (eyes closed, appropriate response to give, etc.)
- Remember neurologic exams are often subjective & difficult to interpret
- Specifically map out any area in which sensory changes are found
- Always compare exam findings bilaterally & distally to proximally

Mental Status (brain/cortex)

Behavior? (Alert, lethargic, confusion, speech)
History? (Gather info. from family & friends)
Orientation (Time, person, place & situation)
Memory/Concentration
- Name President/Prime minister
- 3 word/place recall
- (100) - (7) up to five times (93, 86, 79, 72, 65)

Cranial Nerves (brainstem)
- Smell (I)
- Cardinal fields of gaze (III, IV, VI)
- Accommodation (III)
- Peripheral vision (II)
- Facial expression (VII)
- Stick out tongue (XII)
- Trap/SCM muscle test (XI)
- Hearing (VIII) if (+): Weber, Rinne
- Consensual light reflex (II, III)
- Examine oral mucosa
- Say "ahhhh" (IX, X), bite tongue depressor (V)
- Ophthalmoscopic exam (II)
- Otoscopic & rhinoscopic exam

Cerebellum (RADAR)

Rapid alternating movements
- Finger, hand, foot tapping
- Rapid forearm pronation/supination

Accessory movements
- Intentional tremors or nystagmus

Dysmetria (past pointing)
- Finger to nose, finger to finger
- Heel to shin

Ataxia
- Gait - heel to toe, walk in a circle

Rebound phenomenon
- Holme's sign (release resistance = hit self)

Spinal Cord & Peripheral Nerves

SENSORY

Posterior columns
- Light touch (fasiculis gracilis/cuneatus)
- Vibration (128Hz tuning fork)
- Stereognosis (ID object by touch)
- Graphesthesia (ID number written on skin)
- Proprioception (dorsospinocerebellar tract)
  - Romberg (eyes closed)
  - Position changes

Lateral columns (spinothalamic tract)
- Pain - sharp/dull
- Temperature - hot/cold

MOTOR (corticospinal tract)
- Deltoid (C5, C6) (axillary)
- Brachioradialis (C5, C6) (radial)
- Biceps (C5, C6) (musculocutaneous)
- Triceps (C6, C7, C8, T1) (radial)
- Wrist extensors (C6, C7, C8) (radial)
- Wrist flexors (C6, C7) (median/ulnar)
- Finger flexors (C7, C8, T1) (ulnar/median)
- Interossei (C7, C8, T1) (ulnar)
- Tibialis anterior (L4, L5) (deep peroneal)
- Extensor hallicus longus (L4, L5, S1) (deep peroneal)
- Peroneus longus (L5, S1) (superficial peroneal)

REFLEXES

Deep Tendon Reflexes (DTRs): Biceps (C5); Brachioradialis (C6); Triceps (C7), Patella (L4); Hamstring (L5); Achilles (S1)

Superficial
- Abdominal - umbilicus moves to stimulus
- Cremasteric, Perianal wink

Pathologic
- Hoffman's (clawing of hand w/ finger flick)
- Babinski & Babinski-like reflexes

Nerve Root Tension Orthopedic Tests
SLR, Braggard's, Bowstring, etc.
Shoulder depression, brachial stretch, doorbell sign, Tinel's, others as indicated

DDx List & Follow-up Procedures

Neurologic Exam Form

Neurologic Examination ☑ Check normal, circle & describe abnormal

CC & significant history: _____

Patient: _____ date: _____
Insurance: _____ (primary)
Date of birth: _____ M/F

Key considerations: ☐ headache, ☐ head injury, ☐ dizziness/vertigo, ☐ seizures, ☐ tremors, ☐ weakness, ☐ incoordination, ☐ numbness/tingling, ☐ difficulty swallowing, ☐ difficulty speaking, ☐ significant past history, ☐ environmental hazards, ☐ other: _____

☐ Refer for secondary consultation: _____

☐ Refer for diagnostic imaging: _____

Mental Status: ☐ WNL

Development (☐ good, ☐ fair, ☐ poor)
Behavior (Alert, lethargic, confusion, speech)
Orientation (Time, person, place & situation)
Memory/Concentration
- ☐ Name president/recent newsworthy events
- ☐ 3 word or place recall at 0 and 5 minutes
- ☐ (100) - (7) up to five times (93, 86, 79...)
- ☐ Spell word backwards
- ☐ Draw a clock (make the time 12:30)
- ☐ Draw overlaping pentagons

Cranial Nerves: ☐ WNL

I - Olfactory	R	L
Scent #1		
Scent #2		
II - Optic		
Visual acuity		
Visual fields		
Fundiscopic exam		
III, IV, VI - Oculomotor, trochlear, abducens		
'H' pattern		
Convergence		
Nystagmus		
Consensual light reflex		
V - Trigeminal		
Lateral jaw deviation		
Masseter contraction		
Face sensation		
Corneal touch reflex		

VII - Facial	R	L
Facial expressions		
Facial expression #2		
Normal eye moisture		
VIII - Vestibulocochlear		
Rhomberg's test		
Auditory acuity		
Weber		
Rinne		
IX, X - Glossopharyngeal & Vagus		
Gag reflex		
Elevation of palate		
XI - Spinal accessory		
Trapezius muscle test		
SCM muscle test		
XII - Hypoglossal		
Stick out tongue		

Reflexes: ☐ WNL

DTR (0-5)	R	L
Biceps (C5)		
Brachioradialis (C6)		
Triceps (C7)		
Patella (L4)		
Hamstring (L5)		
Achilles (S1)		

Pathologic	R	L
Babinski		
Abdominal		
Hoffman's		

*Note presence of clonus

Cerebellar: ☐ WNL

	R	L
Rapid finger movement		
Rapid pro/supination		
Finger-to-nose/finger		
Heel down shin		
Holme's rebound sign		
Gait/heel-toe walk		

Sensory: ☐ WNL

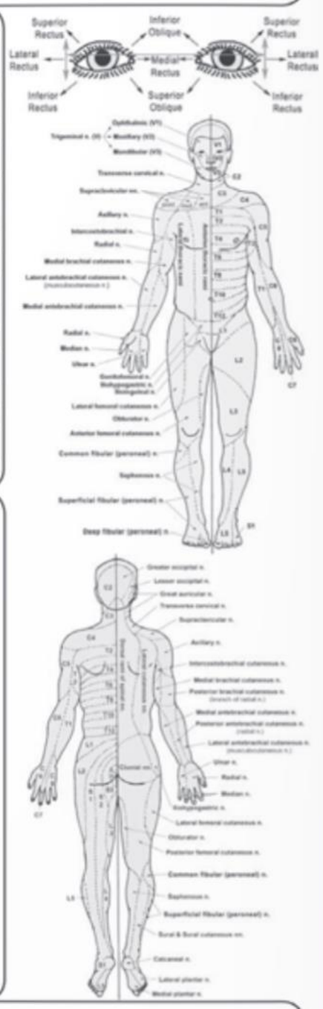
	R	L
Light touch		
Vibration		
Stereognosis		
Graphesthesia		
2-point discrim		
Position sense		
Proprioception		
Romberg		
Sharp/dull		
Hot/cold		

Motor Function: ☐ WNL

Motor (0-5)	R	L
Deltoid (C5, C6) (axillary)		
Brachioradialis (C5, C6) (radial)		
Biceps (C5, C6) (musculocut.)		
Triceps (C6, C7, C8, T1) (radial)		
Wrist flexors (C6, C7) (med./ulnar)		
Wrist extensors (C6, C7, C8) (rad.)		
Interossei (C7, C8, T1) (ulnar)		
Tib. anterior (L4, L5) (deep per.)		
Extensor hallicus longus (L4, L5, S1) (deep peroneal)		
Fibularis (peroneus) longus (L5, S1) (superficial peroneal)		

Nerve Tension: ☐ WNL

	R	L
Straight Leg Raise		
Maximal SLR		
Bragard's		
Femoral nerve traction		
Median nerve traction		
Radial nerve traction		
Ulnar nerve traction		
Tinel's		



DDx:

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

Signature: Date:

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http://www.prohealthsys.com

Neuroanatomy Review

Tract/Region	Function	Test
Spinocerebellar (cerebellum)	• Motor • Gait	• Heel to shin, Finger to nose • Dysdiadochokinesia • Heel to toe (tandem walk)
Posterior Columns	• Sensory • 2 point discrimination • Vibration • Position sense	• Romberg, stand with eyes closed • 2 pins, paper clip • 128 Hz tuning fork • Passive toe movement
Corticospinal	• Motor	• Muscle strength tests • Deep tendon reflexes
Lateral Spinothalamic Anterior Spinothalamic	• Sensory, light touch • Pain & Temperature	• Sharp/dull • Hot & cold test tubes
Vestibulospinal	• Sensory • Auditory	• Balance reflexes • Weber, Rinne

Spinothalamic tract: brainstem or spinal cord lesions result in *contralateral* loss of pain/temp sensation below the level of lesion

Conscious proprioception & stereognosis: spinal lesions result in *ipsilateral* loss of proprioception & stereognosis

Spinocerebellar tract: spinal cord & cerbellar lesions result in *ipsilateral* loss of coordination (unconscious proprioception)

Unilateral cerebral cortex lesions generally result in sensory loss & weakness on the *contralateral* side of the body

Sensory exam terminology:

- **Paresthesia:** abnormal sensation (pins & needles) dysethesia = numbness
- **Hypesthesia:** partial loss of touch sensation
- **Anesthesia:** complete loss of touch sensation
- **Hyperesthesia:** increased touch sensation
- **Hypalgesia:** partial loss of pain sensation
- **Analgesia:** total loss of pain sensation
- **Hyperalgesia:** increased pain sensation
- **Stereognosis:** ability to recognize familiar objects by sense of touch
- **Graphesia:** ability to recognize familiar letters or numbers traced on the skin

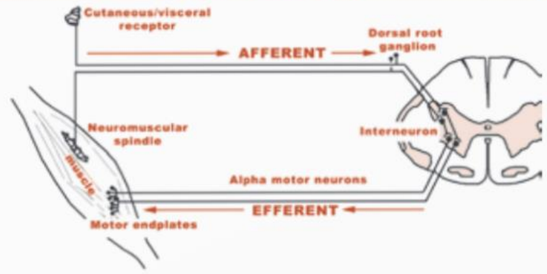
Motor exam terminology:

- **Atrophy:** loss of muscle tone, size & contour
- **Paresis:** muscle weakness
- **Paralysis (flaccid):** complete loss of muscle function & tone
- **Fasciculation:** spontaneous twitches of muscle fibers in a single motor unit
- **Spasticity:** increased muscular resistance initially felt during quick joint motion
- **Clasp knife phenomenon:** increased muscle tension felt when the joint is first moved, but tension decreases as the joint is moved further
- **Rigidity:** involuntary muscle resistance felt when moving a resting joint
- **Cogwheel rigidity:** rigidity that gives way in a series of little jerks (Parkinson's)
- **Lead pipe rigidity:** diffuse muscular rigidity felt through the entire range of joint motion (Parkinson's)

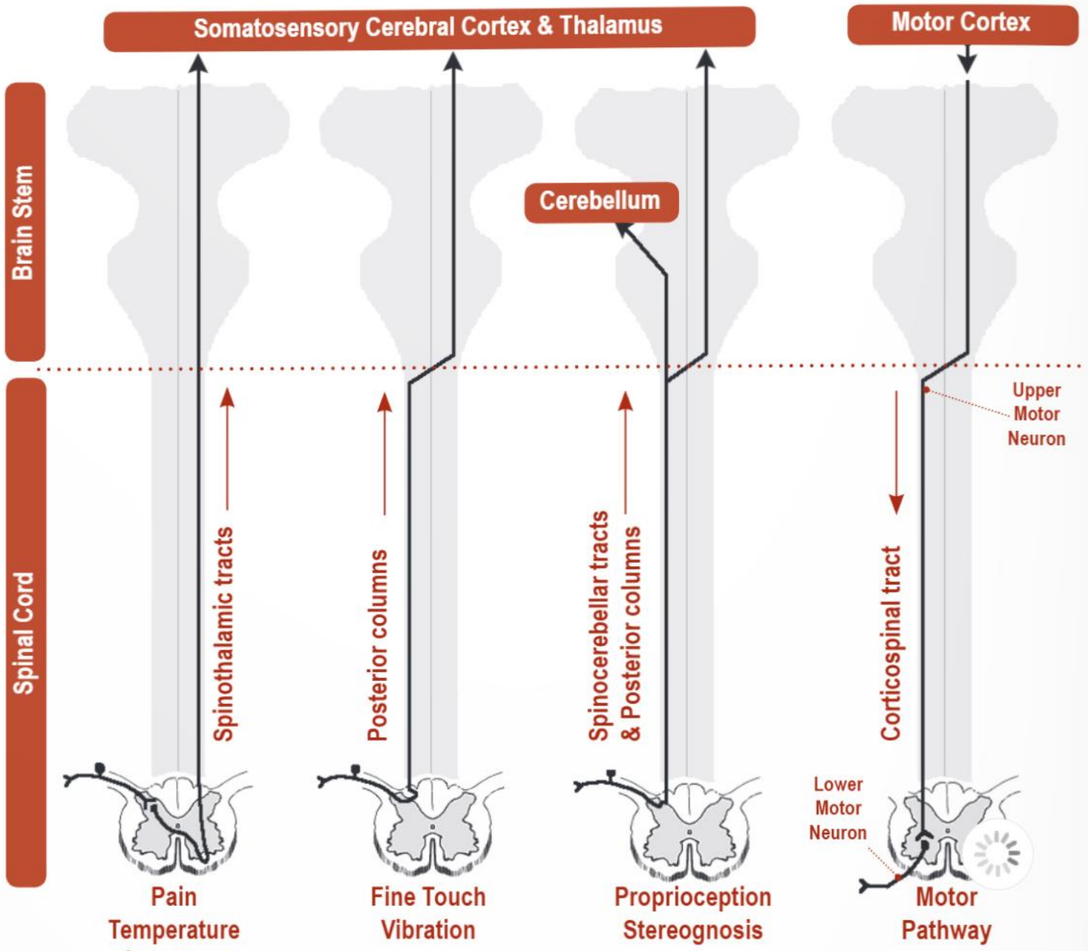
Deep tendon reflexes

- **Clonus:** rapid alternating muscular contraction & relaxation following a deep tendon stretch
- **Jendrassik maneuver:** patient is instructed to interlock fingers or ankles & pull against the other; examiner strikes tendon just as the patient pulls interlocked area
- **Spastic paralysis:** the upper motor neuron lesion that may result in an increased deep tendon reflex response (hyperreflexia)

Simple Reflex Loop



Neuroanatomy Review



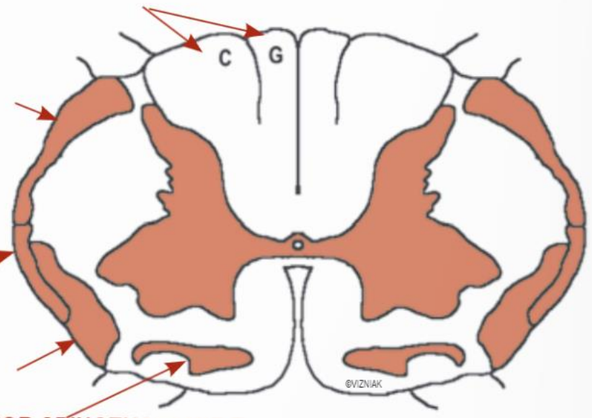
POSTERIOR / DORSAL COLUMNS
(C = f. cuneatus = upper body) - (G = f. gracilis = lower body)
Proprioception, vibration, discriminative touch, deep touch/pressure

DORSAL SPINOCEREBELLAR TRACT
Conscious & unconscious proprioception

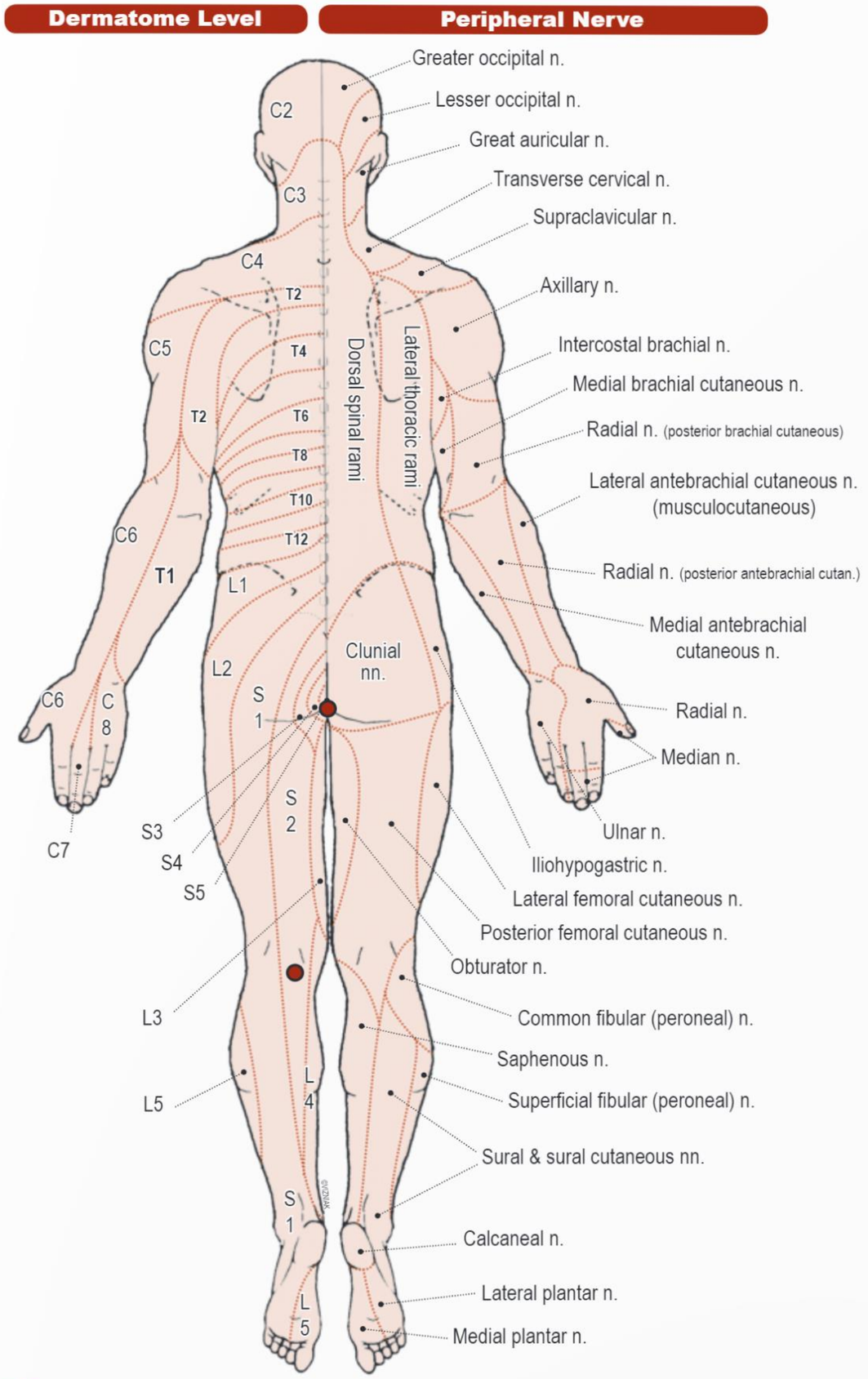
VENTRAL SPINOCEREBELLAR T.
Unconscious proprioception

LATERAL SPINOTHALAMIC T.
Pain & temperature, light touch

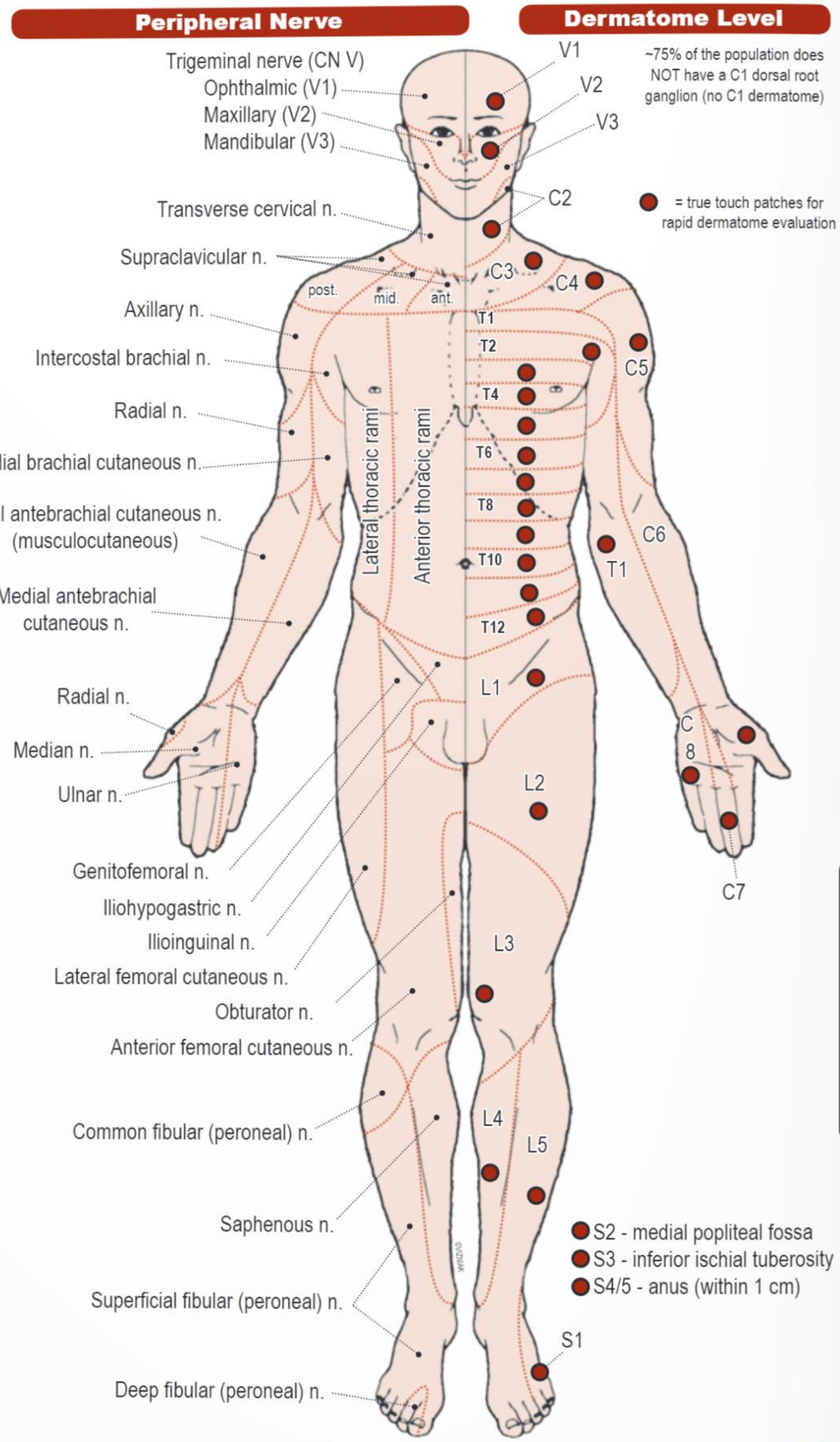
ANTERIOR SPINOTHALAMIC T.
Light touch, pain & temperature



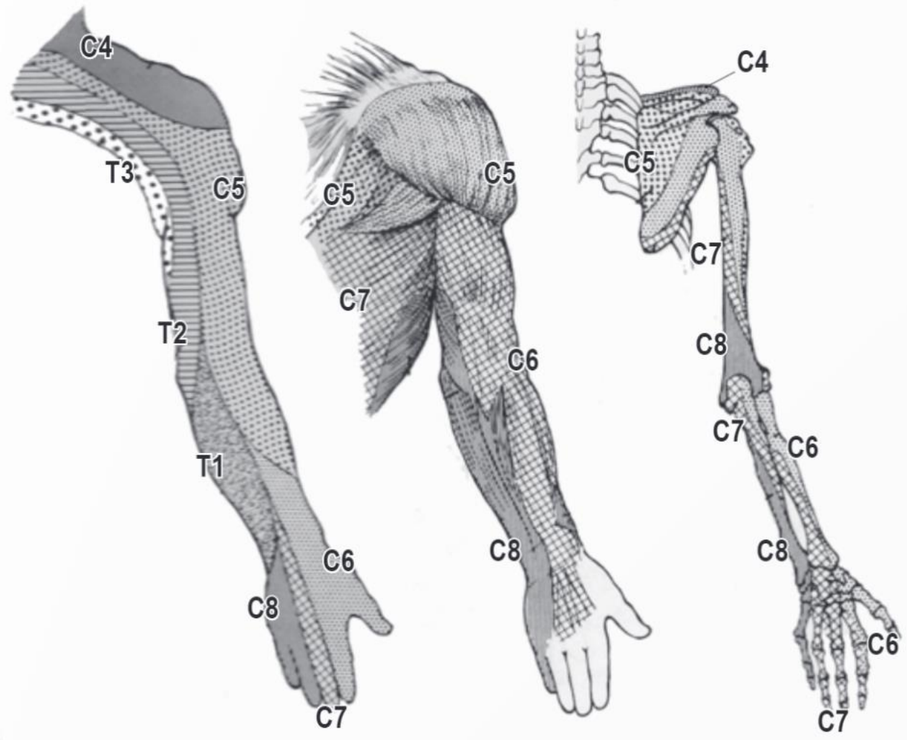
Cutaneous Innervation (posterior)

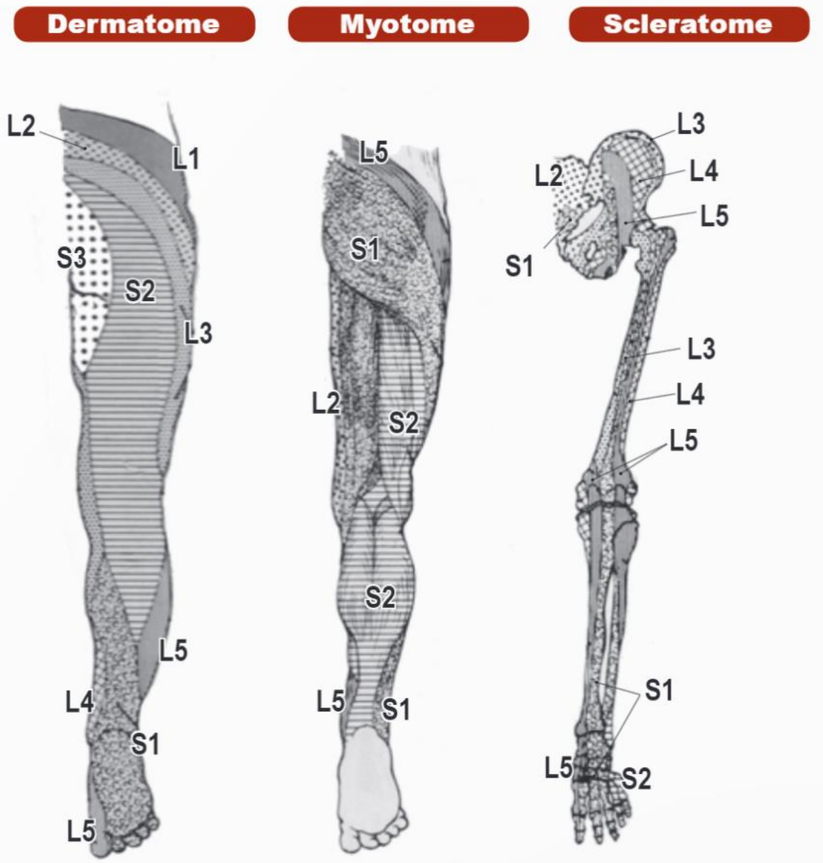


(anterior) Cutaneous Innervation

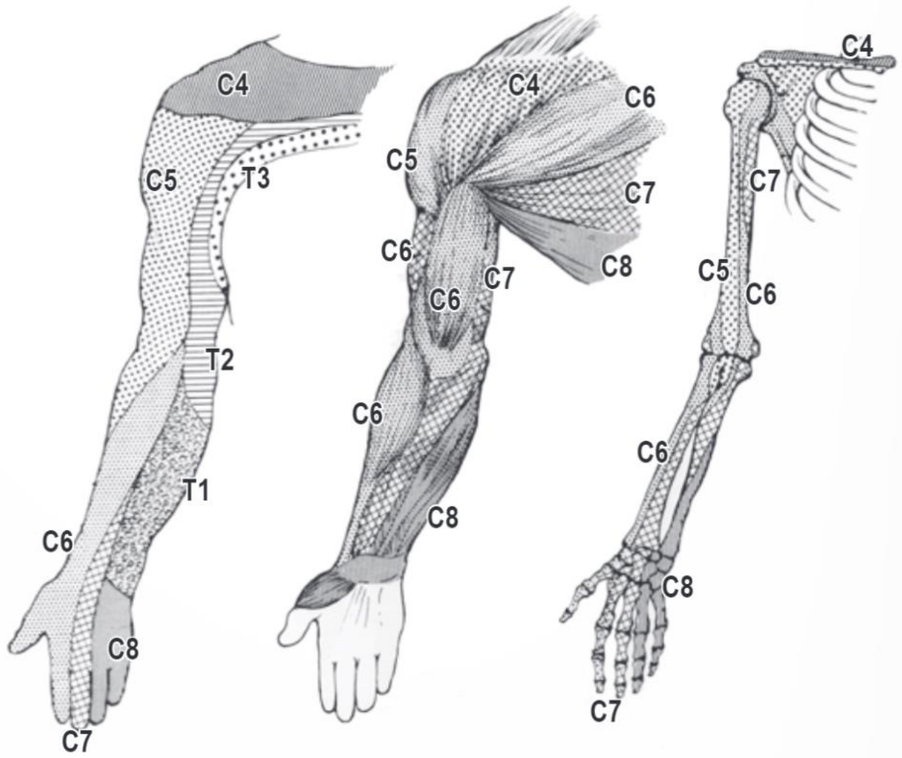


Derma - Myo - Scleratomes





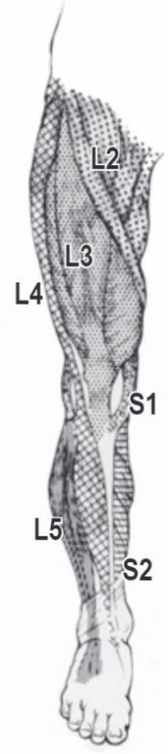
Derma - Myo - Scleratomes



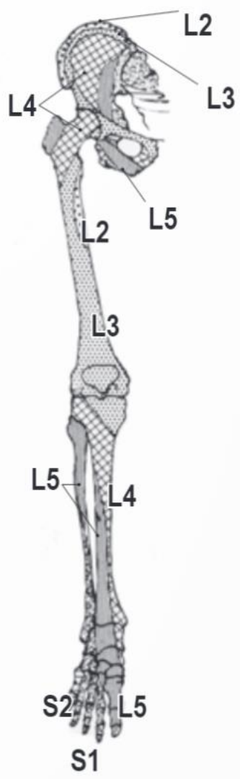
Dermatome



Myotome

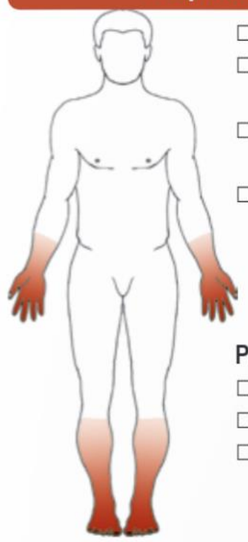


Scleratome



Sensory Lesion Patterns

Peripheral neuropathy

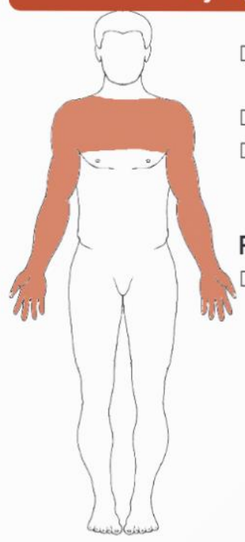


- ☐ Loss of all sensory modes
- ☐ More severe distally (feet & hands)
- ☐ "Glove & stocking" anesthesia
- ☐ Improved sensation proximally; anesthesia zone moves into hypoesthesia then to normal

Potential causes

- ☐ Diabetes, metabolic Dz
- ☐ Nutritional deficiency
- ☐ Pernicious anemia

Syringomyelia

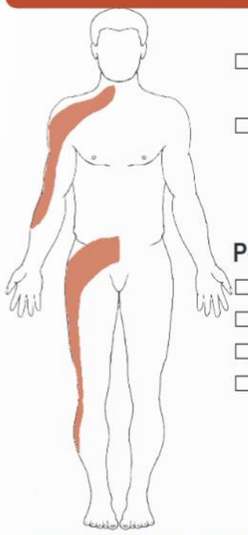


- ☐ Loss of pain & temperature sense
- ☐ "Shawl-like" distribution
- ☐ Normal – light touch & proprioception

Potential cause

- ☐ Syringomyelia = fluid filled cavitation in spinal canal that causes pressure on spinothalamic tract

Individual nerve or roots (radicular syn.)

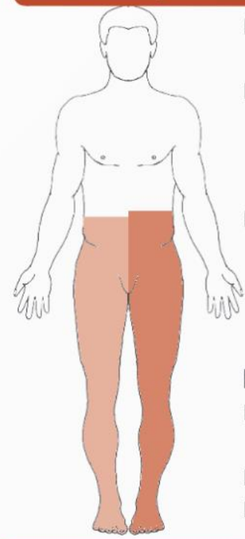


- ☐ Decrease or loss of all sensory modes
- ☐ Area of sensory loss corresponds to anatomical distribution of nerves

Potential causes

- ☐ Trauma
- ☐ Vascular occlusion
- ☐ Disc herniation
- ☐ Impingement syndrome

Spinal cord hemisection

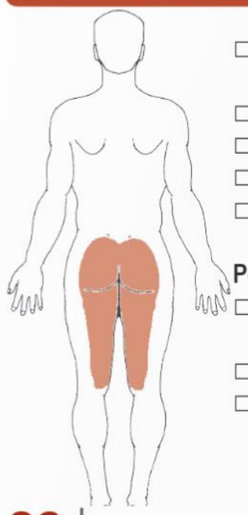


- ☐ "Brown-Séquard syndrome"
- ☐ Loss of pain & temperature, contralateral side starting two levels below lesion
- ☐ Loss of vibration & position sense, spastic paralysis & hyperreflexia on ipsilateral side, below level of lesion

Potential causes

- ☐ Meningioma, neurofibroma
- ☐ Cervical Spondylosis
- ☐ Multiple Sclerosis

Cauda equina syndrome

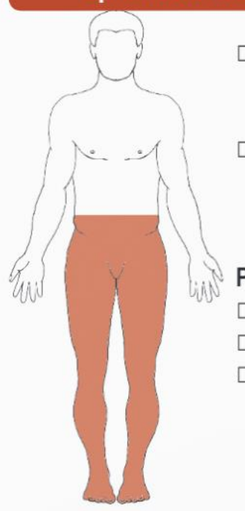


- ☐ Decrease or loss of all sensory modes
- ☐ Saddle anesthesia
- ☐ Urinary retention
- ☐ Incontinence
- ☐ Impotence

Potential causes

- ☐ Large central disc herniation
- ☐ Tumor
- ☐ Trauma (fracture)

Spinal cord transection (complete)

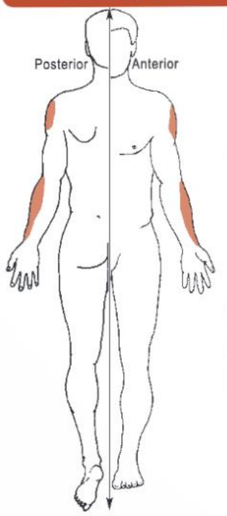


- ☐ Complete loss of all sensory modes below level of lesion
- ☐ Associated with spastic paralysis, hyperreflexia & loss of sphincter control

Potential causes

- ☐ Trauma (fracture)
- ☐ Demyelinating disorders
- ☐ Tumor

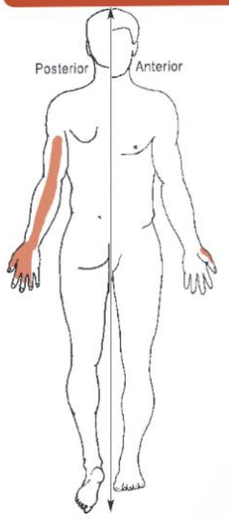
Axillary & musculocutaneous injury



- ☐ Axillary - lateral shoulder sensory loss, deltoid atrophy
- ☐ Musculocutaneous - lateral forearm sensory loss, muscle weakness in elbow flexion

Potential causes
- ☐ Humeral head fracture
- ☐ Surgical error

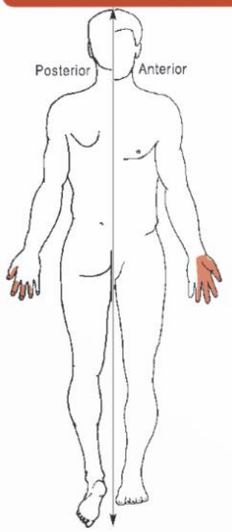
Radial nerve injury



- ☐ Decrease or loss of all sensory modes over posterior arm, forearm, wrist & lateral posterior hand
- ☐ "Wrist drop"
- ☐ Wrist extensor atrophy

Potential cause
- ☐ Brachial plexus injury
- ☐ Shoulder dislocation
- ☐ Direct trauma

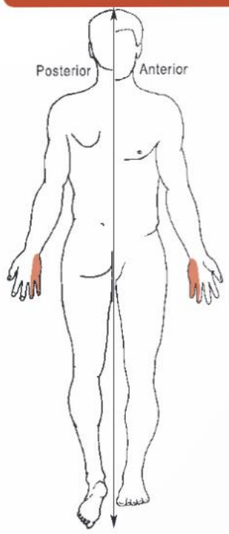
Median nerve injury



- ☐ Decrease or loss of all sensory modes on lateral hand
- ☐ "Ape hand"
- ☐ Thenar atrophy

Potential cause
- ☐ Brachial plexus injury
- ☐ Elbow dislocation
- ☐ Direct trauma
- ☐ Carpal tunnel syndrome

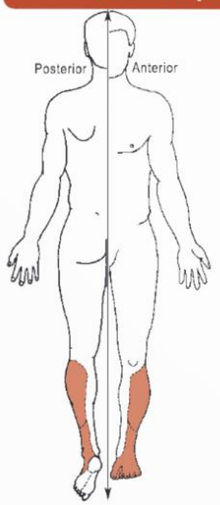
Ulnar nerve injury



- ☐ Decrease or loss of all sensory modes on medial hand
- ☐ "Claw hand" (unopposed action of extensor digitorum)
- ☐ Interosseus atrophy
- ☐ (+) Froment's Sign

Potential cause
- ☐ Brachial plexus injury
- ☐ Humeral head fracture
- ☐ Elbow dislocation
- ☐ Direct trauma

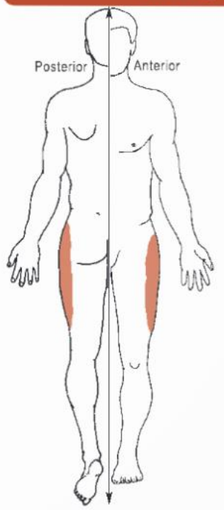
Common peroneal nerve injury



- ☐ Decrease or loss of all sensory modes on lateral shin & foot dorsum
- ☐ "Foot drop"
- ☐ Steppage gait

Potential cause
- ☐ Prolonged sitting with crossed knees
- ☐ Direct trauma to fibular head
- ☐ Fibular head fracture
- ☐ Compression from high boots

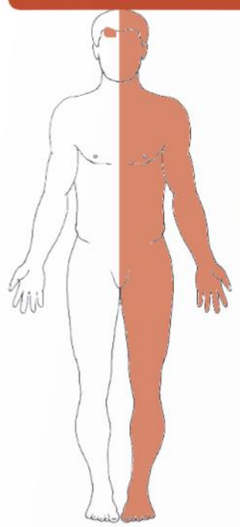
Meralgia paresthetica



- ☐ Paresthesia over anterior lateral thigh
- ☐ Decreased light touch sensation
- ☐ No motor loss

Potential cause
- ☐ Direct trauma
- ☐ Pelvic mass or pregnancy
- ☐ Tight belts/tool belts
- ☐ Obesity

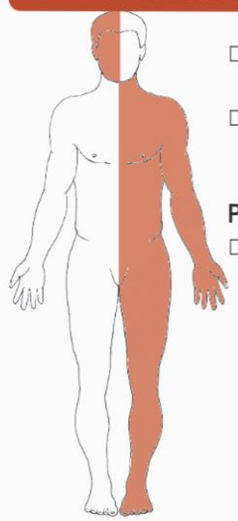
Thalamus lesion



- ☐ Loss of all sensory modes on face & body on side contralateral to lesion

Potential cause
- ☐ Vascular occlusion

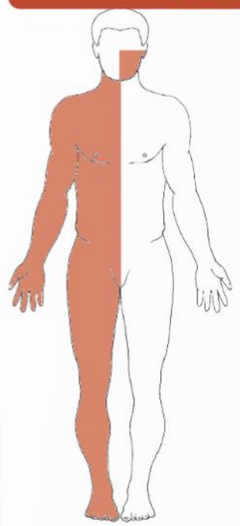
Wallenberg's syndrome



- ☐ Loss of pain & temperature on ipsilateral face
- ☐ Loss of pain & temperature on contralateral body

Potential cause
- ☐ Right posterior inferior cerebellar artery (PICA) occlusion

Brainstem lesion

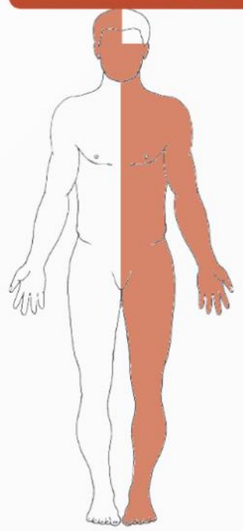


- ☐ Normal pain & temperature sensation
- ☐ Right side: spastic paralysis, hyperreflexia, decreased proprioception
- ☐ Left side: weakness & atrophy of tongue

Lesion location:

Medulla

Brainstem lesion

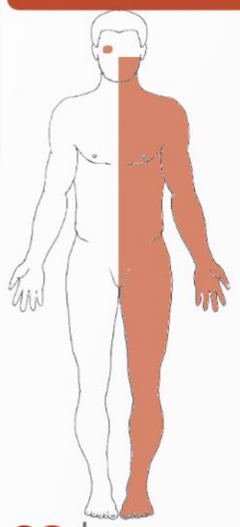


- ☐ Right side: masseter muscle weakness (muscles of mastication), facial anesthesia
- ☐ Left side: weakness of lower face, arm & leg

Lesion location:

Pons

Brainstem lesion

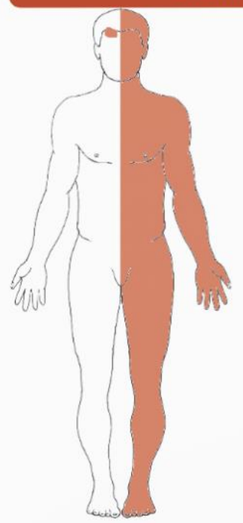


- ☐ Right side: ptosis, dilated pupil, difficulty adducting eye
- ☐ Left side: lower facial paralysis, spastic paralysis of extremities

Lesion location:

Midbrain

Brainstem lesion



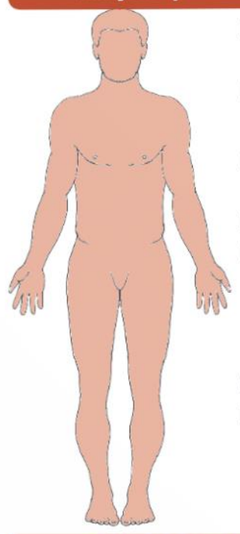
- ☐ Bilateral cranial nerve III (oculomotor) paresis
- ☐ Left side: decrease in all sensory modalities

Lesion location:

Midbrain

CNS Lesion Patterns

Amyotropic lateral sclerosis (ALS)

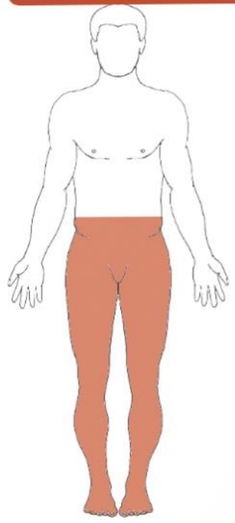


- ☐ Combination of UMNL & LMNL signs
- ☐ Usually effects distal extremities first
- ☐ Muscle atrophy, fasiculations
- ☐ Hyperreflexia
- ☐ Normal cognition, oculomotor & sensory function

Cause

- ☐ ALS (Lou Gehrig's disease) – axonal degeneration

Guillain-Barré syndrome

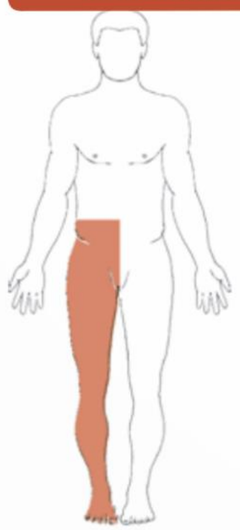


- ☐ Peripheral nerve roots effected
- ☐ Rapid onset of flaccid paralysis
- ☐ Decrease in all sensory modalities

Cause

- ☐ Demyelination disease

Anterior cerebral artery occlusion



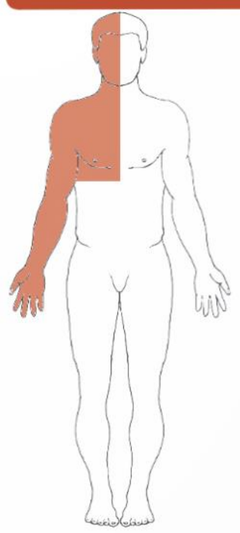
Contralateral:

- ☐ Weakness
- ☐ Decrease of all sensory modes
- ☐ Hyperreflexia

Cause

- ☐ Left anterior cerebral artery occlusion

Middle cerebral artery occlusion



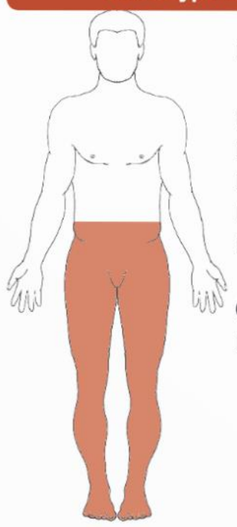
Contralateral:

- ☐ Weakness
- ☐ Decrease of all sensory modes (arm > leg)
- ☐ Hyperreflexia

Cause

- ☐ Left middle cerebral artery occlusion

Neurosyphilis (tabes dorsalis)

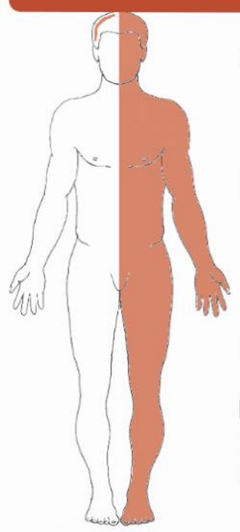


- ☐ Decreased proprioception
- ☐ Hyporeflexia
- ☐ (+) Romberg
- ☐ Sensory loss
- ☐ Ataxia
- ☐ Bladder dysfunction

Cause

- ☐ Organism: Treponema pallidum - syphilis (affects posterior columns)

Cortex lesion



- ☐ Slight loss of pain, vibration & crude touch - these functions are mediated by thalamus
- ☐ Loss of fine touch, graphesthesia, & stereognosis on contralateral side to lesion
- ☐ Cognitive deficits

Potential causes

- ☐ Cerebral cortex trauma
- ☐ Parietal lobe lesion

Neurologic Exam

Deep Tendon Reflexes

Procedure

1. Patient is relaxed, with mild stretch in muscle to be tested
2. Use a quick, precise stimulus (rapidly strike tendon)
3. ***Jendrassik maneuver*** may be required (isometric contraction at another location to distract patient)
4. Compare results bilaterally
5. Note presence or absence of clonus (a repeating reflex with alternate muscular contraction & relaxation in rapid succession)

Note: many elderly patients will have decreased or complete lack of an Achilles reflex; this is usually a normal finding

When possible the examiner may choose to palpate muscle being tested when reflexes are difficult to visually observe

Reflex Grading Scale	
Grade	**Description**
5+	Hyperreflexia - sustained clonus
4+	Hyperreflexia - transient clonus
3+	Hyperreflexia
2+	Normal (lower half of range)
1+	Hyporeflexia (trace response)
0	Absent/no response
Chart reflexes out of 5, e.g.: *2+/5 biceps DTR*	

Hyporeflexia	Hyperreflexia
Diminished to absent DTRs Potential causes: 1. Technique error (most common) 2. LMNL (Lower Motor Neuron Lesion) 3. Peripheral neuropathy (common) 4. Radiculopathy (nerve root - disc lesions)	**Increased or hyperactive DTRs** Potential causes: 1. UMNL (Upper Motor Neuron Lesion), secondary to brain, brainstem / spinal cord lesion or compression 2. Clonus is often associated with UMNL

DTR Jaw Reflex (V)



Procedure

Patient relaxed with jaw open about 10°-15°, examiner applies gentle over pressure on jaw with thumb & proceeds to briskly strike thumb with reflex hammer

Interpretation

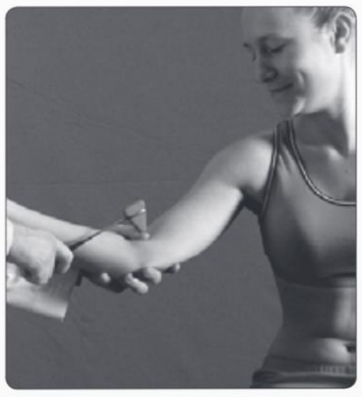
Normal: brisk contraction of masseter & medial pterygoid muscles & closure of the mouth

Clinical notes

Afferent/efferent nerve: Trigeminal nerve

Level: Pons

DTR Biceps (C5)



Procedure

Patient relaxed, examiner applies downward traction force with thumb on the patient's distal biceps brachii tendon, examiner then briskly strikes thumb applying traction & observes/palpates for contraction of the biceps muscle

Interpretation

Normal: brisk contraction of biceps muscle & flexion of the elbow

Additional response: brachioradialis DTR

Clinical notes

Afferent/efferent nerve: Musculocutaneous nerve

Level: C4-C5 (R: 0.94 SN: 24-65 SP: 95 LR+: 13 LR-: 0.4)[14, 32]

Level: C5-C6 (R: 0.73 SN: 14-65 SP: 90-94 LR+: 1.4-11 LR-: 0.95)[30, 32]

DTR Brachioradialis (C6)



Procedure

Patient relaxed, examiner briskly strikes the midpoint of the brachioradialis tendon & observes reflex muscle contraction

Interpretation

Normal: brisk contraction of brachioradialis muscle & supination of the forearm

Additional response: biceps DTR

Clinical notes

Afferent/efferent nerve: Radial nerve

Level: C5 & C6 (R: 0.92 SN: 6-17 SP: 94-95)[14, 30, 32]

DTR Triceps (C7)



Procedure

Patient relaxed, examiner briskly strikes the triceps tendon, just proximal to its insertion point on the olecranon process & observes or palpates reflex muscle contraction of the triceps

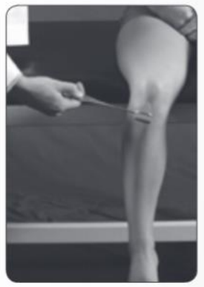
Interpretation

Normal: brisk contraction of triceps muscle & extension of the elbow

Clinical notes

Nerve: Radial nerve - Level: C6 & C7 (R: 0.88 SN: 3-38 SP: 92-98)[14, 30, 32]

DTR Patella (L3-L4)



Procedure

Patient relaxed, examiner briskly strikes the patellar ligament (quadriceps tendon) with a reflex hammer, & observes or palpates reflex muscle contraction in the quadriceps

Interpretation

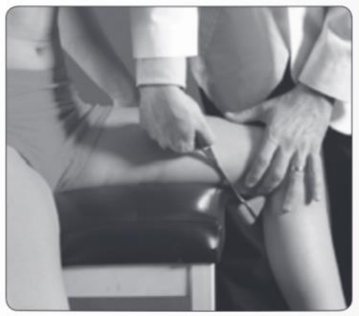
Normal: brisk contraction of quadriceps muscle & extension of the knee

Clinical notes

Afferent/efferent nerve: Femoral nerve

Level: **L3-L4** (SN: 100 SP: 65); L4-L5 (SN: 12 SP: 65); L5-S1 (SN: 12 SP: 65)[28, 30]

DTR Medial Hamstring (L5)



Procedure

Patient relaxed, examiner applies tension with fingers to distal semitendinosus & briskly strikes the fingers & palpates reflex muscle contraction of medial hamstring

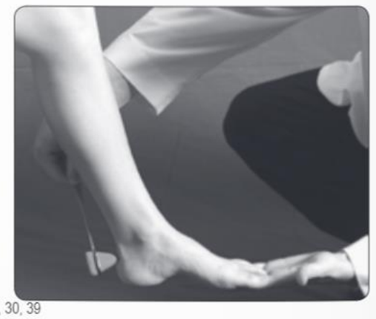
Interpretation

Normal: brisk contraction of hamstring muscle

Clinical notes

Afferent/efferent nerve: Sciatic nerve Level: L5 & S1

DTR Achilles (S1)



Procedure

Patient relaxed, examiner applies slight dorsiflexion tension & briskly strikes the Achilles tendon with a reflex hammer, & observes for reflex muscle contraction in the gastrocnemius & soleus muscles

Interpretation

Normal: brisk contraction of the gastrocnemius & soleus muscles & plantar flexion of the ankle reflex may be normally absent in elderly

Clinical notes

Afferent/efferent nerve: Tibial nerve

Level: L4-L5 (SN: 12-36 SP: 76-89): **L5-S1** (SN: 80-87 SP: 76-89)[23, 27, 28, 30, 39]

Cremasteric Reflex (L1-L2)

Procedure

Patient supine, examiner strokes the patient's proximal medial thigh & observes for elevation of the ipsilateral testis

Interpretation

(-) Elevation of the ipsilateral testicle → Normal response

(+) No testicular elevation → L1-L2 nerve root lesion, corticospinal tract lesion

Clinical notes

If the examination room is cool in temperature, the cremaster muscle may already be contracted (elevating the testicles to keep them warm) thus resulting in a lack of testicular elevation upon stroking of the inner thigh (false positive)

Superficial Gluteal Reflex (L4-L5)

Procedure

Patient prone, examiner strokes the buttock & observes for muscle contraction, the procedure is then repeated on the contralateral side

Interpretation

(-) Gluteal muscle contraction→ Normal response

(+) Lack of gluteal muscle contraction → L4-L5 nerve root lesion, corticospinal tract lesion

Superficial Anal Reflex (S4-S5)

Procedure

Patient prone, examiner strokes the patient's perianal fascia & observes for the presence of anal sphincter contraction ("perianal wink")

Interpretation

(-) Reflex contraction of anal sphincter → Normal response

(+) Lack of anal sphincter contraction → S4-S5-coccygeal nerve lesion

Bulbocavernosus Reflex (S3-S4)

Procedure

Patient supine, examiner gently pitches the glans penis with fingers & observers/palpates contraction of the bulbocavernosus muscle

Interpretation

(-) Reflex contraction of the bulbocavernosus muscle → Normal response

(+) Lack of reflex → S3-S4 nerve root lesion

Clinical notes

In patients with spinal cord injuries (paraplegics, quadriplegics), this reflex is a valuable tool for the assessment of bladder function

Corneal Reflex (V & VII)



Procedure

Seated patient is instructed to "look up", examiner lightly brushes cotton across surface of cornea & observes for bilateral eyelid closure (examiner must be careful not to touch eyelashes or conjunctiva)

Interpretation

(-) Bilateral blinking of the eyes → Normal response
(+) Lack of blink→ Trigeminal or Facial nerve lesion

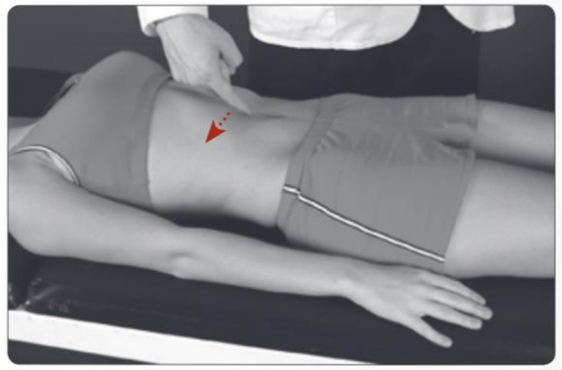
Clinical notes

Afferent Nerve: Trigeminal (V) Nerve
Level: Pons
Efferent Nerve: Facial (VII) Nerve

Upper Abdominal Reflex (T7-T9)

Procedure

Patient supine, examiner strokes skin from medial to lateral above the umbilicus (upper right quadrant) & observes for deviation, the procedure is repeated on the opposite side (upper left quadrant)



Interpretation

(-) Deviation of umbilicus towards stroked side → Normal response
(+) Lack of umbilical movement, non-unilateral movement when exam is performed bilaterally→ T7-T9 nerve root lesion, corticospinal tract lesion

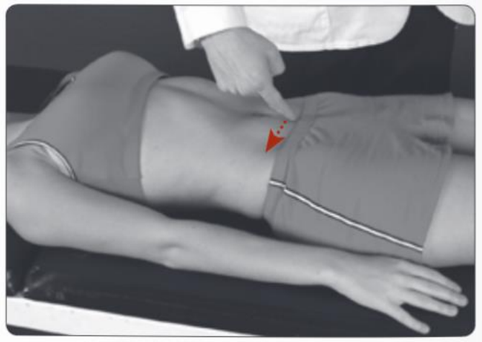
Clinical notes

This reflex may be absent in pregnant patients, obese patients or patients with general abdominal muscle deconditioning

Lower Abdominal Reflex (T10-T12)

Procedure

Patient supine, examiner strokes skin from medial to lateral below the umbilicus (lower right quadrant) & observes for deviation, the procedure is repeated on the opposite side (lower left quadrant)



Interpretation

(-) Deviation of umbilicus towards stroked side → Normal
(+) Lack of umbilical movement, non-unilateral movement when exam is performed bilaterally→ T10-T12 nerve root lesion, corticospinal tract lesion

Clinical notes

This reflex may be absent in pregnant patients, obese patients or patients with general abdominal muscle deconditioning

Dexterity Test

Procedure

Patient seated, examiner instructs patient to sequentially touch each fingertip with the thumb of the same hand, the maneuver is then repeated with the opposite hand

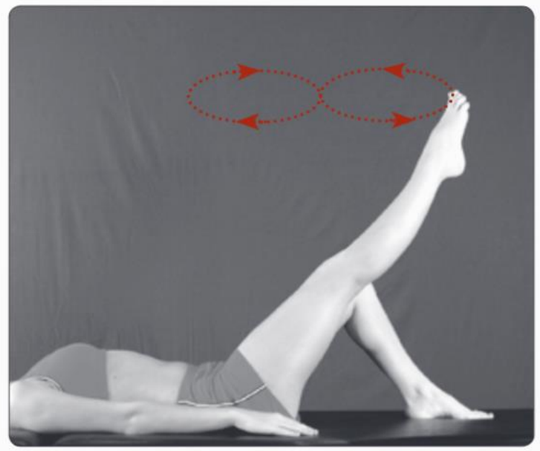
Interpretation

(+) Inability to perform maneuver, tremor, spastic or uncoordinated movements → Impaired cerebellar function

Clinical notes

Patients should be able to perform this maneuver briskly & smoothly
Clinician's option: some examiner's preferred to ask patient to drum index & middle finger up & down as quickly as possible on a table or other flat surface (finger drumming test)

Figure-8 Test



Procedure

Patient supine, examiner instructs patient to draw a "figure 8" in the air with their big toe

Interpretation

(+) Inability to perform maneuver, tremor, spastic or uncoordinated movements → Impaired cerebellar function

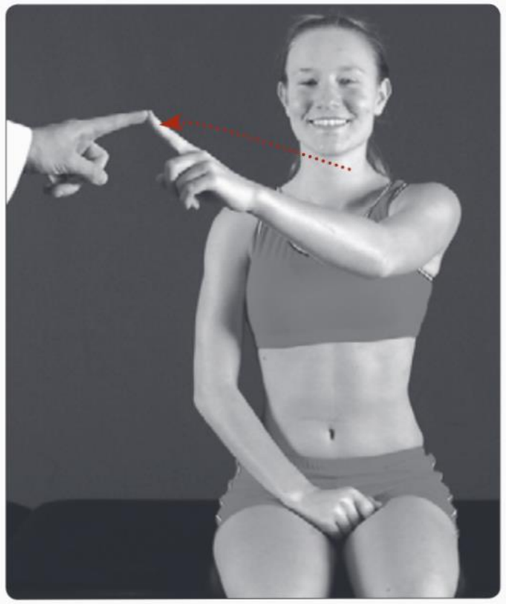
Clinical notes

Patients should be able to perform this maneuver smoothly in a coordinated manner

Finger-Finger Test

Procedure

Patient seated, examiner instructs patient to touch their finger to the examiner's finger with one hand, the maneuver is then repeated with the opposite hand



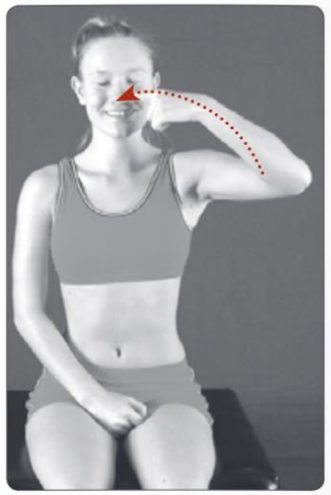
Interpretation

(+) Inability to perform maneuver, tremor with over-shoot or undershoot → Impaired cerebellar function

Clinical notes

A unilateral lesion of one of the hemispheres in the cerebellum will result in ipsilateral extremity signs & symptoms

Finger-Nose Test



Procedure

Patient seated, examiner instructs patient to close eyes & attempt to touch finger to nose with one hand, the maneuver is repeated with the opposite hand

Interpretation

(+) Inability to perform maneuver, tremor with overshoot or undershoot → Impaired cerebellar function

Clinical notes

A unilateral lesion of one of the hemispheres in the cerebellum will result in ipsilateral extremity signs & symptoms

Heel-Knee Test



Procedure

Patient seated or supine, the examiner instructs the patient to place one foot on the opposite knee, then slide foot down shin (maintaining contact between the heel & shin), procedure is then repeated with the legs reversed

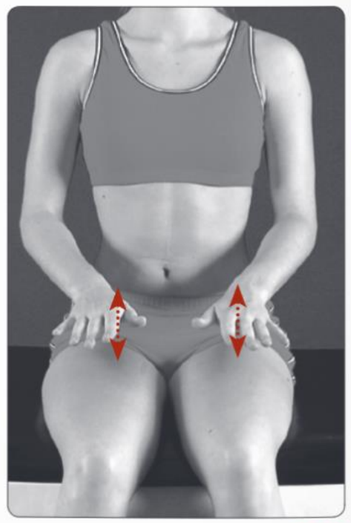
Interpretation

(+) Inability to perform maneuver, tremor, spastic or uncoordinated movements → Impaired cerebellar function

Clinical notes

Patients should be able to perform this maneuver smoothly in a coordinated manner

Patting Test



Procedure

Upper extremity: patient seated, examiner instructs patient to rapidly & repeatedly pat thigh

Lower extremity: patient seated, examiner instructs patient to pat foot rapidly & repeatedly on the floor

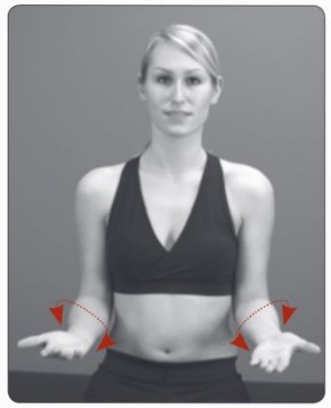
Interpretation

(+) Inability to perform maneuver, tremor, spastic or uncoordinated movements (dysdiadochokinesia) → Impaired cerebellar function

Clinical notes

Patients should be able to perform this maneuver briskly & smoothly

Pronation-Supination Test



Procedure

Patient seated, examiner instructs patient flex elbows 90° & rapidly supinate & pronate arms (rapid alternating movements)

Interpretation

(+) Inability to perform maneuver, tremor, spastic or uncoordinated movements (dysdiadochokinesia) → Impaired cerebellar function

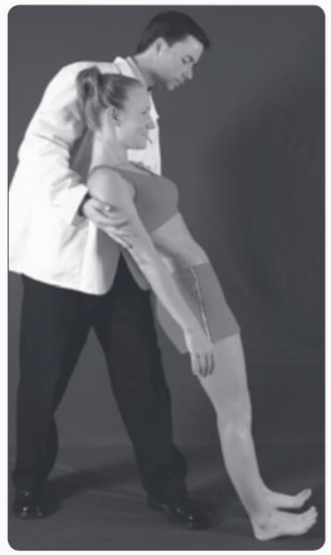
Clinical notes

Synonym: Hand flip test, Hand thigh test

Patients should be able to perform this maneuver briskly & smoothly

Clinician's option: some examiners prefer to have patient's perform rapid alternating supination & pronation while tapping their thigh

Foot Drop Testing



Procedure

Examiner stands behind patient & instructs patient to stand in a rigid posture with feet close together, then without warning examiner grasps the patient's shoulders & pulls the patient's body backwards while observing the movement of the patients toes & forefoot

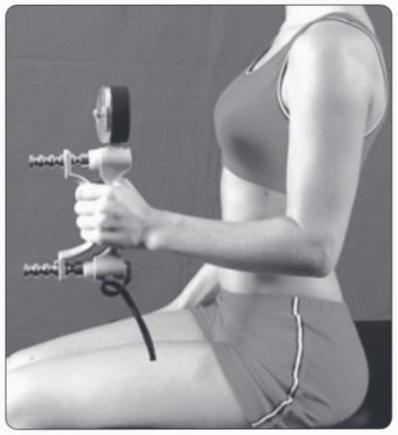
Interpretation

(+) Elevation of the forefoot (which is a normal response) → Simulated foot drop (malingering should be suspected)

Clinical notes

In a healthy patient the normal response is elevation of the forefoot when the body is pulled backwards

Grip Strength Testing



Procedure

Patient seated with elbow flexed 90°, examiner instructs patient to grip examiner's fingers "as hard as they can" with their weak (or paralyzed) hand, without warning the examiner attempts to rapidly pull fingers out of patient grip & observes for the presence of increased resistance

Interpretation

(-) Patient's grip is easily broken → Normal response with true grip strength weakness

(+) Increased momentary resistance is encountered as the examiner rapidly pulls fingers away → Simulated grip strength loss (malingering should be suspected)

Clinical notes

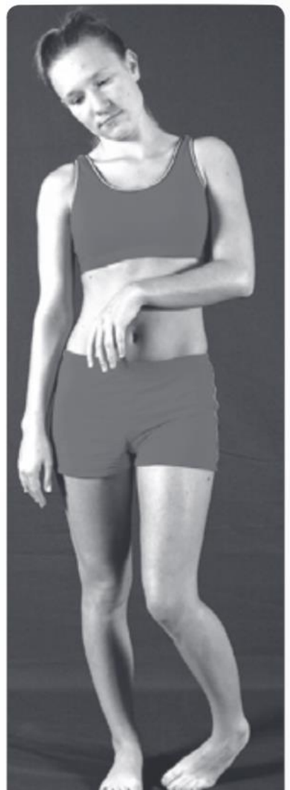
If the patient is simulating grip strength loss, the examiner may notice a brief increase in resistance before the patient realizes with their error, followed by relaxation of the hand

The examiner may use their other hand to actively palpate to forearm flexors & extensors to further evaluate contraction of those muscles & recruitment during grip

Hemiplegic Posturing

Procedure

Examiner observes patient's standing posture



Interpretation

(-) Ipsilateral arm & leg flexion contracture with possible associated muscle atrophy → Hemiplegia due to neurovascular injury (intracerebral hemorrhage, infarction, encephalitis)

(+) Difficulty turning head towards paralyzed side or lack of pronation arm drift → Simulated hemiplegia (malingering should be suspected)

Clinical notes

Malingering patients will often assume that due to paralysis of the body it is difficult for them to rotate their head to the side of paralysis (which is not the case in most forms of true hemiplegia)

Patients with true hemiplegia may also demonstrate the following symptoms, depending upon the location of the lesion:

1. Sensory, motor & deep tendon reflex changes
2. Speech disturbances
3. Muscle atrophy with long-standing conditions

Online video of neurologic procedures & pathologies available at
prohealthsys.com

Limb Drop Test

Procedure

Patient supine, examiner performs a bilateral straight leg raise test, as the examiner lifts the patient's legs; the patient is instructed to push their heels downward against the examiner's resistance, the examiner then removes the supporting hands from the legs & observes the patient's lower extremity movement





Interpretation

(-) Legs fall to the examination table → Hip flexor muscle weakness

(+) Legs move up or hanging in midair for a moment (before falling to examination table) → Simulated lower extremity muscle weakness (malingering should be suspected)

Clinical notes

Lower extremity muscle weakness may be due to a variety of causes (spinal cord damage, general muscle deconditioning, peripheral nerve lesions, multiple sclerosis, poliomyelitis, cerebral palsy, cauda equina syndrome)

Position Sense Testing

Procedure

Patient seated or supine, examiner instructs patient to close eyes & then proceeds to bend the patient's fingers or toes up or down while asking the patient what direction the digit has been moved ("up" or "down")

Interpretation

(+) Correct joint positioned stated ~50% of the time → Proprioceptive loss

(+) Incorrect joint positioned stated ~100% of the time → Simulated proprioceptive loss (malingering should be suspected)

Clinical notes

In normal healthy individuals the correct joint positioned should be given by the patient 100% of the time

As pressure & proprioception are two different sensory pathways the examiner must be careful to grip the lateral sides of the digit during motion to ensure a true proprioceptive test rather than a deep touch or pressure test (which it will be if the examiner grips the ventral & dorsal surface of the digit while attempting the motion)



Cutaneous Sensation

Procedure

Seated or supine patient is asked to identify an area of numbness (lack of cutaneous sensation), examiner proceeds to use a pin or sharp object to test pain sensation & define the boundaries of the numbness

Interpretation

(+) Patient has no response to pain over region & blurry border surrounding the area of numbness → Peripheral neuritis ("stocking & glove" distribution), nerve or nerve root lesion (peripheral or dermatomal nerve distribution)

(+) Simultaneous loss of all forms of sensation (pain, touch, temperature, vibration & proprioception) → Simulated anesthesia (malingering should be suspected in the absence of diagnosed disease or trauma)

Clinical notes

The use of a non-disposable Wartenberg pinwheel should only be employed if sterilization occurs between each use

Potential causes of sensory loss:

1. Peripheral neuropathy (diabetes, metabolic disease, nutritional deficiency)
2. Direct nerve trauma (disc herniation, vascular occlusion, impingement syndrome)
3. Central nervous system lesions (stroke, spinal cord lesions)
4. Other disease processes (amyotrophic lateral sclerosis, multiple sclerosis)

Evidence based analysis:

Superficial pain (sharp): (SN: 23-59 SP: 89-98 LR+: 4-20 LR-: 0.4-0.8)[35, 37]

Vibration: (SN: 22-80 SP: 94-99 LR+: 8-53 LR-: 0.2-0.8)[26, 35, 37]

Light touch: (R: 0.16-0.9 SN: 18-56 SP: 66-86 LR+: 0.7-3.1 LR-: 0.5-1.2)[26, 32, 46]

Romberg's Test



Procedure

Examiner stands near patient (ready to catch them should they fall) & instructs the patient to stand with their feet together first with their eyes open, then with their eyes closed - some clinician's perform this test with the patient's arms straight out in front of the body

Interpretation

(+) Swaying of the body from the ankles with the eyes closed → Posterior column disease

(+) Swaying of the body from the ankles with the eyes open & worse with eyes closed → Impaired cerebellar function

(+) Swaying from the hips catching themselves in the nick of time → Simulated balance problems (malingering should be suspected)

Clinical notes

In the presence of the cerebellar lesion patients will display poor balance or swaying both with eyes opened & with eyes closed

Stoicism Index Test

Procedure

Seated patient is instructed to look straight ahead at a distant object, the examiner observes & times the interval between blinks

Interpretation

(-) Patient blinks once every 20-40 seconds (stoicism index 20-40) → Normal response

(+) Patient blinks more often than once every 15 seconds (stoicism index <15) → Increased sensitivity to pain

(+) Patient blinks less often than once every 60 seconds (stoicism index > 60) → Decreased sensitivity to pain

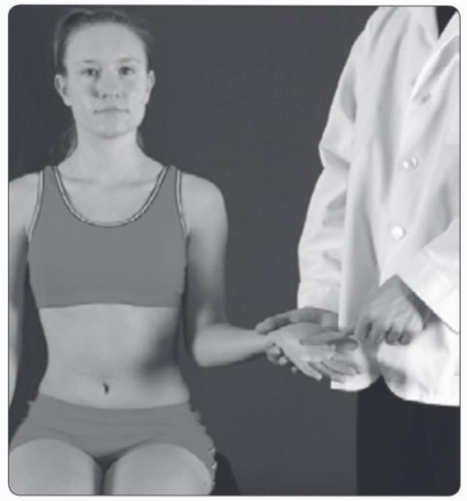
Clinical notes

The validity of this test is extremely subjective, the examiner must be aware that there are numerous conditions that may alter patient blink rates

Patients with a high stoicism index (> 60) are rare & may display decreased sensitivity to pain which should be taken into consideration when performing any provocative (pain inducing) orthopedic test or maneuver as these patients will produce many false negatives



Palmomental Reflex



Procedure

Patient seated, examiner strokes patient's palm of the hand with a mildly noxious stimulus & observes for a twitch of the muscles over the chin on the same side

Interpretation

(-) Lack of a muscle twitch on the chin → Normal response

(+) Ipsilateral muscle twitch on the chin → Damage to the frontal lobes of the brain (frontal lobe releasing sign), Parkinson's disease

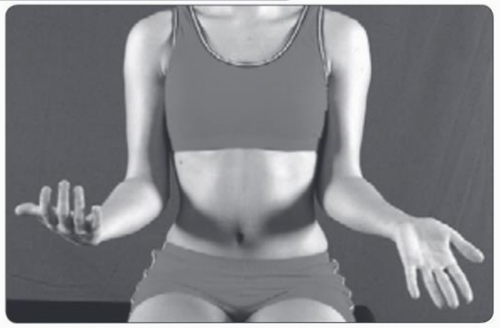
Clinical notes

In the absence of other signs or symptoms of frontal lobe disease the significance of this test is minimal

(R: 99 SN: 24-95 SP: 58-98 LR+: 2-38 LR-: 0.22)[10, 21, 26]

Bechterew's Wrist Sign





Procedure

Examiner instructs seated patient to flex then relax both forearms, while examiner observes motion

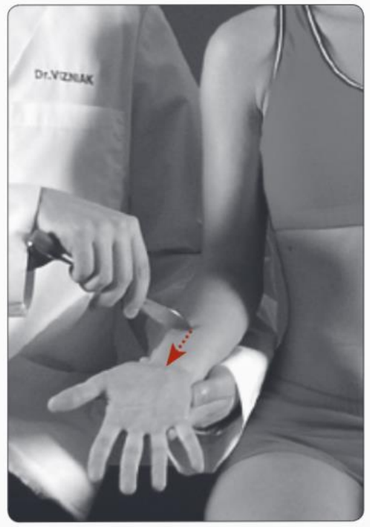
Interpretation

(+) One forearm returns to resting position more slowly, in a jerking manner→ Pyramidal tract lesion (UMNL)

Clinical notes

In the presence of pyramidal tract lesion, this test will only be one of many that should lead you to the exact diagnosis

Chaddock's Wrist Sign



Procedure

Patient seated with elbow flexed 90°, examiner strokes the patient's wrist on the anterior surface of the forearm with a mildly noxious stimulus & observes hand & finger motion

Interpretation

(+) Flexion of the wrist, with extension & fanning of the fingers → Pyramidal tract lesion

Clinical notes

Some authors also demonstrate this test by applying pressure over the palmaris longus tendon

Forced Grasping

Procedure

Patient seated with elbow flexed 90° & hand supinated, examiner strokes the palm of the patient's hand from medial to lateral with a mildly noxious stimulus & observes finger motion

Interpretation

(+) Grasping reaction in hand→ Pyramidal tract lesion (UMNL)

Clinical notes

In the presence of pyramidal tract lesion, this test will only be one of many that should lead you to the exact diagnosis



Gordon's Finger Sign

Procedure

Patient seated with elbow flexed 90° & fingers flexed, examiner grips the patient's wrist & applies pressure in the region of the pisiform bone & observers hand & finger motion

Interpretation

(+) Extension of the fingers → Pyramidal tract lesion



Hoffman's Sign

Procedure

Patient seated with the wrist pronated & elbow flexed 90°, examiner "flicks" the distal end of the patient's middle finger & observes hand & finger motion

Dynamic Hoffman's: have patient slowly flex & extend head while examiner "flicks" finger

Interpretation

(+) Flexion of the thumb & forefingers → Pyramidal tract lesion (UMNL), hyperactive reflex

Clinical notes

When examiner flexes the patient's finger they are actually rapidly stretching the flexor tendon & eliciting a stretch reflex

A unilateral positive Hoffman's sign is indicative of the conditions listed above, however the significance of a bilateral positive Hoffman's sign is debatable

(SN: 28-94 SP: 78 PPV+: 62 PPV-: 75 LR+: 2.2 LR-: 0.6)[5, 42]





Mendel-Bechterew Sign

Procedure

Patient seated or supine, examiner taps the lateral aspect of the dorsum of the foot with a reflex hammer & observes movement of the toes

Interpretation

(-) No toe movement → Normal response

(+) Plantar flexion of the 4 lateral toes → Pyramidal tract lesion

Clinical notes

Synonym: dorsum pedis reflex, Mendel-Bechterew reflex



Rossolimo's Hand Sign

Procedure

Patient seated with elbow flexed 90° & hand supinated, examiner percusses the palmar surface of the metacarpophalangeal joints with reflex hammer & observes for finger flexion

Interpretation

(+) Flexion of all the fingers following percussion→ Pyramidal tract lesion (UMNL)

Clinical notes

In the presence of pyramidal tract lesion, this test will only be one of many that should lead you to the exact diagnosis



Trömner's Sign

Procedure

Patient seated with elbow flexed 90° & hand supinated, examiner taps the palmar surface of the tip of the index & middle fingers

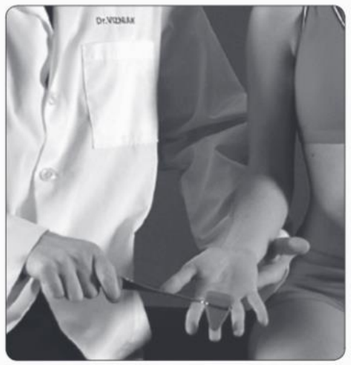
Interpretation

(+) Flexion of all the fingers following tapping → Corticospinal tract lesion (UMNL), hyperactive reflex

Clinical notes

Synonym: finger flexion reflex

In the presence of a corticospinal tract lesion, this test will only be one of many that should lead you to the exact diagnosis



Wrist Clonus

Procedure

Patient seated with elbow flexed 90° & arms relaxed, examiner rapidly & forcibly pushes the wrist into extension or flexion & observes for the presence of clonus

Interpretation

(-) Absence of clonus → Normal response

(+) Clonus (rapid alternating contractions of the muscles of the wrist) → Corticospinal tract lesion (upper motor neuron lesion), multiple sclerosis, amyotrophic lateral sclerosis

Clinical notes

Clonus may also be observed during standard deep tendon reflex testing

Some researchers indicate that a rapidly exhausted clonus may be normal



Babinski Sign

Procedure

Patient supine, examiner strokes the sole of the foot with a mildly noxious stimulus (handle of reflex hammer) & observes toe movement. The stroke pattern on the bottom of the foot goes from the lateral aspect of the heel superiorly towards the medial aspect of the ball of the foot

Interpretation

(-) Toe plantarflexion (often recorded in chart notes as "toes going down") → Normal response

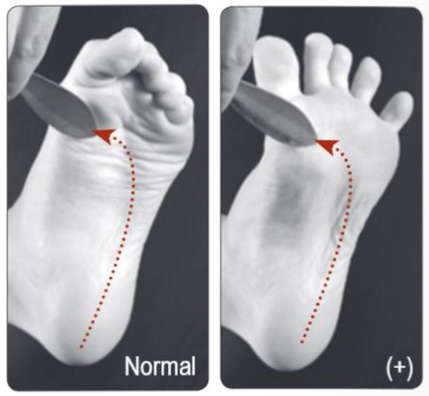
(+) Dorsiflexion of the first toe & fanning digits 2-5 → Pyramidal tract lesion (upper motor neuron lesion)

Clinical notes

It is normal to have a positive result for this test in infants under the age of 16 months

Some patients have hypersensitive feet & may pull away with mild stimulus (warn patients before test)

(R: 0.73 SN: 35-80 SP: 77-90 LR+: 1.5-8 LR-: 0.05-0.8)[12, 14, 16, 19, 34]



Babinski-Like Reflexes

Procedure

Chaddock's Sign: examiner strokes lateral malleolus with a mildly noxious stimulus (handle of reflex hammer) & observes toe movement

Gonda's Reflex: examiner pulls 5th digit down into plantar flexion & releases it with a snap & observes toe movement (SN: 90)[17]

Gordon's Leg Sign: examiner squeezes patient's calf & observes toe movement

Oppenheim's Sign: examiner strokes the medial side of the tibia with a mildly noxious stimulus (handle of reflex hammer) & observes toe movement

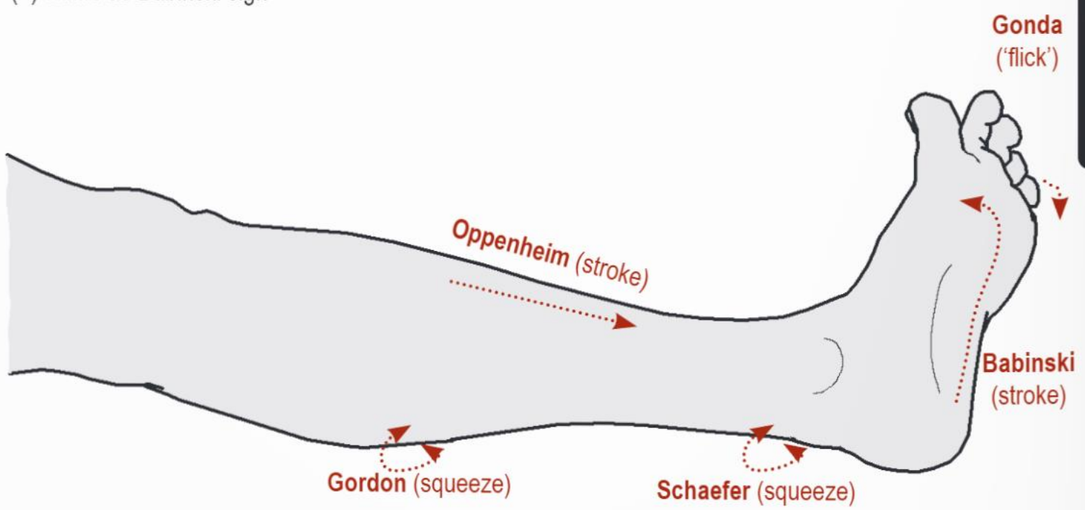
Piotrowski's Sign: examiner percusses the tibialis anterior muscle & observes motion of the foot/toes

Schaefer's Sign: examiner squeezes patient's Achilles tendon & observes toe movement

Throckmortons's Reflex: examiner strokes the lateral aspect of the great toe with a mildly noxious stimulus (handle of reflex hammer) & observes toe movement

Interpretation

(+) Same as Babinski sign



Suprascapular nerve
- Supraspinatus (C4, **C5**)
- Infraspinatus (C5, **C6**)

Long thoracic nerve
- Serratus anterior (C5-C7)

Dorsal scapular nerve
- Levator scapula
- Rhomboid major & minor

Axillary nerve
- Deltoid (**C5**, C6)
- Teres minor (C5, **C6**)

Musculocutaneous nerve
- Biceps brachii (C5, **C6**)
- Brachialis (C5, **C6**)
- Coracobrachialis (C5, **C6**, C7)

Median nerve

Forearm
- Pronator teres (C6, **C7**)
- Flexor carpi radialis (C6, **C7**)
- Palmaris longus (C7, C8)
- Flexor digitorum superficialis (C7, **C8**, T1)
- Flexor digitorum profundus (lateral ½)
- Flexor pollicis longus (**C8**, T1)
- Pronator quadratus (**C8**, T1)

Hand (C8-T1)
- Abductor pollicis brevis
- Opponens pollicis & flexor pollicis brevis
- Lumbricals I & II

Radial nerve

Arm
- Brachioradialis (C5, **C6**, C7)
- Extensor carpi radialis longus (C6-C7)
- Anconeus (C7, C8, T1)
- Triceps (C6, **C7**, **C8**)

Forearm
- Supinator (**C5**, C6)
- Extensor carpi radialis brev. (**C7**, C8)
- Extensor digitorum (**C7**, C8)
- Extensor digiti minimi (**C7**, C8)
- Extensor carpi ulnaris (**C7**, C8)
- Abductor pollicis longus (C7, **C8**)
- Extensor pollicis longus (C7, **C8**)
- Extensor pollicis brevis (C7, **C8**)
- Extensor indicis (C7, **C8**)

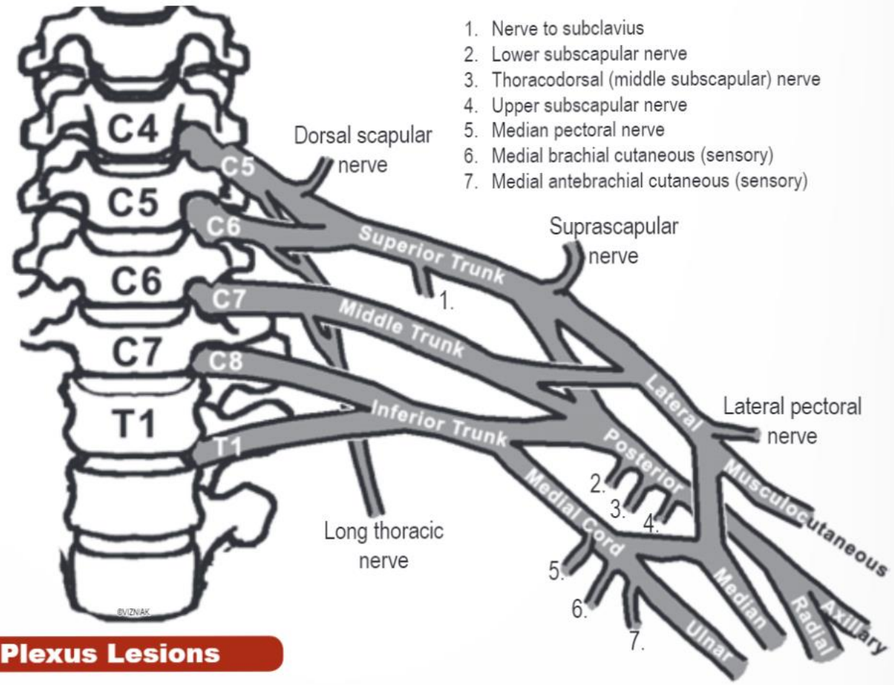
Ulnar nerve

Forearm
- Flexor carpi ulnaris (C7, **C8**)
- Flexor digitorum profundus (medial 1/2)

Hand (C8-T1)
- Flexor & abductor digiti minimi brevis
- Opponens digiti minimi
- Lumbricals III & IV, interossei
- Adductor pollicis
- Flexor pollicis brevis (ulnar portion)

Muscle/Action	C3	C4	C5	C6	C7	C8	T1
Levator scapula							
Rhomboids							
Shoulder (deltoid)							
Pectoralis major							
Latissimus dorsi							
Elbow flexion							
Elbow extension							
Supination							
Pronation							
Wrist extension							
Wrist flexion							
Finger extension							
Finger flexion							
Finger adduction & abduction							
Intrinsic hand muscles							

Brachial Plexus



1. Nerve to subclavius
2. Lower subscapular nerve
3. Thoracodorsal (middle subscapular) nerve
4. Upper subscapular nerve
5. Median pectoral nerve
6. Medial brachial cutaneous (sensory)
7. Medial antebrachial cutaneous (sensory)

Brachial Plexus Lesions

Superior part of the plexus (C5, C6 usually)

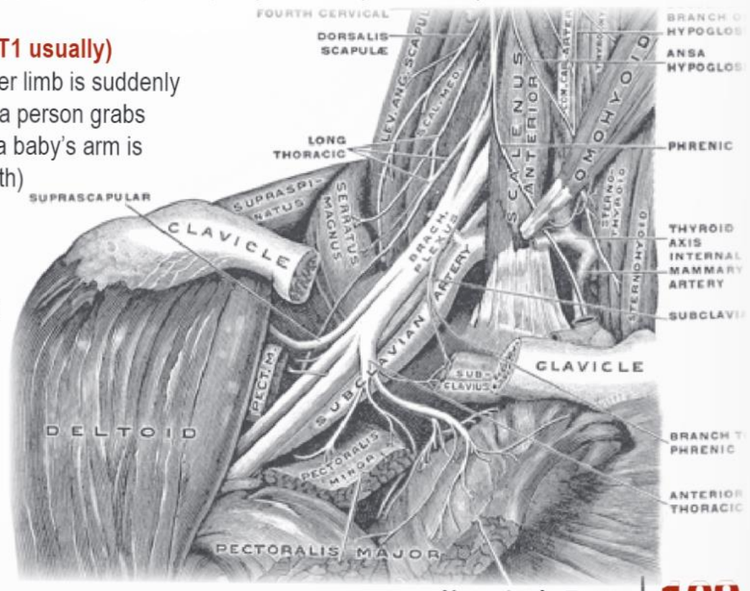
- Injuries can result when an adult is thrown from a motorcycle or horse & their shoulder hits the ground first; may also occur during birth if excessive stretching of the neck occurs on the newborn (result is stretching or tearing of the upper brachial plexus)
- ***Erb's (Erb-Duchenne) palsy*** may result in paralysis of the deltoid, biceps, brachialis & brachioradialis, the patient will present with the shoulder medially rotated & elbow extended, there may also be a loss of sensation over the upper lateral arm ('waiter's tip' deformity)
- ***Backpacker's palsy*** - repetitive microtrauma from carrying a heavy back-pack can also result in upper plexus damage

Compression of the cords (lateral, posterior, medial)

- Compression of the cord can result from prolonged hyperabduction of the shoulder during overhead activities (e.g. painting); the cords are compressed between the coracoid process of the scapula & pectoralis minor (space occupying lesions (cancer) may also compress cords)

Inferior part of the plexus (C8, T1 usually)

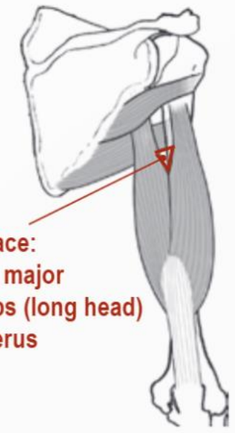
- Typically result when the upper limb is suddenly pulled superiorly (e.g. when a person grabs something to break a fall or a baby's arm is pulled excessively during birth)
- ***Kulpke's palsy*** can be caused by difficult breech delivery; cervical rib or by abnormal insertion or spasm of the anterior and middle scalene muscles may result at child birth. Symptoms include paralysis of intrinsic hand muscles (claw hand), and ulnar nerve distribution numbness



Radial Nerve

Sites of impingement - the radial nerve is usually impinged at one of three sites

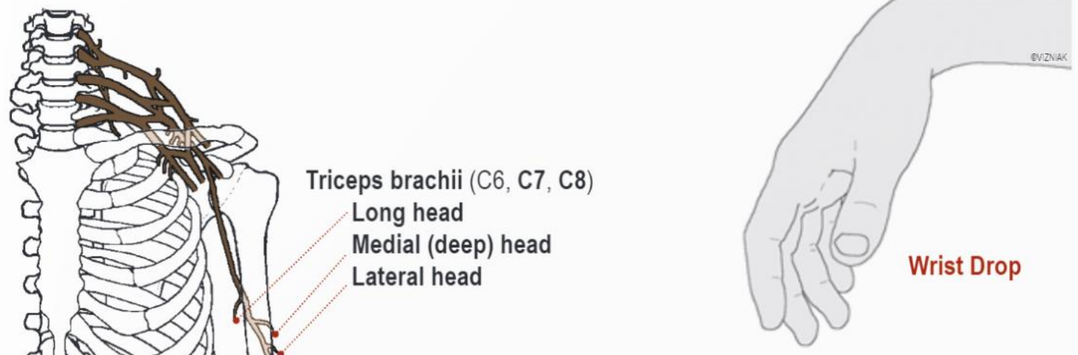
1. ***Triangular space*** - due to poorly adjusted crutches, humeral fractures & dislocations, falling asleep with arm over back of chair - 'Saturday Night Palsy'
   SSx: weakness of elbow extension, weakness of wrist extension - wrist drop
   - Loss of triceps reflex
   - Loss of sensation to entire posterior arm & forearm (except lateral forearm, supplied by musculocutaneous nerve)
   - Loss of sensation to posterior lateral 3 ½ fingers to DIP joints

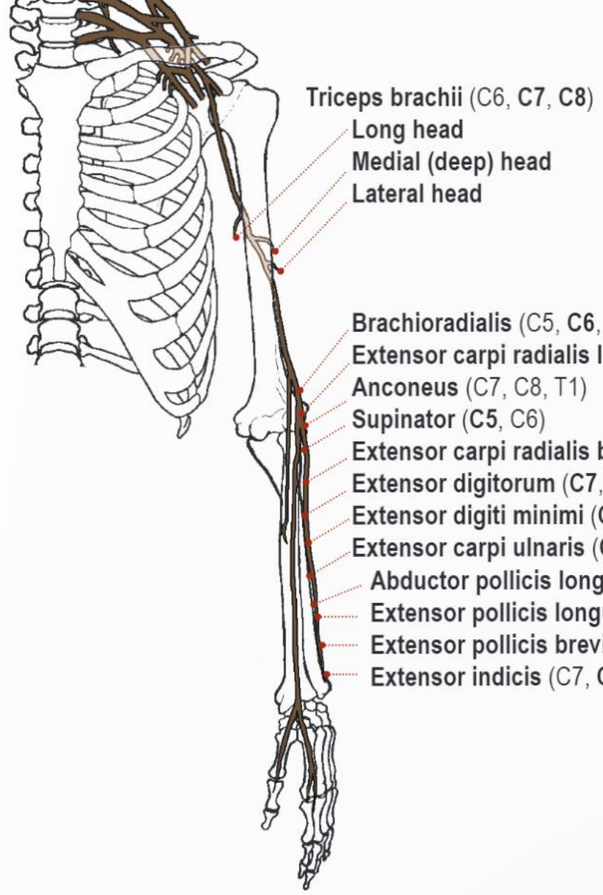


Triangular space:
- **teres major**
- **triceps (long head)**
- **humerus**

2. ***Radial groove*** - often due to compression from humeral fractures, tourniquets or blood pressure cuffs or entrapment below triceps brachii muscle
   SSx: weakness of wrist extension or wrist drop
   - Loss of sensation to posterior lateral 3 ½ fingers to DIP joints

3. ***Elbow*** - deep branch of radial nerve is compressed by fractures of proximal radius or as it passes through the two planes of the supinator muscle (also, less commonly, compression can occur by the extensor carpi radialis brevis muscle)
   SSx: weakness of thumb & MCP extension

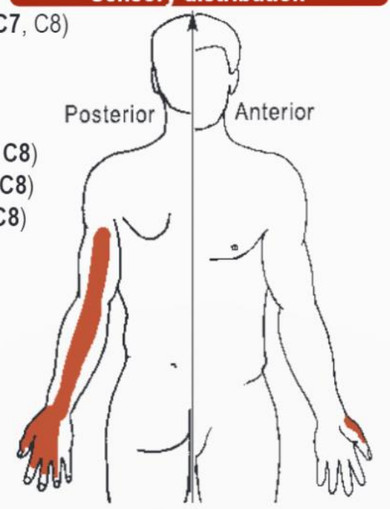




Triceps brachii (C6, **C7**, **C8**)
- **Long head**
- **Medial (deep) head**
- **Lateral head**

Brachioradialis (C5, **C6**, C7)
Extensor carpi radialis longus (C6, C7)
Anconeus (C7, C8, T1)
Supinator (**C5**, C6)
Extensor carpi radialis brevis (**C7**, C8)
Extensor digitorum (**C7**, C8)
Extensor digiti minimi (**C7**, C8)
Extensor carpi ulnaris (**C7**, C8)
Abductor pollicis longus (C7, **C8**)
Extensor pollicis longus (C7, **C8**)
Extensor pollicis brevis (C7, **C8**)
Extensor indicis (C7, **C8**)

Sensory distribution



Musculocutaneous nerve

Sites of impingement

- Axillary fold or coracobrachialis muscle belly

Signs/symptoms

- Weakness of elbow flexion
- Loss of cutaneous sensation to anterior & lateral forearm (lateral antebrachial cutaneous nerve)
- Loss of biceps reflex
- When examining patients with traumatic injury involving the axillary nerve, it is important to search for paralysis of the long head of the triceps brachii. If present, it is a sign of a severe axillary nerve lesion requiring early surgical repair at 3 months

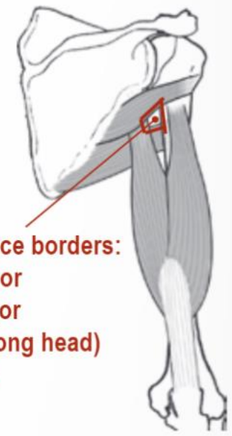
Axillary nerve

Sites of impingement

- ***Quadrangular space*** - often due to fractures of humerus, dislocations & poorly adjusted crutches
  - Borders of the quadrangular space: teres major, teres minor, triceps (long head) & humerus (see image)
  - Quadrangular space contains:
    - Axillary nerve
    - Posterior humeral circumflex artery

Signs/symptoms

- Weakness in deltoid & teres minor muscles - results in weak abduction of arm
- Loss of cutaneous sensation to superior posterior & lateral arm



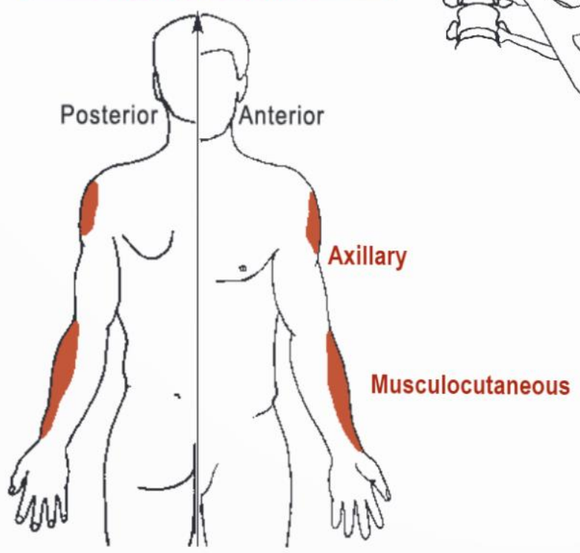
Quadrangular space borders:

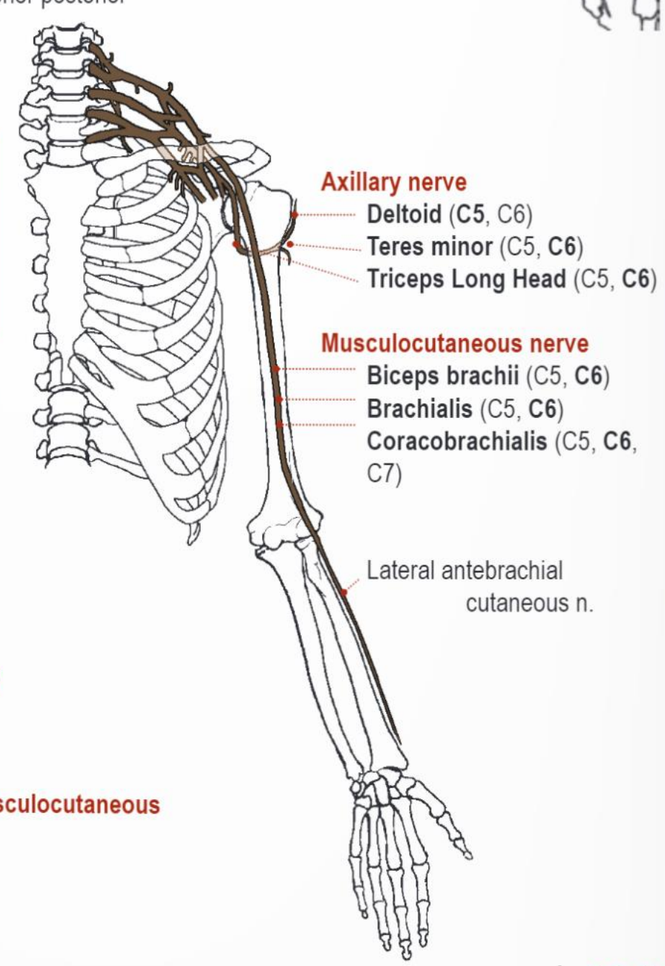
- **teres minor**
- **teres major**
- **triceps (long head)**
- **humerus**

Axillary Nerve & Triceps Brachii

More recent studies show triceps brachii long head may be innervated by the axillary nerve (de Seze, 2006; Rezzouk, 2002)

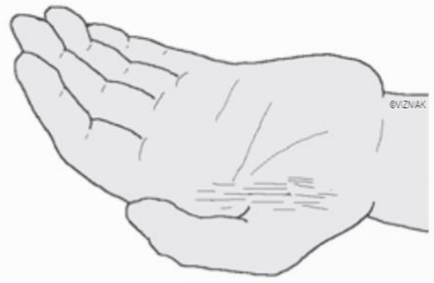
Sensory distribution





Sites of impingement: the median nerve is compressed usually at one of three sites

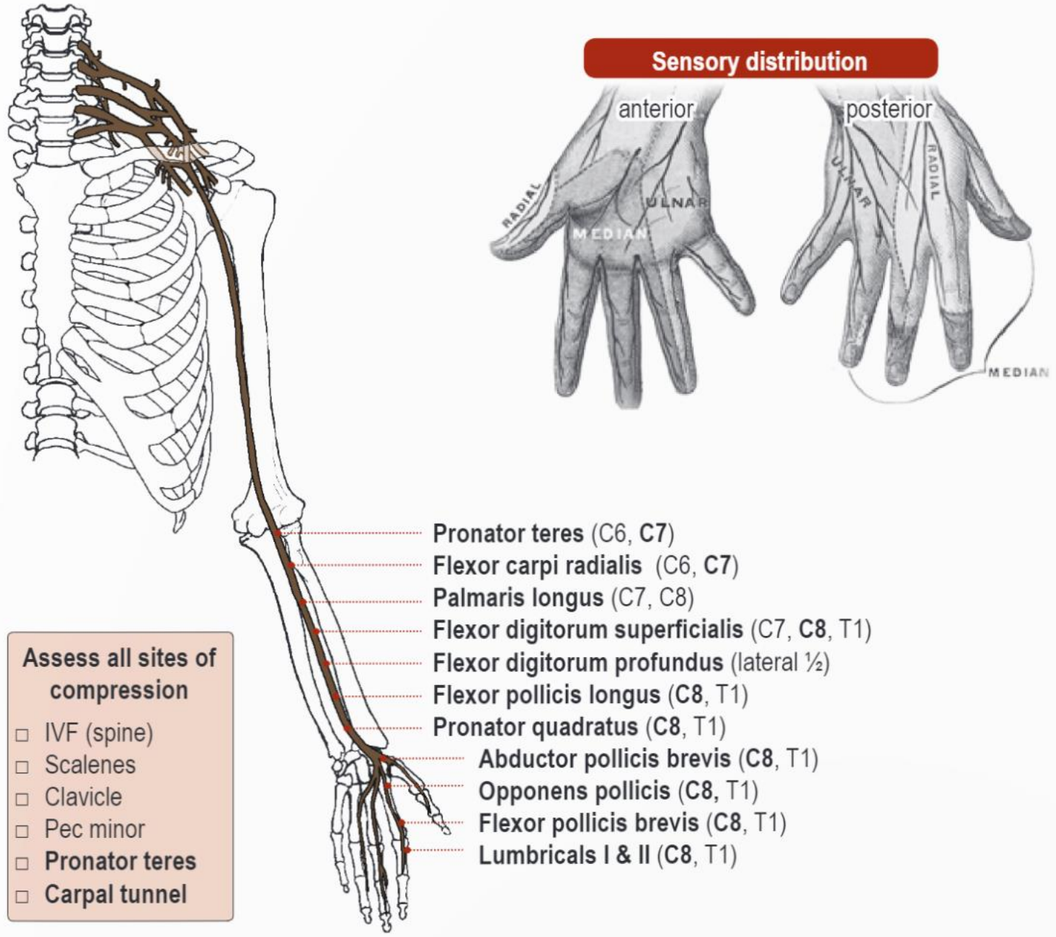
1. ***Elbow*** - occasionally compression due to sleeping on elbow, or medial supracondylar fractures
   SSx: weakness of forearm & wrist pronation, weakness of wrist flexion
   - Ape hand deformity
   - Loss of sensation to palm & palmar surface of lateral 3 ½ fingers including posterior distal interphalangeal joints



Ape Hand Deformity
(atrophy of thenar muscles)

2. Passage of the nerve through two heads of hypertonic ***pronator teres muscle*** - Pronator Teres Syndrome
   SSx: throbbing/aching pain in wrist & forearm, weakness in gripping & holding objects
   - Pain with forearm pronation, pain with wrist flexion
   - Ape hand deformity
   - Loss of sensation to palm & palmar surface of lateral 3 ½ fingers including posterior DIPs
3. ***Wrist*** - most commonly due to carpal tunnel syndrome, possibly secondary to lacerations or puncture wounds
   SSx: ape hand deformity (atrophy of thenar muscles)
   - Loss of sensation to palm & palmar surface of lateral 3 ½ fingers including posterior DIPs

Note: injury of median nerve through carpal tunnel results in loss of sensation to palmar surface of lateral 3 ½ fingers to DIPs but NOT the palm of the hand; this may help to differentiate injury of median nerve above carpal tunnel vs. injury within carpal tunnel



Sensory distribution

Assess all sites of compression

- ☐ IVF (spine)
- ☐ Scalenes
- ☐ Clavicle
- ☐ Pec minor
- ☐ **Pronator teres**
- ☐ **Carpal tunnel**

Ulnar Nerve

Sites of impingement: the ulnar nerve is usually compressed at one of two sites

1. ***Elbow*** - *cubital tunnel syndrome*, compression due to fractures at medial epicondyle or sustained pressure &/or anomalies in the anconeus muscle (anconeus epitrochlearis muscle); when one hits their 'funny bone' it is usually a sensation due to the compression of the ulnar nerve as it passes posterior to the medial epicondyle
   SSx: weakness of wrist flexion (ulnar side)
   - Claw hand deformity with normal PROM
   - Loss of sensation to medial 1½ fingers

   The **cubital tunnel** is formed by the tendinous arch joining the humeral & ulnar heads of the flexor carpi ulnaris; thus inflammation or swelling of the flexor carpi ulnaris may compress the ulnar nerve resulting in the signs & symptoms below

2. ***Wrist*** - *Tunnel of Guyon* (medial to carpal tunnel), defensive wounds from cuts, stab wounds or other trauma, repeated impact form riding a bicycle with out padded gloves
   SSx: Bishops or claw hand deformity; loss of sensation to medial 1 ½ fingers, with normal PROM

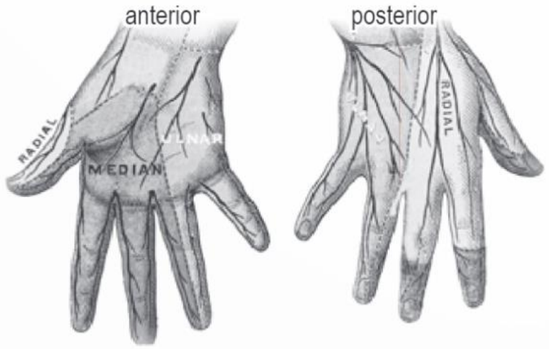


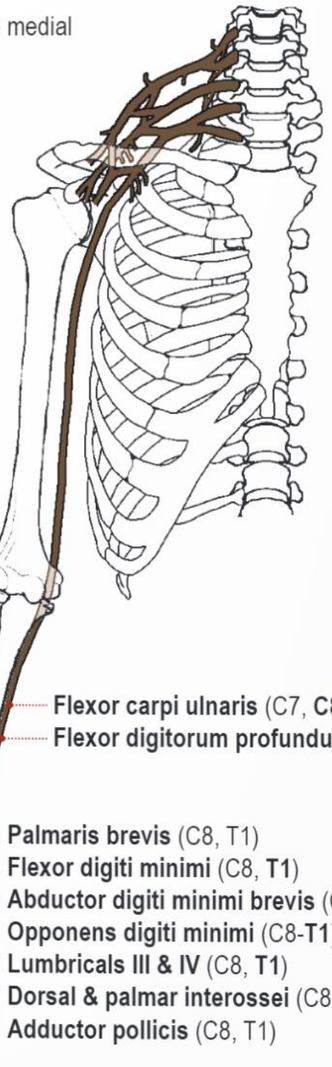
Claw hand deformity



Bishop's hand deformity

Sensory distribution





Flexor carpi ulnaris (C7, **C8**)
Flexor digitorum profundus (medial 1/2)

Palmaris brevis (C8, T1)
Flexor digiti minimi (C8, **T1**)
Abductor digiti minimi brevis (C8, **T1**)
Opponens digiti minimi (C8-**T1**)
Lumbricals III & IV (C8, **T1**)
Dorsal & palmar interossei (C8, T1)
Adductor pollicis (C8, T1)

Assess all sites of compression

- ☐ IVF (spine)
- ☐ Scalenes
- ☐ Clavicle
- ☐ Pec minor
- ☐ **Cubital tunnel**
- ☐ **Tunnel of Guyon**

Myotomes Lower Extremity

Superior gluteal nerve
Tensor fascia lata (L4, L5)
Gluteus medius (**L5**, S1)
Gluteus minimus (**L5**, S1)

Inferior gluteal nerve
Gluteus maximus (L5, **S1**, **S2**)

Femoral nerve
Thigh
Pectineus (**L2**, L3)
Sartorius (L2, L3)

Quadriceps:
rectus femoris (L2, **L3, L4**)
vastus lateralis (L2, **L3, L4**)
vastus intermedius (L2, **L3, L4**)
vastus medialis (L2, **L3, L4**)

Obturator nerve
Gracilis (**L2**, L3)
Adductor longus (L2, **L3**, L4)
Adductor brevis (L2, **L3**, L4)
Adductor magnus (L2, **L3, L4**)
Obturator externus (L3, **L4**)

Sciatic nerve (tibial division)
Popliteus (**L4, L5**, S1)
Semitendinosus (**L5, S1**, S2)
Semimembranosus (**L5, S1**, S2)
Biceps femoris (long head) (L5, **S1**, S2)

Leg
Tibialis posterior (L4, L5)
Gastrocnemius (S1, **S2**)
Plantaris & Soleus (S1, **S2**)
Flexor digitorum longus (**S2**, S3)
Flexor hallicus longus (**S2**, S3)

Foot
Abductor hallicus & abductor digiti minimi
Dorsal interossei

Sciatic nerve (fibular/peroneal division)
Biceps femoris (short head) (L5, **S1**, S2)

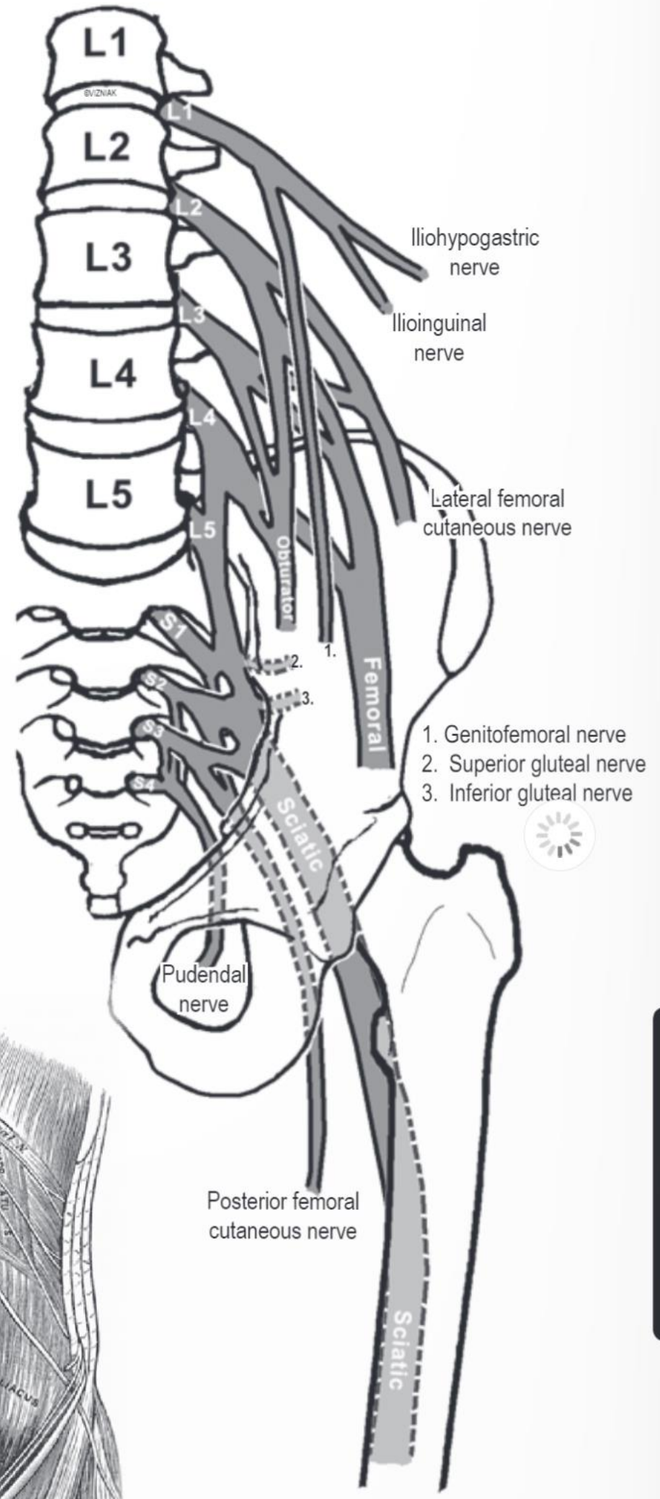
Leg (deep fibular nerve)
Tibialis anterior (**L4**, L5)
Extensor hallicus longus (**L5**, S1)
Extensor digitorum longus (L5, S1)
Fibularis tertius (L5, S1)

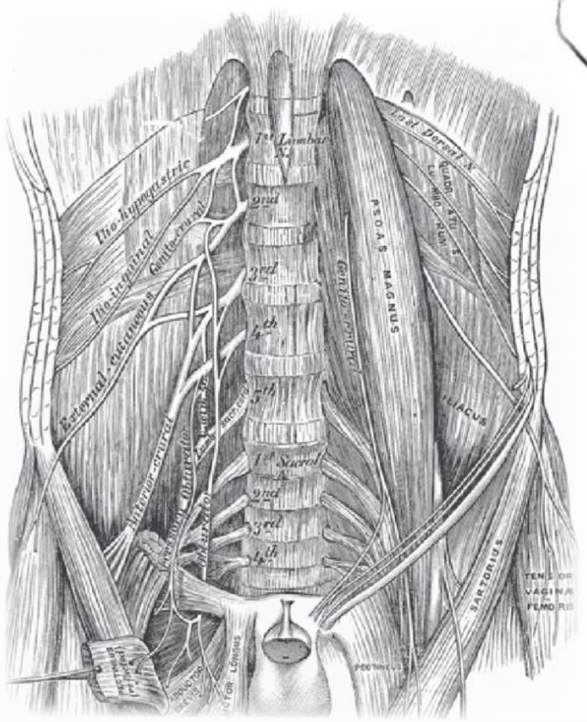
Foot (superficial fibular nerve)
Extensor digitorum brevis
Fibularis longus (**L5, S1**, S2)
Fibularis brevis (**L5, S1**, S2)

Muscle group/Action	L1	L2	L3	L4	L5	S1	S2
Hip extension & external rotation					■	■	■
Hip external rotation				▪	■	■	▪
Hip abduction & internal rotation		■	■	■			
Hip abduction				■	■	■	
Hip extension					■	■	■
Hip flexion	■	■	■	▪			
Knee flexion				■	■	■	■
Knee extension		▪	■	■			
Extensor hallicus				■	■	■	
Toe extension				■	■	■	
Plantar flexion				▪	■	■	▪
Dorsiflexion				■	■	■	
Ankle inversion				■	■	▪	
Ankle eversion				▪	▪	■	

DDx list of nerve impingement due to mechanical pressure

- Orthopedic changes → bone spurs, entrapment, herniation
- Ice - e.g. excessive icing of the knee → peroneal palsy
- Clothing/belts position – meralgia parasthetica, tight shoes or casting
- Local inflammatory products (bradykinen & histamine)
- Neoplasm or space occupying lesion
- Anatomical variation - split sciatic, abnormal path of nerve
- Hypertrophy of muscle or recurrent forceful contraction (bodybuilding)
- Iatrogenic & post surgical scarring
- Fracture fragment - i.e. fibular fracture → peroneal palsy
- Poor fracture management - cast, bandage too tight
- Traumatic contusion (direct trauma)
- Compartment syndrome (edema)
- Atrophy, fibrosis, myositis, scar tissue
- Biomechanical, overuse - i.e. overpronation → tarsal tunnel syndrome





Femoral nerve

Sites of impingement
- Compressed anywhere along course of nerve but often compromised due to nerve root irritation

Signs/symptoms
- Weak hip flexion & weak knee extension
- Plantar reflex reduced or absent
- Pain, tingling or loss of sensation to medial knee, leg & foot

Lateral (external) femoral cutaneous nerve

Sites of impingement
- Compressed near the inguinal ligament as the nerves passes under or through the ligament
- Often compressed due to tight clothes, heavy work belts, obesity or pregnancy
- Compression of lateral femoral cutaneous nerve results in condition called Meralgia Paresthetica

Signs/symptoms
- Pain, tingling or loss of sensation to lateral thigh

Obturator nerve

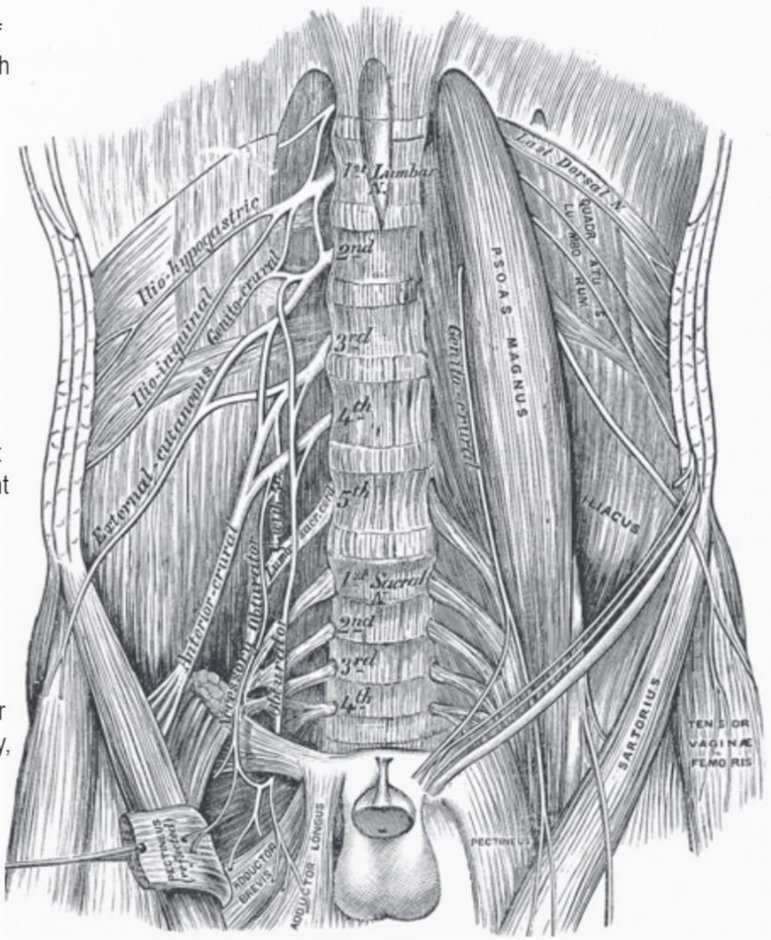
Sites of impingement
- Compressed anywhere along course of nerve but often compromised due to nerve root irritation
- An obturator hernia (typically seen in elderly women) may also result in pain or tingling over the cutaneous distribution (Howship-Romberg sign)

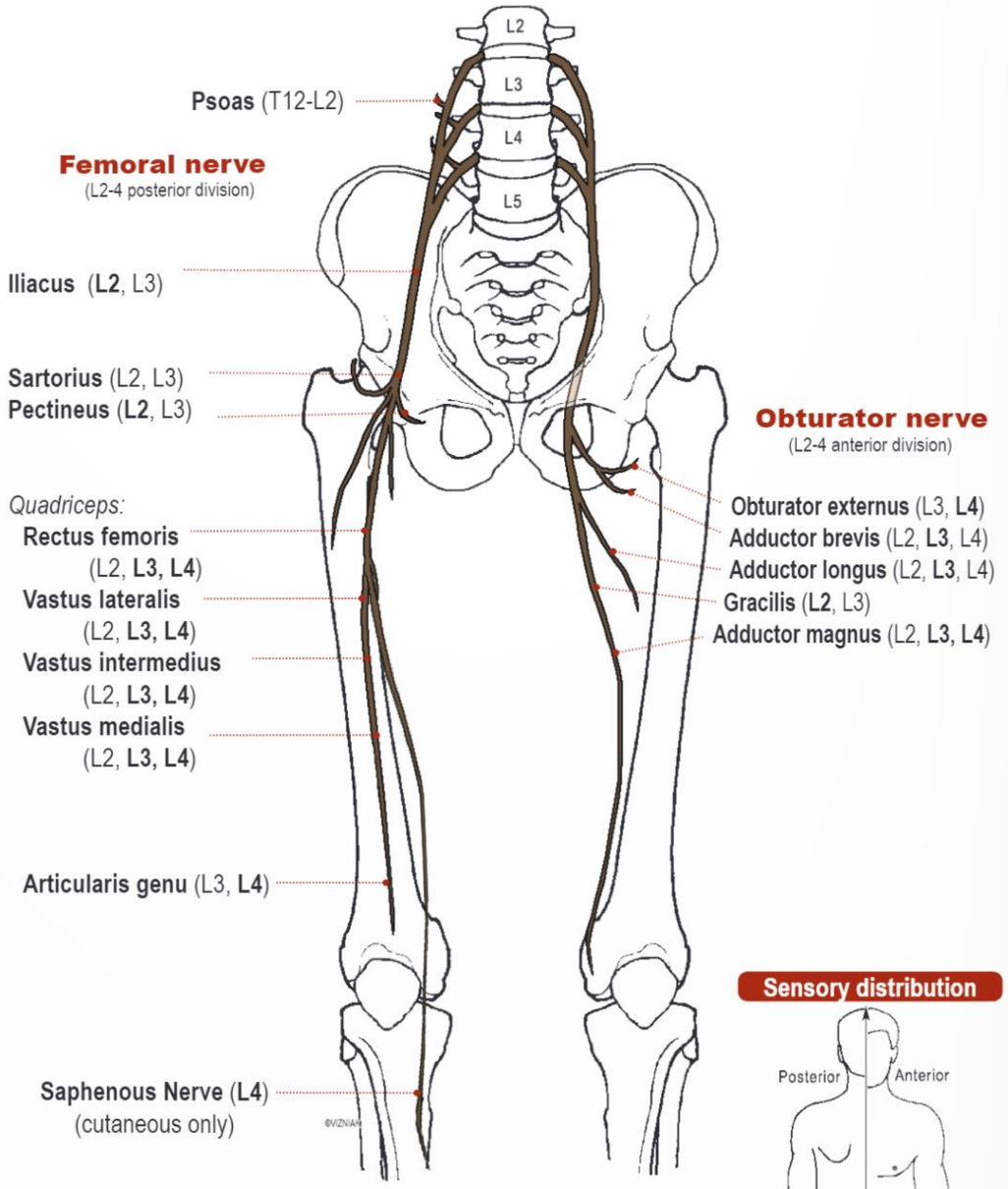
Signs/symptoms
- Weak adduction of thigh, patient will have difficulty crossing legs - results in difficult ambulation (gait abnormalities)
- Possible isolated loss of sensation to medial thigh
- Decreased adductor tendon jerk (reflex is elicited by tapping with a reflex hammer over a finger placed across the distal adductor magnus ~5 cm (2″) above the medial epicondyle

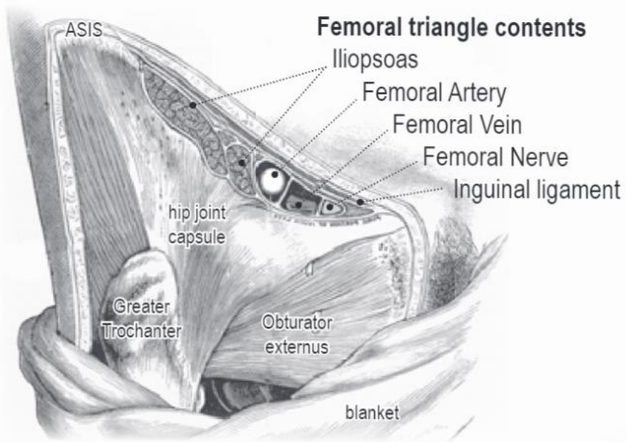
Genitofemoral nerve

Sites of impingement
- Typically compressed at inguinal ligament by tight clothing

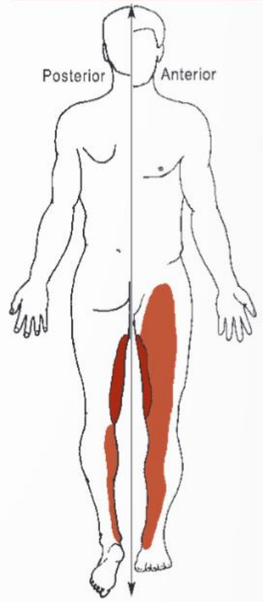
Signs/symptoms
- Pain &/or numbness over anterior medial thigh just below inguinal ligament
- Patient may have a prior history of appendectomy, psoas muscle infection or local trauma

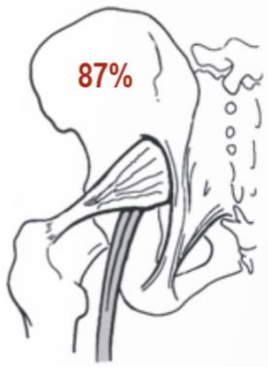






Sensory distribution



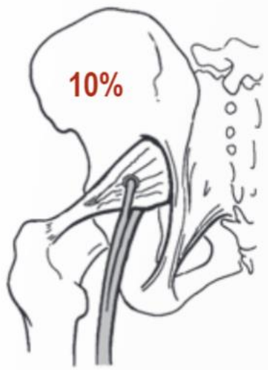


Sciatic nerve

Note: Sciatic nerve is composed of common fibular (peroneal) & tibial nerve. The following information refers to sciatic nerve from the greater sciatic notch to the upper popliteal fossa where it splits into its component nerves

Sites of impingement

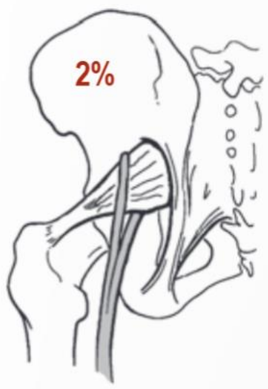
- May be compromised anywhere along course of nerve from greater sciatic notch to popliteal fossa
- Common causes include nerve root irritation from disc herniations, osteoarthritis, or lumbar facet dysfunction
- Less common causes are misplaced intramuscular injections, pelvic tumors, back labor, vertebral/pelvic fractures, hip dislocations



Signs/symptoms

- Most common for the more superficial common fibular/peroneal portion of sciatic nerve to be affected
- Pain or loss of sensation along course of nerve from buttocks, posterior thigh, leg & foot (except medial leg supplied by saphenous nerve)
- Weakness of hip extension & knee flexion
- Foot drop with subsequent steppage gait

Tibial nerve (from popliteal fossa to leg & foot)



Sites of impingement

- Less often affected due to nerve being well protected
- If affected, often due to direct trauma but possible compromise from nerve root irritation

Signs/symptoms

- Pain or loss of sensation to sole of foot, weakness of plantar flexion

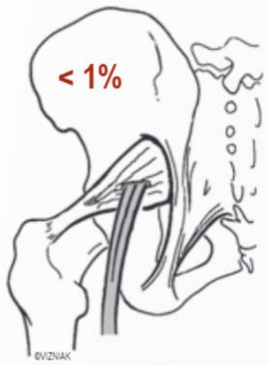
Common fibular (peroneal) nerve

Sites of impingement

- Most often affected at the head or neck of fibula
- Common causes include anterior compartment syndrome (esp. by extensor digitorum longus), fractures & dislocations of fibula
- May also be affected due to tight cast, splint or brace of knee/leg

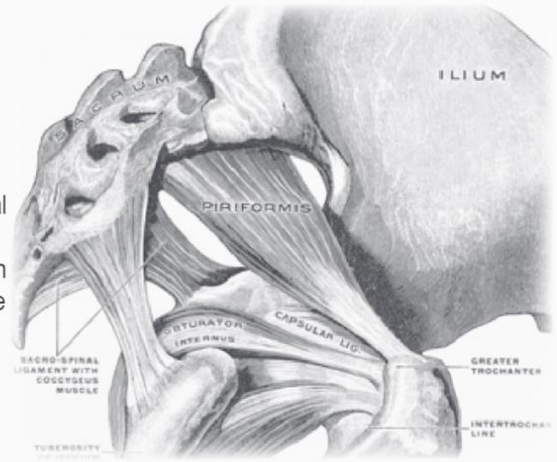
Signs/symptoms

- Mild pain or loss of sensation to anterolateral leg & dorsum of foot
- Foot drop with subsequent steppage gait
- Anterior compartment syndrome (shin splints) may compromise the deep branch of common peroneal nerve resulting in isolated sensation loss to web space between 1st & 2nd toe



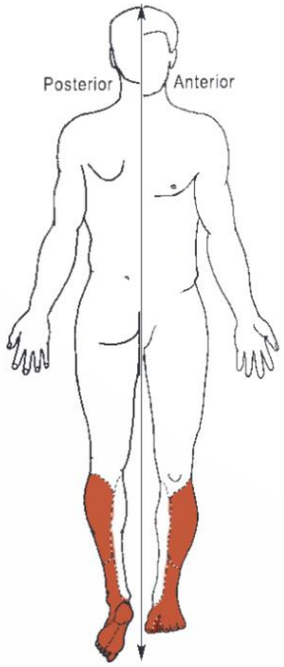
Based on 2250 cadaver limb studies

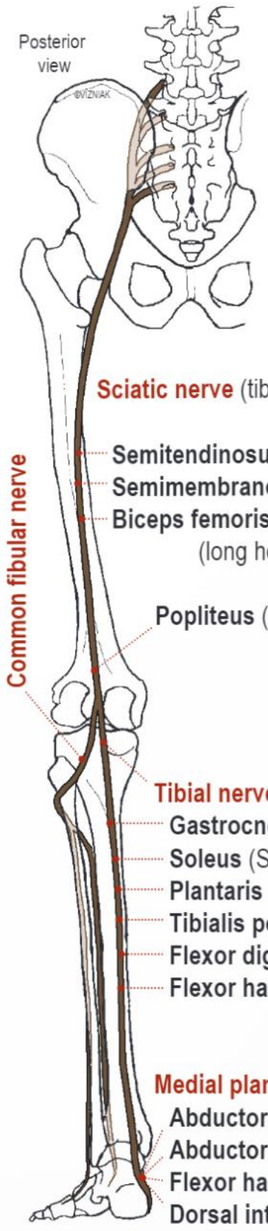
(Beaton & Anderson. The relationship of the sciatic nerve & its subdivisions to the piriformis muscle. Anat Rec 70 (Suppl.):1-5, 1937)



Sciatic Nerve

Sensory distribution





Sciatic nerve (tibial division)

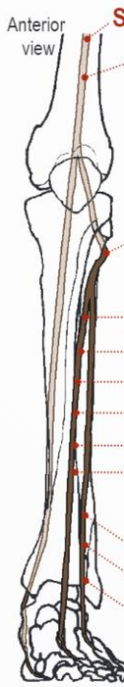
- **Semitendinosus** (**L5, S1**, S2)
- **Semimembranosus** (**L5, S1**, S2)
- **Biceps femoris** (L5, **S1**, S2) (long head)

Common fibular nerve

- **Popliteus** (**L4, L5**, S1)

Tibial nerve

- **Gastrocnemius** (S1, **S2**)
- **Soleus** (S1, **S2**)
- **Plantaris** (S1, **S2**)
- **Tibialis posterior** (L4, L5)
- **Flexor digitorum longus** (**S2**, S3)
- **Flexor hallicus longus** (**S2**, S3)



Sciatic nerve (fibular/peroneal division)

- **Biceps femoris** (L5, **S1**, S2) (short head)

Common fibular (peroneal) **nerve**

Deep fibular nerve

- **Tibialis anterior** (**L4**, L5)
- **Extensor hallucis longus** (**L5**, S1)
- **Extensor digitorum longus** (L5, S1)
- **Fibularis tertius** (L5, S1)
- **Extensor digitorum brevis** (**S1**, S2)

Superficial fibular nerve

- **Fibularis longus** (**L5, S1**, S2)
- **Fibularis brevis** (**L5, S1**, S2)

Medial plantar nerve

- **Abductor hallucis** (S2, S3)
- **Abductor digiti minimi** (S2, S3)
- **Flexor hallucis brevis** (S2, S3)
- **Dorsal interossei** (S2, S3)

Lateral plantar nerve

All other muscles on sole of foot

Cranial Nerve Exam

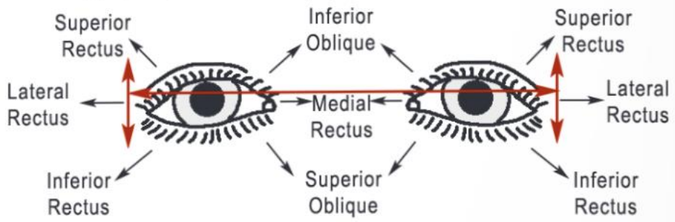
Nerve	Function	Lesion
I-Olfactory	sensory: smell	anosmia (loss of smell)
II-Optic	sensory: vision	visual field deficits
III-Oculomotor	motor: superior, inferior & medial rectus muscles; inferior oblique, levator palpebra parasympathetic: constrictor pupillae, cillary muscles (lens shape)	dilated pupil, ptosis, eye turned down & lateral loss of pupillary light reflex on lesion side
IV-Trochlear	motor: superior oblique	inability to look down when eye is adducted
V-Trigeminal	sensory: V1(ophthalmic), V2(maxillary), V3(mandibular), sensation anterior 2/3 tongue motor: V3 - masseter, temporalis, lat & med pterygoid, anterior belly digastric, mylohyoid, tensor tympani/veli palatini	paresthesia (pain & touch) mandible deviation to side of lesion when mouth is opened, masseter & temporalis do not contract
VI-Abducens	motor: lateral rectus muscle	no abduction if ipsilateral eye medial strabismus, diplopia
VII-Facial	sensory: taste – anterior 2/3 of tongue motor: frontalis, occipitalis, orbicularis, buccinator, zygomaticus, mentalis, post. belly digastric, stapedius, stylohyoid parasympathetic: lacrimal, nasal & palatine, sublingual, lingual submandibular, labial	loss of taste anterior 2/3 tongue paralysis of facial muscles, hyperacousis (stapedius paralysis) ↓ salivation, lacrimation
VIII-Acoustic *(vestibulocochlear)*	sensory: hearing & equilibrium	unilateral hearing loss balance problems
IX-Glossopharyngeal	sensory: sensation & taste posterior 1/3 of tongue, pharynx, tympanic cavity, carotid baro/chemo receptors motor: stylopharyngeus muscle parasympathetic: parotid gland	loss of taste on posterior 1/3 of tongue loss of sensation on affected side of soft palate ↓ salivation
X-Vagus	sensory: pinna of ear, GI distension motor: muscles of palate, pharynx & larynx parasympathetic: heart, esophagus, GI tract up to distal 2/3 of transverse colon	ipsilateral: uvula deviates to opposite side of lesion, dyspnea, hoarse voice bilateral: death
XI-Accessory *(spinal accessory)*	motor: SCM, trapezius	paralysis of SCM & superior fibers of trapezius → drooping of shoulder
XII-Hypoglossal	motor: intrinsic muscles of tongue, genioglossus, styloglossus, hyoglossus	tongue deviates toward side of lesion on protrusion (action of genioglossus)

I. Olfactory
- Scent (coffee, mint)

II. Optic Nerve
- Visual acuity (eye chart), visual fields, pupillary constriction (III)
- Fundiscopic exam

III. Oculomotor (eye movement)

IV. Trochlear (eye movement)



VI. Abducens
- Patient holds head still - tracking 'H' pattern with eye movement only
- Smooth tracking & nystagmus? - Finish with convergence & observe pupil constriction

V. Trigeminal
- Motor: pterygoids = lateral deviation of the jaw against resistance
- Masseters = palpation of masseters while patient clenches jaw or patient 'bites down'
- Sensory: sensory perception of the face & buccal mucosa - bilaterally equal?
- Sensory: test afferent fibers of the **corneal reflex**
  - Examiner lightly brushes cotton across surface of the patient's cornea
  - Normal: lid closure of both eyes when one eye is touched
  - Abnormal: V. afferent deficit or VII. efferent deficit

VII. Facial
- Motor: all voluntary & involuntary movements of the face - does not include jaw movements; includes elevation of the eyebrows, wrinkle forehead, smile, frown, grimace, puff out cheeks with air
- Sensory: taste anterior 2/3 of tongue
- Note: VII also innervates lacrimal glands, submandibular & submaxillary glands; these are not routinely tested, but be aware of presence or absence of saliva & tears

VIII. Vestibulocochlear (Acoustic)
- Vestibular division tested with Romberg's
- Cochlear division: auditory acuity (watch test); Weber & Rinne tests

IX. Glossopharyngeal
- Often tested with Vagus; taste to posterior 1/3 of tongue; motor: stylopharyngeus muscle
- Gag reflex: general sensation, tonsillar & pharyngeal mucosa

X. Vagus
- Motor: palate, pharynx contracting muscles
- Vagus function: patient says 'Ahhhh'; examiner observes for palate elevation & symmetry
- Normal: symmetrical elevation of palate & contraction of pharyngeal muscles
- Lesion: palate & uvula deviate to unaffected side

XI. Spinal Accessory
- Motor: Trapezius & SCM strength against slight resistance (muscle tests)

XII. Hypoglossal
- Check for tongue deviation toward affected side with protrusion, fasciculations
- Check tongue ROM, muscle tone; patient laterally deviates tongue against cheek

Olfactory Nerve (I)

Procedure

Seated patient is instructed to close one nostril with finger & close eyes, examiner then places an aromatic substance under the open nostril & asks the patient if they can identify the odor

Interpretation

(+) Inability to identify odor (anosmia = loss of smell) → Olfactory (cranial nerve I) lesion

Clinical notes

Typical aromatic substances used for this test may include, peppermint oil, coffee grinds, tobacco, tea leaves

The examiner must be aware that numerous conditions may cause a decrease in the sense of smell thus resulting in a false positive (decreased smell sensation is common with elderly patients, sinus infections, rhinitis & deviated septum)

Optic Nerve (II)

Procedure

Visual acuity test: patient is instructed to cover one eye & read a Snellen eye chart, procedure is then repeated with the other eye

Visual field test: patient covers one eye & looks directly ahead, examiner slowly brings hands into patient's field of view & asks the patient when they can see the examiner's hands

Swinging light test: light in eyes back & forth – afferent pupilary light defect

Funduscopic exam (see eye exam in head & neck chapter)

Interpretation

(+) Decreased visual acuity, visual field deficit, optic disc atrophy → Optic (cranial nerve II) lesion

Clinical notes

See figure demonstrating lesion location with associated visual field loss (see head & neck chapter)



Marcus Gunn's Test

Procedure

Patient seated, examiner instructs patient to look straight ahead at a fixed point & shines a strong light into the patient's normal eye, the examiner should observe bilateral pupil constriction; examiner then proceeds to shine light on the affected eye & observes for the presence of bilateral pupil dilation or lack of constriction

Interpretation

(+) Bilateral pupil dilation or lack of constriction when light is shone into the affected eye → Optic nerve damage (afferent pupillary defect) on the affected side (see page 58 for more pupil associated lesion differentials)

Clinical notes

Optic neuritis is usually unilateral & may be due to any of the following:

1. Infection (meningitis, encephalitis, syphilis)
2. Multiple sclerosis
3. Poisoning (methyl alcohol, carbon tetrachloride, lead)

Oculomotor (III)

Procedure

Seated patient is instructed to hold head still while following the examiner's fingertip or penlight in an "H" pattern with eye movement only, examiner observes for smooth tracking & nystagmus; examiner finishes with convergence & observes for pupil constriction

Pupillary light reflex: examiner shines light into one eye & observes for bilateral pupillary constriction, procedure is repeated with the other eye

Interpretation

(+) Loss of pupillary light reflex, dilated pupil, ptosis (inability to open eyelid), eye turned down & lateral, diplopia → Oculomotor (cranial nerve III) lesion

Clinical notes

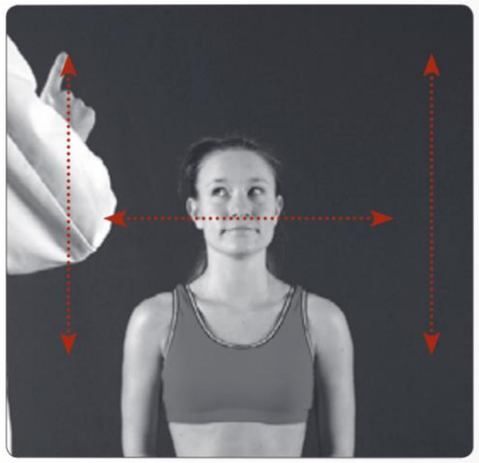
The eye may appear in a down & lateral position due to muscle weakness of the medial, superior, inferior rectus muscles & injury to the superior oblique muscle



Trochlear (IV)

Procedure

Seated patient is instructed to hold head still while following the examiner's fingertip or penlight in an "H" pattern with eye movement only, examiner observes for smooth tracking & nystagmus



Interpretation

(+) Inability to look down when the eye is adducted, diplopia → Trochlear (cranial nerve IV) lesion

Clinical notes

Motor distribution: superior oblique

Trigeminal (V)

Procedure

Motor test: lateral deviation of the jaw against resistance or palpation of the masseters while the patient clenches jaw or have patient bite down on tongue depressor

Sensory test: sensory perception of the face & buccal mucosa (compare bilaterally), jaw jerk reflex

Special sensory test: examiner lightly brushes cotton across surface of cornea & observes for bilateral eyelid closure (corneal reflex)



Interpretation

(+) Weakness in the muscles of mastication, facial paresthesia, lack of eyelid closure following corneal irritation, lack of a jaw jerk reflex, mild hearing impairment → Trigeminal (CN V) lesion

Clinical notes

Sensory: V1 (ophthalmic), V2 (maxillary), V3 (mandibular), sensation anterior 2/3 tongue

Motor: V3 - masseter, temporalis, lat & med pterygoid, anterior belly digastric, mylohyoid, tensor tympani/veli palatini

Abducens (VI)

Procedure

Seated patient is instructed to hold head still while following the examiner's fingertip or penlight in an "H" pattern with eye movement only, examiner observes for smooth tracking & nystagmus

Interpretation

(+) Inability to abduct affected eye, diplopia → Abducens (cranial nerve VI) lesion

Clinical notes

Motor distribution: lateral rectus muscle

Facial (VII)

Procedure

Examiner instructs seated patient to demonstrate numerous actions of facial expression, raise eyebrows (wrinkle forehead), closed the eyes, whistle, smile showing teeth, frown, grimace, stick out tongue (last action tests hypoglossal nerve)

Sensory tests: taste on the anterior 2/3 of the tongue

Interpretation

(+) Inability to perform actions of facial expression, unilateral facial muscle paralysis, decreased taste sensation on anterior tongue, absence of saliva & tear production → Facial (cranial nerve VII) lesion

Upper motor neuron lesion: usually no effect on for head & eyelid muscles, non-symmetrical smile

Lower motor neuron lesion: lack of wrinkling of the forehead with elevation of the eyebrows, symmetrical smile in the presence of a lesion

Clinical notes

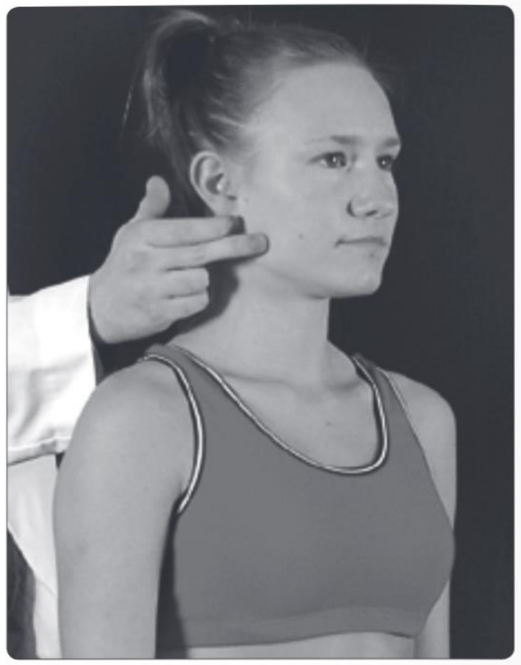
Sensory: taste – anterior 2/3 of tongue; motor: frontalis, occipitalis, orbicularis, buccinator, zygomaticus, mentalis, post. belly digastric, stapedius, stylohyoid

Parasympathetic: lacrimal, nasal & palatine, sublingual, lingual submandibular, labial glands

The simplest way to have a patient do these action is to have them copy your facial expressions, patients really enjoy the interaction (personal touch; start with a smile end with sticking out the tongue, technically Hypoglossal Nerve function (CN XI) ☺ but patients enjoy it)



Chvostek Test (Facial VII)



Procedure
Patient seated, examiner taps the parotid gland (over the masseter muscle) & observes for facial muscle contraction or patient sensation of tingling

Interpretation
(+) Facial muscle contraction → Facial (VII) nerve compression near the parotid gland

Clinical notes
Test is essentially Tinel's test for the facial nerve (except the examiner is looking for muscle contraction, not paresthesia)

Vestibulocochlear (VIII)

Procedure
Auditory acuity: examiner instructs seated patient to close eyes & listen for the sound of the examiner's fingers "swishing" together (or the clicking of the secondhand on watch - watch test), the examiner slowly moves hands further from patients head & asks the patient when they can no longer hear the sound

Weber & Rinne test: air conduction versus bone conduction of sound

Vestibular testing:

- ***Swivel chair test:*** to differentiate cervical from vestibular vertigo (see head & neck chapter)
- ***Veering test:*** patient instructed to walk in a straight line with eyes closed (also consider Romberg's test)
- ***Past pointing test:*** patient instructed to raise hand overhead, then attempt to touch examiner's finger with eyes open
- ***Dix-Halpike maneuver:*** seated patient rotates head 45°, examiner helps patient lie down on table & observes for signs of nausea or nystagmus



Interpretation
(+) Unilateral hearing loss, balance problems, vertigo → Vestibulocochlear (cranial nerve VIII) lesion

Clinical notes
Sensory distribution: hearing & equilibrium

Glossopharyngeal (IX)

Procedure
Often tested in conjunction with the Vagus nerve (see below)
Taste: taste to the posterior 1/3 of tongue
Gag reflex: the examiner gently brushes the back of the patient's throat & observes for the presence of reflex (general sensation of the tonsillar & pharyngeal mucosa)

Interpretation
(+) Loss of taste on posterior tongue, absence of gag reflex, decrease salivation → Glossopharyngeal (cranial nerve IX) lesion

Clinical notes
Sensory: sensation & taste posterior 1/3 of tongue, pharynx, tympanic cavity, carotid baro/chemo receptors
Motor: stylopharyngeus muscle
Parasympathetic: parotid gland
Due to overlap of distribution & anatomical variation clinically the Glossopharyngeal & Vagus nerve are often tested in conjunction

Vagus (X)



Procedure
Often tested in conjunction with the Glossopharyngeal nerve
Motor: examiner instructs patient to open mouth & say "Ahh-hhhhh," examiner observes for symmetrical elevation of the palate & contraction of the pharyngeal muscles (lack of uvula deviation)

Interpretation
(+) Non-symmetrical palate & uvula deviation, hoarse voice, dyspnea → Vagus (cranial nerve X) lesion, uvula deviation is contralateral to the side of lesion (all signs are for a unilateral vagal lesion)
Note: a gag reflex may also test the integrity of the vagus nerve fibers as they have some sensory input over the pharynx

Clinical notes
Sensory: pinna of ear, GI distension
Motor: muscles of palate, pharynx & larynx
Parasympathetic: heart, esophagus, up to 2/3 of transverse colon
Due to overlap of distribution & anatomical variation clinically the Glossopharyngeal & Vagus nerves are often tested in conjunction



Spinal Accessory (XI)

Procedure

Patient seated, examiner performs resisted muscle testing of the trapezius & SCM muscles



Interpretation

(+) Muscle weakness (0-4/5) in the trapezius or SCM muscles, drooping of the shoulder → Spinal accessory (cranial nerve XI) lesion

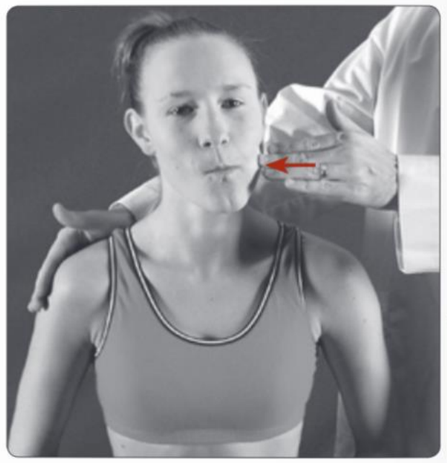
Clinical notes

Motor distribution: SCM, trapezius

Hypoglossal (XII)

Procedure

Patient seated, the examiner places hand on patient's cheek & instructs patient to press against examiner's hand through the cheek, procedure repeated on the opposite side; examiner then instructs patient to protrude tongue & observes for the presence of deviation, muscle tone or fasciculations



Interpretation

(+) Deviation of the tongue, fasciculations, unilateral atrophy, muscle weakness → Hypoglossal (cranial nerve XII) lesion, if deviation is present the tongue will deviate toward the side of the lesion (action of the genioglossus muscle)

Clinical notes

Motor distribution: intrinsic muscles of tongue, genioglossus, styloglossus, hyoglossus

Cranial nerve mnemonics

I. **O**lfactory	**O**h	**O**ut	**O**pt
II. **O**ptic	**O**nce	**O**f	**O**ut
III. **O**culomotor	**O**ne	**O**ur	**O**f
IV. **T**rochlear	**T**akes	**T**eeny	**T**rouble,
V. **T**rigeminal	**T**he	**T**iny	**T**ry
VI. **A**bducens	**A**natomy	**A**irport	**A**nd
VII. **F**acial	**F**inal,	**F**ly	**F**eed
VIII. **V**estibulocochlear	**V**ery	**V**ery	**V**egan
IX. **G**lossopharyngeal	**G**ood	**G**ood	**G**irls
X. **V**agus	**V**acations	**V**acations	**V**egetables
XI. **A**ccessory (spinal)	**A**re	**A**nd	**A**t
XII. **H**ypoglossal	**H**eavenly	**H**olidays	**H**ome

There is another common mnemonic that does stick in the mind better but will not be printed here ☺

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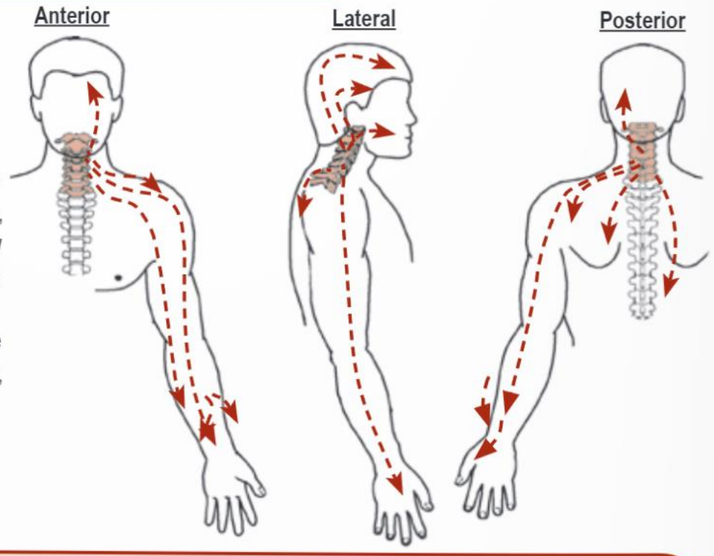
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Cervical Spine & Musculature Pain Referral

The cervical spine & cervical muscles may refer pain to many regions including the posterior head (suboccipital), periorbital, around the ears, into the jaw, over the shoulders, thoracic spine, down the arms, elbow & into the hands. Pain referral down the arms or into the head may be secondary to a serious cervical spine lesion (radiculopathy, trauma, cancer, infection) & careful consideration must be taken to differentially diagnosis referred pain from other head & neck pain generators



Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Cervical Assessment

History considerations
- Patient age? (OA after 60)
- Specific mechanism of injury & forces involved?
- Any impact trauma? Loss of consciousness?
- Associated headache? Dizziness? Nausea? trouble speaking? Double vision?
- Any numbness, tingling or weakness?
- Type of work, typical posture, sleeping posture?

Inspection
- Inspection of head & neck, skin, general appearance
- Posture of head, neck & thoracic spine, shoulder

Auscultate heart & carotid arteries

Palpation (may be done after ROM assessment)

Mandible	Articular pillars
Masseter/Parotids	Facet joints
Submandibular gland	Spinous processes
Submental gland	Upper trapezius
Thyroid gland	Levator scapulae
Trachea	Splenius cerv./cap.
Lymph nodes	Semispinalis capitis
SCM	Suboccipitals
Doorbell Sign	Upper rib motion
Mastoid processes	Supraclavicular fossa
Carotid artery	Clavicle

Functional assessment (ADLs)
- Breathing, swallowing, shoulder check, looking up at ceiling & down at floor

AROM

Flexion.....60°
Extension.....60°
Lateral flexion (x2).....**45°**
Rotation (x2).....**80°**
TMJ ROM (pain, clicking?)

PROM & Joint Play (if lacking AROM in any motion)

Myotomes (may be done prone)
- Cervical flexion (C1-C2)
- Cervical extension (C2, C3, XI)
- Cervical lateral flexion (C3)
- Shoulder elevation (C4, XI)
- Deltoid (**C5**, C6 - axillary)
- Brachioradialis (C5, C6 - radial)
- Biceps (C5, **C6** - musculocutaneous)
- Triceps (C6, **C7**, C8, T1 - radial)
- Wrist extensors (**C6**, C7, C8 - radial)
- Wrist flexors (C6, **C7** - median/ulnar)
- Finger flexors (C7, **C8**, T1 - ulnar/median)
- Interossei (C7, C8, **T1** - ulnar)

Cranial nerve exam (if indicated)

EENT (if indicated)
Ophthalmic exam, Otoscope exam
Rhinoscopic & pharyngeal exam

Neurovascular screen

Sensory:
- Cranial nerve exam (if indicated)
- Corneal reflex (V, VII)
- Light touch (face/arms)
- Sharp/dull or pinwheel (face/arms)
- Vibration (DIP, 3rd digit)

DTR: Biceps (C5), brachioradialis (C6), triceps (C7), patella (L4), hamstring (L5), Achilles (S1)
- Hoffman (or dynamic Hoffman)
- Dynamometer (grip strength)
- Girth measurement (arm, forearm)
- Radial & brachial pulse, blanching, temperature

Orthopedic tests (as indicated)

VBI (may be done before AROM)
- Vizniak VBI
- Vertebral basilar artery function test
- Dekleyn's test

Instability
- Alar ligament stress test
- Lateral shear test
- Sharp-Purser test
- Transverse ligament stress test
- Rust's Sign

Radiculopathy/Nerve tension
- Cervical compression/distraction
- Brachial plexus compression test
- Soto-Hall Test
- Upper limb tension test
- Valsalva maneuver

Sprain/Strain
- Cervical distraction
- Cervical AROM/PROM & Muscle Tests
- O'Donoghue maneuver
- Scalene cramp test

Thoracic spine & shoulder screen

Diagnostic imaging (if indicated)

Press Esc to exit full screen

Condition		Clinical notes
Radiculopathy		*Hx:* numbness, tingling, weakness or shooting electrical pain down arm *SSx:* ↓ pain when supine; (+) neurologic signs (↓ DTR, muscle weakness, ↓ sensation); (+) cervical compression for arm pain *DDx:* disc herniation, IVF encroachment, space occupying lesion, TOS
Osteoarthritis		*Hx:* patient > 50 yrs; gradual onset; crepitus; morning stiffness; dull achy pain *SSx:* ↓ pain with movement, worse at rest; limited AROM; confirm on x-ray (decreased joint space, osteophyte formation) *DDx:* rheumatoid, IVF encroachment, ankylosing spondylitis
Cervical strain		*Hx:* trauma or overuse; muscle pain/soreness *SSx:* tender to palpation; AROM limited by pain; pain with muscle testing *DDx:* cervical sprain, facet syndrome, meniscoid entrapment
Cervical joint dysfunction		*Hx:* insidious onset of local pain or discomfort *SSx:* tender to palpation; limited joint play; local myospasm; bone out of place *DDx:* cervical sprain, facet syndrome, meniscoid entrapment
Facet syndrome		*Hx:* well localized unilateral pain that may radiate to shoulder, antalgic posture *SSx:* ↑ pain w/ extension (loading facets); (+) cervical compression (local pain) *DDx:* cervical sprain, meniscoid entrapment, torticollis
Instability		*Hx:* recurrent neck pain or 'clicking or clunking' sensation *SSx:* ↑ PROM w/ over pressure; x-ray flexion/extension views will show ↑ ROM *DDx:* cervical sprain, osteoarthritis
Headache	**Cervico-genic**	*Hx:* ipsilateral head pain localized to the neck & occiput (may refer over eye) *SSx:* ↓ ROM due to pain; neck tenderness or symptoms reproduction with palp. *DDx:* rule out other causes of headache
	Migraine	*Hx:* possible prodrome (visual changes) triggers (stress, rapid hormonal change, rapid blood sugar changes, vasoactive foods, Seasonal allergies, meds) *SSx:* unilateral mod/severe throbbing pulsating or photophobia nausea *DDx:* rule out other causes of headache
	Cluster	*Hx:* **severe** ipsilateral head pain, "feels like a red hot poker in eye", men>women *SSx:* lacrimation & rhinorrhea, with restlessness, 15 min – 3 hour, can's sit still *DDx:* rule out other causes of headache
	Pathologic	*Hx:* Recent head trauma? LOC? Abrupt severe headache for the first time? Patient's age (worrisome for over 50 or a child with persistent headache)? *Red Flags:* abrupt onset, very severe "worst headache I have ever had", nuchal rigidity – high diastolic pressure (>115), persistent/severe HA in child, drug/alcohol abuse, known cancer, papilledema (swollen optic disk) Fever
TMJ syndrome		*Hx:* jaw/facial pain worse with eating; locking/catching of jaw; chronic headaches *SSx:* ↓ ROM due to pain; crepitus; tenderness to palpation *DDx:* Bell's palsy, trigeminal neuralgia, dental infection
Vertebral basilar ischemia (VBI)		*Hx:* atherosclerosis, hypertension, diabetes, smoking, ligamentous hypermobility *SSx:* vertigo, dizziness, unsteadiness, visual changes, nystagmus; (+) VBI tests *DDx:* stroke, transient ischemic attack, positional vertigo

↑ = increased, ↓ = decreased, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis

Head & Neck

Cervicothoracic Regional Exam

☑ Check normal, circle & describe abnormal

Chief complaint & significant history: _____

Patient: _____ date: _____

Insurance: _____ (dd/mm/yr)

Date of birth: _____ M/F

Vital Signs: Height: _____, Weight: _____, Blood Pressure: L _____/_____, R _____/_____, Resp: _____/min, VBI: L _____ R _____

Observation: □ WNL

Development: □ good, □ fair, □ poor

□ Posture: _____

□ Skin (bruising, scars): _____

□ Antalgia: _____

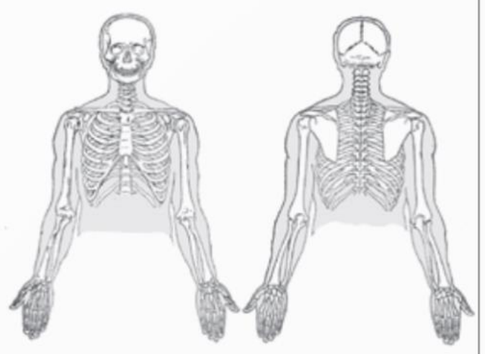
□ Asymmetry: _____

Observation		L	R
Cervical	Head tilt		
	Head rotation		
	Head carriage (ant. / post.)		
	Lordosis (hyper / hypo)		
Thoracic	High shoulder		
	Scoliosis		
	Kyphosis (hyper / hypo)		
	Adam's sign		

Palpation: □ WNL

Palpation	L	R
Skin (masses, temp)		
Lymph nodes		
Temporalis		
Masseter		
TMJ		
Scalenes		
SCM		
Levator scapulae		
Trapezius/rhomboids		
Suboccipitals		
Posterior c-spine muscles		
Trachea mobility		
Thyroid gland		
Clavicle / thoracic outlet		
Rotator cuff		

Mark on drawing □ pain (circle), □ spasm (s), □ edema (e), □ fibrotic (f), □ MFTP (x), □ ache (a), □ burning (b), □



ROM & Joint Play: □ WNL

Cervical spine	Active L	Active R	Passive L	Passive R
Flexion (50°)				
Extension (60°)				
Lateral flexion (45°)				
Rotation (80°)				

Shoulder	L	R	L	R
Flexion (180°)				
Extension (50°)				
Abduction (180°)				
Adduction (30°)				
Internal rotation (90°)				
External rotation (80°)				
Scapulocostal rhythm				

TMJ	
Depression/elevation	
Lateral deviation	

Neurologic: □ WNL

Sensation □ WNL	L	R
Light touch		
Sharp/dull		
Vibration		

Reflexes (0-5) □ WNL	L	R
Biceps (C5)(musculocut.)		
Brachioradialis(C6)(radial)		
Triceps (C7)(radial)		

Motor (0-5) □ WNL	L	R
Cervical flexion (C1-C2)		
Cervical extension (C2, C3, XI)		
Cervical lat. flexion (C3)		
Cervical rotation (C1-4, XI)		
Trapezius (CN XI)(accessory)		
Deltoid (C5)(axillary)		
Biceps (C6)(musculocut.)		
Triceps (C7, C8)(radial)		
Wrist extensors (C6)(radial)		
Wrist flexors (C7)(med./ulnar)		
Interossei (C8, T1)(ulnar)		

Cranial nerves □ WNL	
□ I (smell)	□ VII (facial expres)
□ II (light, vision)	□ VIII (Weber, Rinne)
□ III, IV, VI (gaze)	□ IX, X (ahhh)
□ V (bite, sensation)	□ XI (trap/SCM)
□ V, VII (corneal ref.)	□ XII (tongue)

Orthopedic: □ WNL

Screening	L	R
Valsalva		
Cervical compression		
Max. compression		
Cervical distraction		
Soto Hall		
Jull's test		
Brachial stretch		
Shoulder depression		

TOS	L	R
Eden's		
Wright's		
Adson's		
Roo's		

L		R
	C0	
	C1	
	C2	
	C3	
	C4	
	C5	
	C6	
	C7	
	T1	
	T2	
	T3	
	T4	
	T5	
	T6	

Additional procedures: □ WNL

□ Abdominal exam: _____

□ Auscultation (heart, lungs): _____

□ Ophthalmoscopic exam: _____

□ Otoscopic exam: _____

□ Other: _____

DDx:

Signature: **Date:**

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Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution.

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Joint types:
Gliding (zygapophyseal joints)
Pivot (atlantoaxial joint)
Fibrocartilaginous (intervertebral joints)
Hinge & gliding (TMJ)

Articular surfaces
Atlanto-occipital joint: *convex* (occipital condyles of occiput) on *concave* (superior articular facets of atlas)
Atlantoaxial: *concave* (articular facet for dens on atlas) *on convex* (anterior facet of dens on axis)
Zygapophyseal: facets are oriented 45°
Intervertebral discs: horizontal plane
TMJ: *convex* (mandibular condyle & disc) *on concave* (mandibular fossa of temporal bone)

Active range of motion
Flexion ..... **60°**
Extension ..... **60°**
Lateral Flexion ..... **45°**
Rotation ..... **80°**
TMJ ..... **35-50 mm opening**

Main muscle actions
Flexion: sternocleidomastoid (SCM), longus cervicis, longus capitis, rectus capitis anterior
Extension: trapezius, splenius cervicis & capitis, longis. capitis, levator scapulae, suboccipitals
Lateral flexion: scalenes, levator scapula, longissimus capitis, splenius capitis & cervicis, rectus capitis lateralis
Rotation: SCM, longus capitis & coli, rotatores, splenius, suboccipitals

Resting position
C-spine: slight extension
TMJ: mouth closed with teeth not in contact

Close packed position
C-spine: full extension
TMJ: teeth clenched

Capsular pattern of restriction
C-spine: lateral flexion = rotation, extension
TMJ: limitation of mouth opening

Normal end feel: tissue stretch (for all actions)

Abnormal end feel
Early myospasm → muscle/ligament tear
Late myospasm → instability
Empty → ligament rupture
Hard → bone approximation (osteophyte)

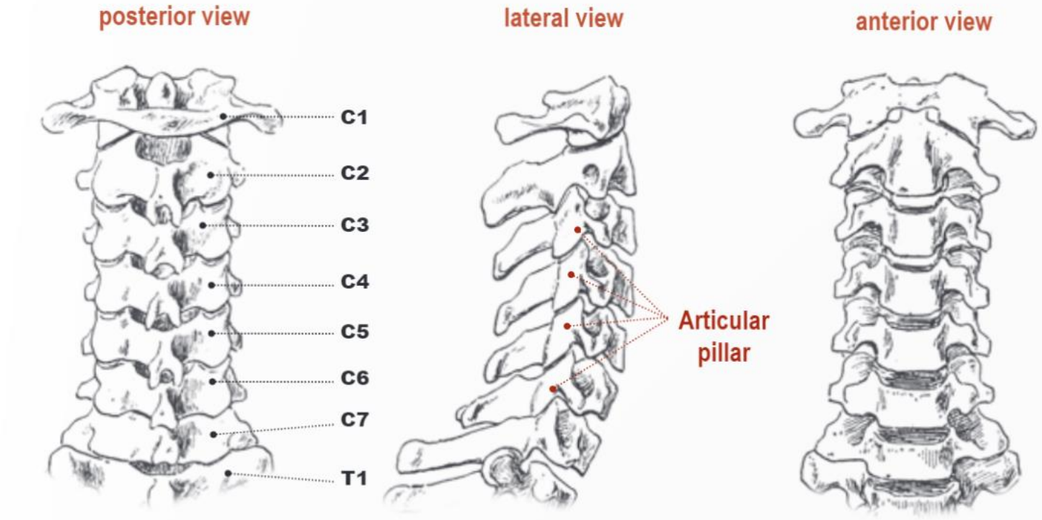
Coupled motions (C2-C7 vertebral segments)
Left lateral flexion coupled with left rotation
Right lateral flexion coupled with right rotation

'Text Neck' or 'Computer Spine'

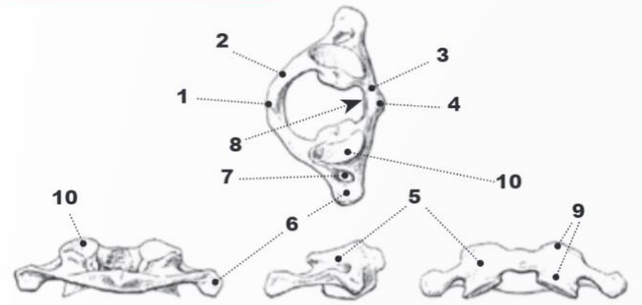


Neutral - 0°	15°	30°	60°	45°
~10 lbs	~27 lbs	~40 lbs	~60 lbs	~49 lbs
4.5 kg	12 kg	18 kg	27 kg	22 kg

With increased cervical flexion and prolonged held postures the forces and potential for injury are huge and reaching epidemic levels in urban societies - you must limit your screen time and have consistent changes of body position through the entire day - **prolonged sitting is the new smoking**

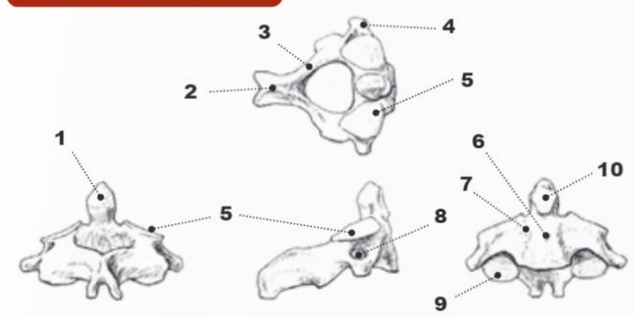


C1 - Atlas



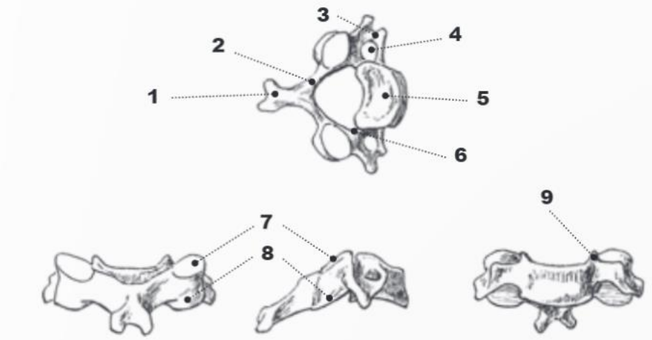
1. Posterior tubercle (no spinous process)
2. Posterior arch
3. Anterior arch
4. Anterior tubercle
5. Lateral mass (no vertebral body)
6. Transverse process
7. Transverse foramen
8. Articular facet for dens
9. Articular process (superior & inferior)
10. Superior articular facet

C2 - Axis



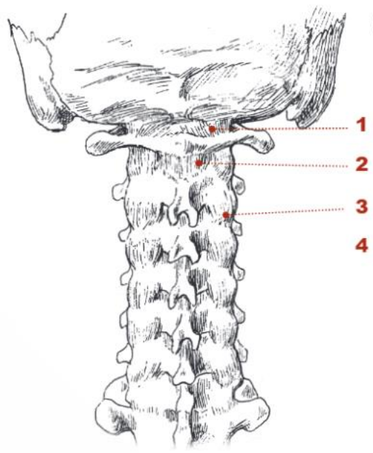
1. Dens (odontoid process)
2. Spinous process (bifid)
3. Lamina
4. Transverse process
5. Superior articular facet
6. Body
7. Pedicle
8. Transverse foramen
9. Inferior articular facet
10. Facet for anterior arch of C1

Typical Cervical Vertebra

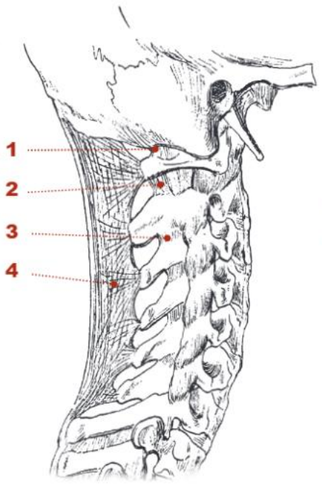


1. Spinous process (bifid)
2. Lamina
3. Transverse process
4. Transverse foramen
5. Body
6. Pedicle
7. Superior articular facet
8. Inferior articular process
9. Uncinate process (uncus)

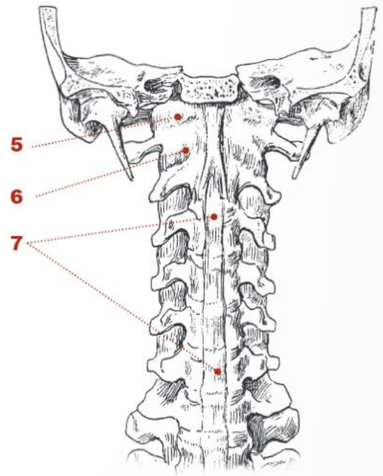
posterior view



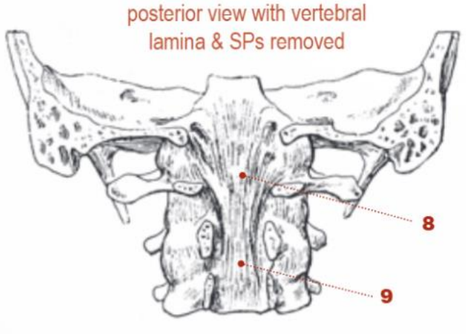
lateral view

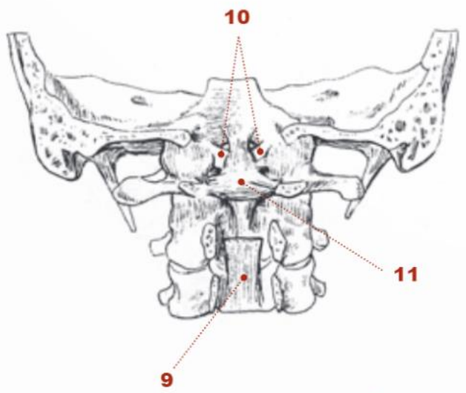


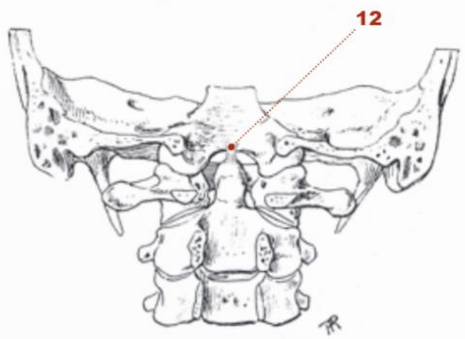
anterior view



posterior view with vertebral lamina & SPs removed



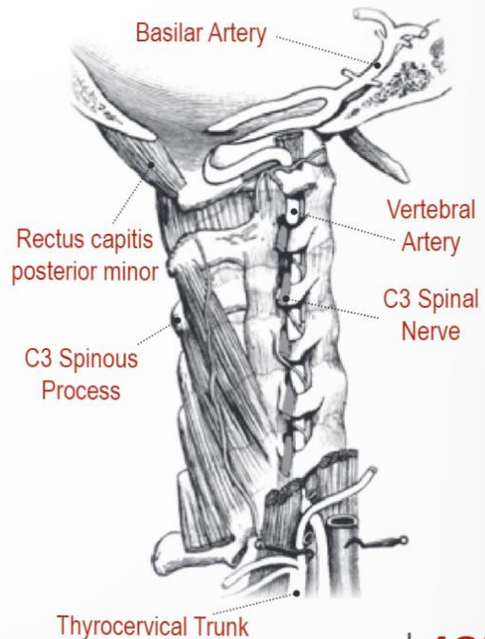




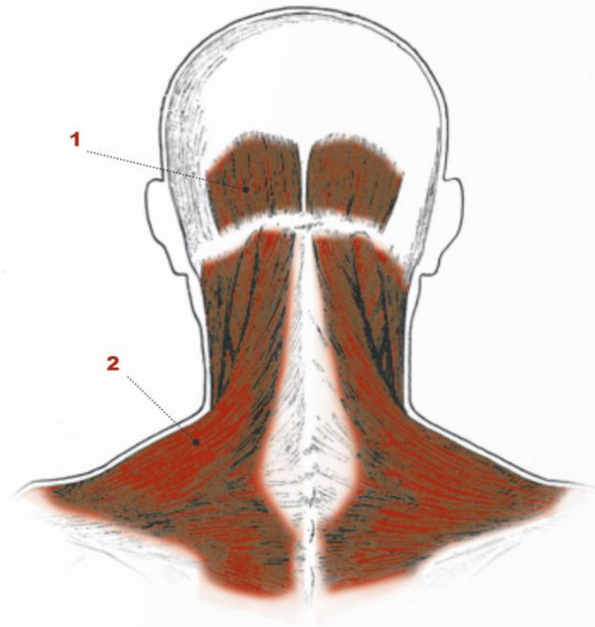
1. Posterior atlantooccipital membrane
2. Posterior atlantoaxial membrane
3. Capsular ligaments (zygapophyseal)
4. Nuchal ligament
5. Anterior atlantooccipital membrane
6. Anterior atlantoaxial membrane
7. Anterior longitudinal ligament
8. Tectorial membrane
9. Posterior longitudinal ligament
10. Alar ligaments
11. Cruciform / cruciate ligament
12. Apical ligament

Vertebral Arteries & Basilar Artery

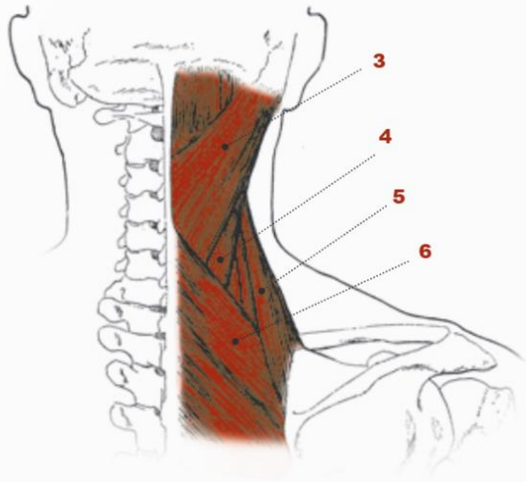
(right lateral view)



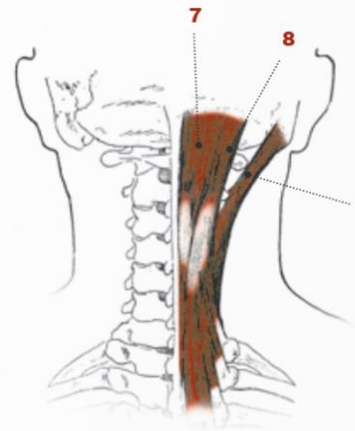
Superficial

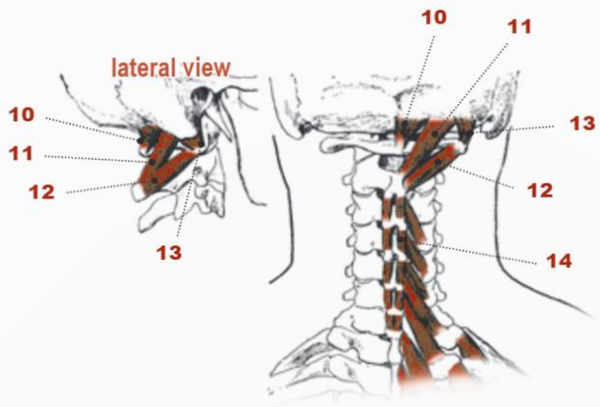


1. Occipitalis
2. Trapezius (upper fibers)
3. Splenius capitis
4. Splenius cervicis
5. Levator scapulae
6. Rhomboid minor
7. Spinalis capitis
8. Semispinalis capitis
9. Longissimus capitis



Deep





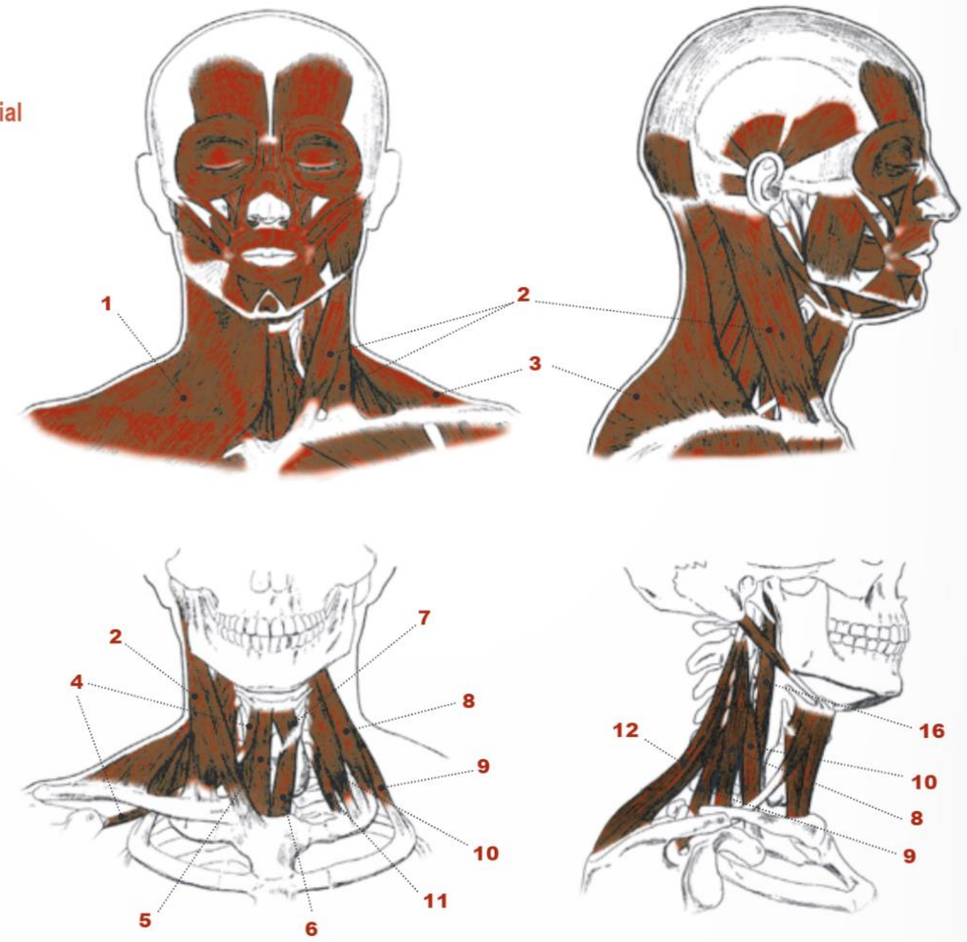
Suboccipital muscles*

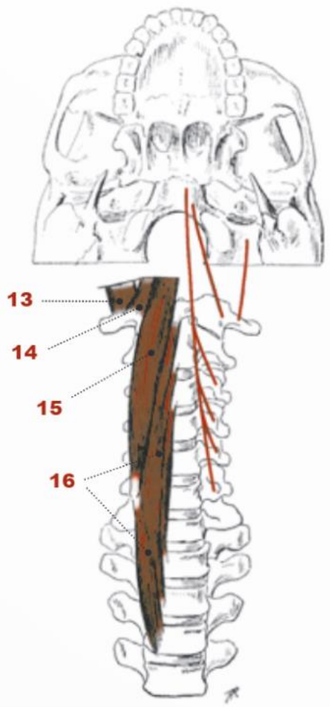
10. Rectus capitis posterior minor*
11. Rectus capitis posterior major*
12. Obliquus capitis inferior*
13. Obliquus capitis superior*
14. Interspinalis

Press Esc to exit full screen

Cervical M

Superficial





Deep

1. Platysma
2. Sternocleidomastoid
3. Trapezius
4. Omohyoid
5. Sternohyoid
6. Sternothyroid
7. Thyrohyoid
8. Middle scalene
9. Posterior scalene
10. Anterior scalene
11. Scalenus minimus
12. Levator scapulae
13. Rectus capitis lateralis
14. Rectus capitis anterior
15. Longus capitis
16. Longus cervicis (coli)

Lines indicate muscle attachments to the base of the skull

C-Spine Palpation

All palpation methods involve tactile movement of soft tissues & osseous structures to evaluate **variations in elasticity, tone, motion from side to side, pain and/or discomfort.** - clinical style & preference will determine which specific methods clinicians use (use what works best for you)

'Neck Walk'

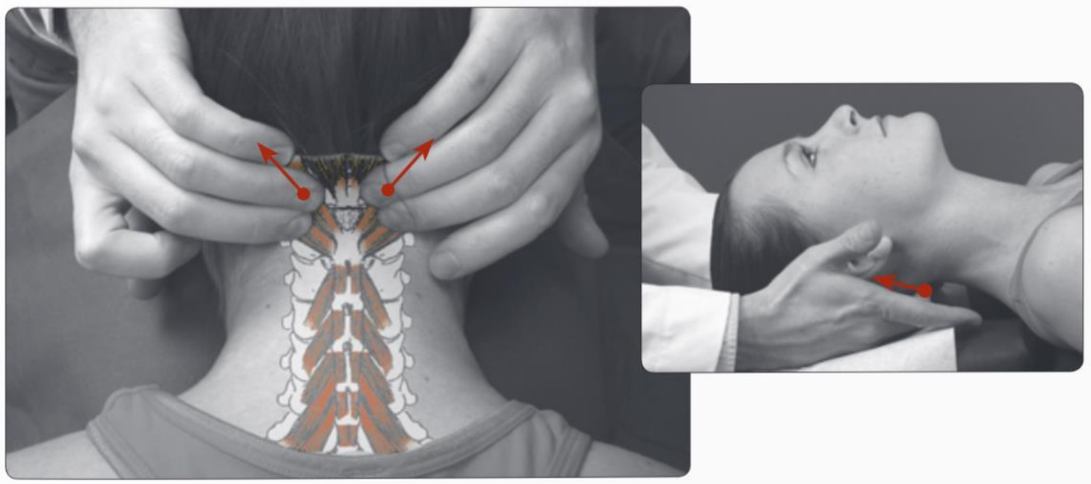
Procedure

Patient supine, examiner starts superficially to introduce touch & assess integrity of superficial tissues; examiner then proceeds to palpate deeper soft tissue & osseous structures (walk over neck with hands and give your self an anatomy review!)

Interpretation

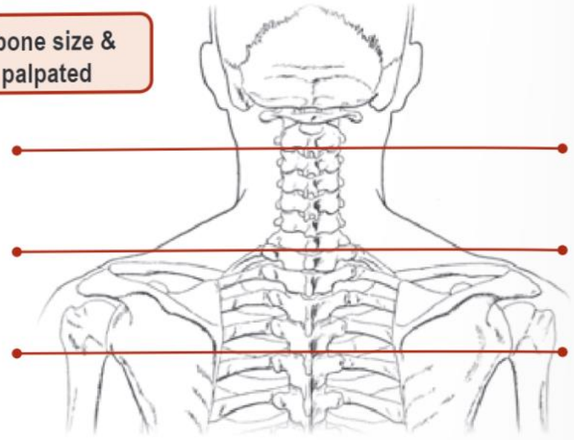
(+) Nonuniform motion, muscle spasm, hypertonicity, pain → joint dysfunction (subluxation), trigger point, muscle tightness, sprain/strain, local joint irritation (possible degeneration)





Realize that normal anatomical variation in bone size & shape may alter exact spinal levels being palpated

- **C2** - first palpable SP below the occipital bone
- **C7 or T1** - most prominent SP at base of neck (C7 will usually move from a palpating finger with cervical flexion/extension)
- **T4** - level with the root of the spine of scapula or apex of axillary fold



Structure	Location
EOP	midline of occipital base
C1 TP	~1 cm (½" inch) anterior & inferior to mastoid process (under ear lobe)
C2 SP	1st prominent SP below EOP
C4 SP	hyoid bone
C5 SP	thyroid cartilage
C7 SP	usually second most prominent SP, slides anterior during cervical extension
T1 SP	most prominent SP (usually)

TP = transverse process, SP = spinous process, thoracic TP palpation rule of 3s is a guideline more than a strict rule

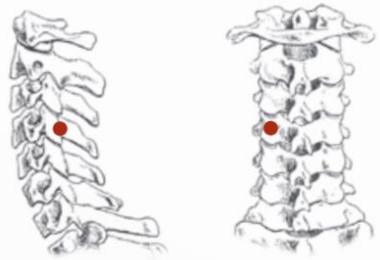
Segmental Assessment

Procedure

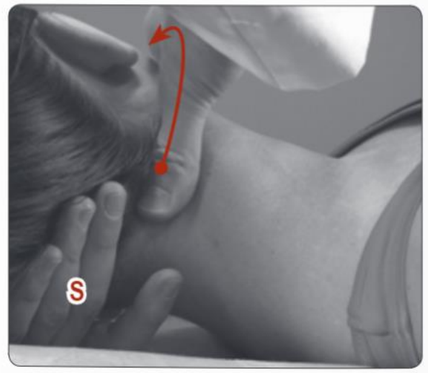
Patient supine, examiner palpates through musculature to articular pillars; flexes, laterally flexes & finally rotates patient head/neck - (lateral flex one direction/ rotate opposite direction) **'walk' hands up & down the c-spine - observe end feels at each individual segment**

Interpretation

(+) Nonuniform motion → joint dysfunction (subluxation), malposition or restriction of motion, soft tissue contracture







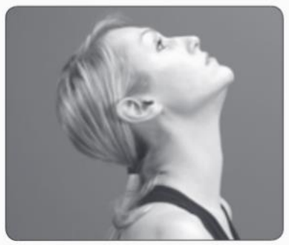
Compare bilaterally, prior to ROM the examiner should make an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."

Cervical Segmental Joint Motions			
Motion Segment	Combined Flexion & Extension	Lateral Flexion (One side)	Rotation (One side)
C0-1	25°	5°	5°
C1-2	20°	5°	**40°**
C2-3	10°	10°	3°
C3-4	15°	11°	7°
C4-5	20°	11°	7°
C5-6	20°	8°	7°
C6-7	17°	7°	6°
C7-T1	9°	4°	2°
Cervical	**~130°**	**~60°**	**~80°**

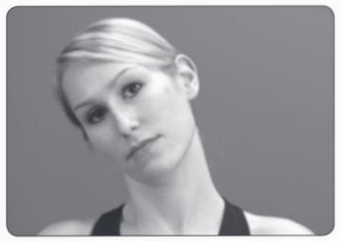
Flexion (50°-70°)
Muscles Activated: sternocleidomastoid (SCM), longus cervicis, longus capitis, rectus capitis anterior
Tissue Stretched: trapezius, splenius cervicis & capitis, longissimus capitis, suboccipitals, nuchal ligament, interspinous ligament, posterior IVD, posterior facet joint capsule
Tissue Compressed: anterior neck muscles, trachea, esophagus, carotid arteries



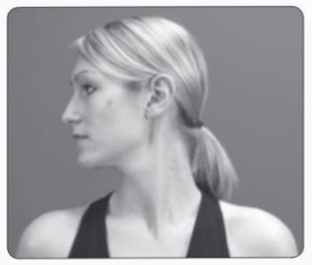
Extension (50°-70°)
Muscles Activated: trapezius (upper), splenius cervicis & capitis, longissimus capitis, suboccipitals
Tissue Stretched: anterior neck muscles, anterior longitudinal ligament, anterior IVD, trachea, esophagus, carotid arteries
Tissue Compressed: posterior neck muscles, posterior intervertebral discs, facet (z-joints) joints



Lateral Flexion (45°-60°)
Muscles Activated: *ipsilateral:* trapezius (upper), splenius cervicis & capitis, longissimus capitis, levator scapulae, suboccipitals
Tissue Stretched: *contralateral:* trapezius (upper), longissimus capitis, SCM, lateral IVD, carotid artery, z-joints
Tissue Compressed: *ipsilateral:* trapezius (upper), longissimus capitis, SCM, lateral IVD, carotid artery, z-joints

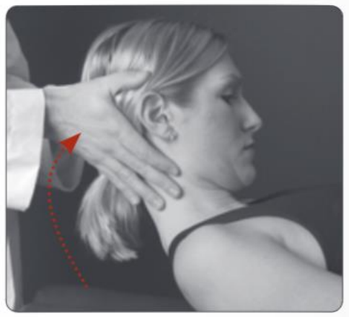
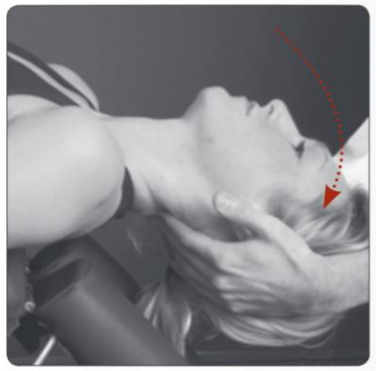
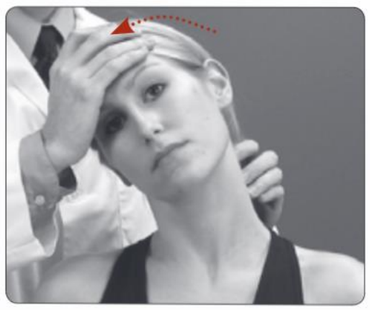
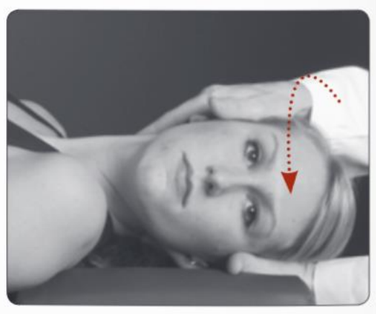


Rotation (80°-90°)
Muscles Activated: *ipsilateral:* splenius cervicis & capitis, suboccipitals; *contralateral:* SCM
Tissue Stretched: *contralateral:* splenius cervicis & capitis, suboccipitals; *ipsilateral:* SCM
Tissue Compressed: *ipsilateral:* splenius cervicis & capitis, suboccipitals; *contralateral:* SCM



Compare bilaterally; if possible palpate joint during PROM & use the shortest level possible, apply over pressure at end ROM; introduction statement:
"If any of the actions or movements are painful or uncomfortable please let me know."

PROM may be performed with the patient seated or supine

	Seated	Supine
Flexion (> 50°-70°)		
Extension (> 50°-70°)		
Lateral Flexion (> 45°-60°)		
Rotation (> 80°-90°)		

Flexion (> 50°-70°)
Tissue Stretched: upper trapezius, splenius cervicis & capitis, longissimus capitis, suboccipitals, nuchal ligament, interspinous ligament, posterior IVD, posterior facet joint capsule
Tissue Compressed: anterior neck muscles, trachea, esophagus, carotid arteries

Extension (> 50°-70°)
Tissue Stretched: anterior neck muscles, anterior longitudinal ligament, anterior IVD, trachea, esophagus, carotid arteries
Tissue Compressed: posterior neck muscles, posterior intervertebral discs, facet (z-joints) joints, vertebral artery

Lateral Flexion (> 45°-60°)
Tissue Stretched:
contralateral: trapezius (upper), longissimus capitis, SCM, lateral IVD, carotid artery, z-joints
Tissue Compressed:
ipsilateral: trapezius (upper), longissimus capitis, SCM, lateral IVD, carotid artery, z-joints

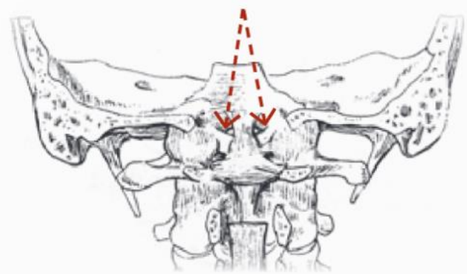
Rotation (> 80°-90°)
Tissue Stretched:
contralateral: splenius cervicis & capitis, suboccipitals; *ipsilateral:* SCM
Tissue Compressed:
ipsilateral: splenius cervicis & capitis, suboccipitals

Alar Ligament Stress Test ★★

Procedure
Patient supine; examiner stabilizes C2 (axis) with a grip over the lamina (not spinous process), examiner then proceeds to laterally flex the head & C1 (atlas) to the left & right, noting the degree of joint motion & end feel - *you should feel the spinous process move to the opposite side* - repeat on the other side



Interpretation
(+) Lack of C2 movement during lateral flexion &/or soft end feel, muscle spasm, pain → alar ligament injury possible cervical instability (R: 0.76)



Clinical notes
This test also challenges the C0-C1 joint capsule; typically, minimal lateral flexion occurs with strong capsular end feel; follow-up for a positive test should include diagnostic imaging (radiographs or MRI) with cervical flexion & extension views

Bakody's Sign/Shoulder Abduction Test ★★★★★

Synonyms: shoulder abduction test, relief test

Procedure
Patient places hand on top of head; hand is placed on head to reduce pain

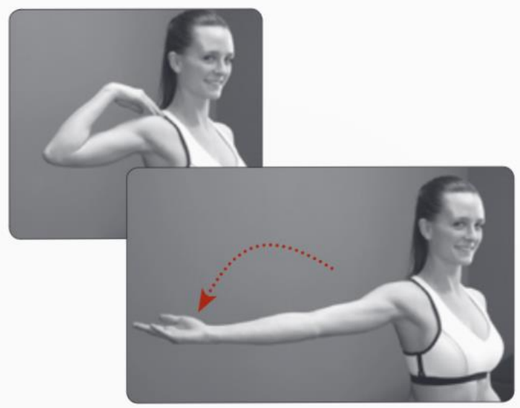


Interpretation
(+) Reduction of symptoms by reducing tension on cervical nerve root → Nerve tension or cervical radiculopathy

Clinical notes
Patients with radicular conditions may present in this position as it is an antalgic (pain-relieving) posture
Good diagnostic (not screening) test for cervical radiculopathy
(SN: 17-68 SP: 80-100 +LR: 1.9-2.2 -LR: 0.7-0.9)[5, 14, 34, 36]

Bikele's Sign ★★

Procedure
Patient seated, shoulder abducted 90°, elbow fully flexed; examiner instructs patient to extend elbow

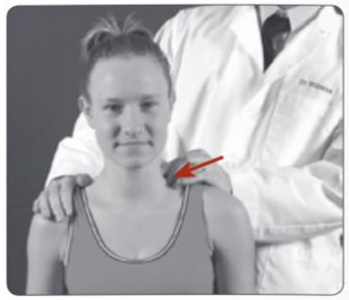


Interpretation
(+) Reproduction of radicular symptoms → Nerve root tension, brachial plexus neuritis, possibly meningitis

Clinical notes
DDx other causes of radiculopathy: SOL in spinal cord or lung apex (tumor), fractured clavicle or callous formation, cervical rib, history of trauma

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Brachial Plexus Compression Test ★★★★★



Procedure

Patient seated, examiner applies compressive force over the brachial plexus (squeeze brachial plexus between fingers & thumb) for a duration of 10 seconds

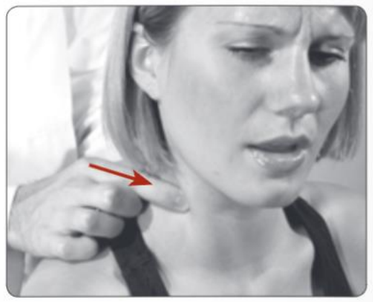
Interpretation

(+) Radicular symptoms → Nerve root compression, TOS, anterior scalene syndrome (SN: 69 SP: 94 +LR: 3.7 -LR: 0.8)[36]

(+) Local pain or discomfort → Cervical strain/sprain

Clinical notes

When performing maneuver, the examiner must be sure that they are not compressing the common carotid artery or any other vascular tissue supplying the head as it may result in undesired side effects



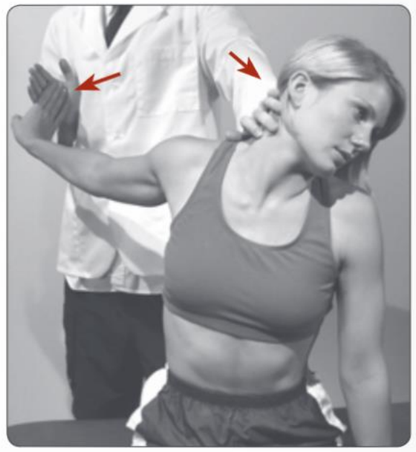
Doorbell Sign - when the injured tissue is pressed there is an almost immediate result of pain (pressing a doorbell results in an almost immediate "ding-dong" ☺

Brachial Plexus Stretch Test ★★★★

Procedure

Patient seated or supine, examiner passively

1. Abducts straight arm & observes for signs of discomfort, then
2. Extends patient's wrist, then
3. Laterally flexes head & extends wrist



Interpretation

(+) Reproduction of radicular symptoms with wrist extension → cervical radiculopathy (commonly C5)

(+) Local 'stretch' in arm or forearm → myofascial contracture

Clinical notes

Consider cervical spine flexion to further stretch brachial nerve roots (similar to lumbar flexion in maximal SLR)

Clinicians option: examiner may further stress brachial plexus by taking fingers palpating neck & applying direct pressure over the scalene muscles - also consider standing in front of patient to see facial expressions

Brudzinski's Sign ★★★★

Procedure

Patient supine with legs straight, examiner flexes patient's head & neck

Interpretation

(+) Involuntary hip & knee flexion → Meningeal irritation/inflammation (meningitis)

Clinical notes

If meningitis is suspected follow up with a dural slump test & consider a cerebrospinal fluid analysis (WBC count) should be considered as a follow-up procedure



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Cervical Compression Test ★★★★★

Synonym: Spurling's , Modified Spurling's, Foraminal compression test, maximal compression test, Jackson compression



Procedure (patient seated, 3 stages - least to most invasive)

1. Examiner gently applies axial downward pressure on patient's head in neutral position
2. Examiner gently applies downward pressure with head in mild rotation & lateral flexion to affected side
3. Examiner gently applies downward pressure with head in extension, rotation & lateral flexion toward side of concern (maximal cervical compression)



Interpretation

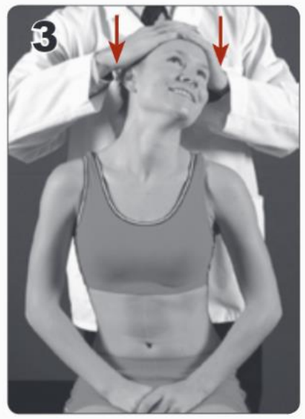
(+) Increased peripheral pain or numbness → increased pressure on nerve roots = IVF encroachment (DJD osteophyte), radiculopathy (R: 0.62 SN: 11-100 SP: 74-100 +LR: 4.3-18.6 -LR: 0.25-.75)[23, 24, 27, 31, 34]

(+) Local neck pain → local sprain/strain, joint damage, facet lock, meniscoid entrapment, cervical subluxation

Clinical notes

With radicular symptoms, further evaluation is warranted - detailed neurologic examination & diagnostic imaging

With extension, these maneuvers may also compress the vertebral artery & cause VBI-type symptoms (dizziness, vertigo, nystagmus)



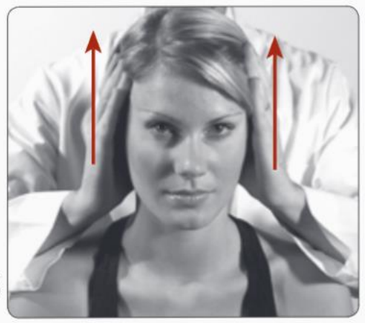
Maximal cervical compression: (used to further compress IVF & facet on side of lateral flexion) patient's head is rotated, laterally flexed & slightly extended examiner applies straight superior to inferior force (position 3)

Spurling's Test - has been demonstrated by applying a "vertical blow" to the top of the head downward (interpretation is the same as above) - **Reverse Spurling's Sign** - pain on the opposite side to which the head is bent → cervical sprain/strain (stretching of damaged tissue)

Jackson Compression - head/neck are only rotated → same as above

Cervical Distraction Test ★★★★★

Procedure: Patient seated or supine is instructed to take a large breath in, on exhalation the examiner distracts patient's head (stabilize under occiput or mandible)



Interpretation

(+) Increased local pain → muscle, ligament or joint capsule damage

(+) Decreased peripheral pain/numbness → decreased pressure on nerve roots, IVF encroachment, cervical radiculopathy (R: 0.82 SN: 40-50 SP: 80-100 +LR: 4.4 -LR: 0.62)[5, 12, 34, 36]

(+) Decreased local pain → facet impingement, DJD

Clinical notes: this test is best performed in the seated (gravity dependant) position as the weight of the head may compression structures; consider timing of distraction after exhalation of a deep breath (results in better relaxation & more distraction)

If patient experiences a reduction in pain with cervical distraction, this test may indicate an appropriate treatment method for their condition (consider using cervical distraction techniques in treatment protocol)

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Hautant's Test ★



Procedure

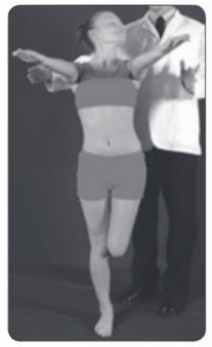
Patient seated, both shoulders flexed 90°, elbows extended & wrist straight; examiner instructs patient to close eyes then rotate & extend head to one side

Interpretation

(+) Arm drift, pre-syncope, vertigo, visual changes and/or nausea → VBI

Clinical notes

Test may be used as a screening procedure before cervical manipulation

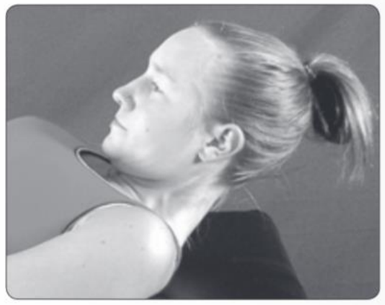


Underburg's Test: Patient standing, shoulders flexed 90°, eyes closed - patient is instructed to march in place while extending & rotating the head; examiner ***must*** stand near patient & be ready to support them should they lose balance

(+) Loss of balance, dropping of arms, pronation of hands, pre-syncope, vertigo, and/or nausea → VBI, cerebellar dysfunction

This test variation is very involved test & should not be performed with geriatric patients due to level of difficulty

Jull's/Neck Flexor Endurance Test ★★★★



Procedure

Patient supine, examiner instructs patient to maintain neck in flexed position (~3 cm/1" off table) for 5-10 seconds & observes patient

Interpretation

(+) Chin jutting upward or excessive shaking or inability to maintain position → Deep neck flexor muscle weakness or deconditioning

Clinical notes

This maneuver should be performed in 2 positions (head 3 cm off table & near full flexion)

Normal Values: men: 38.9 sec, women: 29.4 seconds

Lateral Shear Test ★★★

Procedure

Patient supine with head supported, examiner places one hand (2nd MCP) against the transverse process of C1 (atlas) & the other hand (2nd MCP) against the opposite transverse process of C2 (axis); examiner then proceeds to approximate hands (applying a shearing force between C1-C2)

Interpretation

(+) Soft end feel, muscle spasm, dizziness, nystagmus, nausea → Odontoid dysplasia or aplasia

Clinical notes

During this maneuver it is crucial that the examiner is aware of the cervical vascular structures they may be compressing with their hand positions (jugular veins, carotid arteries); follow-up for a positive test should include referral for diagnostic imaging (xray & doppler ultrasound)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

L'hermitte's Sign/Cervical Hyperflexion ★★★★★



Procedure - Patient may be seated or supine, patient's head is passively flexed forward, examiner may apply gentle over pressure

Interpretation

(+) Reproduction of radicular symptoms (sharp, shooting down spine or extremities) → cervical radiculopathy

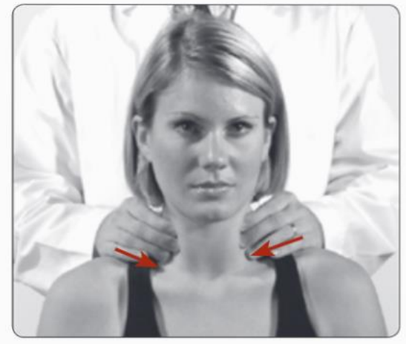
Clinical notes

Cervical myelopathy may be caused by: cord tumor, posterior column disease, meningeal adhesions or irritation, multiple sclerosis, stenosis, disc herniation

(R: 0.6 SN: 3-89 SP: 41-97 +LR: 1-1.5 -LR: 0.27-1)[5, 36, 44]

This test is effectively passive ROM with over pressure

Naffzinger's Test ★



Procedure

Patient seated, examiner holds pressure over the jugular veins (bilaterally) for ~30 seconds, patient then instructed to cough

Interpretation

(+) Pain along the distribution of a peripheral nerve → space occupying lesion in cervical spine near brachial plexus

Clinical notes

Test is contraindicated in patients that may be vascular compromised: geriatric patients suspected of having atherosclerosis

O'Donoghue Maneuver ★★★



Procedure

Patient seated, examiner moves cervical spine through isometric resisted rotation, then through passive rotation, both actions are repeated bilaterally

Interpretation

(+) Pain during resisted motion → muscle strain

(+) Pain during passive motion → ligament sprain

Clinical notes

Resisted rotation may be performed as an isometric contraction in which the examiner holds the patient's head still while they attempt to rotate from side to side

Rust's Sign ★★★★



Procedure - Patient presents supporting neck or head

Interpretation

(+) → Upper cervical instability, severe cervical sprain, rheumatoid arthritis, cervical spine fracture, severe cervical spine subluxation

Clinical notes

This sign represents a serious pathological finding & should be followed immediately by diagnostic imaging

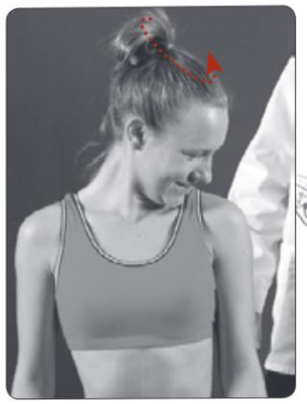
Consideration should also be given to the use of a cervical collar or brace

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Scalene Cramp Test ★★★

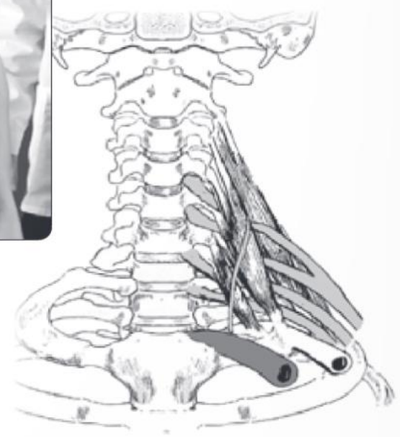
Procedure

Seated patient turns head to affected side & tucks chin into the supraclavicular fossa (flexion & rotation of cervical spine); examiner observes for sign of pain or discomfort



Interpretation

(+) Increased local pain → Scalene myofascial trigger point
(+) Radicular symptoms → TOS, brachial plexus compression, nerve root irritation



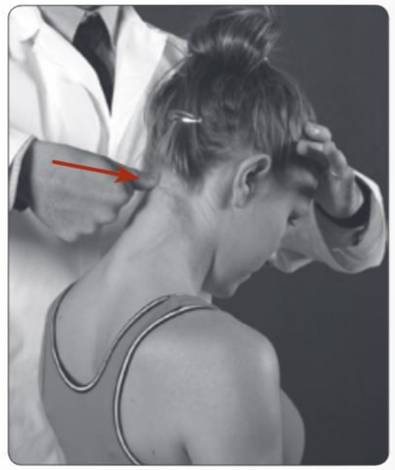
Clinical notes

With scalene trigger point it is possible to have pain referral over the shoulder & down the arm

Sharp-Purser Test ★★★★★

Procedure

Patient seated or supine, examiner stabilizes patients head with one hand over forehead & places the other thumb over the spinous process of C2 (axis); patient is then instructed to slowly flex head forward, while the examiner gently applies A→P pressure on forehead



Interpretation

(+) Reduction of neurologic symptoms &/or "clunk" with motion → subluxation of the atlas that has reduced

Clinical notes

Due to the sensitive structures involved, this test must be performed with extreme caution; follow-up for a positive test should include diagnostic imaging (radiographs) with cervical flexion & extension views (SN: 69 SP: 96 +LR: 17.3 -LR: 0.3)[32]

Sharp-Purser test should be performed before the Transverse Ligament Stress Test, because the Sharp-Purser test works to reduce symptoms, while the Transverse Ligament Stress Test works to reproduce symptoms

Shoulder Depression ★★★

Procedure

Patient may be seated or supine, patient laterally flexes head away from side being tested, with a broad contact the examiner presses down on shoulder



Interpretation

(+) Arm pain → Radiculopathy
(+) Local pain → Sprain/strain

Clinical notes

Examiner's hand on head is placed for stabilization not over-pressure

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Soto-Hall Test ★★★

Procedure

Patient supine, examiner passively flexes neck & applies pressure on sternum



Interpretation

(+) Radicular pain → nerve root tension
(+) Local pain → sprain/strain, rib subluxation

Clinical notes

Patient may have elevation of the knees with flexion of the neck which suggests meningeal irritation or inflammation (Brudzinski's sign)
Clinician's option: by having the patient cross their hands over their chest inappropriate contact can be avoided (more relevant for female patients)

Swivel Chair (dizziness) Test ★★★★

Procedure

Patient seated in a chair that has swivel capabilities, examiner stabilizes patient's head & instructs patient to twist body on rotating chair (patient walks legs around floor)



Interpretation

(+) Vertigo → Cervicogenic vertigo, cervical joint dysfunction

Clinical notes

Test is useful to help differentiate cervicogenic vertigo from vestibular vertigo, as the vestibular apparatus is kept stationary during this test by the examiner, whereas the cervical spine is moving as the patient's body twists

TMJ 3 Knuckle Test ★★★★

Procedure: patient seated or standing, is instructed to place 3 knuckles between incisors



Interpretation

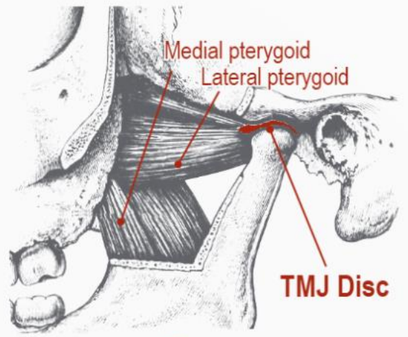
(+) Pain or inability to perform test → TMJ dysfunction or contracture

Clinical notes

Examiner may also choose to measure maximum distance between teeth as a quantitative assessment of actual motion available at the TMJ to use as a clinical outcome marker to show improvement with treatment

Intraoral palpation of medial pterygoid & masseter are also useful as assessment & treatment option

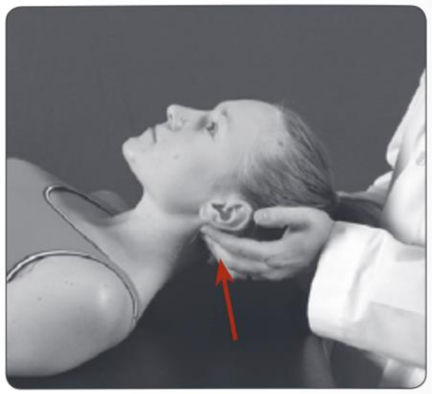
Also observe mandible AROM for deviation to one side, clicking or catching with motion



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Transverse Ligament Stress Test ★★★

Procedure: patient supine, examiner supports the patients head with two hands, & places fingertips over the posterior arch of C1, the examiner then proceeds to lift the head anteriorly ~5 cm (allowing no flexion or extension of the neck), this position is held for 15 seconds



Interpretation

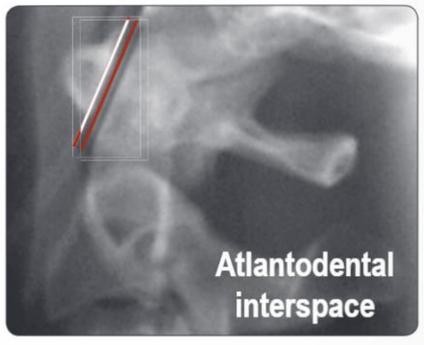
(+) Soft end feel, muscle spasm, dizziness, nystagmus, nausea → hypermobility of the atlantoaxial articulation with potential brainstem compression

Clinical notes

Follow-up for a positive test should include diagnostic imaging (cervical flexion/extension views) - mobilization & manipulation are contraindicated

Transverse ligament helps hold the odontoid process of C2 against the anterior arch of C1, rupture of this ligament will result in atlantoaxial instability which may be seen with prior trauma, rheumatoid arthritis, Down syndrome & other conditions

Atlantodental Interspace (ADI):
Normal: children - 1-5 mm, adults - 1-3 mm
Interpretation: trauma, occipitalization, Down's syndrome, pharyngeal infection, ankylosing spondylitis, RA, psoriatic arthritis, reactive arthritis



Valsalva Maneuver ★★★★★

Procedure

Patient may be seated or standing, patient is instructed to take a deep breath & hold while bear down as if "straining at stool"



Interpretation

(+) Radicular pain → possible space occupying lesion (SOL); disc herniation, tumor, IVF encroachment
(+) Soft tissue protrusion in abdomen → inguinal, femoral or umbilical hernia

Clinical notes

This test increases intra-abdominal & intra-thecal pressure; some patients may experience vertigo or syncope while performing this test & caution should be used

Moderately specific test for cervical radiculopathy (R: 0.69 SN: 22 SP: 94 +LR: 3.67 -LR: 0.82)[36]

Dejerine's triad - radicular symptoms with coughing, sneezing or straining (mini-valsalva maneuvers)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Vertebralbasilar Artery Function Test ★★★

Procedure

Patient seated, eyes open; examiner does the following:
1. Observation for carotid or subclavian pulsations
2. Auscultation for bruits
3. Palpation with patient rotating & extending head (bilaterally)



Interpretation

(+) Pulsations, bruits, pre-syncope, vertigo, nystagmus, and/or nausea → VBI (vertebral basilar insuficiency)

Clinical notes

The third part of this exam should only be performed if no pulsations are observed & no bruits are noted during auscultation

VBI Test ★★★★

Synonyms: George's test, DeKleyn Test

Procedure

Patient supine or seated; examiner supports head & follows 3 steps
1. Lateral flexion of patients neck, then
2. Rotation of the neck to the same side & lastly
3. Extension of the neck - then ask the patient to look at a fixed point on the ceiling - position may be held for up to 30 seconds and ask patient to count backwards from 10



Interpretation

(+) Pre-syncope, nystagmus, vertigo, slurred speech, visual changes and/or nausea → VBI, cervicogenic vertigo, cervical instability with brainstem compression
(+) Tingling or electrical arm pain → nerve root compression (IVF)

Clinical notes

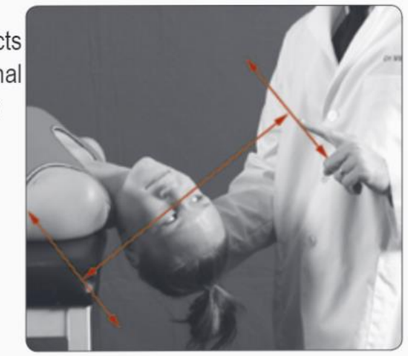
Patient's eyes must be opened to observe the presence of nystagmus (SN: 9.3 SP: 98 +LR: 4.2 -LR: 0.98)[1, 10]



Interpretation of the tests is controversial, however many malpractice insurance providers suggest using this test prior to cervical mobilization or manipulation to show that the practitioner was a aware of the potential for VBI be aware that a negative test does NOT rule out the potential of VBI

Cervical Quadrant test: patient supine, examiner gently extends & laterally flexes patient's neck; examiner then rotates patients head to same side & holds for ~30 sec

Vizniak VBI: position 3 held for 15 seconds, examiner then instructs patient to follow finger movement with eyes ('H' pattern for cardinal fields of gaze), test is repeated on contralateral side y combining the VBI screen with eye tracking, the sensitivity of the test may be increased by helping to detect more subtle deficiencies & increasing physical examination efficiency (saving time)



5Ds And the 3Ns of VBI signs & symptoms
Dizziness, Drop attacks, Diplopia, Dysarthria, Dysphagia
Ataxia (loss of motor control or unsteady gait)
Nausea, Numbness, Nystagmus

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Upper Limb Tension Tests ★★★★

Synonym: Elvey's Tests

Procedure

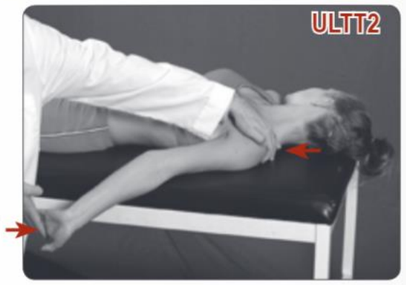
Patient supine with shoulder in a depressed position (it is crucial that the shoulder remains depressed through the entire testing procedure); cervical spine laterally flexed away from the side being examined

During each of the maneuvers the examiner slowly moves the arm towards the appropriate end-range position noting the presence of neurologic & local musculoskeletal signs & symptoms

As the elbow approaches end range motion symptoms are most often noted (flexion stresses the ulnar nerve & extension stresses the median & radial nerves), thus flexion & extension of the elbow should be the last action of each maneuver

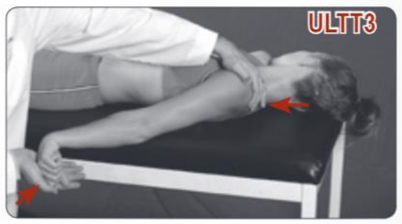


ULTT1 (median): shoulder depressed & abducted 110°, elbow, wrist & fingers extended, forearm supinated (median nerve tension) (similar to seated brachial stretch test)



ULTT2: shoulder depressed, externally rotated & abducted 10°, elbow, wrist & fingers extended, forearm supinated (median, musculocutaneous, axillary nerve tension)

ULTT3 (radial): shoulder depressed, internally rotated & abducted 10°, elbow extended, forearm pronated, wrist flexed & deviated towards ulna, fingers flexed (radial nerve tension)



ULTT4 (ulnar): shoulder depressed, externally rotated & abducted 90° (patient's hand should approximate ipsilateral ear), elbow flexed, forearm supinated, wrist extended & deviated towards the radius, fingers extended (ulnar nerve tension)



Interpretation

(+) Arm pain or reproduction of neurologic symptoms → radiculopathy, peripheral nerve or fascial adhesions

ULTT1/Median nerve: (R: 0.76 SN: 97 SP: 22 +LR: 1.2 -LR: 0.14)[36]

ULTT3/Radial nerve: (R: 0.83 SN: 72 SP: 33 +LR: 1.1 -LR: 0.84)[12, 36]

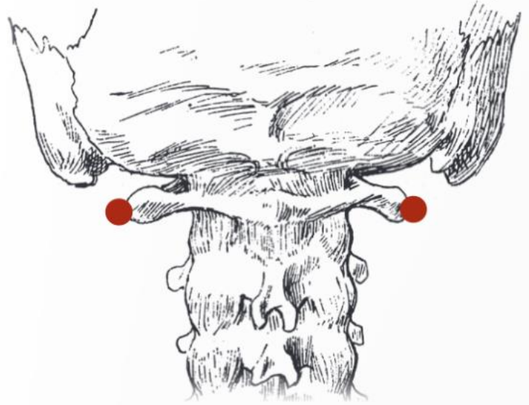
Clinical notes

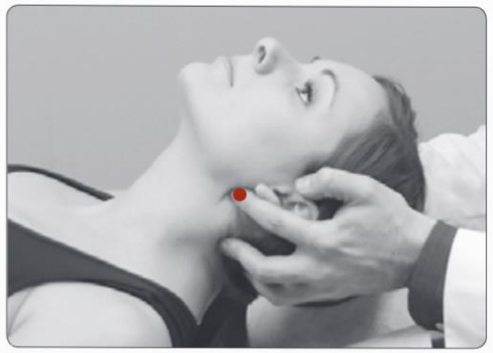
Non-symptomatic side should be tested before symptomatic side; tests are analogous to SLR in lower extremity

Clinician's option: to further increase nerve tension the examiner may instruct the patient to rotate head away, flex neck & take a deep breath, all of which may increase nerve root or brachial plexus tension

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

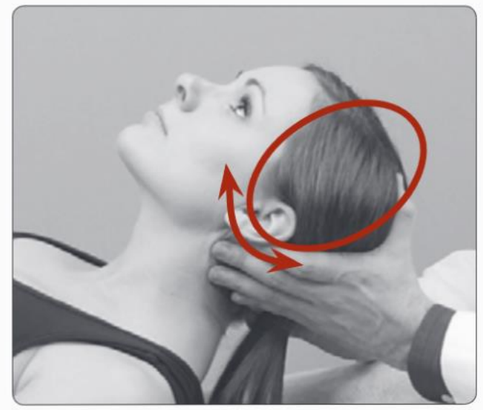
C1 is often difficult to assess, one easier method is to place your fingers just anterior & inferior to the mastoid process, **palpate the C1 TPs bilaterally**, then palpate for local tenderness, asymmetrical lateral displacement, muscle hypertonicity, or asymmetrical motion as the patient is taken through cervical ROM (flex, lat flex, rot.)



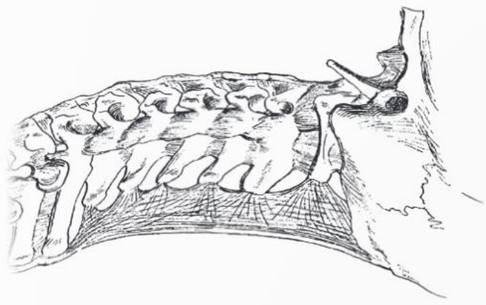




The Egg in the Spoon: many clinicians find it useful to assess C0-C1 motion in multiplanar arching actions - try and visualize an egg (C0) sitting in a spoon (C1) and then move into multiple directions looking for asymmetry or restriction of motion



By fully flexing the lower cervical spine many of the posterior ligaments & joint capsules may be stretched and tightened allowing for a more isolated assessment of C0-C1





S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Definition: pain & tenderness due to a dysfunction of the TMJ or surrounding musculature & soft tissue - an often overlooked cause for patient discomfort

- Divided into 3 subtypes (that often co-exist):
  1. **Myofascial pain dysfunction**
  2. **Internal derangement** (disc/cartilage)
  3. **Degenerative joint disease**

History

- Jaw or facial pain - increased with mastication
- Locking or catching with motion
  - Limited ROM, TMJ clicking, grinding & popping
- Headache, earache & neck pain
- Past head or facial trauma (whiplash)

Physical

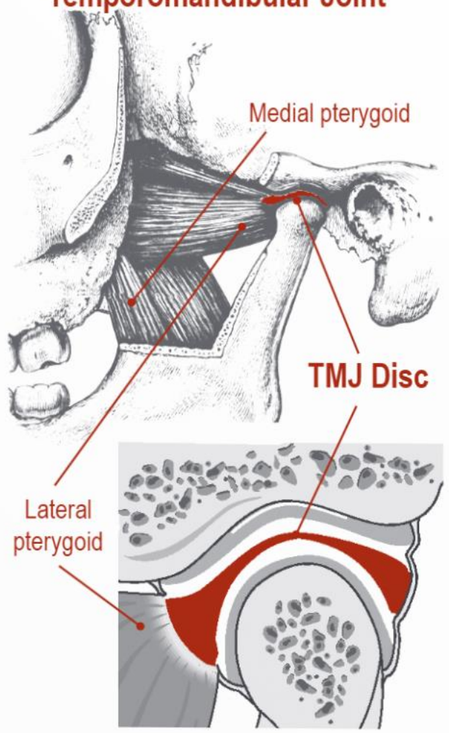
- Observation: asymmetry, muscle hypertrophy
  - Malocclusion of jaw, abnormal dental wear
- Tenderness to palpation over mastication muscles
  - Myospasm in muscles of mastication & facial muscles (masseter, pterygoids), TMJ via the external auditory meatus
- Check ROM - decreased jaw opening (normal 40 mm minimum or ~ 3 knuckles inserted between upper & lower incisors); protrusion, lateral deviation (movement is normally ~10 mm)



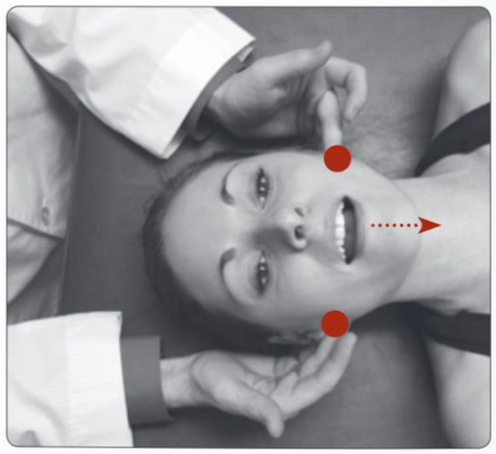
Measurement of TMJ ROM (32mm)

- **Abnormal mandibular tracking (gait):** lateral deviation of mandible; non-uniform pattern





- Palpation of TMJ with motion is extremely diagnostic - crepitis over joint (may indicate disc damage) also look for muscle spasm, non-uniform motion and pain or apprehension



- S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

High risk factors?
- Age > 65
- Significant mechanism of injury (fall > 1 m; axial load to head - diving; high speed MVA; bicycle collision)
- Paresthesias in extremities

Yes → Diagnostic Imaging

No ↓

Low risk factors allowing safe ROM assessment?
- Normal cognition, no neurologic symptoms
- Simple rear end MVA
- Sitting position in waiting room
- Ambulatory at any time
- Delayed onset of neck pain
- Absence of mid-line C-spine tenderness

No → Diagnostic Imaging

Yes ↓

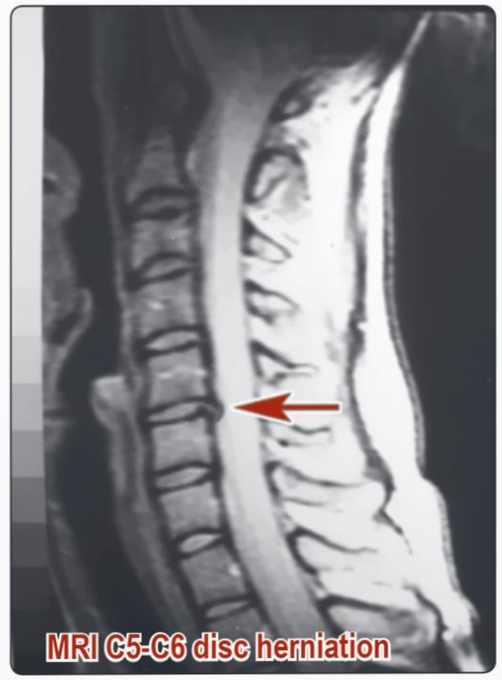
Able to rotate neck 45° to right & left?

Unable → Diagnostic Imaging

Able → No Imaging



Film (above) shows fracture of C2 vertebral body, with straightening of the cervical curvature and a large osteophyte at on the anterior inferior margin of C5



B = Bone: evaluate film for fractures & dislocations, describe variations in cortices, medullary & subchondral bone, density, shape, size, trabecular patterns & relationship of osseous arrangements.

A = Alignment: analyze spinal curves & posture, result of various measurements; misalignments (e.g. anterolisthesis, retrolisthesis, laterolisthesis)

C = Cartilage: inspect the intervertebral disc space, articular spaces for any abnormalities; pay attention to symmetry, continuity, widening or loss of joint space & calcification of cartilage

S = Soft Tissue: evaluate soft tissues; look for unusual calcifications, including in blood vessels, masses, displaced fascial lines & unusual gas distribution, fluid density (swelling) behind esophagus

Sagittal curve:

1. Ensure that loss of curve is not due to poor positioning or hyperplastic articular pillars.
2. If it is a true loss of curve, then measure angle of cervical lordosis (normal 35-45°)

Other cervical spine measurements:

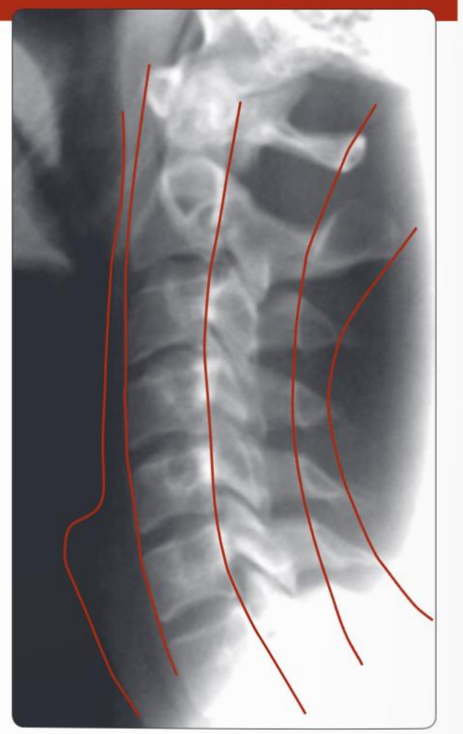
1. Chamberlain's or McGregor's lines evaluate for basilar impression (only mention if positive)
2. Evaluate atlantodental interspace (ADI) (3 mm adults or 5 mm children). Especially following trauma or in rheumatologic patients
3. In high risk patients, mention if it is normal, otherwise report only if abnormal
4. Check for sella turcica enlargement. (12 mm vertical x 16 mm horizontal max.)
5. Draw George's line & evaluate for anterolisthesis or retrolisthesis
6. Check for disruption of posterior cervical line (spinous-lamina junction line)
7. Measure sagittal aspect of cervical spinal canal (spinal stenosis less than 12 mm)
8. Examine prevertebral soft tissue line
   - C2 vertebral body = retropharyngeal (should be less than 6 mm)
   - C6 vertebral body = retrotracheal (should be less than 22 mm)

Variants & anomalies:

1. Occipitalization, spina bifida occulta, posterior ponticulum, C1 posterior arch agenesis, odontoid pseudofracture, odontoid agenesis, thyroid cartilage calcification, cervical ribs

Cervical Lines

- All bony lines should be smooth & continuous
- Proper alignment indicates absence fractures, dislocation, or ligament laxity
- Antero/retro-listhesis; may indicate instability due to fracture, dislocation, ligament laxity, DJD



1. Prevertebral Soft-Tissue Line

- Use rule of 6's & 2's. (6mm at C2 & 22mm at C6)
- Soft tissue mass may increase measurements including: post traumatic hematoma, retropharyngeal abscess, or neoplasm from adjacent bone & soft tissue structures.

2. Anterior Vertebral Body Line

3. Posterior Vertebral Body Line (George's Line)

4. Spinolaminar Junction Line

- Line is useful in detecting subtle odontoid fractures & atlantoaxial subluxation

5. Spinous Process Line

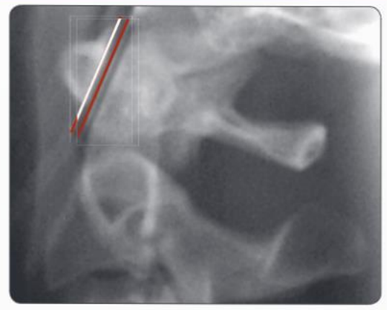
- Line useful in detecting spinous process fractures

Atlantodental Interspace

Normal: children - 1-5 mm, adults - 1-3 mm

Interpretation: trauma, occipitalization, Down's syndrome, pharyngeal infection, ankylosing spondylitis, RA, psoriatic arthritis, Reiter's syndrome



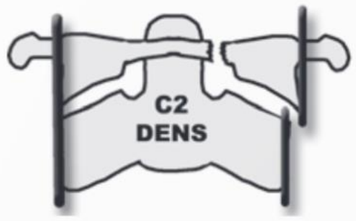


Atlanto-axial Alignment

Normal: lateral margins of C1 & C2 should line up

Interpretation: Jefferson's fracture (C1 burst fracture), odontoid fracture, alar ligament instability

Children up to 4 yrs, bilateral overhang of atlas may be normal



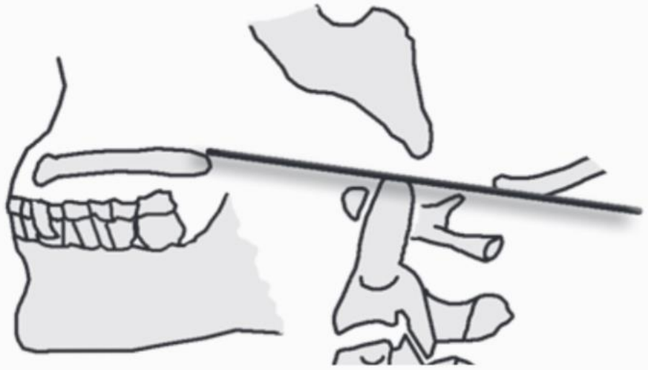


McGregor's Line

Normal: dens apex < 8 mm males, 10 mm females, above line

Interpretation: platybasia, atlas occipitalization, rheumatoid arthritis, Paget's disease, osteomalacia

Most accurate way to measure basal impression



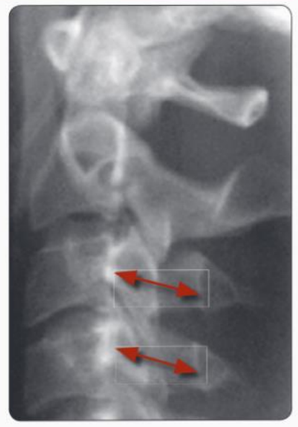
C-spine Sagittal Dimension

Normal (range):
C1: 22 mm (16-31 mm)
C2: 20 mm (14-27 mm)
C3: 18 mm (13-23 mm)
C4-C7: 17 mm (12-22 mm)

Interpretation: less than 12 mm suggests stenosis

Most accurate stenosis measurement is Pavlov's ratio - canal diameter:body diameter ratio (less than 0.82 indicates stenosis)

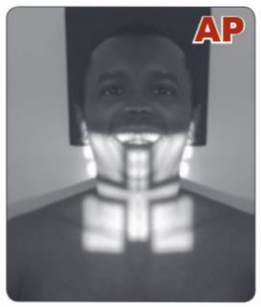


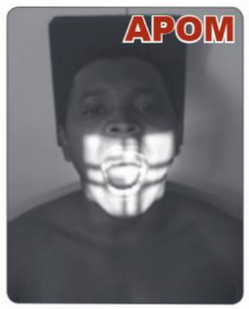


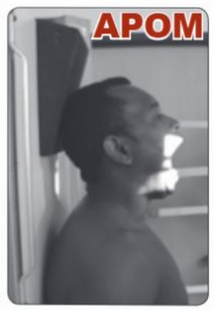
Cervical Views

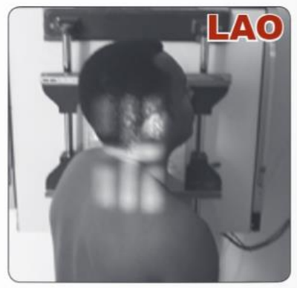
View Cassette, SID kV range	Central Ray Tube angle Grid Collimation, F. spot	Measure Marker Shielding	Breathing Clinical notes
AP 8x10, **40"** 75±5 kV	C4 up 15°, yes 8" x skin, small	C4 @15° Ear lobe shadow ½ apron, eye, breast	Susp. expiration Center to thyroid Wedge behind head
APOM 8x10, **40"** 80±5 kV	Corner of mouth 0°, yes tips-to-lips, small collimation corners of mouth, upper & lower lips	AP + 4kV Ear lobe shadow ½ apron, eye, breast, thyroid	Susp. expiration 15° sponge to support head
Lateral 8x10, **72"** 75±5 kV	C4 0°, optional < film, small	C4 Occipital area ½ apron, eye, breast, thyroid	Susp. expiration May use Air gap method weights, non-grid holder
Lateral Extension 8x10, **72"** 75±5 kV	C4 0°, optional < film, small	C4 Extension marker ½ apron, eye, breast, thyroid	Susp. expiration may use Air gap method weights, non-grid holder
Lateral Flexion 8x10, **72"** 75±5 kV	C4 0°, optional < film, small	C4 Flexion marker ½ apron, eye, breast, thyroid	Susp. expiration May use Air gap method weights, non-grid holder
Oblique 8x10, **72"** 75±5 kV	C4 Ant. 15° down Post: 15° up optional < film, small	C4 IVF side of interest ½ apron, eye, breast	Susp. expiration May be done seated mAs ↑30-50% from lateral

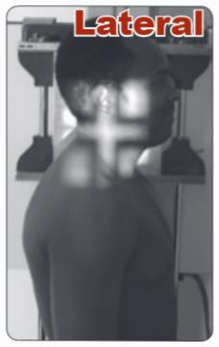
8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended, F. spot = Focal Spot, Cr. = central ray, IVF = Intervertebral foramen, SID = Source Image Distance (inches)

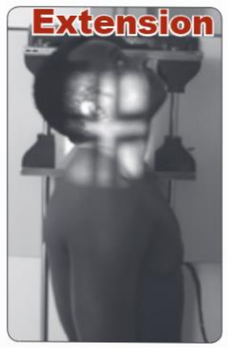


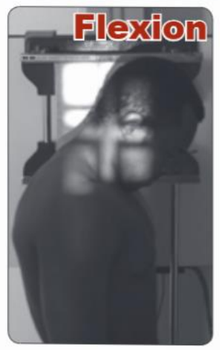








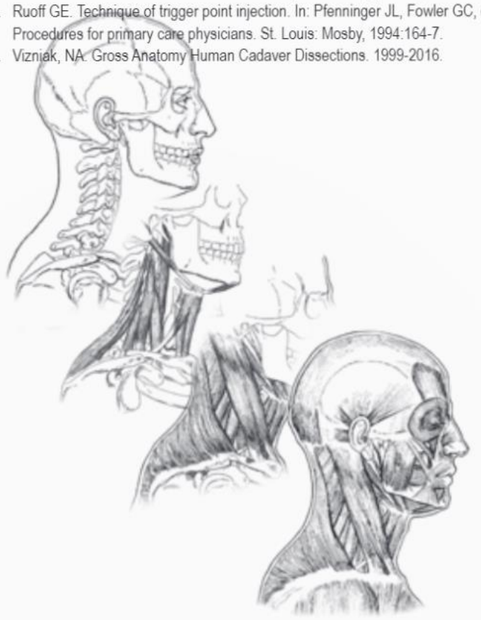






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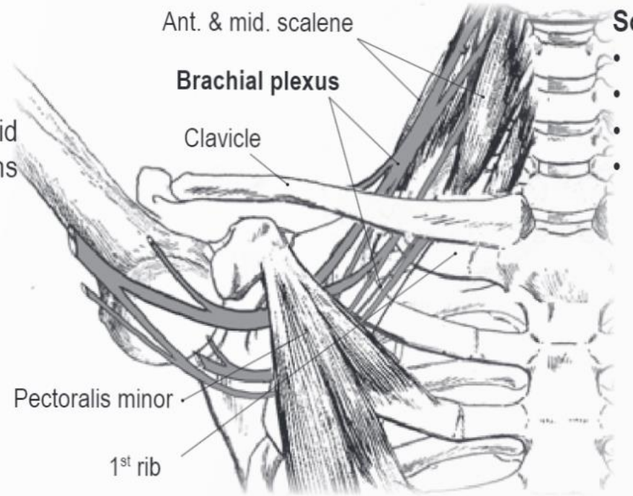
Chest Pain DDx

	Condition	History	Physical exam	Diagnostic tests
Cardiovascular disorders	**Angina pectoris**	Substernal pressure Lasts 2-3 min Exertion/emotional Relieved: rest/nitroglycerine	Usually transient SSx Tachycardia, hypertension Systolic murmur	Stress ECG, Coronary arteriogram
	Mycardial infarction	Substernal pain or pressure on chest, lasts a few seconds Radiates left neck & arm	Patient may be pale, sweating or anxious Increased or irregular heart rate	ECG exercise stress test Ultrasound PET scan
	Mitral valve prolapse	Young F>M, non-exertional Unpredictable	Mid-systolic click Late systolic murmur	ECG
Chest wall disorders	**Rib fracture**	Sharp, local pain following trauma or prolonged cough	Palpable crepitus Possible edema & or discoloration Pain with chest motion	x-ray
	Rib subluxation	Sharp local pain on near spine with inspiration	Palpatory tenderness & local myospasm	Joint play & passive ROM
	Breast disorder	Tender mass Family history breast CA Large breasts Vague chest wall pain	Palpable, unilateral mass Non-supportive bra	Mammogram, biopsy
Abdominal disorders	**Esophagitis**	Burning, substernal pain ↑ by lying & eating ↓ by antacids	Usually WNL Possible: thrush or herpetic lesions	CBC, endoscope, barium swallow
	Peptic ulcer	Burning, epigastric pain, Dietary indiscretions ↑ by fasting, stress ↓ by food & antacids	Usually WNL	Barium swallow
	Biliary colic	Epigastric ache, nausea, vomiting, restlessness ↑ by fatty meals	Usually WNL	Oral cholecysto-gram, ultrasound
Respiratory	**Pleuritis**	Sharp, lateral chest pain, Increased inspiratory effort Precipitated by cough Relieved by analgesics	Possible: fever, dull percus-sion, bronchial breath sounds, friction rub	Chest x-ray, CBC
	Bronchitis/ Asthma/ COPD	Vague recurrent chest pain Prolonged coughing Asthma/infection	Possible: rales, rhonchi, wheezing, ↑ with chest motion, cough, respiration	Chest x-ray
Other	**Herpes Zoster (**Hx: dermatomal pain, prolonged duration, PE: rash) **Biomechanical, Myofascial Trigger Points, Thoracic outlet syndrome**			

↑ = increase pain, ↓ = decrease pain

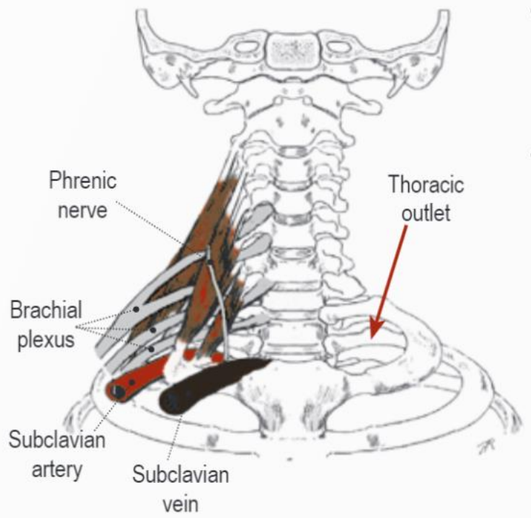
TOS & Rib Subluxation

Bony Lesions
- Cervical rib
- Long C7 TP
- Enlarged coracoid
- Clavicle variations



Soft tissue lesions
- Scalenus minimus
- Costoclavicular lig.
- Fibrous bands
- Pectoralis minor

Neurologic SSx (90%)
- Pain
- Numbness, tingling
- Weakness
- Atrophy
- Raynaud's (sympathetic)



Vascular SSx (~10%)
- Subclavian artery
  - loss of pulse
  - motor weakness
  - claudication
- Subclavian vein
  - Edema
  - Cyanosis
  - Venous distension

Rib Subluxation
- Usually sudden, onset of local back or mid scapula **pain with a deep breath**, cough, sneeze or trunk movement, patient may have history of chronic poor posture
- Pain may be described as sharp with motion, then a dull ache & is usually **localized to posterior thorax**, but may radiate to anterior chest wall
- Pain with respiration, restriction of thoracic movement & sleep may be affected
- Difficulty breathing due to pain & may be associated with active trigger points or myospasm

Physical
- Tenderness over costotransverse joint & rib angle
- Ribs may be prominent to palpation, have local tenderness or muscle spasm
- Motion palpation will show decreased tissue compliance (springiness) over affected segments
- Must DDx from cardiac event or fracture

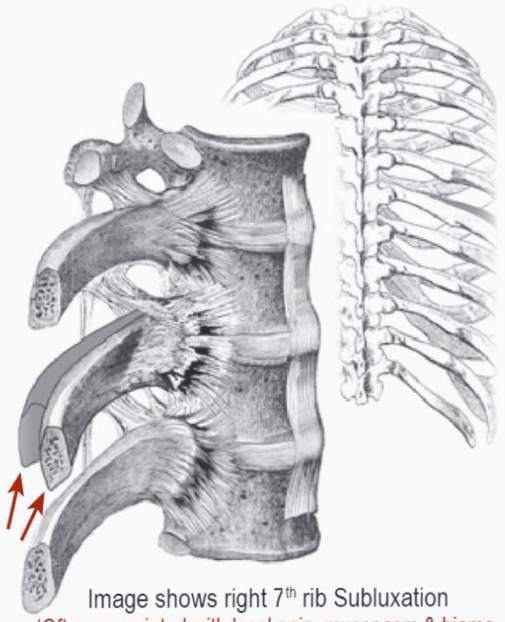


Image shows right 7th rib Subluxation
(Often associated with local pain, myospasm & biome-chanical thoracic vertebral joint dysfunction)

Joint types:
- Gliding (zygapophyseal, costotransverse, costovertebral, sternocostal)
- Fibrocartilaginous (intervertebral disc joints)

Articular surfaces
- Thoracic z-joints are oriented in coronal plane

Active range of motion (lumbar)
Flexion ..... **60°** (Adam's test)
Extension ..... **25°**
Lateral Flexion ..... **35°**
Rotation ..... **50°**

Main muscle actions
- **Flexion:** rectus abdominis, abdominal obliques
- **Extension:** multifidi, erector spinae
- **Lateral flexion:** erector spinae, semispinalis, abdominal obliques, quadratus lumborum
- **Rotation:** rotatores, multifidi, semispinalis, erector spinae, internal/external oblique
- **Rib elevation:** erector spinae, intercostals, serratus posterior superior & inferior, levator costarum

Resting position: mid way between flexion & extension

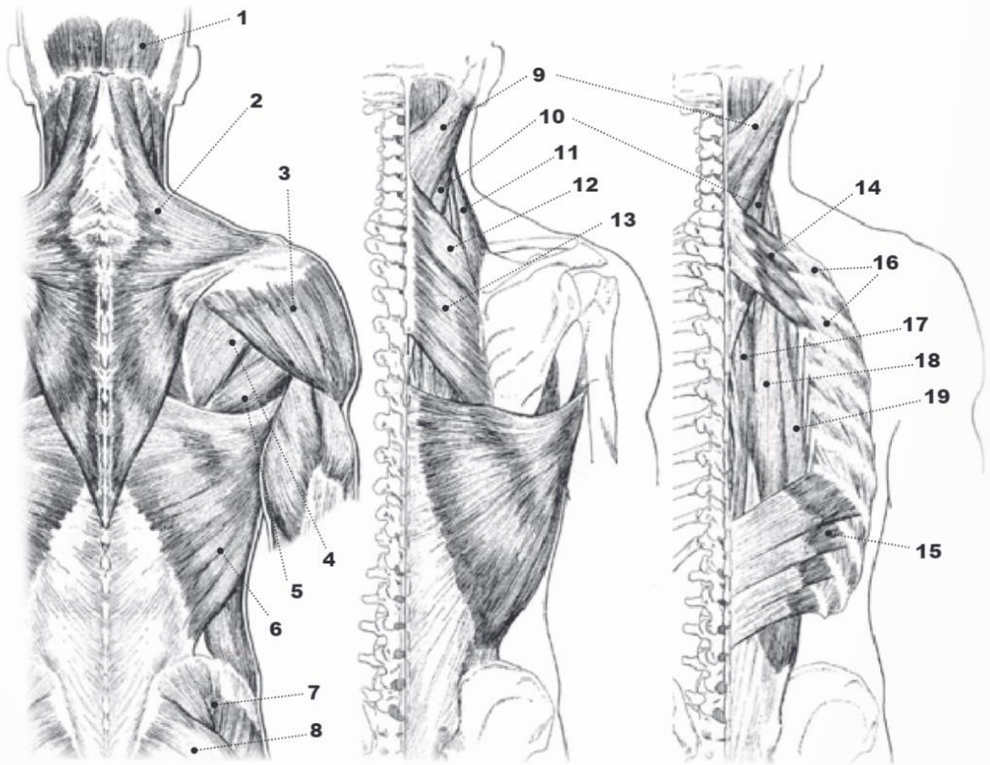
Close packed position: full extension

Capsular pattern of restriction
- **T-spine:** lateral flexion = rotation, then extension

Normal end feel: tissue stretch

Coupled motions
- **C2-T5 segments**
  - Left lateral flexion coupled with left rotation
  - Right lateral flexion coupled with right rotation
- **T6-L5 vertebral segments**
  - Left lateral flexion coupled with right rotation
  - Right lateral flexion coupled with left rotation

Thoracic Muscles



1. Occipitalis
2. Trapezius
3. Deltoid
4. Infraspinatus
5. Teres minor & major
6. Latissimus dorsi
7. Gluteus medius
8. Gluteus maximus
9. Splenius capitis
10. Splenius cervicis
11. Levator scapulae
12. Rhomboid minor
13. Rhomboid major
14. Serratus posterior superior
15. Serratus posterior inferior
16. Intercostal muscles

Erector spinae (deep layer)
17. Spinalis
18. Longissimus
19. Iliocostalis

Compare bilaterally; prior to ROM the examiner makes an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."

Thoracic Segmental Joint Motions

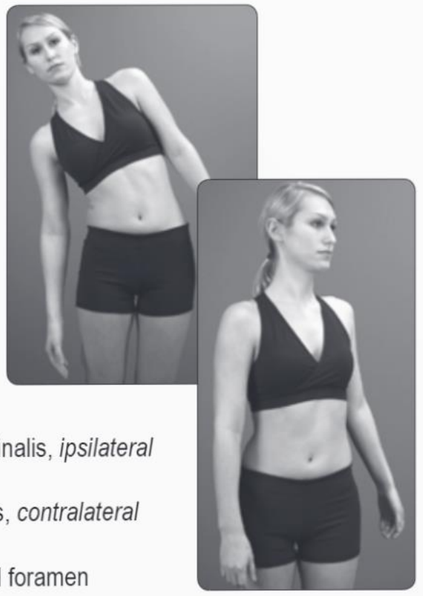
Motion Segment	Combined Flexion & Extension	Lateral Flexion (One side)	Rotation (One side)
T1-2	4°	2.5°	9°
T2-3	4°	3°	8°
T3-4	4°	2.5°	8°
T4-5	4°	3°	8°
T5-6	4°	3°	8°
T6-7	5°	3°	7°
T7-8	6°	3°	7°
T8-9	6°	3°	6°
T9-10	6°	3°	4°
T10-11	9°	3.5°	2°
T11-12	12°	4.5°	2°
T12-L1	12°	4°	2°
Thoracic	**~75°**	**~35°**	**~50°**

AROM

Flexion (50°-70°)
Muscles Activated: *eccentric* contraction of erector spinae
Tissue Stretched: erector spinae, supraspinous & interspinous ligaments, posterior IVD, posterior facet joint capsule & intercostal muscles
Tissue Compressed: anterior thoracic structure, anterior longitudinal ligament, anterior IVD, lungs, heart, aorta



Extension (20°-30°)
Muscles Activated: *concentric* contraction of erector spinae
Tissue Stretched: rectus abdominis, anterior longitudinal ligament, aorta, lungs, anterior intercostal muscles
Tissue Compressed: erector spinae, supraspinous & interspinous ligaments, posterior IVD & IVF, z-joint capsule & posterior intercostal muscles



Lateral Flexion (25°-35°)
Muscles Activated: *eccentric* contraction of *contralateral* erector spinae, transversospinalis
Tissue Stretched: *contralateral* erector spinae, transverso-spinalis, intercostal muscles, contralateral IVD & IVF, z-joints
Tissue Compressed: *ipsilateral:* erector spinae, transverso-spinalis, intercostal muscles, ipsilateral IVD & IVF, z-joints

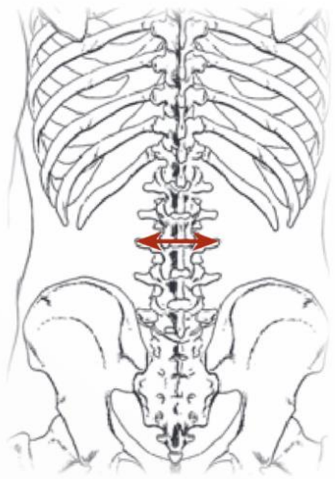
Rotation (40°-55°)
Muscles Activated: *contralateral* external oblique & transverso-spinalis, *ipsilateral* internal oblique
Tissue Stretched: *ipsilateral* external oblique & transverso-spinalis, *contralateral* internal oblique
Tissue Compressed: abdominal contents, ipsilateral intervertebral foramen

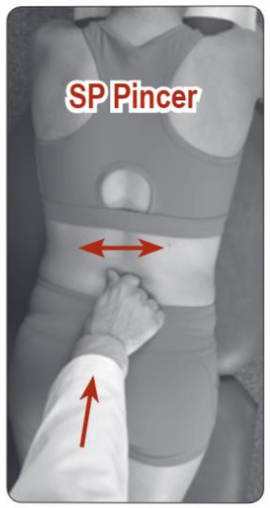
Press Esc to exit full screen

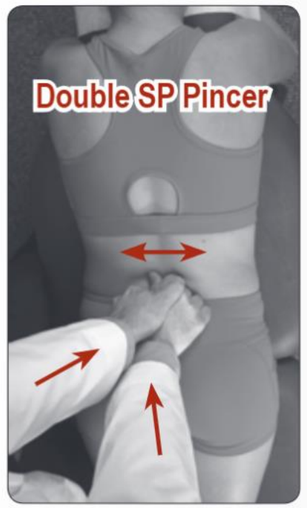
All palpation methods involve tactile movement of soft tissues & osseous structures to evaluate **variations in elasticity, tone and motion from side to side, pain or discomfort.** - clinical style & preference will determine which specific methods clinicians use (use what works best for you)

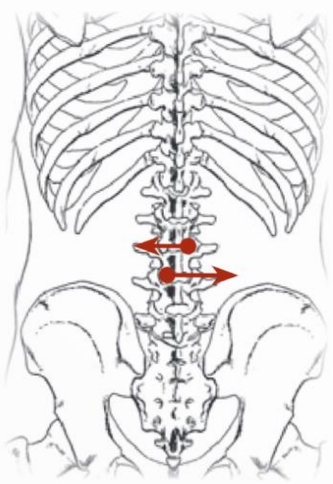
Prone Variations

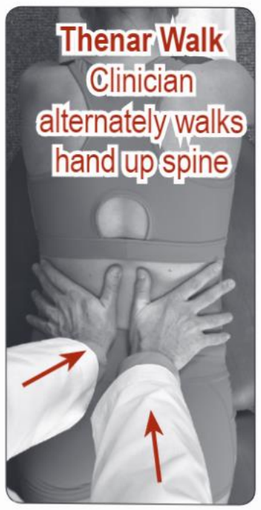


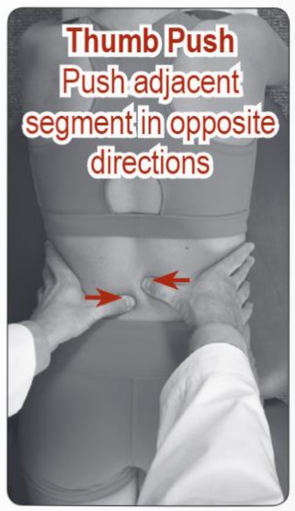












Antalgia Sign ★★★★



Procedure

Standing patient presents with antalgic (pain avoidance) posture, lateral flexion of the lumbar spine

Interpretation

(+) Lateral flexion → facet irritation or in the presence of radicular symptoms:
Patient leans away from affected side → Disc herniation lateral to nerve root
Patient leads toward the affected side → Disc herniation medial to nerve root

Clinical notes

With central disc herniations, patient's often present flexed forward without lateral bending; if lumbar disc herniation is suspected a detailed neurologic exam is required

Active Sit-Up Test ★★★

Synonym: Lewin Supine Test

Procedure

Patient supine, examiner holds patients feet & ask patient to perform a sit-up, test is repeated with knees bent (ask patient to hold position at ~45° for 5 seconds)

Interpretation

(+) Inability to perform motion → core muscle deconditioning, lumbar arthritis/fibrosis, lumbar disc herniation, nerve root compression



Clinical notes

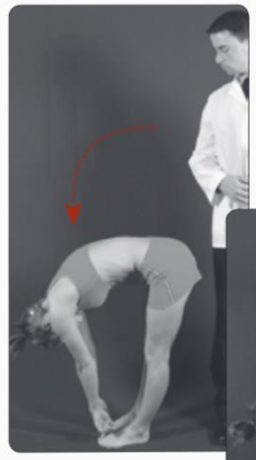
Test is effectively resisted muscle test of trunk flexors & is useful in determining the contribution of abdominal and hip flexor weakness to the patient's symptoms; decreased core strength is a common impairment in individuals with low back pain

Belt Test ★★★★

Synonym: Supported Adam's Test

Procedure

Standing patient is instructed to bend forward & touch toes with knees straight & return to standing; examiner then stabilizes the patient's pelvis bilaterally over the ASISs with hands & patient's sacrum with examiner's lateral thigh, then patient is instructed to repeat motion of touching toes





Interpretation

(+) Pain with both supported & unsupported flexion → Lumbar spine pathology
(+) No pain with support, pain without support → Sacroiliac joint pathology

Clinical notes

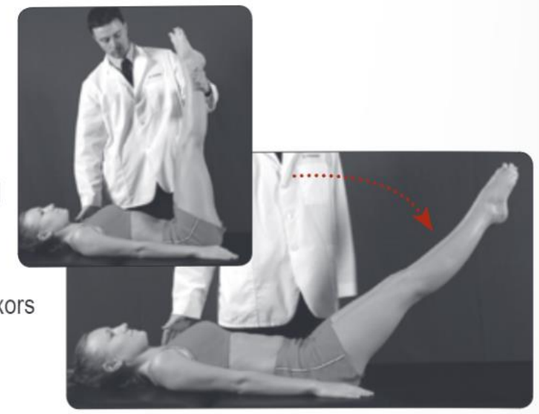
By supporting the patient's pelvis & sacrum the examiner should effectively prevent motion at the sacroiliac joint, thus eliminating it as a potential pain generator during supported forward flexion
An excellent differential for SI vs. lumbar pain generation that can be performed during active ROM assessment

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Bilateral Leg-Lowering Test ★★★★

Procedure

Patient supine, examiner passively flexes patient's hips to 90°, patient then lowers legs to a 45° angle



Interpretation

(+) Pain or legs dropping to table → Lumbosacral pathology, sprain/strain, lumbar disc lesion, general muscle deconditioning

Clinical notes

This test will be difficult for patients with weak hip flexors & core body strength

Bowstring Sign ★★★★

Procedure

Patient supine, examiner flexes patient's hip with knee slightly flexed; examiner then applies pressure with thumbs on hamstring muscles: if no pain is elicited, examiner then proceeds to
apply pressure to the popliteal fossa (traction on the sciatic nerve)

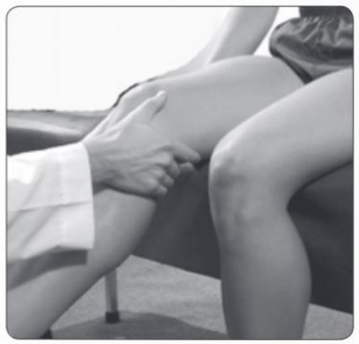


Interpretation

(+) Leg pain → radiculopathy, IVF encroachment, SOL, nerve root tension, sciatica
(+) Local back or hamstring pain → sprain/strain

Clinical notes

Traction of the sciatic nerve increases tension resulting in radicular symptoms in the presence of nerve compression
Deyerle's Sign/seated bow string: traction on sciatic nerve at popliteal fossa in seated position
Sukip & Broom found this test positive for radiculopathy in 71% of cases with disc herniations



Braggard's Sign ★★★★

Procedure

Test should follow a straight leg raise, patient supine, affected leg is lowered to angle just below the production of pain, examiner then dorsiflexes the foot



Interpretation

(+) Leg pain or reproduction of SLR test symptoms → radiculopathy, IVF encroachment, SOL, nerve root tension, disc herniation
(+) Local back, hamstring or calf pain → sprain/strain or contracture

Clinical notes

Dorsiflexion of the foot may increase sciatic nerve root tension resulting in radicular symptoms

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Centralization Test ★★★★★

Procedure

Patient prone or standing; examiner instructs patient to move in multiple directions to assess end range of each lumbar ROM (flexion, extension, lateral flexion), movements are repeated up to 5-10 times until a definite pattern of centralization of peripheralization occurs (essentially repeated AROM)



Interpretation

(+) Centralization of radicular symptoms → Lumbar radiculopathy, disc herniation, IVD pathology

Clinical notes

Test is effectively AROM assessment & will guide examiner to potentially beneficial treatment & rehab. options; **this is an excellent test for lumbar spine assessment & can be applied anywhere in the body** (SN: 40-92 SP: 64-94 +LR: 3-7 -LR: 0.12-0.63)[18, 28]

Dejerine's Triad ★★★★

Procedure

Seated patient is instructed to cough, sneeze & strain (Valsalva maneuver), examiner observes for signs of pain or discomfort



Interpretation

(+) Reproduction of symptoms → Leg pain → Nerve root tension, radiculopathy, disc herniation, SOL
Local lumbosacral pain → Lumbosacral sprain/strain

Clinical notes

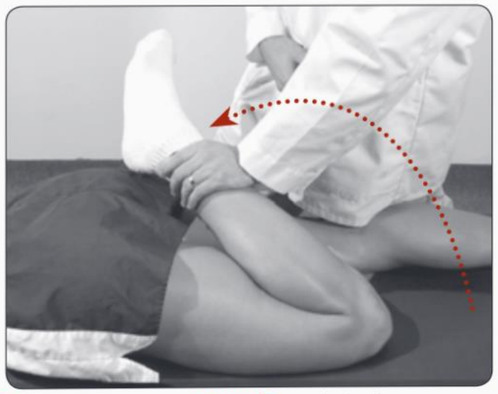
All three actions in Dejerine's Triad cause increased intra-abdominal or intrathecal pressure, which in the presence of a disc herniation may cause increased nerve root compression - Note: it may be difficult to instruct a patient to sneeze ☺

Ely's Heel to Buttock Test ★★★★

Synonym: Ely's Sign

Procedure

Patient prone with legs relaxed, examiner passively flexes knee approximating heel to contralateral buttock, examiner then extends hip by elevating the knee



Interpretation

(+) Pain with knee flexion → Femoral nerve or root compression, quadriceps muscle contracture
(+) Pain with hip extension → Femoral nerve or root compression, iliopsoas muscle strain or inflammation

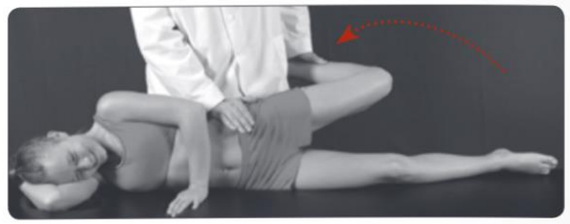
Clinical notes

It is possible with L1-L3 disc herniation to have radicular symptoms radiate to the anterior thigh & groin

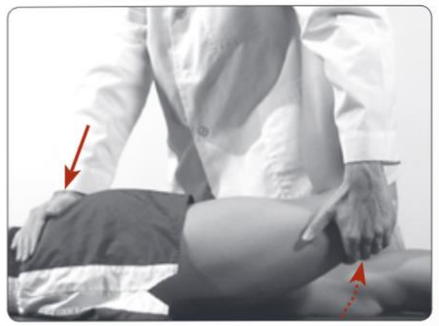
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Femoral Nerve Traction Test ★★★★

Procedure
Patient side-lying with back straight & neck slightly flexed; examiner extends the patient's hip 15° & flexes the knee (stretching the femoral nerve)



Interpretation
(+) Pain radiation to anterior thigh → Femoral nerve or root compression (L2-L4 radiculopathy - SN: 84[34]), lateral disc herniation

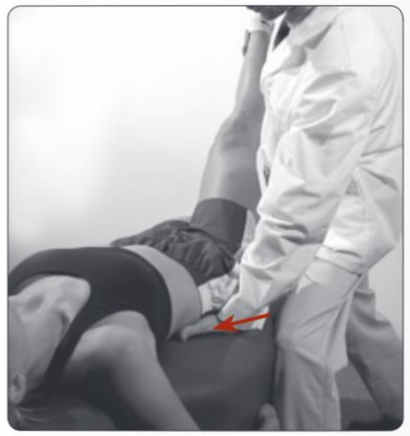


Clinical notes
Note: this test is very similar in motion to the Heel to Buttock test performed with the patient prone

Hyperextension test: Patient prone with knee flexed 90°, examiner stabilizes lumbar spine while slowly extending the lower extremity with the other hand (SN: 84)[34]

Goldthwait's Test ★★★★

Procedure
Patient supine, examiner slowly raises the patient's affected leg with one hand while palpating motion at the lumbar spine with the other hand; the test is then repeated on the opposite side



Interpretation
(+) Pain before lumbar spine motion is felt → Sacroiliac joint pathology (ligamentous sprain, arthritis)
(+) Pain beginning when lumbar spine motion is felt → Lumbosacral pathology (sprain/strain, possible disc syndrome)

Clinical notes
Sacroiliac joint involvement should be suspected if the unaffected leg can be elevated higher than the affected leg
Consider placing one finger to palpate SI joint (just medial to PSIS) and other to palp lumbar spine to better asses motion

Heel Walk, Toe Walk ★★★★

Procedure
Patient is instructed to walk away from examiner with heels up (foot plantar flexed - toe walk), & back toward examiner with toes up (foot dorsiflexed - heel walk)



Interpretation
(+) Muscle weakness with;
Toe walk (heel drop) → S1 myotome pathology
Heel walk (foot drop) → L5 myotome pathology

Clinical notes
To save time during your physical exam have patients walk away from examiner with their heels up & towards examiner with their toes up for better observation

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Jackson's One-Legged Hyperextension ★★★★★

Procedure
Patient stands on one leg & extends back; examiner stands ready to support patient & observes for signs of pain & discomfort, test is repeated on other side

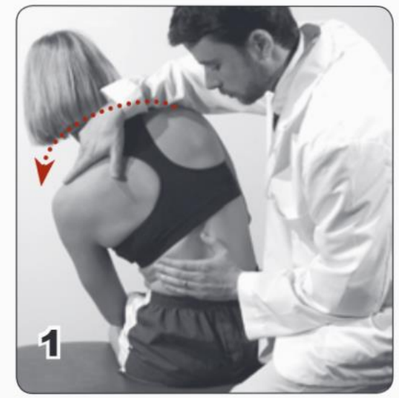


Interpretation
(+) Low back pain on right side when standing on left foot → right sided lumbar pathology, facet impaction, impending pars fracture
(+) Pain in SI on support leg → SI pathology (SN: 7-19 SP: 98-100 +LR: 3.5 -LR: 0.95)[26]

Clinical notes
By standing on one leg the SI joint is loaded on the ipsilateral side; thus when contra-lateral pain is felt it is possible to rule out the elevated leg SI joint as a primary cause

Kemp's / Lumbar Quadrant Test ★★★★

Procedure
Patient seated, examiner stabilizes lumbar spine with one hand & supports patient's shoulders with the other hand & forearm; 3 parts
1. Patient leans away from examiner (stretch)
2. Then is forward flexed (stretch)
3. Then back into lateral flexion & extension (compression)

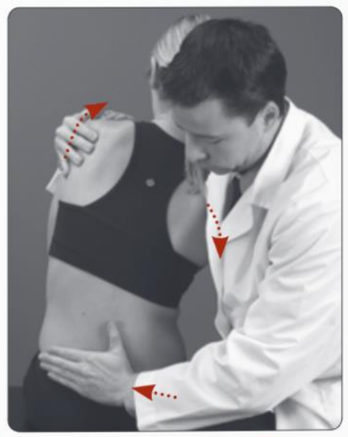






Interpretation
(+) Leg pain → nerve root compression, radiculopathy
(+) Local low back pain → local lesion (sprain/strain, facet syndrome, meniscoid entrapment)

Clinical notes
As with all orthopedic tests, you must state what the positive finding reveals in your clinical chart notes; example, "Kemp's test was positive for radiating right L5 dermatomal pain, indicating L5 nerve root compression"
Test may also be performed by stabilizing/hugging patient over the front as is done with seated PROM of the lumbar spine

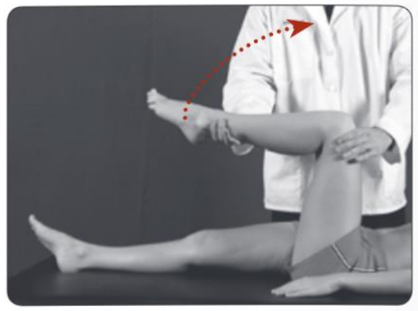


S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Kernig's Sign/ Lasège's Differential ★★★★

Procedure

Patient supine, examiner flexes patient's hip to 90° with knee flexed, examiner then extends patient's knee



Interpretation

(+) Pain with hip & knee flexed → hip joint pathology
(+) Leg pain → radiculopathy
(+) Increased resistance → hamstring tightness
(+) Involuntary flexion of the opposite knee & hip → meningitis

Clinical notes

Extension of the knee increases nerve &/or root tension on the sciatic nerve, resulting in radicular symptoms

Sign of the buttock - perform SLR to limited ROM then flex knee to increase hip flexion
(+) No change in hip flexion when the knee is flexed → SI joint dysfunction, bursitis, gluteal muscle strain, abscess, tumor
(+) Increased hip flexion when the knee is flexed → Lumbar spine pathology, nerve root tension, hamstring contracture



Lasège's Seated Test ★★★★

Procedure

Patient seated with knees flexed 90°, examiner extends the patient's knee (PROM into extension of knee)



Interpretation

(+) Leg or foot pain → radiculopathy, IVF encroachment, nerve tension
(+) Increased resistance → hamstring tightness/contracture
(+) Local pain → sprain/strain

Clinical notes

Test is essentially the same as performing a supine straight leg raise as the angle at the hip is ultimately the same, thus resulting in the same stretch of the sciatic nerve (seated SLR)

Bechterew's sitting test: same as above except patient performs AROM into knee extension

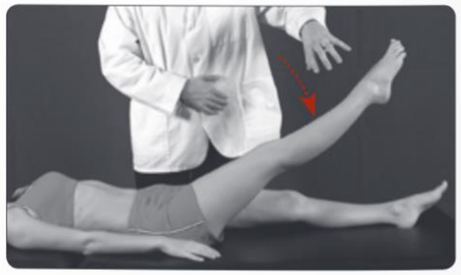
Lasège's Rebound Test ★★★

Procedure

Patient supine, examiner flexes straight leg to angle at which symptoms are reproduced, then without warning examiner releases leg & allows it to drop back to the exam table

Interpretation

(+) Back pain or muscle spasm → intervertebral disc pathology



Clinical notes

Patient may be able to catch leg before it hits the table in less severe cases; however angle of inclination after patient catches leg should not be greater than angle that caused pain, if this happens suspect malingering

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Lewin's Punch Test ★★★

Procedure

Patient standing, examiner firmly percusses (punches) the patients upper buttock on the affected side



Interpretation

(+) Pain referred to the back → Low back sprain/strain, possible intervertebral disc herniation, could aggravate kidney infection

Clinical notes

Warn the patient that you will be "forcefully tapping" their buttock before initiation of procedure

Lewin's Snuff Test ★★★

Procedure

Patient standing, examiner asks patient to sniff an aromatic substance (snuff or pepper), in an attempt to induce a sneeze reflex (instant Valsalva maneuver)



Interpretation

(+) Exacerbation of symptoms →
Radicular symptoms → Nerve root compression
Local back pain → Sprain/strain

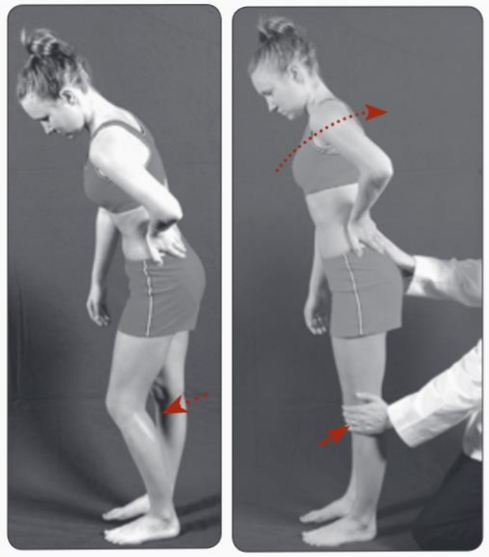
Clinical notes

Sneezing, coughing & straining (Dejerine's Triad) all increase intra-abdominal pressure & may reproduce radicular symptoms in the presence of a disc herniation or nerve root tension

Lewin's Standing Test ★★★★

Procedure

Patient standing, examiner stabilizes pelvis & sharply extends knee on affected side; movement is then repeated on opposite extremity



Interpretation

(+) Pain that is followed by the knee snapping back into flexion → Hamstring myospasm, sciatic nerve tension, radiculopathy (if shooting pain/NTW past knee)

Clinical notes

Extension of the knee increase nerve &/or root tension on the sciatic nerve, resulting in radicular symptoms
Patients may also compensate to reduce pain by standing up straighter

Neri's Bowstring Sign: with standing lumbar flexion patient flexes knee to relieve pain or numbness

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Lewin-Gaenslen's Test ★★★★

Procedure

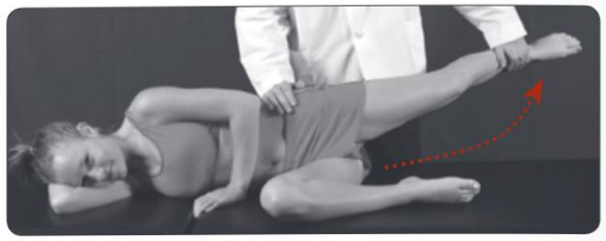
Patient side-lying on unaffected side & brings unaffected knee towards chest, examiner then applies gentle over pressure attempting to hyperextended the affected thigh

Interpretation

(+) Sacroiliac or anterior thigh pain → Sacroiliac joint pathology (ligamentous sprain, instability, arthritis)

(+) Muscle tightness of the extended hip → Iliopsoas muscle contracture

Clinical notes - Also see Gaenslen's Test



Linder's Sign ★★★★

Procedure

Patient supine or seated, examiner passively flexes patient's head & neck

Interpretation

(+) Lumbar spine & radicular leg pain → Lumbar nerve root compression

(+) Loacl neck pain → sprain/strain, subluxation

Clinical notes

Similar to Brudzinski's (neck flexion causes involuntary knee flexion indicating meningitis) or Soto-Hall of the cervical spine (similar interpretation)



Maximal Straight Leg Raise ★★★★★

Procedure

Patient supine, motion is the same as a SLR with the additional of the following performed in conjunction:

1. Internal rotation & adduction of the hip,
2. Dorsiflexion of the foot,
3. Neck flexion,
4. Valsalva maneuver (instruct patient to bear down)

Interpretation

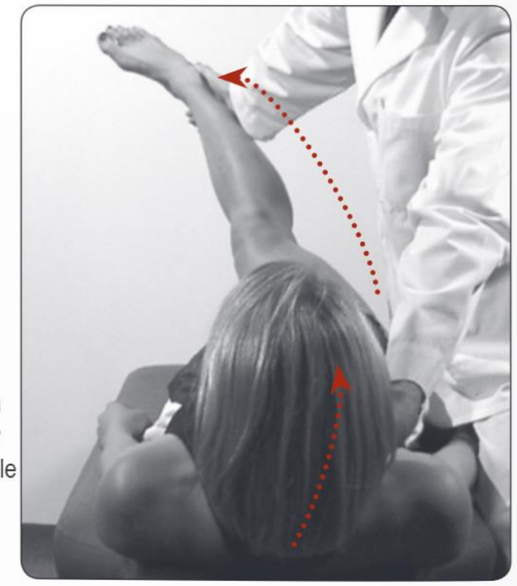
(+) Radicular leg pain → Nerve root compression, intervertebral disc herniation

(+) Low back pain → SI/lumbar sprain/strain

Clinical notes

This maneuver places the maximum amount of tension possible on lumbar nerve roots & sciatic nerve & may be particularly useful in the detection of clinically subtle nerve compression pathologies

Slowly add steps in difficulty to patient tolerance (least invasive to most invasive)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Milgram's Test ★★★★

Procedure

Patient supine, examiner instructs patient to lift heels 10 cm (5 in.) off the table & hold position for as long as possible (typically 30 seconds is a long enough duration)

Interpretation

(+) Low back pain → Lumbar spine pathology, intervertebral disc herniation, muscle strain

(+) Inability to maintain position may also indicate hip flexor & core body strength deconditioning

Clinical notes

This test increases intrathecal pressure, if the patient is able to hold this position for the minimum 30 seconds without pain, then pathology of thecal origin may be ruled out



Minor's Sign ★★★★

Procedure

Examiner observes patient rising from seated position to standing; patient may use arms & unaffected lower extremity to support body weight or use hands to "walk" up legs

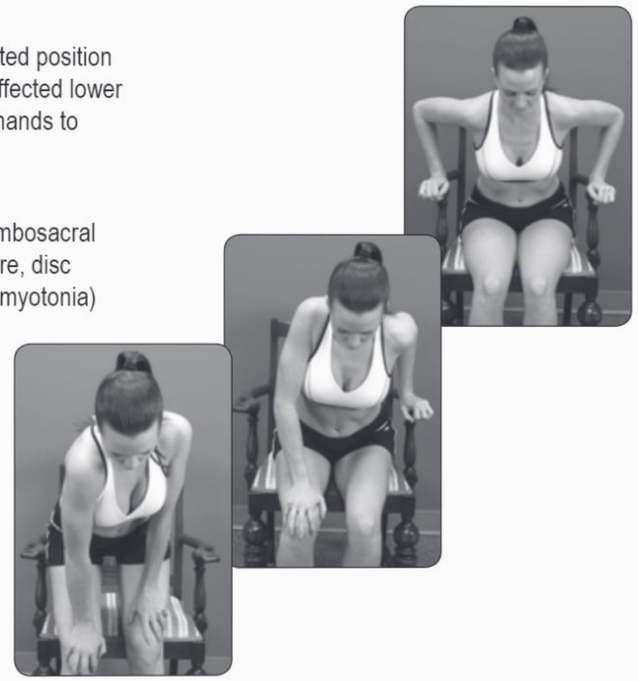
Interpretation

(+) Presence of antalgic movement → Lumbosacral pathology (SI/lumbar sprain/strain, fracture, disc syndrome, muscular dystrophy, sciatica, myotonia)

Clinical notes

Patient is in an antalgic posture attempting to minimize spinal loading; thus they will attempt to distribute body weight through their arms & hands

Gower's sign: starting from squat position, patient walks up own legs with hands (muscular dystrophy finding)



Nachlas' Test ★★★

Procedure

Patient prone, examiner flexes knee in attempt to touch patient's heel to ipsilateral buttock

Interpretation

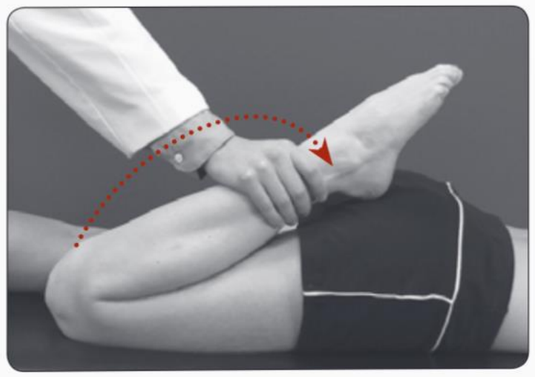
(+) Local pain → SI/lumbar/knee ligament sprain, quadricep strain

(+) Radiating pain → Femoral nerve pathology

Clinical notes

Motion of test stretches the femoral nerve & may cause radicular symptoms

Patients with quadriceps contracture will show decreased ROM



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Posterior Anterior Glide Test ★★★★★

Procedure

Patient prone; examiner applies posterior to anterior pressure (~4 kg or nail bed blanching force) on the patient's lumbar spinous process; examiner starts on L1 and progresses one SP at a time down to L5



Interpretation

(+) Local pain → Segmental pathology

(+) Linear displacement → Lumbar instability (R: 0.4-0.78 SN: 29-75 SP: 81-95 +LR: 2.3-8.6 -LR: 0.3-0.7)[10, 13, 14, 16, 19, 31, 32, 33]

Clinical notes

If lumbar instability is suspected lumbar flexion-extension studies (radiographs) are warranted

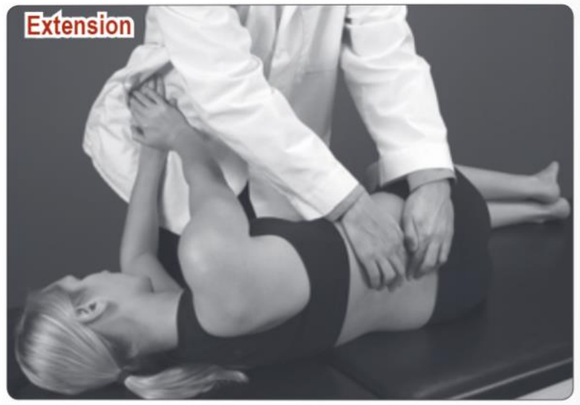
Passive Lumbar Flexion Extension Test ★★★★★

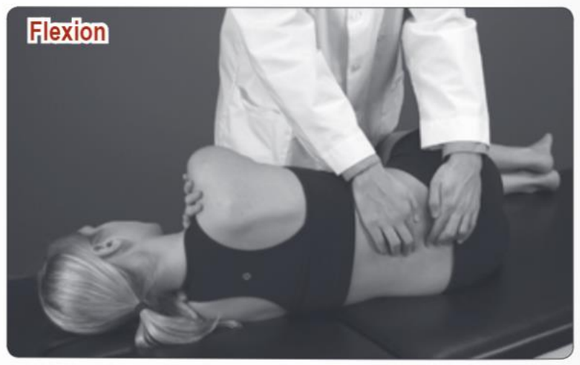
Procedure

Patient side lying;

Extension: patient extends & locks elbows & places hands on examiners ASIS; examiner applies posterior to anterior pressure examiner starts on L1 and progresses one SP at a time down to L5

Flexion: patient crosses arms in front of body, flexes hips & knees to 90° & places knees on examiners ASIS; examiner stabilizes superior segment by pulling anteriorly & applies anterior to posterior force through patients knee & palpates segment below starting on L1 and progressing one SP at a time down to L5





Interpretation

(+) Flexion excess movement → Segmental pathology (SN: 16-22 SP: 97-98 +LR: 7.3-8 -LR: 0.8-0.85)[10]

(+) Extension excess movement → Lumbar instability (SN: 5 SP: 99 +LR: 5-10 -LR: 0.95)[10]

Clinical notes

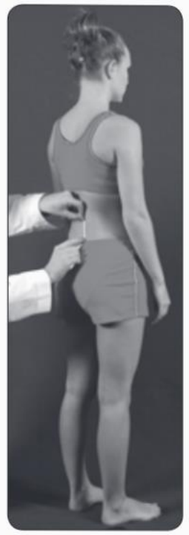
If lumbar instability is suspected lumbar flexion-extension studies (radiographs) are warranted

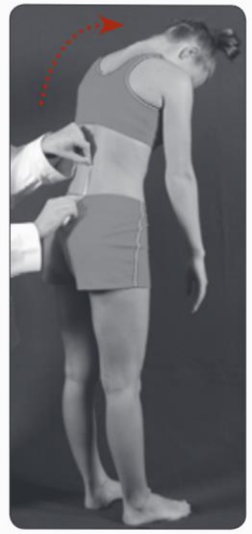
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Schober's Test ★★★★★

Procedure

Patient standing, examiner places a mark at S2 spinous process & 10 cm above S2, distance between the two points as measured (10 cm); patient is then instructed to flex forward as if attempting to touch toes, examiner re-measures distance between two lines with patient flexed





Interpretation

(+) Less than 5 cm increase in length with trunk flexion → Decreased lumbar spine range of motion, ankylosing spondylitis

Clinical notes

This test is almost exclusively associated with Ankylosing Spondylitis, but may also be decreased in the presence of decreased lumbar ROM due to pain, contracture, congenital anomalies or segmental fusion

Segmental Instability Test ★★★★★

Procedure

Patient prone with legs hanging off table & feet resting on floor, examiner applies P-A pressure over the lumbar spine & instructs patient to raise legs off the floor (extend back/hips)



Interpretation

(+) Low back pain → lumbosacral muscle strain/sprain

(+) Low back pain with associated "click" or "clunk" → lumbar instability (spondylolisthesis)

Clinical notes

Types of spondylolisthesis: dysplastic, isthmic, degenerative, traumatic, pathologic

Ullmann's Line & the Meyerding grading method are common radiographic parameters used to detect & measure the degree of instability (R: 0.69 SN: 61 SP: 57 +LR: 1.4 -LR: 0.69)[19]



Prone instability test (PIT) - patient prone with legs & pelvis hanging off table & feet resting on floor,

1. examiner applies P-A pressure over the lumbar spinous process & assesses for pain,
2. then patient lifts his legs off the floor;
3. examiner applies pressure against the lumbar spine again.

Pain is documented initially after the pressure is exerted and once again after the patient's legs are off the ground

(+) pain with pressure in the resting position, and the pain decreases in the active position same as above → lumbar instability (SN: 72 SP: 58 +LR: 0.48 -LR: 1.7)[19]

Active extension activates lumbar muscles which help to stabilize the hypermobile segment & can indicate how much core stabilization program would help patient

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Slump Test ★★★★★

Procedure
Seated patient is instructed to slump forward, examiner extends one knee & may apply gentle overpressure to increase spinal flexion

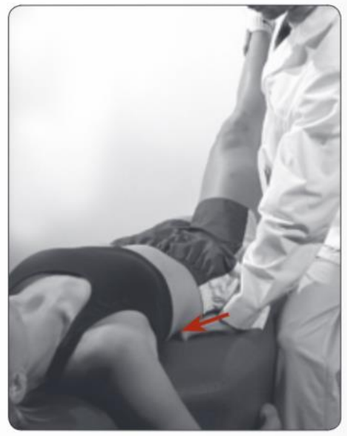


Interpretation
(+) Reproduction of symptoms → Leg pain → Nerve root tension (shooting or electrical pain), radiculopathy, disc herniation, SOL, osteophyte
(+) Local lumbosacral pain → Lumbosacral sprain/strain

Clinical notes
To further increase potential nerve root pressure examiner may instruct patient to bear down (Valsalva - increasing intra-abdominal pressure) & extend/dorsiflex the patient's toes & ankle
(SN: 83 SP: 55 +LR: 1.8 -LR: 0.3)[36]
Synonym: dural slump test

Smith-Petersen Test ★★★★

Procedure
Patient supine, examiner performs a SLR while palpating the lumbar spine, the procedure is then repeated on the opposite leg, then performed again with a double straight leg raise

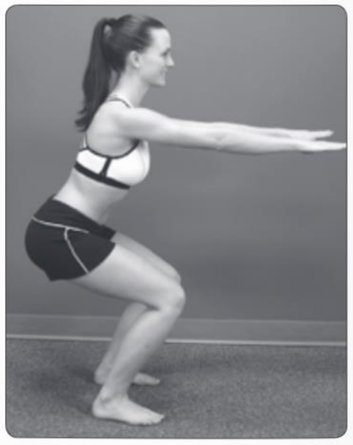


Interpretation
(+) Pain before the lumbar spine begins to move → SI joint lesion
(+) Pain after the lumbar spine begins to move → Lumbosacral or sacroiliac joint lesion
(+) Pain with double straight leg raise → Lumbosacral lesion

Clinical notes
As the straight leg is raised the hamstrings tighten & apply tension leverage first to the sacroiliac joint & then eventually the lumbosacral spine (test is similar to Goldwait's test with double SLR added at end)

Squat & Rise ★★★★

Procedure
Standing patient is instructed to squat down & then return to a standing position, examiner observes motion



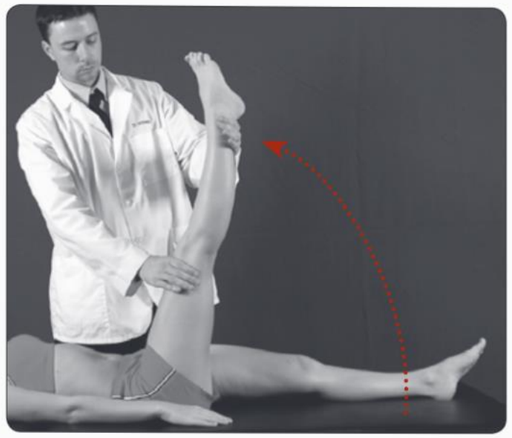
Interpretation
(+) Inability to perform motion → SI/lumbar/hip/knee/ankle pathology (depending upon the region the patient reports pain)
(+) Heels lifting off of ground → Tight gastrosoleus muscles

Clinical notes
Useful as a general screen & functional assessment procedure, however the examiner must be aware of certain patient limitations (elderly patients & patients with known pathologies that may limit their ability to perform task)
Examiner should be available to provide support to the patient should they lose their balance

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Straight Leg Raise (SLR) ★★★★★

Procedure
Patient supine, examiner places one hand under patient's ankle & other hand over patient's knee (to insure knee stays extended during action); examiner then proceeds to passively elevate the straight leg



Interpretation
(+) Radicular leg pain → nerve root compression, intervertebral disc herniation, piriformis entrapment
(+) Low back pain → SI/lumbar sprain/strain
Degrees of flexion → tissue involved
0° to 35°→ hip joint
35° to 70°→ disc/nerve root involvement
> 70°→ SI/lumbar joint pain

Clinical notes
First ask patient to perform an active straight leg raise as a measure of functional capability
SLR also assess hamstring tightness (contracture)
Criteria for sciatica secondary to disc herniation
1. Leg pain > back pain
2. Dermatomal paresthesia
3. SLR limited to 50% of normal
4. Two of four neurological signs (atrophy, motor weakness, ↓ sensation, ↓ DTR)

(R: 0.92 SN: 78-98 SP: 11-64 +LR: 1.03-2.2 -LR: 0.05-0.86)[1, 2, 5, 12, 13, 15, 20, 22, 21, 23, 24, 25, 34, 36, 37]

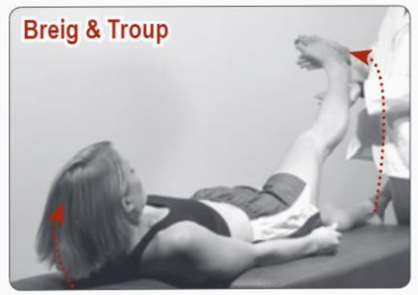


Siccard's Sign: examiner elevates straight leg to angle just below reproduction of symptoms, then examiner extends (dorsiflexes) the first toe
Interpretation - (+) Radicular leg pain → sciatic radiculopathy, nerve root compression (extension of first toe can mildly increase sciatic nerve root tension (picture demonstrates exaggerated response ☺)



Bonnet"s sign: examiner performs a straight leg raise then lowers the patient's leg to the point just before the exacerbation of symptoms, then internally rotates & abducts the patient's hip
Interpretation - (+) Radicular leg pain → sciatic radiculopathy, nerve root compression

Breig & Troup Test: examiner performs a straight leg raise then lowers the patient's leg to the point just before the exacerbation of symptoms, then examiner dorsiflexes the ankle, medially (internally) rotates the hip & instructs the patient to flex their neck
Interpretation - (+) Radicular leg pain → sciatic radiculopathy, nerve root compression (neck flexion increases nerve root tension)



Turyn's Sign: reproduction of radicular pain with dorsiflexion of the big toe

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Cox Sign ★★★

Procedure

Patient supine, during straight leg raise pelvis rises off of table as patient attempts to avoid hip flexion (maintenance of antalgic position)

Interpretation

(+) Rise of pelvis instead of hip flexion → radiculopathy, IVF encroachment, SOL, nerve root tension, sciatica

Clinical notes

Patient prevents hip flexion as a guarding mechanism to prevent increased pain & discomfort from increased nerve or root tension



Well Leg Raise ★★★★★

Procedure

Patient supine, examiner passively flexes straight leg & dorsiflexes the foot on the asymptomatic side

Interpretation

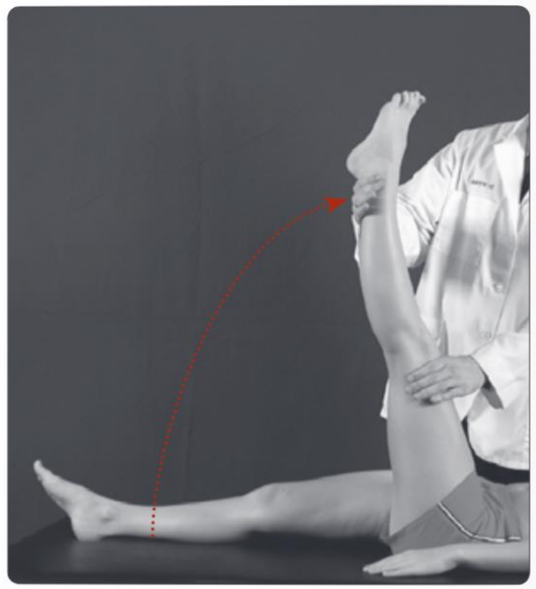
(+) Pain on the symptomatic side → radiculopathy, IVF encroachment, SOL, nerve root tension, sciatica

Clinical notes

Synonyms: Fajersztan Test, Prostrate Leg Raise, Well SLR

This test is useful as a confirmatory diagnostic maneuver to help rule in lumbar radiculopathy due to its high specificity

(SN: 23-43 SP: 88-100 +LR: 1.9-14.3 -LR: 0.59-0.86)[1,2,5, 21, 22, 23, 24, 35]

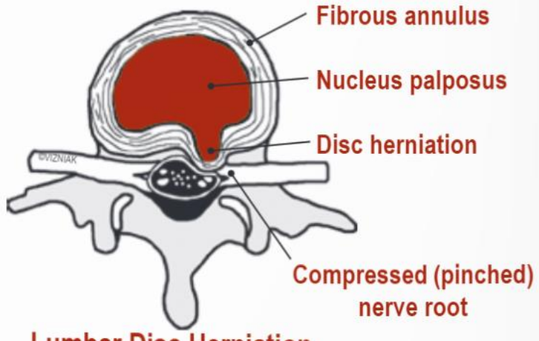


Disc Herniation Definition: tear or rupture of fibrocartilagenous material (annulus) that surrounds the intervertebral disc

- **Synonyms:** slipped or bulging disc, prolapsed disc, herniated nucleus palposus (HNP)
- Most common spinal levels: L4-L5, L5-S1 (95%-98% of all disc herniations)

Pathophysiology: secondary to disc degeneration or wear & tear the annulus fibrosis

- External protrusion of the gelatinous nucleus palposus through the annular fibers potentially causing compression of spinal nerve segment (radiculopathy)
- In addition to direct tissue damage & compression there is also potential chemical irritation from the release of inflammatory products & local edema



Lumbar Disc Herniation

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

B = Bone: evaluate film for fractures & dislocations, describe variations in cortices, medullary & subchondral bone, density, shape, size, trabecular patterns & relationship of osseous arrangements.

A = Alignment: analyze alignment & posture, result of various measurements; misalignments

C = Cartilage: inspect the joint spaces, articular spaces for any abnormalities; pay attention to symmetry, continuity, widening or loss of joint space & calcification of cartilage

S = Soft Tissue: evaluate soft tissues; look for unusual calcifications, including in blood vessels (abdominal aortic aneurysm), masses, displaced fascial lines & unusual gas distribution; note the presence of fat-pad signs ('sail sign') and soft tissue edema

Lumbar Angles & Lines

- Lumbosacral disc, lumbar lordosis
- Sacral base angle
- Gravitational line
- Evaluate stress studies for instability - displacement of more than 4mm may indicate instability (flexion/extension or weight/non-weight bearing)
- Antero or retro -listhesis - evaluate the amount of translation
  - Give answer in millimeters of motion or percentage of shift
- Spinal canal measurement: Eisenstein's method

Variants & Anomalies

- Clasp knife deformity
- Nuclear impression
- Transitional segments
- Facet tropism
- Lumbar ribs
- Paraglenoid sulcus, limbus bone
- Risser's sign (skeletal maturity)
- Block vertebra
- Always examine for presence of abdominal aortic aneurysms & other soft tissue abnormalities



Lumbar DJD

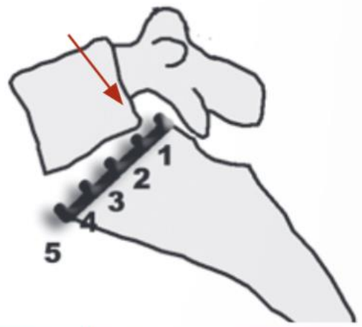
Film of an elderly male displaying advanced DJD of the lumbar spine

1. Decreased disc height (especially L4-S1)
2. Osteophyte formation (multiple levels)
3. Subchondral bone sclerosis (esp. L5)
4. Subchondral cysts (geodes)
5. Subluxation (retrolisthesis of L3 & L2)
6. Potential IVF encroachment (L5-S1)
7. Degeneration of posterior elements (L3-L5)

Meyerding's Grading Method of Spondylolisthesis

Measure from the posterior inferior corner of L5 over sacral base (grade 1 shown on illustration)
Interpretation:

1. **Grade 1 = < 25% translation**
2. **Grade 2 = < 50% translation**
3. **Grade 3 = < 75% translation**
4. **Grade 4 = < 100% translation**
5. **Grade 5 = spondyloptosis (vertebral body completely slipped off sacral promontory)**



Ullmann's Line

Normal: L5 body behind line
Interpretation: L5 vertebral body anterior to line indicates anterolisthesis (spondylolisthesis)



Lumbosacral Angle

Normal: 26°-57°
Interpretation: ↑ angle may cause LBP by ↑ stress on posterior lumbosacral joints



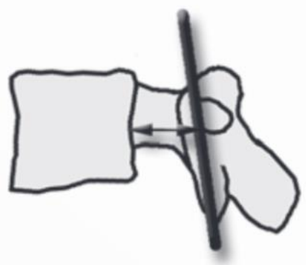
Lumbosacral Disc Angle

Normal: 10°-15°
Interpretation: ↑ angle may cause LBP by ↑ stress on posterior joints



Eisenstein's Method Sagittal Canal Measurement

Line: connects sup. & inf. articular processes
Normal: always greater than 15 mm
Interpretation: < 15 mm → spinal stenosis
Note: best plain film way to evaluate stenosis



Lumbar Gravity (Ferguson's) Line

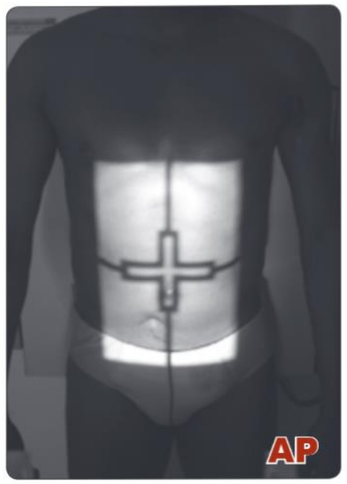
Normal: line should intersect anterior sacral base
Interpretation:
Line anterior to sacral base > 10 mm → ↑ shear stress anteriorly on lumbosacral zygapophyseal joints (z-joints)
Line posterior on sacral base → ↑ weight bearing on z-joints & possibly cause LBP



< = less than, > = greater than, → = may indicate, ↑ = increase

View Cassette, SID kV range	Central Ray Tube angle, Grid Collimation, F. spot	Measure Marker Shielding	Breathing Clinical notes
AP 14x17, **40"** 85±5 kV	Iliac crest 0°, yes 12x17, small	Iliac crests Corner of film Gonad, breast	Suspended expiration raises diaphragm Recumbent, sponges, Knees flexed
Lateral 14x17, **40"** 90±5 kV	ASIS 0°, yes 10x17, large	Iliac crests Corner of film Gonad, breast	Suspended expiration Scatter strip Compensation filter - for wide hips & narrow waist
Lat. Spot L_5/S_1 View 8x10, **40"** 85±5 kV	ASIS 0°, yes 5x5, large	L_5/S_1 Corner of film Gonad	Suspended Scatter strip, sponge ↑kVp 10% from lateral good for spondylolisthesis view
AP Axial 10x12, **35"** 85±5 kV	ASIS **25°**, yes 10x8, large	ASIS @25° Corner of film Gonad, breast	Suspended Knees elevated Correct for tube tilt
Oblique 10x12, **40"** 85±5 kV	Iliac crest @ 45° 0°, yes < film, large	Iliac crests @ 45° Corner of film Gonad, breast	Susp. ex. - Posterior oblique - shows same side IVF Patient prone Good for viewing Z-joints & pars nearest film
Instability Assessment*			
Flexion 10x12, **40"** 85±5 kV	ASIS 0°, yes < film, large	ASIS Anatomical gonad, breast	Suspended expiration Compression belt Stabilizing device or chair with back for support Use pelvis as a fulcrum
Extension 10x12, **40"** 85±5 kV	ASIS 0°, yes < film, large	ASIS Anatomical Gonad, breast	Suspended expiration May be done standing or lying
Traction 10x12, **40"** 85±5 kV	ASIS 0°, yes < film, large	ASIS Anatomical Gonad, breast	Suspended expiration Patient hangs from a bar with toes barely touching floor Set central ray while hanging
Compression 10x12, **40"** 85±5 kV	ASIS 0°, yes < film, large	ASIS Anatomical Gonad, breast	Suspended expiration Patient with 40lbs (20kg) vest, arms holding pole for support Do after traction - less strenuous

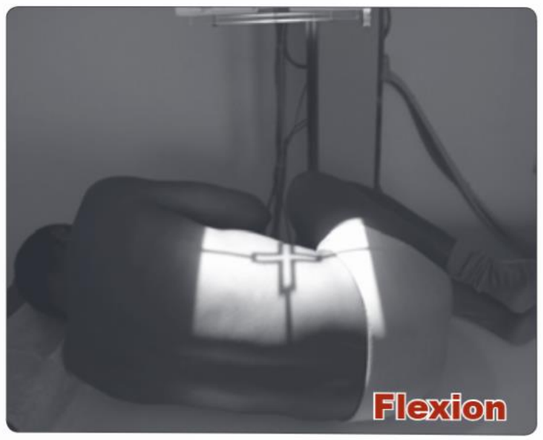
8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended, F. spot = Focal Spot, Cr. = central ray, IVF = Intervertebral foramen, SID = Source Image Distance (inches)
** In the assessment of instability either a flexion/extension series or a compression/distraction series is ordered, not both*
Adapted, with permission, from Hank Hirsh, RT(R), (ARRT), LRT

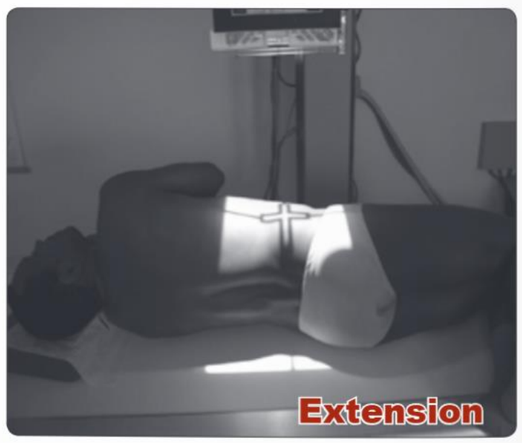






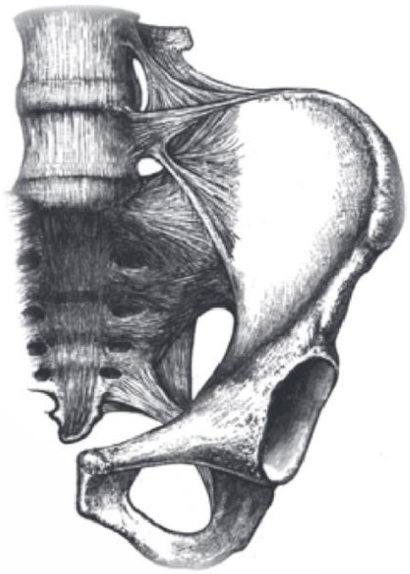






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Most doctors and therapists have never actually seen inside a SI joint in real life as the dissection is quite challenging & the process is NOT covered in many anatomy programs! - if they have been among the fortunate few it was likely on a geriatric donor rather than their standard patient population

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Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Special history questions

- Specific mechanism of injury & forces involved? - lifting & twisting?
- Any numbness, tingling or weakness?
- Coughing, sneezing or straining make it worse?
- Type of work, typical posture, sleeping posture?
- Prior injuries or treatments?
- What makes it better or worse?
- Review of systems (GI, urinary, cardiovascular)

Inspection

- Asymmetry, bruising, bumps, color, swelling, iliac crest height
- Posture

Palpation (may be done after ROM assessment)

Abdominal palpation	TFL
Inguinal lymph nodes	Greater trochanter
Femoral pulse	Piriformis
Pubic symphysis	Sacrotuberous lig.
ASIS	Sacroiliac joint
Iliac crest	Sacrospinous lig.
Paraspinal muscles	Gluteus maximus
Quadratus lumborum	Iliopsoas
Sciatic notch	Quadriceps
PSIS	Gastrosoleus
Ischial tuberosities	Spinous processes
Hamstrings	Lower ribs

Functional assessment (ADLs)

- Squat & rise

AROM

Flexion/Extension ..... **0-10°**
Int./external rotation ... **0-10°**

PROM & Joint Play (if indicated)

Myotomes (resisted isometric movements)

- Trunk rotation (T6-L2, segmental nn.)
- Trunk lateral flexion (T6-L2, segmental nn.)
- Trunk flexion/extension (T6-L2, segmental n.)
- Hip flexion (L1-L3, femoral n.)
- Knee extension (L3-L4; femoral n.)
- Knee flexion (L4-S2, sciatic n.)
- Ankle dorsiflexion (**L4**, L5 - deep peroneal),
- Ankle inversion (L4, **L5** - tibial & deep peron.)
- Ankle eversion (L5, **S1** - sup. peroneal)
- Big toe extension, (**L5**, S1; deep peroneal)
- Big toe flexion (L5-S1, tibial nerve)

Leg length measurements

- Greater trochanter to lateral malleolus
- Pubic symphysis to medial malleolus
- Umbilicus to medial malleolus
- Prone leg length evaluation

Abdominal exam (if indicated)

- Observe, auscultate, percuss, palpate, sit-up (abdominal strength & Beevor's sign)

Neurovascular screen

Sensory: Light touch, sharp/dull
Vibration (DIP, 3rd digit)
UMNL: Babinski (L1 & above)
DTR's: Patella (L3, L4), hamstring (L5), Achilles (L5, S1)
Vascular: femoral, popliteal, dorsal pedal pulses, nail bed blanching

Special tests (if indicated)

Screening

- Minor's sign
- Belt test, Gillette Test (SI step test)
- Flamingo test, Fortin finger test
- Allis test (sky-line)
- SI joint anesthetic injection

SI joint dysfunction

- SI motion palpation test (step test)
- Sit-up leg length test (long sit test)
- Static palpation

SI sprain/strain

- Motion palpation
- Sacral shear
- Sacrotuberous stress test

Iliopsoas contracture

- Gaenslen's test
- Lewin-Gaenslen's test
- Thomas test

Lumbar spine & Hip Screen

Diagnostic imaging (if indicated)

Condition	Clinical notes
Ankylosing spondylitis	*Hx:* 20-35 yrs old, M > F; insidious onset of vague LBP & stiffness worse with waking better with motion *SSx:* loss of lumbar/SI ROM, (+) blood tests HLA-B27, ↑ ESR *DDx:* progressive sclerosis of SI joints, expands up the spine visible on x-ray
Cauda equina syndrome	*Hx:* **bilateral** neurologic symptoms, saddle anesthesia, loss of bladder control *SSx:* gait abnormalities; ↓ DTRs, motor strength; (+) Babinski *DDx:* visible on MRI, spinal canal stenosis
Disc herniation	*Hx:* **unilateral** L4-S1 neurologic signs (numbness, weakness); antalgic posture *SSx:* ↑ pain with flexion; ↓ DTRs, motor strength; (+) SLR *DDx:* visible on MRI, IVF osteophyte encroachment, cauda equina syndrome
Lumbar (DJD) osteoarthrosis	*Hx:* local central pain, worse in morning, better with mild activity *SSx:* possible crepitus with motion; decreased AROM & PROM *DDx:* visible on x-ray: ↓ joint space, osteophyte formation
Lumbar joint dysfunction	*Hx:* insidious onset of local pain or discomfort *SSx:* tender to palpation; limited joint play; local myospasm; bone out of place *DDx:* lumbar sprain/strain, facet syndrome, meniscoid entrapment
Lumbar sprain/ strain	*Hx:* history of trauma, local pain with motion *SSx:* no neurologic signs; decreased AROM & PROM, RROM due to pain *DDx:* lumbar joint dysfunction often coexist
Pelvic fracture	*Hx:* significant trauma, severe pain *SSx:* gait abnormalities; (+) SI compression, distraction stress test *DDx:* visible on x-ray or CT, severe SI sprain
SI instability	*Hx:* chronic SI pain, possible repeatable "clunk" of SI joint; may occur during or shortly after pregnancy *SSx:* (+) sacral glide test for increased motion *DDx:* SI joint dysfunction, lumbar instability
Spinal stenosis	*Hx:* M > F (2:1), chronic low back pain, worse with prolonged standing *SSx:* decreased AROM & PROM; confirm with x-ray ↓ spinal canal diameter *DDx:* vascular claudication
SI joint dysfunction	*Hx:* insidious onset of local pain or discomfort (may be due to fall on sacrum) *SSx:* tender to palpation; limited joint play; local myospasm; bone out of place *DDx:* lumbar sprain/strain, PI ilium or AI (nutated) sacrum are most common
Piriformis syndrome	*Hx:* possible pain down back of leg, worse when sitting on hard surface *SSx:* tender to palpation, (+) SLR, sign of the buttock, (+) piriformis test *DDx:* lumbar radiculopathy, disc herniation, lumbar sprain/strain, stenosis

↑ = increase, ↓ = decrease, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis

Lumbopelvic Regional Exam

☑ Check normal, circle & describe abnormal

Patient: _____ date: _____ (dd/mm/yr)
Insurance: _____
Date of birth: _____ M/F

CC & significant history: _____

Fracture screen (tuning fork, percussion, torsion test, 5-step test): □ **WNL** □ **Refer for X-ray:** _____

Observation: □ WNL

Development: □ good, □ fair, □ poor
□ Posture: _____
□ Skin (bruising, scars): _____
□ Swelling: _____
□ Asymmetry: _____

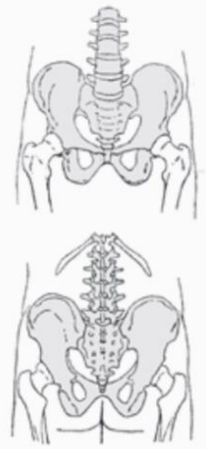
Observation □ WNL	L	R
Antalgia		
Lordosis: hyper, normal, hypo		
Scoliosis		
Postural asymmetry		
Heel walk (L4)		
Toe raises, multiple (S1)		
Squat & rise		
Gait		

Palpation: □ WNL, □ pain (circle), □ spasm (s), □ edema (e), □ fibrotic (f), □ MFTP (x), □ ache (a), □ tingling (t)

Palpation	L	R
Abdomen		
Inguinal lymph nodes		
Skin temperature		
Pubic symphysis		
ASIS		
Iliac crest		
Paraspinal muscles		
Quadratus lumborum		
Sciatic notch		
PSIS		
Ischial tuberosities		
Hamstrings		
TFL		
Greater trochanter		

Palpation	L	R
Piriformis		
Sacrotuberous lig.		
Sacroiliac joint		
Sacrospinous lig.		
Gluteus maximus		
Gluteus medius		
Quadriceps		
Gastro-soleus		

Pulses (0-4)	L	R
Femoral pulse		
Tibial pulse		
Dorsal pedial		



ROM & Joint Play: □ WNL

□ Pain at end ROM: _____
□ Abnormal motion: _____

Lumbar ROM	Active		Passive	
	L	R	L	R
Flexion (60°)				
Extension (25°)				
Lateral flexion (25°)				
Rotation (10°)				

Sacroiliac joint	L	R	L	R
Flex-ext (0-10°)				
Extern/intern (5-10°)				
Lumbopelvic rhythm				

Left	Joint Play	Right
	T12	
	L1	
	L2	
	L3	
	L4	
	L5	
	S1	
	SI	

Neurologic: □ WNL

Sensation, □ WNL	L	R
Light touch		
Sharp/dull		
Vibration		

Reflexes (0-5), □ WNL	L	R
Patellar (L4)		
Hamstring (L5)		
Patellar (S1)		
Babinski		

Motor (0-5), □ WNL	L	R
Abdomen (Beevor's sign)		
Resisted trunk rotation		
Resisted trunk lateral flexion		
Quadriceps (L2-L4)(femoral)		
Iliopsoas (L1-L3)(femoral)		
Tib. anterior (L4-L5)(deep f.)		
Ext. hal. long. (L4-S1)		
Flex. hallicus (L5-S2)		
Fibularis long. (L5-S1)		
Glut. max. (L5-S2)(inf. glut.)		
Hamstring (L4-S1)(sciatic)		
Glut. medius (L4-S1)		

Orthopedic: □ WNL

	L	R
Adam's sign		
Minor's sign		
Belt test		
Neri bowing		
Trendelenburg		
Lat. pelvic shift		
Valsalva		
Bechterew		
Slump test		
Deyerle		
Kemp's test		
Ober's		
Anvil test		
Allis' sign		

	L	R
SLR active/passive		
SLR maximal		
Bragard's		
Goldwait's		
Patrick FABERE		
LaGuerre		
Hip circumduction		
SI compression		
SI distraction		
Thomas/Gaenslen		
Homan's		
Nachlas/Ely/Hibb		
Brudzinski's		
Leg length		

Additional procedures: □ WNL

□ Hip exam: _____
□ Knee exam: _____
□ Abdominal: _____

DDx:

Signature: **Date:**

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Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution.
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Condition	History	Physical exam	Diagnostic tests
Aortic aneurysm	Severe pain radiating to low back	Pulsatile tender mass Possible hypotension, shock & oligourea	Abdominal x-ray Diagnostic ultrasound Angiography
Acute appendicitis	Dull periumbilical pain that becomes severe & localizes to RLQ	Increased pain with hip extension Nausea, vomiting Fever	Rebound tenderness over McBurney's point (Rovsing's sign) Diagnostic Ultrasound
Acute pancreatitis	Severe, constant pain around abdomen & back Possible alcohol abuse	Nausea, vomiting Tachycardia, shock Tender to palpation	↑ serum & urinary amylase
Cholecystitis/ Cholelithiasis	Colicky epigastric pain that may radiate to right shoulder ↑ Pain following meals (especially fat & eggs)	Nausea, vomiting Patient writhes (+) Murphy's Sign May be jaundiced	Bilary tract ultrasound
Ectopic pregnancy	Sudden severe lower abdominal pain	↑ Pain with movement Tachycardia, shock Tender to palpation Rebound tenderness	Positive pregnancy test Diagnostic ultrasound
G.E.R.D.	"Heart burn" sensation following meals	↑ Pain with recumbency or after meal	Chest x-ray may show hiatal hernia
Intestinal obstruction	Colicky periumbilical or lower abdominal pain	↑ Pain with ingestion of food or drink Abdominal distension	Abdominal x-ray (air fluid levels in bowel)
Ureteral stones	Extremely intense pain Radiates from low back & progresses to groin & scrotum	Patient writhes Hematurea	Abdominal x-ray (90% of stones visible) Diagnostic ultrasound Urogram, Helical CT
Pelvic inflammatory disease	Lower abdominal pain Dyspareunia (painful intercourse)	Fever, chills Vaginal discharge	Urine based ligase chain reaction Laparoscopy
Peptic ulcer	Sudden onset of severe epigastric pain May wake patient from sleep	Duodenal ulcer: ↓ pain with eating, NSAIDs Gastric ulcer: ↑ pain with eating Nausea, fever, shock Rebound tenderness	Abdominal or chest x-ray (air under diaphragm) Endoscopy with biopsy (*H. pylori*) may be found anywhere in GI

↑ = increase, ↓ = decrease, RLQ = right lower quadrant, patients writhe in search of a comfortable position to help relieve their pain

Pelvis Kinesiology

Joint types:
- **SI:** gliding (synovial & syndesmosis regions)
- **Pubic symphysis:** cartilagenous (syndesmosis)

Articular surfaces
- **Sacrum:** concave
- **Ilium:** convex (rough sections)
- **Sacroiliac:** facets oriented ~45° from sagittal
- Fibrocartilage on ilium & hyaline cartilage on sacrum (FISH - fibro ilium, sacrum hyaline)
- Cartilage is ~2-3x thicker on the sacrum
- After ~60 yrs most males have fused SI joints

Active range of motion (sacroiliac)
Flexion/Extension.....0-10°
Int./external rotation ...0-10°

Resting position: neutral

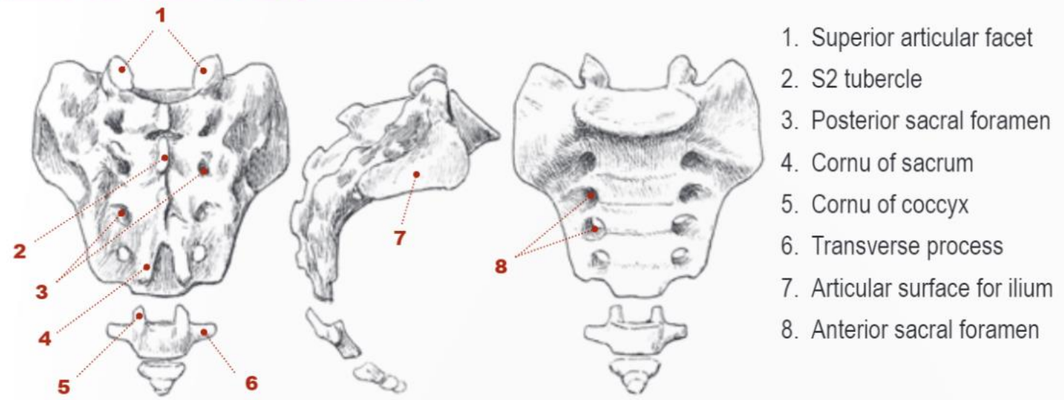
Close packed position: full nutation (SI flexion)

Capsular pattern of restriction
- Pain with torsion or shearing of joint

Normal end feel: firm ligamentous tissue stretch

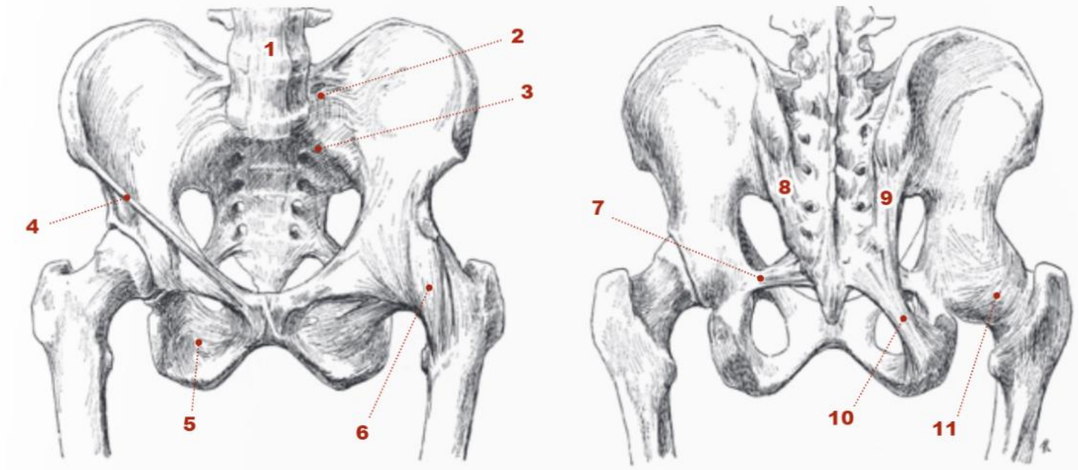
Coupled motions
- Sacral motion is also coupled with lumbar motion
  - Lumbar extension (or hyperlordosis) is coupled with sacral ***nutation*** (anterior sacral tilting or "nod")
  - Lumbar flexion (or hypolordosis) is coupled with sacral ***counter-nutation*** (posterior sacral tilting)
  - Rotation of the SI joint follows the lumbar pattern

Sacrum & Coccyx

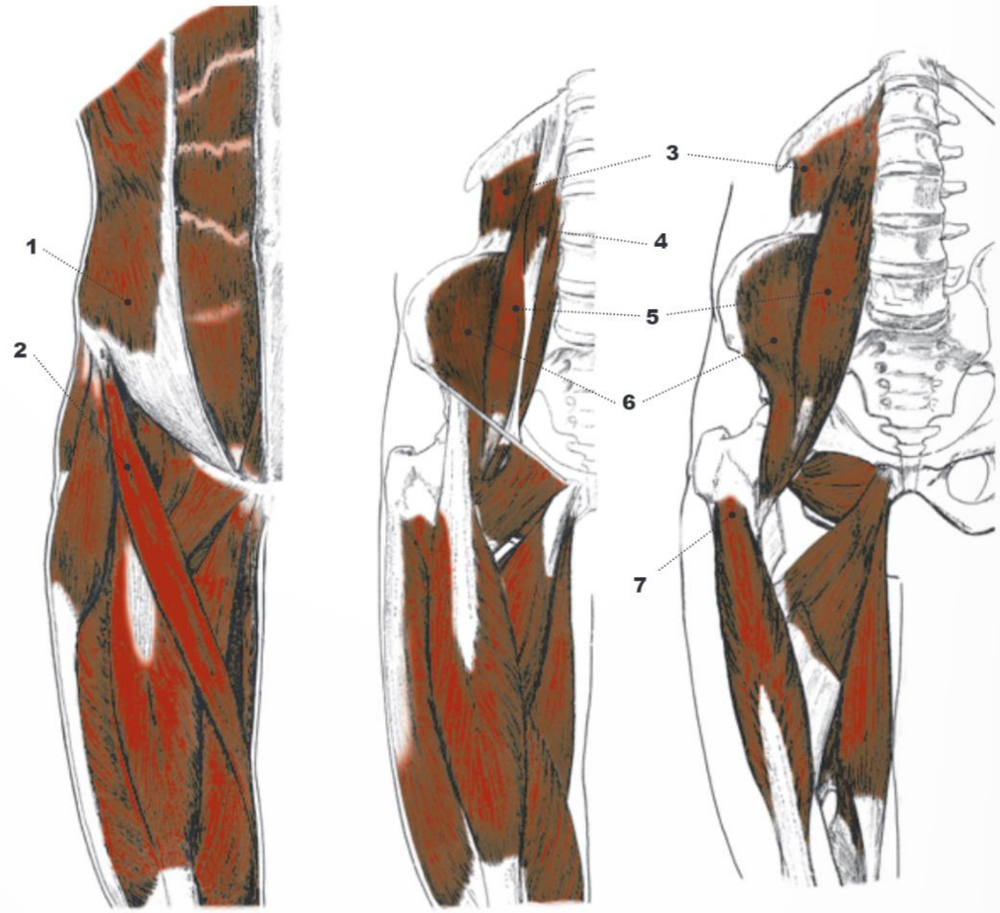


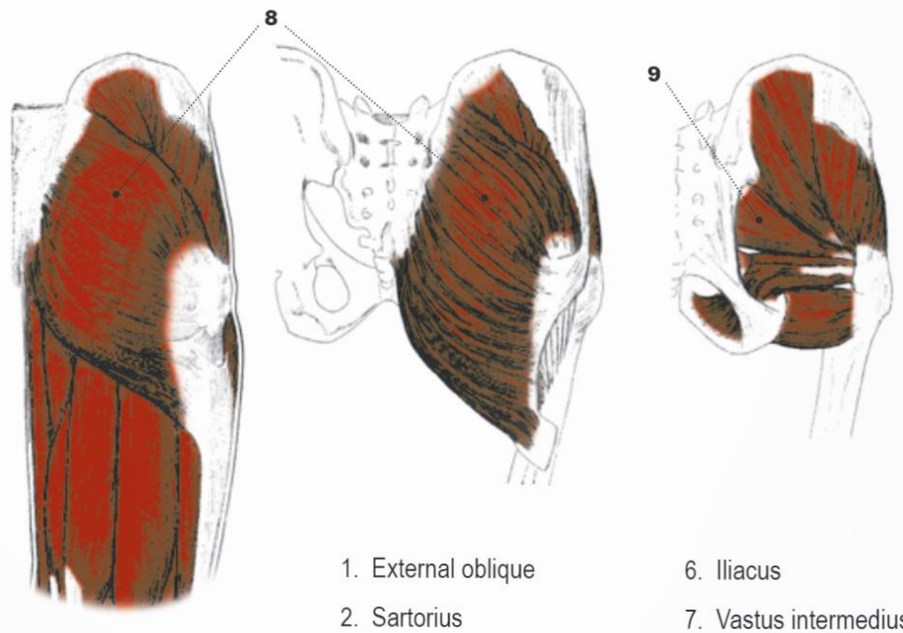
1. Superior articular facet
2. S2 tubercle
3. Posterior sacral foramen
4. Cornu of sacrum
5. Cornu of coccyx
6. Transverse process
7. Articular surface for ilium
8. Anterior sacral foramen

Pelvic Ligaments



1. Anterior longitudinal ligament
2. Iliolumbar ligaments
3. Anterior sacroiliac ligaments
4. Inguinal ligament
5. Obturator membrane
6. Iliofemoral ligament
7. Sacrospinous ligament
8. Posterior sacroiliac ligament
9. Long posterior sacroiliac ligament
10. Sacrotuberous ligament
11. Acetabulofemoral joint capsule



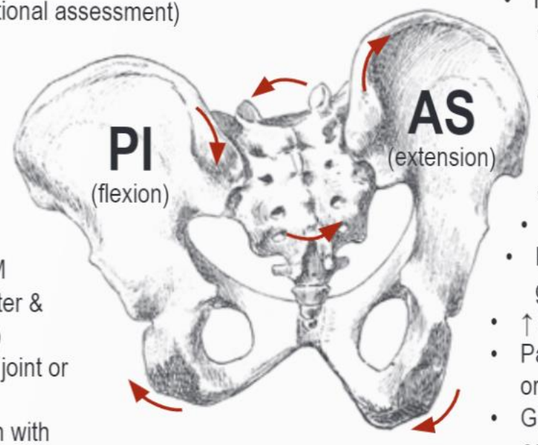


1. External oblique
2. Sartorius
3. Quadratus lumborum
4. Psoas minor
5. Psoas major
6. Iliacus
7. Vastus intermedius
8. Gluteus maximus
9. Piriformis

PI ilium (flexion malposition) - more common

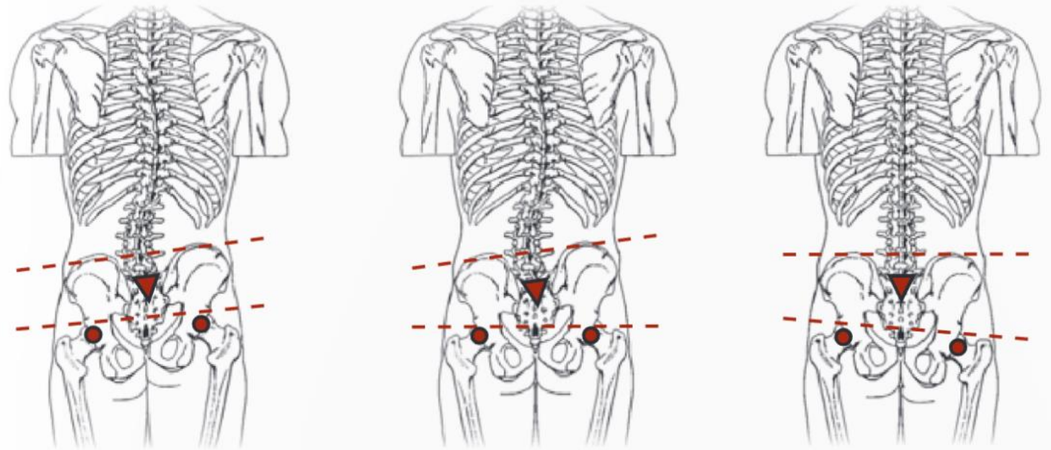
- Low iliac crest & PSIS when standing
- Short leg (supine functional assessment)
- Possible lumbar scoliosis to same side
- PSIS more pronounced
- ASIS high when standing
- ↓ thigh extension ROM
- Lower greater trochanter & gluteal fold (standing)
- Pain in lower 1/2 of SI joint or inguinal ligament
- Gillette's test: ↓ motion with *ipsilateral* hip flexion
- ↓ motion with prone SI flexion mobilization

AS ilium (extension malposition)



- High iliac crest & PSIS
  - Long leg (supine assessment)
  - Possible lumbar scoliosis to opposite side
  - PSIS less pronounced
- ASIS low when standing
- High greater trochanter & gluteal fold (standing)
- ↑ thigh extension ROM
- Pain in lower 1/2 of SI joint or inguinal ligament
- Gillette's test: ↓ motion with *contralateral* hip flexion
- ↓ motion with prone SI extension mobilization

Leg Length & Pelvic Malposition

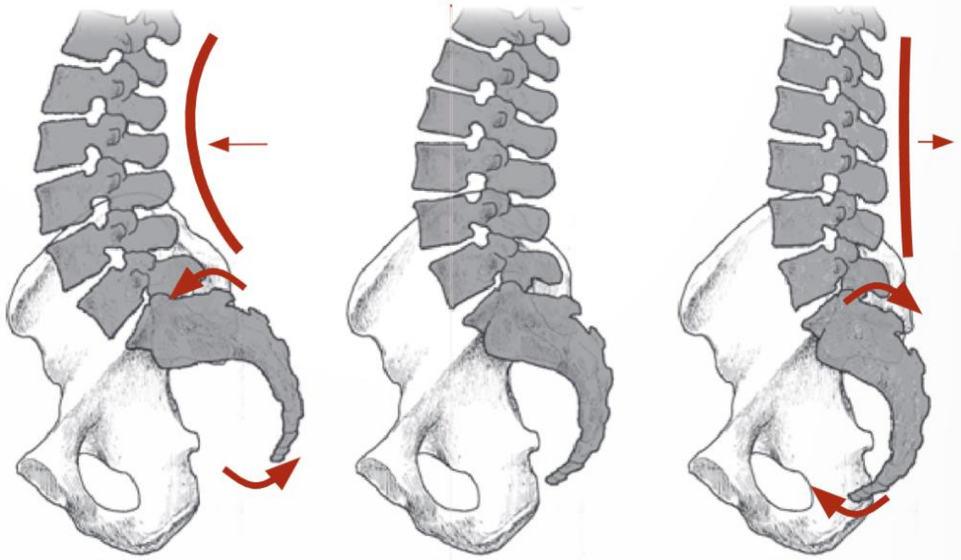


Anatomical Leg Inequality	Functional Leg Inequality	Functional Pelvic Torsion
• Right leg is anatomically long • Lifts right ilium & femoral head • Causes compensatory scoliosis	• *Right AS ilium* causing a functionally *long right leg* OR • *Left PI ilium* causing a functionally *short left leg*	• Left PI & right AS compensation of the pelvis to induce a level sacral base & neutral spine

Sacral Motion

Sacral Nutation (SI flexion)	Sacral Counter-Nutation (SI extension)
• Sacral base moves **Anterior Inferior (AI)** • Induces lumbar **hyperlodosis** • PSIS is *more* prominent to palpation	• Sacral base moves **Posterior Superior (PS)** • Induces lumbar **hypolordosis** • PSIS is *less* prominent to palpation

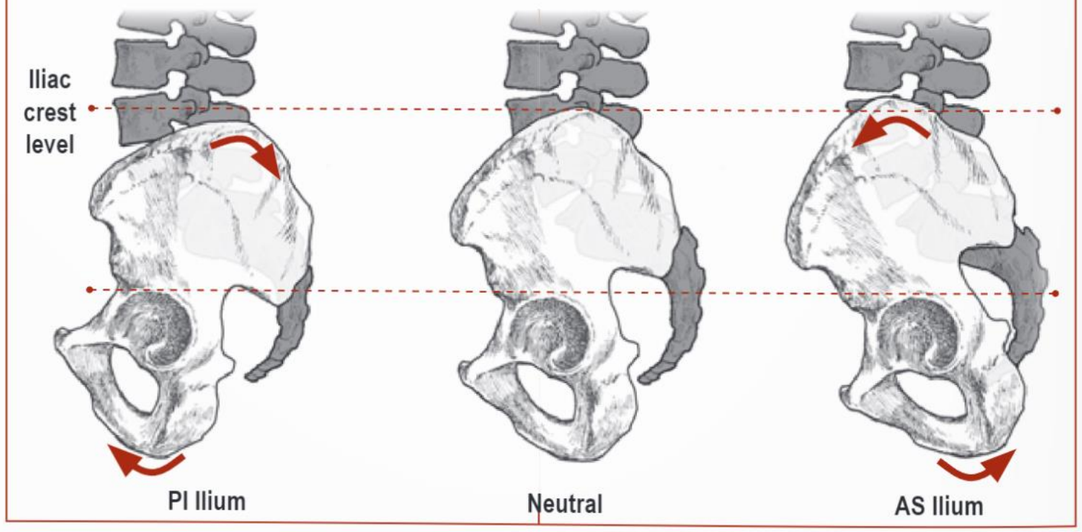
Sacral Motion with the Ilium (innominate) in Static Position



Ilium (innominate) Motion

PI (SI flexion) - more common	AS Ilium (SI extension)
• Ilium PSIS moves **Posterior Inferior (PI ilium)** • **Low iliac crest** when standing • PSIS become *more* prominent to palpation	• Ilium PSIS moves **Anterior Superior (AS ilium)** • **High iliac crest** when standing • PSIS become *less* prominent to palpation

Ilium (innominate) Motion with the Sacrum in Static Position and Equal Leg Length



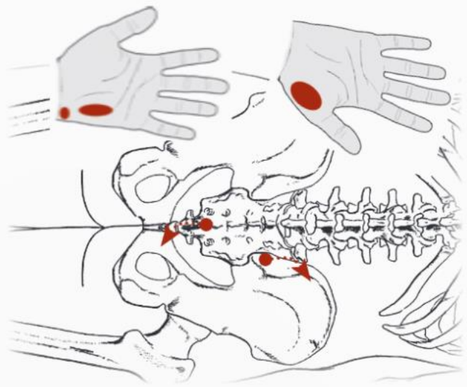
All palpation methods involve tactile movement of soft tissues & osseous structures to evaluate **variations in elasticity, tone, motion from side to side, pain and/or discomfort.** - clinical style & preference will determine which specific methods clinicians use (use what works best for you)

Prone Variations



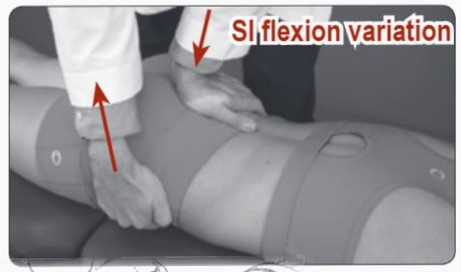


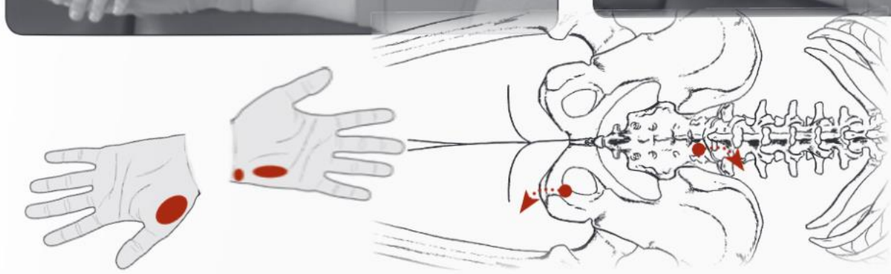




~90% of SI lesions are extension restrictions (PI ilium or nutated sacrum) due to the gravitational force pushing down on a the sacrum & normal lumbar lordotic curvature





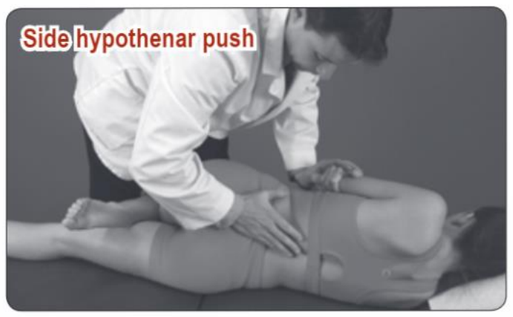


S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Supine & Side-Posture Variations



Side-posture palpation is performed by the clinician moving the patient's thigh & hip (abducting, adducting, flexing and/or extending) to induce SI motion - if the clinician is likely going to choose side-posture mobilization or manipulation as a treatment method then by using side posture assessment one can improve their clinical efficiency & avoid unnecessary changes in patient position.













Sacroiliac Marching Test

Synonyms: Gillette Test, SI motion palpation, Step Test, Sacral Fixation Test

Procedure

1. Patient standing with arm against wall, examiner palpates the PSIS & S2 tubercle (spinous process)
2. Patient is instructed to flex *ipsilateral* hip to 90°, examiner observes/palpates motion of PSIS relative to S2 (normally PSIS moves closer to S2 tubercle)
3. Examiner then instructs the patient to flex *contralateral* hip to 90°, examiner observes/palpates motion of S2 relative to PSIS (normal motion should move S2 away from PSIS)
4. Repeat test on contralateral SI joint

Interpretation

(+) Pain → Sacroiliac or pubic joint sprain, pelvic fracture
(+) Excess motion → hypermobility, joint dysfunction
(+) Decreased ROM → ipsilateral SI joint dysfunction

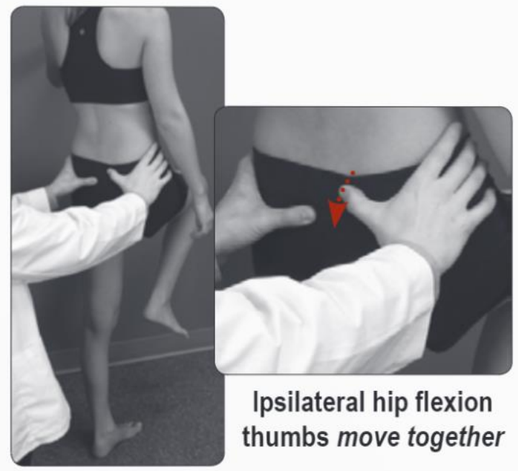
Clinical notes

Occasionally patients will have a repeatable 'click' or 'snap' with this maneuver, this finding is most likely due to a tendon snapping over a tubercle

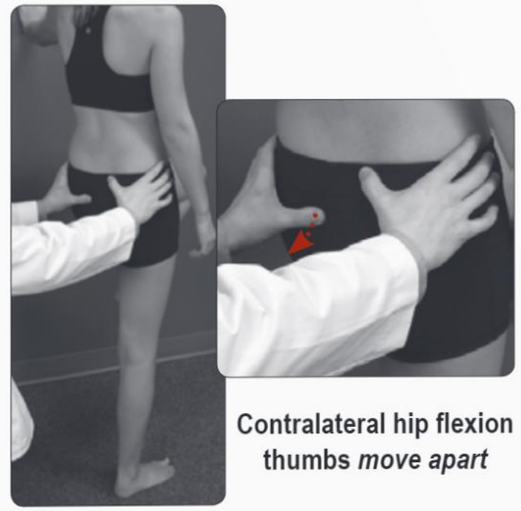
Some clinicians further modify this test by palpating the PIIS & sacral apex or S2 tubercle & ischial tuberosity to evaluate the lower SI joint separately (given that these variations still involve contact on the same two bones as the above method, it is questionable if they really offer any additional clinical assessment information)

Clinician's option (other SI motion maneuvers): Patient prone, examiner applies force over the sacral base & ischial tuberosity to check SI flexion; test repeated with force applied over the sacral apex & PSIS to check SI extension





Ipsilateral hip flexion thumbs *move together*



Contralateral hip flexion thumbs *move apart*

Lack of thumb movement indicates joint fixation

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion



Have patient angled on treatment table to allow for maximum SI joint motion while maintaining balance - sacrum balanced on corner

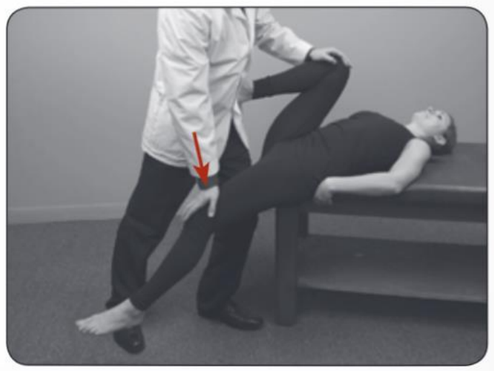
Clinician anchors patient's foot into their pelvis or shoulder (this allow clinician biomechanical advantage of using body weight)



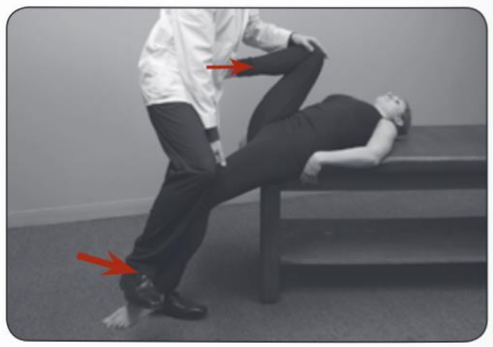
Clinician leans body toward patient (note left sided hip flexion and knee extension on this patient)



Clinician applies over pressure to the hanging leg to lengthen the left iliopsoas



Clinician also apply over pressure on patient's hand ankle to further stretch (go slow and make sure you have good balance)



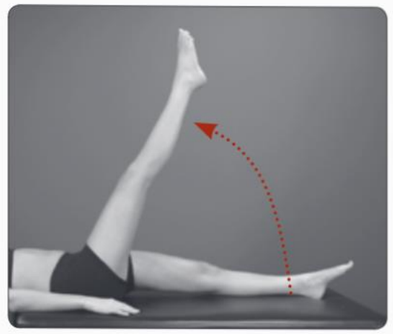
The sequence demonstrated in this page is one of the best SI mobilization techniques this author has used (excellent results, easy on the clinician's body - it just works!)

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Active SLR ★★★★★

Procedure

Patient supine; examiner instructs patient to lift affected leg 15 cm (6 inches) off the table, if movement in painful examiner stabilizes pelvis by compressing over ASISs & asks patient to repeat movement



Interpretation

(+) Inability to raise leg or pain with pelvic stabilization → pelvic fracture (SN: 90 SP: 95 +LR: 18 -LR: 0.1)[25]

(+) No pain with SI stabilization → sacroiliac lesion (R: 0.82 SN: 77-87 SP: 55-94 +LR: 1.7-14.5 -LR: 0.13-0.42)[19, 38]

Clinical notes

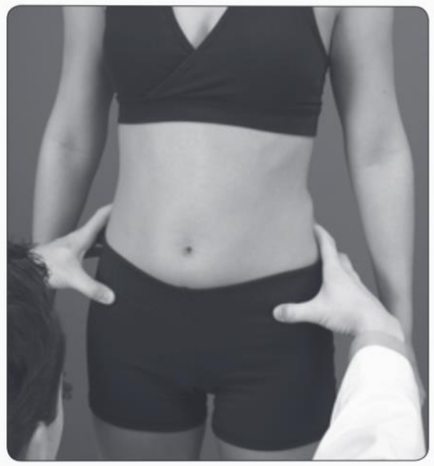
Test may be more sensitive in patients with SI pain during pregnancy

If fracture is suspected patient history should support diagnosis & diagnostic imaging in warranted

ASIS Asymmetry ★★★★

Procedure

Patient standing or seated; examiner compares ASIS height & symmetry; iliac crest height should be assessed at the same time as ASIS (see image)



Interpretation

(+) Standing asymmetry → Sacroiliac lesion

(+) Seated asymmetry → Sacroiliac lesion (R: 0.75 SN: 74 SP: 21 +LR: 0.9 -LR: 1.2)[32]

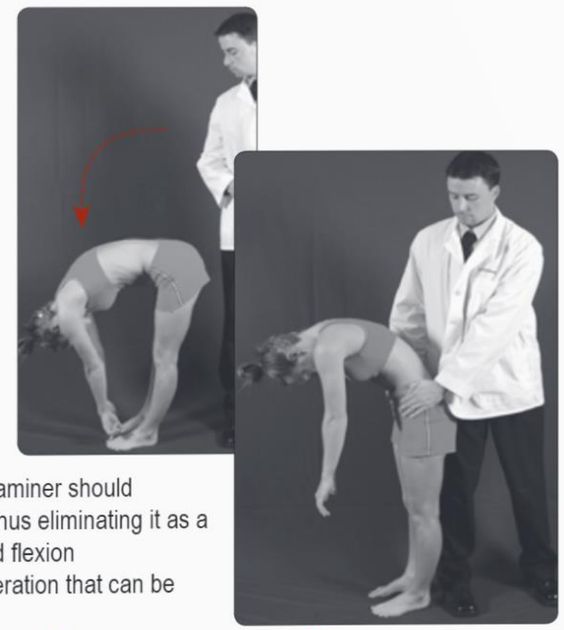
Clinical notes

Test may indicate pelvic rotation with an anterior ilium having a more prominent ASIS, the PSIS is a better landmark to use for evaluation of pelvic rotation. Potter & Rothsteion[41] noted poor reliability (38%-44% agreement) on this test

Belt Test ★★★★

Procedure

Standing patient is instructed to bend forward & touch toes with knees straight & return to standing; examiner then stabilizes the patient's pelvis bilaterally over the ASISs with hands & patient's sacrum with examiner's lateral thigh, then patient is instructed to repeat motion of touching toes



Interpretation

(+) Pain with both supported & unsupported flexion → Lumbar spine pathology

(+) No pain with support, pain without support → Sacroiliac joint pathology

Clinical notes

By supporting the patient's pelvis & sacrum the examiner should effectively prevent motion at the sacroiliac joint, thus eliminating it as a potential pain generator during supported forward flexion

An excellent differential for SI vs. lumbar pain generation that can be performed during active ROM assessment

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Erichen's Sign ★★★

Procedure
Patient prone, examiner places hands bilaterally over the dorsum of the ilia (PSIS & PIIS), then applies a high velocity low amplitude thrust toward midline

Interpretation
(+) Sacroiliac pain → sacroiliac pathology

Clinical notes
Thrust vectors of maneuver combined to form a motion that stresses the SI joint

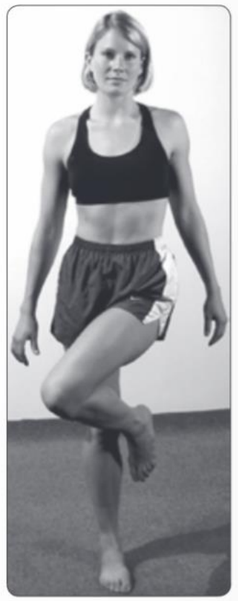


Flamingo Test ★★★★

Procedure
Standing patient is instructed to stand on one leg & hop & place, examiner observes for signs of discomfort or pain; by standing on one leg pressure is increased on the ipsilateral hip, sacroiliac joint & pubic symphysis

Interpretation
(+) Local SI pain → Sacroiliac joint dysfunction, hip joint lesion (pain secondary to trauma may indicate fracture)

Clinical notes
Examiner should provide the patient with a stable support or be prepared to stabilize patient manually should they lose their balance
This test is a good functional screen for pathology in the lower extremity (sacroiliac, hip, knee, ankle & foot lesions)
Test can be followed with Jackson's one leg hyper extensions test (ask the patient to extend their lumbar spine while standing on one leg to help DDx SI from lumbar issues)

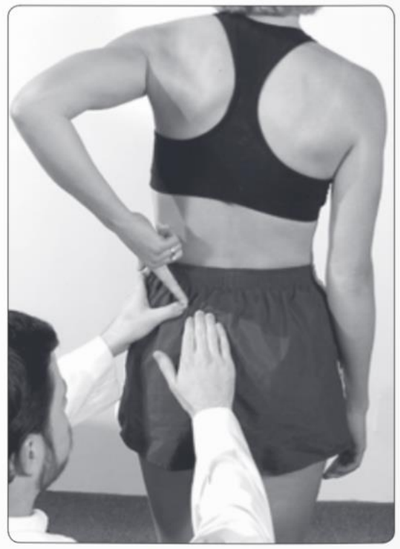


Fortin Finger Test ★★★★★

Procedure
Standing patient is asked to point to area of pain or discomfort

Interpretation
(+) Sacroiliac pain patient point within 1 cm of PSIS → sacroiliac lesion (R: 81 SN: 76-100 SP: 47 +LR: 0.9 -LR: 1.3)[5, 21, 23]

Clinical notes
Versions of this test can be applied to other regions of the body when dealing with musculoskeletal ailments ("point to where it hurts" - a question covered during initial history hopefully ☺)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Gaenslen's Test ★★★★★

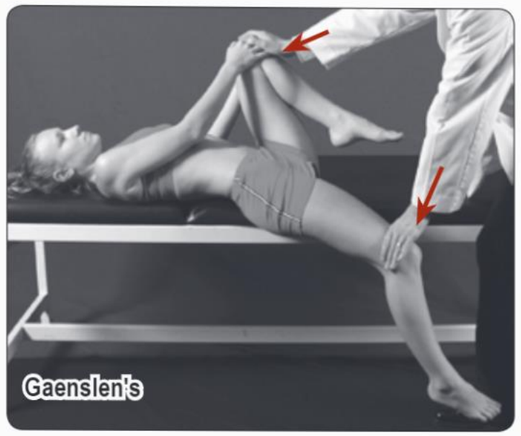
Procedure
Patient supine, examiner flexes knee & thigh of affected leg to patient's abdomen, then examiner slowly hyperextends the opposite leg & observes the patient for signs of discomfort or pain, the test is then repeated on the opposite extremity

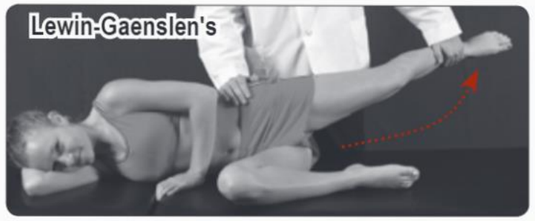
Interpretation
(+) Sacroiliac or anterior thigh pain → sacroiliac joint pathology (ligamentous sprain, instability) (R: 0.6-0.72 SN: 50-71 SP: 26-77 +LR: 1-2.2 -LR: 0.65-1.1)[21, 27, 28, 29]
(+) Elevation of extended hip → iliopsoas contracture
(-) No sacroiliac pain → possible lumbar or hip pain origination (if the leg hanging off the table starts to straighten look for iliopsoas contracture)

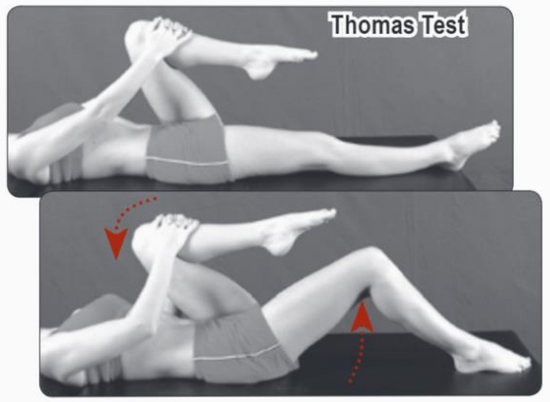
Clinical notes
Clinician's option: examiner may have patient bring the knee to chest & hyperextend the straight leg off the lateral edge of the examination table

Lewin-Gaenslen's Test - patient side-lying on unaffected side & brings unaffected knee towards chest, examiner then applies gentle over pressure attempting to hyperextended the affected thigh

Thomas Test / Knee to Shoulder Test - patient supine, examiner flexes affected knee & hip to 90°, then examiner pushes flexed knee toward the opposite shoulder (+) Elevation of the straight leg → hip capsule contracture, tight iliopsoas or rectus femoris





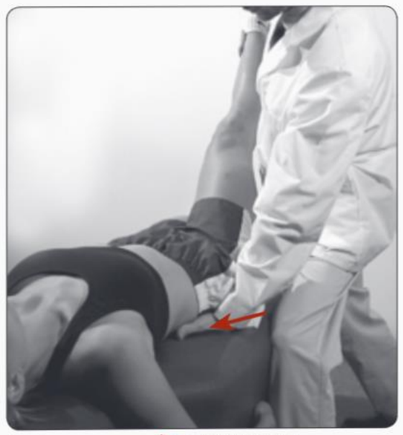


Goldthwait's Test ★★★★★

Procedure
Patient supine, examiner slowly raises the patient's affected leg with one hand while palpating motion at the lumbar spine with the other hand; the test is then repeated on the opposite side

Interpretation
(+) Pain before lumbar spine motion is felt → Sacroiliac joint pathology (ligamentous sprain, arthritis)
(+) Pain beginning when lumbar spine motion is felt → Lumbosacral pathology (sprain/strain, possible disc syndrome)

Clinical notes
Sacroiliac joint involvement should be suspected if the unaffected leg can be elevated higher than the affected leg



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Hibb's Test ★★★★

Procedure

Patient prone with knee flexed 90°, examiner then stabilizes the patient's pelvis with one hand & proceeds to slowly push the patient's ankle laterally (causing internal rotation of the femur)



Interpretation

(+) Sacroiliac pain → sacroiliac joint pathology
(+) Hip pain → hip lesion (strain/sprain, arthritis)
(+) Radicular pain → piriformis entrapment of sciatic nerve

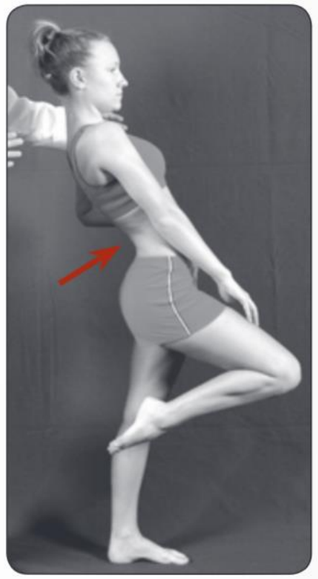
Clinical notes

Caution should be taken when dealing with patients with known knee pathologies, as the internal rotation motion of the femur will place stress on the medial collateral ligaments of the knee
Internal rotation of the femur causes stretching of the piriformis muscle, which may in turn compress the sciatic nerve & potentially cause radicular symptoms

Jackson's One-Legged Hyperextension ★★★★

Procedure

Patient stands on one leg & extends back; examiner stands ready to support patient & observes for signs of pain & discomfort, test is repeated on other side



Interpretation

(+) Low back pain on right side when standing on left foot → right sided lumbar pathology, facet impaction, impending pars fracture
(+) Pain in SI on support leg → SI pathology (SN: 7-19 SP: 98-100 +LR: 3.5 -LR: 0.95)[26]

Clinical notes

By standing on one leg the SI joint is loaded on the ipsilateral side; thus when contra-lateral pain is felt it is possible to rule out the elevated leg SI joint as a primary cause

Laguerre's Test ★★★★

Procedure

Patient supine, examiner flexes, abducts & laterally rotates the patient's affected leg, then applies gentle over pressure at the end ROM



Interpretation

(+) Ipsilateral sacroiliac pain → sacroiliac joint pathology (ligamentous sprain, instability, sacroiliitis)
(+) Hip pain → hip joint pathology (arthritis, sprain, possibly infection)

Clinical notes

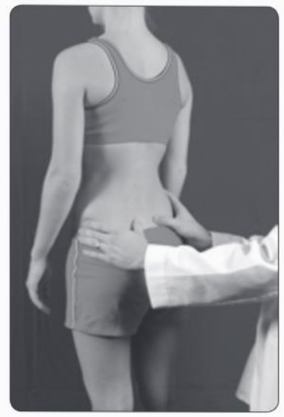
Clinician's option: examiner may choose to stabilize the opposite side of the pelvis to help limit joint motion
Mnemonic: "Laguerre is a FABERE in the air"

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Mennell's Sign ★★★

Procedure

Patient standing, examiner applies pressure bilaterally to patient's posterior superior iliac spine (PSIS), then applies pressure just medial to the PSIS



Interpretation

(+) Increased pain or tenderness medial to the PSIS → strain of superior sacroiliac ligaments, nutated sacrum

Clinical notes

Pain felt during direct palpation of a ligament or any other soft tissue structure usually indicates tissue damage

Resisted Abduction Test ★★★★★

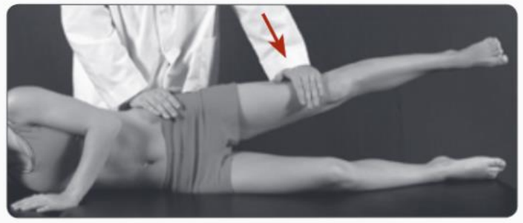
Procedure

Patient supine with hip abducted ~30°, examiner attempt to push legs together & observes for signs of pain or discomfort



Interpretation

(+) Reproduction of low back pain → sacroiliac joint dysfunction (SN: 87 SP: 100), instability, sprain
(+) Abductor muscle weakness → muscle deconditioning, muscle strain (gluteus medius)



Clinical notes

When this test is clustered, it is highly useful in identifying those suffering from sacroiliac joint dysfunction
Test may also be done side posture for SI pathology detection (R: 0.63 SN: 73 SP: 46 +LR: 1.4 -LR: 0.6)[14]

Seated Flexion Test ★★★★

Synonyms: Piedallu test, seated forward flexion test

Procedure

Patient seated, examiner locates the posterior superior iliac spines (PSIS) bilaterally & notes their height; if one PSIS is higher than the other than the patient is instructed to flex forward



Interpretation

(+) Lower PSIS becomes higher with forward flexion → sacroiliac joint dysfunction, abnormality in torsion movement
(+) Pain with forward flexion → sacroiliac joint dysfunction

Clinical notes

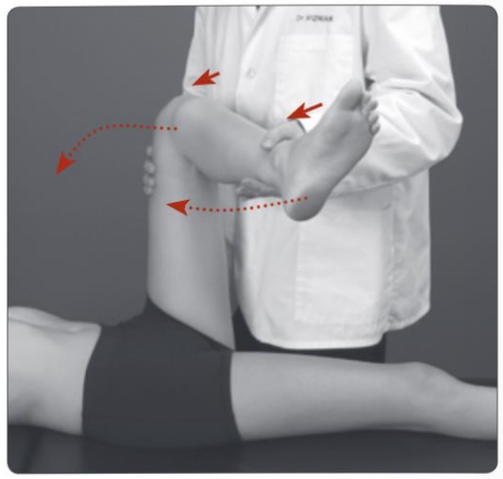
There is also the potential for anatomical variation in ilium size & shape that may result in false positives with this test
(R: 0 SN: 69 SP: 98 +LR: 35 -LR: 0.9)[10]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Piriformis Test ★★★★

Procedure

Patient supine, patient is instructed to flex hip to 90° & ipsilateral knee; examiner pushes patient's knee across body towards the patient's contralateral shoulder (muscle stretch of piriformis), examiner may further apply pressure over the piriformis or externally rotate thigh



Interpretation

(+) Radicular leg or buttock pain → piriformis syndrome, piriformis myospasm

Clinical notes

To confirm piriformis involvement examiner may chose to muscle test piriformis looking for muscle weakness or reproduction of symptoms

Thigh Thrust/Oostagard Test ★★★★★

Procedure

Patient supine with painful side hip flexed ~90° & knee flexed; examiner stands on opposite side of pain & places hand under sacrum to create a bridge; examiner then applies downward pressure on femur & attempts to stress SI joint



Interpretation

(+) SI pain → SI joint pathology
(+) Hip pain → hip joint pathology

Clinical notes

Test shows good sensitivity for SI pathology (R: 0.7-0.82 SN: 80-93 SP: 69-100 +LR: 2.8-46.5 -LR: 0.07-0.5)[10, 15, 19, 28, 40]

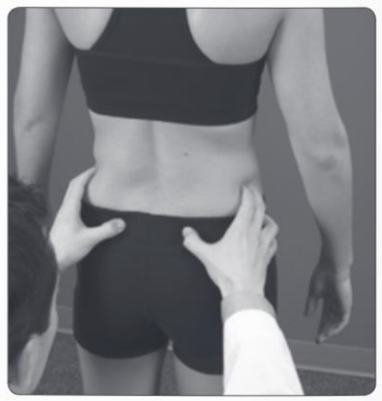
Posterior Shear (POSH) test: same as above except examiner stand on & movers ipsilateral affected side & flex hip to ~90° & then varies the amount of hip abduction & adduction while applying force - (+) SI pain → SI joint pathology (SN: 80 SP: 100 -LR: 0.2)



PSIS Asymmetry ★★★★

Procedure

Patient standing or seated; examiner compares PSIS height & symmetry; iliac crest height should be assessed at the same time



Interpretation

(+) Standing or seated asymmetry → sacroiliac lesion, anatomical variation in osseous structure size & shape

Clinical notes

Test may indicate pelvic rotation with an anterior ilium having a less prominent PSIS

Potter & Rothsteion[41] noted poor reliability (35% agreement) (R: 0.7 SN: 69-79 SP: 22-29 +LR: 0.9-1.1 -LR: 0.6-0.7)[33]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Pubic Shear Test ★★★★★

Procedure

Patient supine; examiner applies superior force & inferior force to contralateral pubic symphysis



Interpretation

(+) Pain in symphysis → Pubic symphysis pathology, symphysiolysis

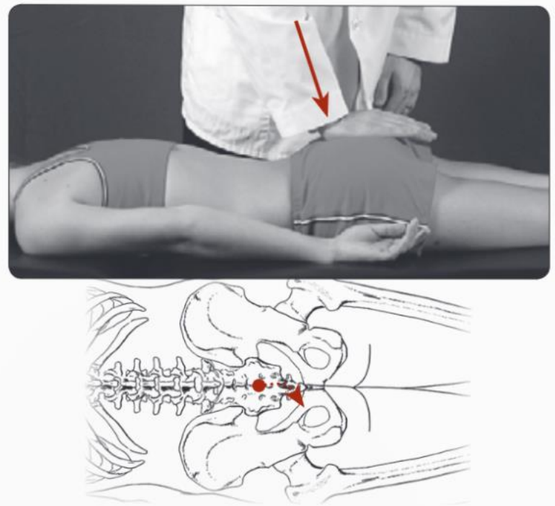
Clinical notes

Symphysiolysis should be confirmed with diagnostic imaging (R: 0.89 SN: 76-81 SP: 94-99 +LR: 4.7-12.7 -LR: 0.2-0.26)[10, 26]

Sacral Apex Test ★★★★

Procedure

Patient prone, examiner applies downward pressure over the apex of the sacrum, then pushes over the sacral base & then left & right sides of the sacrum



Interpretation

(+) Sacroiliac joint pain → SI joint pathology (ligamentous sprain, joint dysfunction) (SN: 63 SP: 75)[10]

Clinical notes

Test should be followed with sacral glide/shear testing

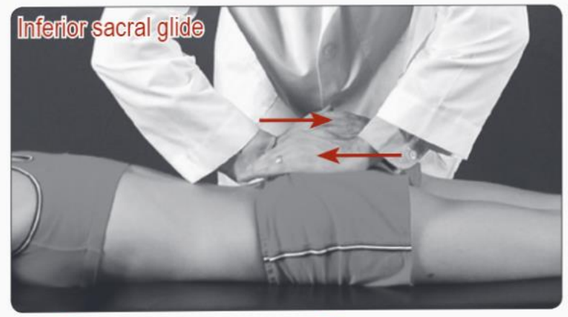
Sacral Glide/Shear Test ★★★

Procedure

Patient prone, two part test;

1. Superior sacral glide: examiner stabilizes the patient's pelvis over the PSIS, & applies an inferior to superior force over the sacrum
2. Inferior sacroiliac glide: examiner stabilizes the patient's pelvis over the ischial tuberosity & applies a superior to inferior force over the base of the sacrum





Interpretation

(+) Sacroiliac joint pain or increased motion → Sacroiliac joint pathology (ligamentous sprain, joint dysfunction, instability)

Clinical notes

This test is a useful method for joint play of the sacroiliac joint during a physical exam

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

SI Compression or Squish Test ★★★★★





Procedure

Two versions:

1. Patient supine, examiner places hands bilaterally on lateral pelvis & applies pressure from lateral to medial (compressing pelvis)
2. Patient side-lying, examiner places hands on superior ilium & applies downward pressure (compressing pelvis)

Interpretation

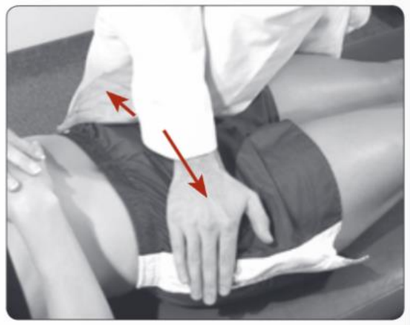
(+) Pain → Sacroiliac sprain/strain, fracture, SI joint dysfunction
(+) ↓ Pain → Sacroiliac instability (instability is also indicated if patient stands with feet wide apart & pain is reduced - abducted hips increase SI joint compression & pelvic stability)

Clinical notes

Test demonstrates good reliability & specificity
(R: 0.64-0.79 SN: 25-69 SP: 63-100 +LR: 1.6-2.2 -LR: 0.4-0.63)[10, 13, 25, 27, 28, 29, 41]

Sacroiliac Distraction Test ★★★★★

Synonyms; Gapping Test, Sacroiliac Stretch Test



Procedure

Patient supine, examiner places hands bilaterally over the patient's ASIS, then applies a force downwardly & laterally in an attempt to distract the pelvis

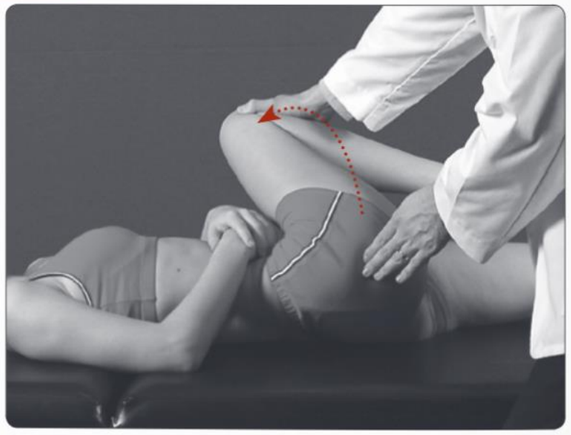
Interpretation

(+) Pain → Anterior sacroiliac or pubic joint sprain, pelvic fracture

Clinical notes

Test stresses the SI ligaments, anterior mainly
(R: 0.36-0.94 SN: 11-60 SP: 74-100 +LR: 1.1-3.2 -LR: 0.5-0.98)[10, 13, 25, 27, 28, 29, 35, 41, 44]

Sacrotuberous Ligament Stress Test ★★★★



Procedure

Patient supine with affected leg up, hip flexed 90° & knee fully flexed; the examiner adducts & internally rotates the hip, while palpating the sacrotuberous ligament with the other hand

Interpretation

(+) Pain → Sacrotuberous ligament sprain

Clinical notes

Test motion stresses the sacrotuberous ligament which runs from the posteriolateral sacrum to ipsilateral ischial tuberosity
Palpation may also be done with the patient prone

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Sit-up Leg Length / Long Sit Test ★★★★★

Procedure

Patient supine with leg straight, examiner at foot of examination table places one ankle in each hand & evaluates leg length by comparing side to side (malleoli length), examiner then instructs patient perform a sit-up (which induces flexion of the hip)

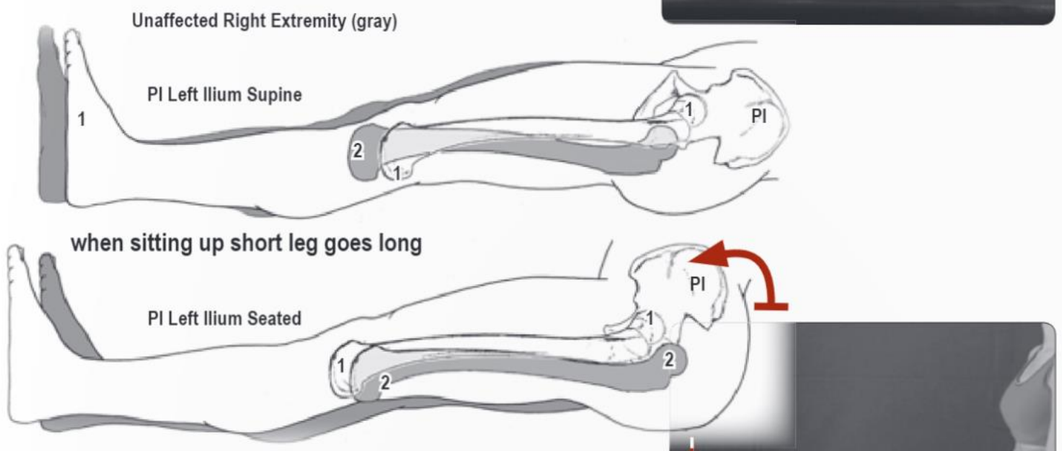
Interpretation

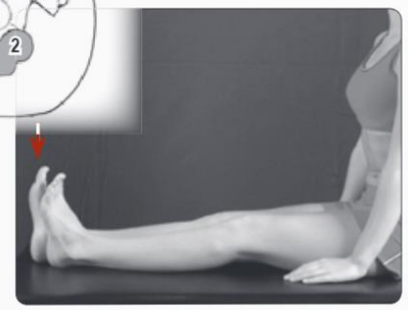
(+) Leg that was shorter supine becomes longer when the patient sits up → Sacroiliac joint dysfunction (PI ilium on the leg that went from short supine to long sitting, or an AS ilium on the opposite side)

Clinical notes

Clinician option: to avoid examiner induced error, examiner may elect not to grip the patient's ankles as they sit up, & simply observe leg length change (helps reduce examiner bias)
(R: 0.19-0.4 SN: 42-62 SP: 64-83 +LR: 1.4-3.6 -LR: 0.46-0.9)[12, 33, 41, 42]

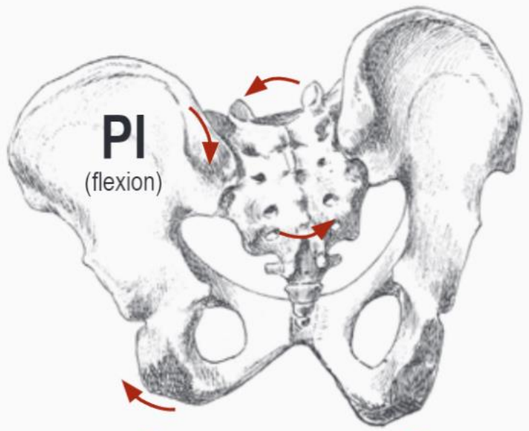






PI ilium (flexion) findings

- Low iliac crest & PSIS when standing
- Short leg (supine functional assessment)
- Possible lumbar scoliosis to same side
- PSIS more pronounced
- ASIS high when standing
- ↓ thigh extension ROM
- Lower greater trochanter & gluteal fold (standing)
- Pain in lower 1/2 of SI joint or inguinal ligament
- Gillette's test: ↓ motion with *ipsilateral* hip flexion
- ↓ motion with prone SI flexion mobilization



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Trendelenberg Test ★★★★★



Procedure

Patient standing is instructed to lift one leg off the ground, examiner observes for hip motion from behind

Interpretation

(+) Pelvic lateral tilt → Weak hip abductor muscles (especially gluteus medius), neurologic or muscle conditioning deficit (R: 0.68 SN: 73 SP: 77 +LR: 3.2 -LR: 0.36)[5]

(+) Pain in SI on support leg → SI pathology (SN: 7-19 SP: 98-100 +LR: 3.5 -LR: 0.95)[21, 26]

Clinical notes:

~10% of patients with hip pain will demonstrate a false positive on Trendelenberg test (muscle weakness due to pain)

Trendelenberg gait may also be noted with initial assessment

Bird (2001) verified gluteus medius tear with MRI[14]

Vanzetti's Sign ★★★

Procedure

Patient standing, examiner observes any lateral pelvic tilt or compensatory spinal scoliosis





Interpretation

(+) Lumbar scoliosis with no pelvic tilt → nerve root compression, sciatica

(+) Lumbar scoliosis with pelvic tilt → lumbosacral strain/sprain, leg length inequality, congenital osseous defect, antalgic posture

Clinical notes

The presence of Vanzetti's Sign should first be noted during the initial observation of the patient posture

Yeoman's Test ★★★★

Procedure

Patient prone with knee flexed 90°, with one hand examiner applies downward pressure over the PSIS, & lifts the patient's flexed knee off the examining table & attempts to extend the thigh with the other hand

Interpretation

(+) Sacroiliac or anterior thigh pain → SI joint pathology (ligamentous sprain, instability, arthritis)

(+) Muscle tightness of the extended hip → iliopsoas or rectus femoris contracture

Clinical notes

In the presence of femoral compressive neuropathy, this test may also induce femoral radicular symptoms as it may stretch the femoral nerve or its roots (L2-L4)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Pelvic Film Evaluation

View Cassette, SID kV range		Central Ray Tube angle, Grid Collimation	Measure Marker Shielding	Breathing Clinical notes
Sacrum	**AP** (axial) 10x12, **40"** 80±5 kV	Sacrum 15° cephalad, yes < film	Sacrum up 15° Anatomically Gonad, breast	Susp. Cushion under knees Correct for tube tilt
	Lateral 10x12, **40"** 80±5 kV	ASIS (slightly below) 0°, yes < film	Mid-sacrum Anatomically Gonad, breast	Susp. Scatter strip on table If pain in general area - include coccyx & sacrum in one film
Coccyx	**AP** 8x10, **40"** 80±5 kV	Symphysis Pubis 10° down (caudad) 10° caudad, yes ***Tightly*** to coccyx	Symphysis pubis 10° down Anatomically Breast, gonad, (place accurately)	Susp. Scatter strip Foam wedge Lower kVp for ↑contrast
	Lateral 8x10, **40"** 80±5 kV	Symphysis pubis 0°, yes ***Tightly*** to coccyx	Symphysis pubis Anatomically Breast, gonad	Susp. Scatter strip Lower kVp for ↑contrast
Sacroiliac	**AP** (RPO/LPO) 8x10, **40"** 90±5 kV	Mid SI @25°-30° 0°, yes < film	Mid SI @25°-30° Anatomical - side of interest Gonadal	Susp. 25°-30° is less than oblique Always bilateral study Aim ***central ray 1" medial*** to the ***up (superior) ASIS***
	PA (RAO/LAO) 8x10, **40"** 90±5 kV	Mid SI @25°-30° 0°, yes < film	Mid SI @25°-30° Anatomical - side of interest Gonadal	Susp. Support the body with wedge Knee flexed, arm behind patient & ***central ray to PSIS***

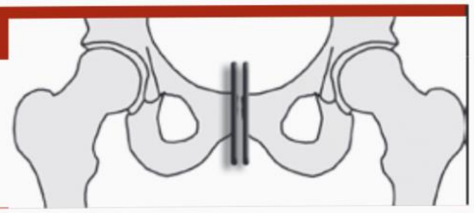


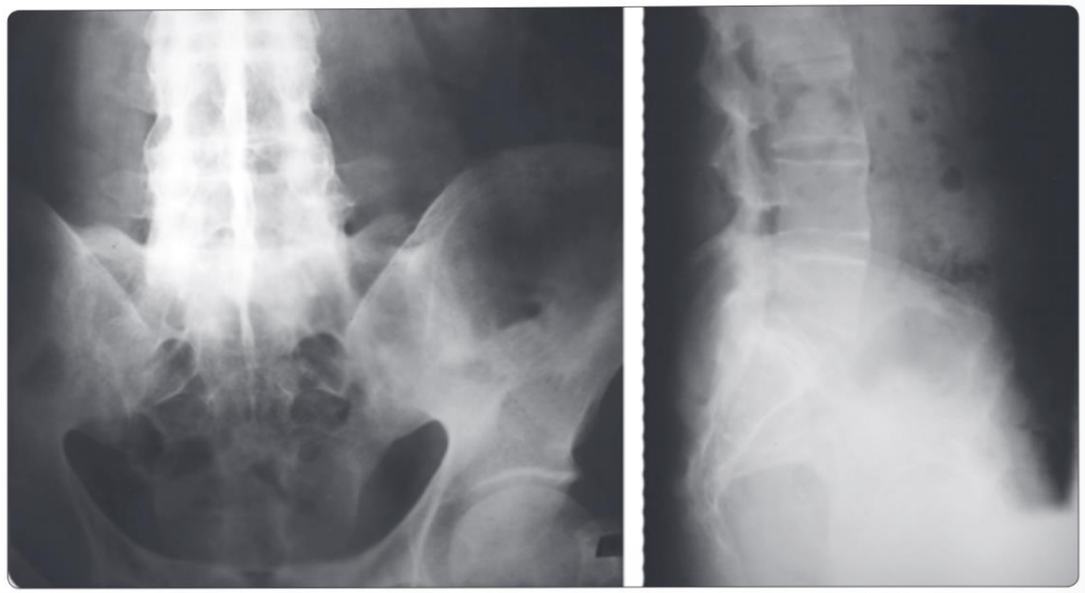
Film shows degeneration of pubic symphysis

Symphysis Pubis Width

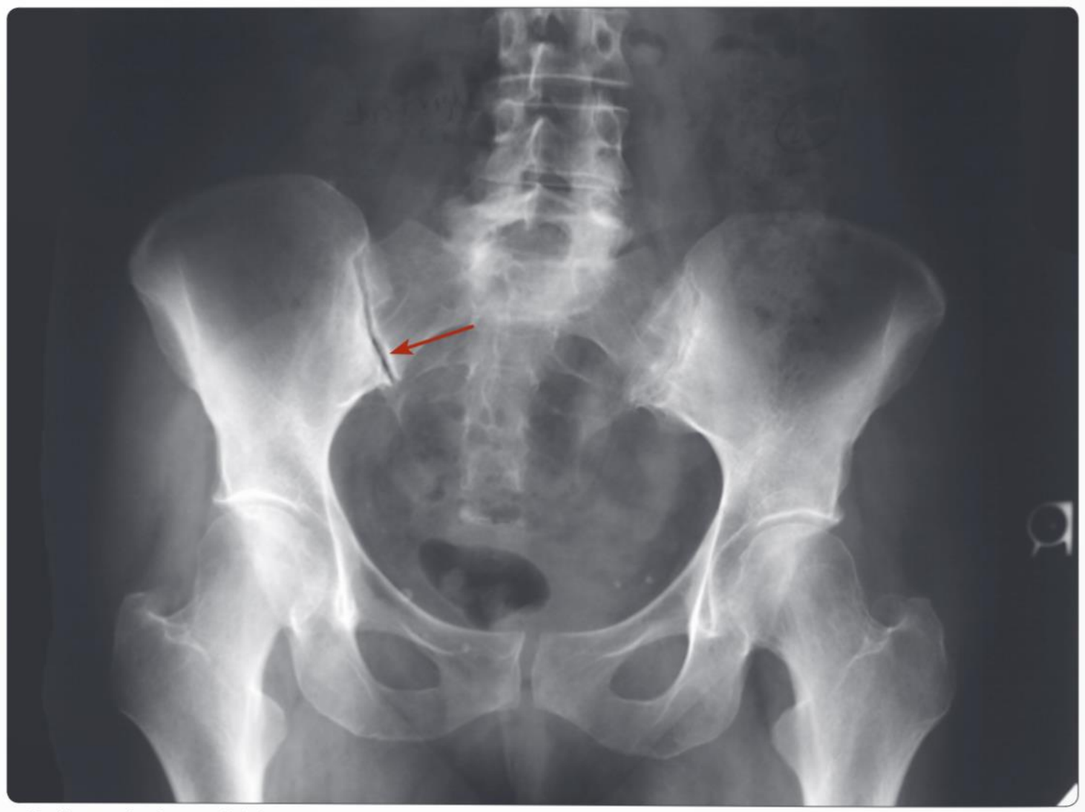
Normal: female 3.8-6 mm, male 4.8-7.2 mm

Interpretation: increased width → cleidocranial dysplasia, hyperparathyroidism, post traumatic diastasis, ankylosing spondylitis, osteitis pubis, gout





Radiographs SI joint fusion in a 30 yr. old patient with Ankylosing Spondylitis
Note SI joint fusion & "bamboo spine"



Radiograph show mild degeneration of SI joint bilaterally (non uniform joint space loss, reactive sclerosis, small osteophytes. In the left SI joint there is a vacuum phenomena (linear region of dark black air density in the joint) - while the significance is debatable, vacuum phenomena are often associated with trauma and degeneration in both the lumbar and SI joints

SI & Pelvis

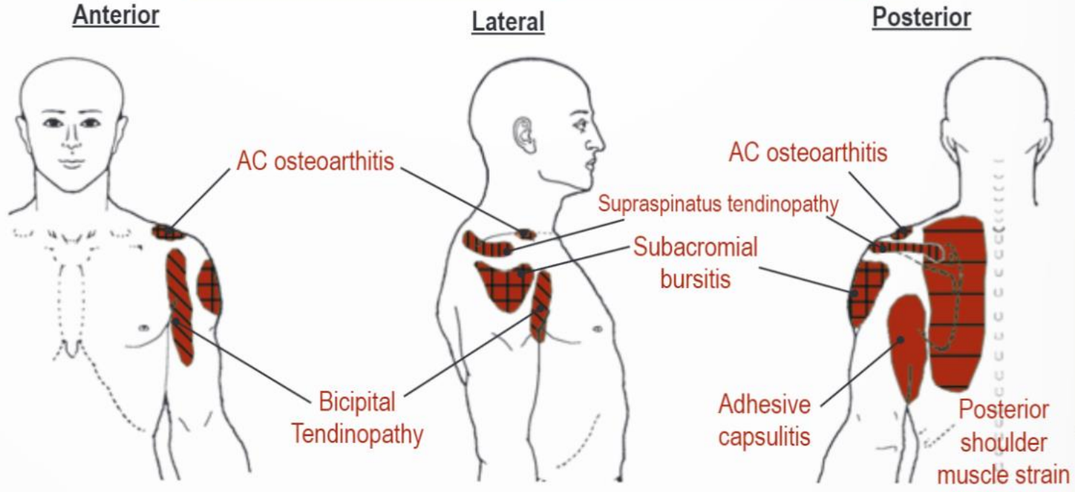
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Selected Shoulder Pain Referral Patterns



Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Shoulder Exam Flow

prohealth

Follow HIP-MNRS
(History, Inspection, Palpation - Motion, Neurovascular screen, Referred pain, Special tests

Special history questions
- Specific mechanism of injury & forces involved?
  - Did you fall on outstretched hand?
- Any numbness, tingling or weakness?
- Type of work, typical posture, sleeping posture?
  - Overuse/overhead work? (Impingement)
- Prior injuries?

Inspection
- Asymmetry, bruising, bumps, color, swelling, height, head tilt, winging of scapula
- Posture of head, neck & thoracic spine, shoulder

Palpation (may be done after ROM assessment)

Middle trapezius	Rotator cuff superior
Lower trapezius	Rotator cuff anterior
Rhomboids	Teres major
Thoracic spine	Latissimus dorsi
Ribs 1-9 posterior	Subscapularis
Levator scapulae	Serratus anterior
Upper trapezius	Triceps brachii
Scalenes	Deltoid
Thoracic outlet	Deltoid tuberosity
Cervical spine	Pectoralis minor
Supraspinatus	Coracoid process
AC joint	Coracobrachialis
Infraspinatus	Biceps brachii
Teres minor	Bicipital groove
AC step defect	Pectoralis major
Rotator cuff posterior	SC joint

Functional assessment (ADLs)
- Apley's superior & inferior

AROM
Flexion ..... 180°
Extension ..... 50°
Int./ext. rotation ..... 90°/80°
Abduction ..... 180°
Adduction ..... 35°
Horizontal Add./Abd. 130°/30°
Scapulocostal rhythm

PROM & Joint Play (if lacking AROM in any motion)

Myotomes (resisted isometric movements)
- Shoulder elevation (C4, XI)
- Deltoid (**C5**, C6 - axillary)
- Brachioradialis (C5, C6 - radial)
- Biceps (C5, **C6** - musculocutaneous)
- Triceps (C6, **C7**, C8, T1 - radial)
- Wrist extensors (**C6**, C7, C8 - radial)
- Wrist flexors (C6, **C7** - median/ulnar)
- Finger flexors (C7, **C8**, T1 - ulnar/median)
- Interossei (C7, C8, **T1** - ulnar)

Neurovascular screen
- ***Sensory:*** light touch, two point discrimination, Vibration (3rd digit), Tinel's
- ***DTR's:***
  - Biceps (C5), Brachioradialis (C6), Triceps (C7)
- Girth measurements
- Grip strength (Dynamometer)
- Radial & brachial pulse, blanching, temperature

Orthopedic tests (as indicated)
Screening
- Apley's scratch
- Codman's arm drop
- Mouth Wrap-around Test

Impingement
- Hawkins-Kennedy
- Impingement sign
- Painful arc

Biceps tendinitis
- Hyperextension
- Speed's, Yergason's
- Modified Yergason's

Rotator cuff
- Empty can
- Lift-off test

Labral tear (SLAP lesion)
- Hyperabduction
- Clunk, Crank, O'brien's test
- Biceps Load Test II

Glenohumeral joint stability
- Ant/post drawer
- Ant/post apprehension
- Load & shift

Elbow & Spinal Screen

Diagnostic imaging (if indicated)

Condition	Clinical notes
AC separation	*Hx:* prior trauma - fall onto shoulder or impact over shoulder *SSx:* possible step defect; tenderness to palpation over AC joint; (+) AC shear, cross-body test, O'Brien's *DDx:* supraspinatus rupture, impingement syndrome, rotator cuff tear
Adhesive capsulitis	*Hx:* patient age 40-60, usually female, weeks of shoulder pain & restriction *SSx:* restricted AROM in clear capsular pattern (external rotation > abduction > internal rotation); extremely painful & limited PROM *DDx:* cervical pathology, impingement syndrome, rotator cuff tear
Bicipital tendonitis	*Hx:* pain over anterior shoulder, history of repetitive elbow flexion (weight lifter) *SSx:* exquisite pain with direct palpation of biceps long head tendon; pain with resisted horizontal adduction *DDx:* cervical pathology, rotator cuff strain
Bursitis (subacromial)	*Hx:* pain over superior or lateral GH joint, pain at night difficulty sleeping *SSx:* tender palpation over acromion/deltoid; ↓ shoulder ROM in abduction & flexion; pain may be relieved by GH inferior distraction *DDx:* cervical pathology, rotator cuff strain, impingement syndrome
Glenohumeral osteoarthritis	*Hx:* insidious onset of pain, morning stiffness, worse with excessive activity *SSx:* crepitus & pain w/ ROM; (+) Ellman compression test (GH scour test) *DDx:* AC osteoarthrosis, GH instability, impingement syndrome
Impingement	*Hx:* pain with overhead movements, may refer pain down lateral arm *SSx:* pain with ROM; (+) painful arc, Hawkin's-Kennedy, Neer's *DDx:* cervical pathology, GH instability, poor posture
Instability	*Hx:* prior trauma; patient may be able to demonstrate ↑ motion; patient may have impingement type symptoms due to excess GH movement *SSx:* observation of sulcus sign; (+) load & shift test *DDx:* rotator cuff strain, impingement syndrome, congenital ligament laxity
Rotator cuff tear	*Hx:* prior trauma - lifting or throwing injury; degeneration of rotator cuff? (elderly) *SSx:* weakness in specific rotator cuff movements, abnormal scapulohumeral rhythm; (+) Codman's arm drop, impingement signs, painful arc *DDx:* supraspinatus rupture, impingement syndrome, congenital ligament laxity
Supraspinatus tendonitis	*Hx:* pain with overhead movements or hand placed behind back *SSx:* exquisite pain with resisted supraspinatus movements; (+) empty can test, impingement, pain with direct palpation *DDx:* cervical pathology, GH instability, complete supraspinatus rupture
Thoracic outlet syndrome	*Hx:* pain & paresthesia, possible muscle weakness into shoulder, arm &/or hand *SSx:* myospasm of cervical musculature (depending on cause); (+) TOS tests *DDx:* cervical radiculopathy, cervical disc herniation, carpal tunnel syndrome

↑ = increase, ↓ = decrease, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis

Shoulder Regional Examination

☑ Check normal, circle & describe abnormal

Patient: _____ date: _____
Insurance: _____ (dd/mm/yr)
Date of birth: _____ M/F

CC & significant history: _____

Fracture screen (tuning fork, percussion, torsion test, ultrasound): □ **WNL** □ **Refer for X-ray** **Pulses** (bilateral): □ **WNL** _____

Observation: □ WNL

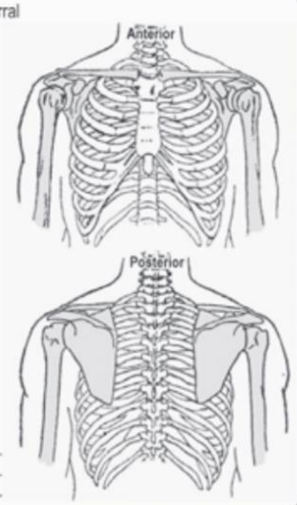
Development: □ good, □ fair, □ poor
□ Posture: _____
□ Skin (bruising, scars): _____
□ Asymmetry: _____

Observation □ WNL	L	R
Head tilt		
Head rotation		
Shoulder high		
Scapula		
Scapula winging		
Shoulder rounded		
Scapula rotated medial		
Scapula rotated lateral		
Humerus internally rotated		
Humerus externally rotated		
GH sulcus sign		
AC step defect		

Palpation: □ WNL, texture, tenderness, pain referral

Palpation	L	R
Middle trapezius		
Lower trapezius		
Rhomboids		
Thoracic spine		
Ribs 1-9 posterior		
Levator scapulae		
Upper trapezius		
Scalenes		
Thoracic outlet		
Cervical spine		
Supraspinatus		
AC joint		
Infraspinatus		
Teres minor		
AC step defect		
Rotator cuff post.		

Palpation	L	R
Rotator cuff sup.		
Rotator cuff ant.		
Teres major		
Latissimus dorsi		
Subscapularis		
Serratus anterior		
Triceps brachii		
Deltoid		
Deltoid tuberosity		
Pectoralis minor		
Coracoid process		
Coracobrachialis		
Biceps brachii		
Bicipital groove		
Pectoralis major		
SC joint		



ROM & Joint Play: □ WNL

□ Painful arc: _____
□ Pain at end ROM: _____
□ Abnormal motion: _____

ROM	Active L	Active R	Passive L	Passive R
Flexion (180°)				
Extension (50°)				
Abduction (180°)				
Adduction (35°)				
Internal rotation (90°)				
External rotation (80°)				
Horizontal abd. (30°)				
Horizontal add. (130°)				
Scapulocostal rhythm				

Joint Play	L	R	Comments
Scapula			
Glenohumeral			
Scapulocostal			
AC joint			
SC joint			

Neurologic: □ WNL

Reflexes (0-5), □ WNL	L	R
Biceps (C5)		
Brachioradialis (C6)		
Triceps (C7)		
General grip strength		

Motor (0-5), □ WNL	L	R
Pec major clavicular (C8-C8)		
Pec major sternal (C7-T1)		
Latissimus dorsi (C6-C8)		
Subscapularis (C5-C7)		
Supraspinatus (C4-C6)		
Infraspinatus/teres minor (C4-C6)		
Serratus anterior (C5-C7)		
Biceps brachii (C5-C6)		
Triceps brachii (C6-C8)		
Deltoid (anterior) (C5-C6)		
Deltoid (middle) (C5-C6)		
Deltoid (posterior) (C5-C6)		
Pectoralis minor (C8-T1)		
Teres major (C6-C7)		
Rhomboids (C4-C5)		
Trapezius (lower) (C3-C4)		
Trapezius (middle) (C3-C4)		
Trapezius (upper) (CN IX)		
Levator scapulae (C4-C5)		

*General sensation is done through palpation

Orthopedic: □ WNL

Screening	L	R
Apley superior		
Apley inferior		
Codman arm drop		
Dugas		

Impingement	L	R
Hawkins-Kennedy		
Impingement sign		
Painful arc		
Passive Neer's		

Bicep tendonitis	L	R
Yergason's		
Speed's		
Bicipital instab. test		
Empty can		

Labral tear	L	R
Hyperabduction		
Clunk		
Crank		
Obrien's		

Instability	L	R
Anterior apprehen.		
Posterior drawer		
Load & shift		
Faegan's		

Other	L	R

DDx: _____

Signature: **Date:**

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

Shoulder & Arm

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Joint type: synovial
Ball & socket (glenohumeral)
Gliding (scapulothoracic)

Articular surfaces
Glenohumeral: *convex* (head of humerus) on *concave* (glenoid fossa)
Scapulothoracic: *concave* (subscapular fossa) *on convex* (posterior ribs)

Active range of motion (shoulder)
Flexion ..... **180°**
Extension ..... **60°**
Int./ext. rotation ..... **90°/80°**
Abduction ..... **180°**
Adduction ..... **35°**
Horizontal Add./Abd. ..**130°/45°**
Scapulohumeral (humerus: scapula)
120°:60° (2:1)

Main muscle actions
Flexion: anterior deltoid, biceps brachii, coracobrachialis, pectoralis major
Extension: posterior deltoid, latissimus dorsi, triceps brachii, teres major
Abduction: middle deltoid, supraspinatus
Adduction: latissimus dorsi, teres major, pectoralis major
Horizontal adduction: pectoralis major, coracobrachialis, anterior deltoid
Horizontal abduction: posterior deltoid, teres major
Internal rotation: subscapularis, pectoralis major, latissimus dorsi
External rotation: infraspinatus, teres minor

Resting position
GH: 55°-70° abduction, 30° horizontal abduction
Acromioclavicular: arm at side
Sternoclavicular: arm at side

Close packed position
Glenohumeral: maximal abduction & lateral rotation
Acromioclavicular: 90° abduction
Sternoclavicular: full elevation

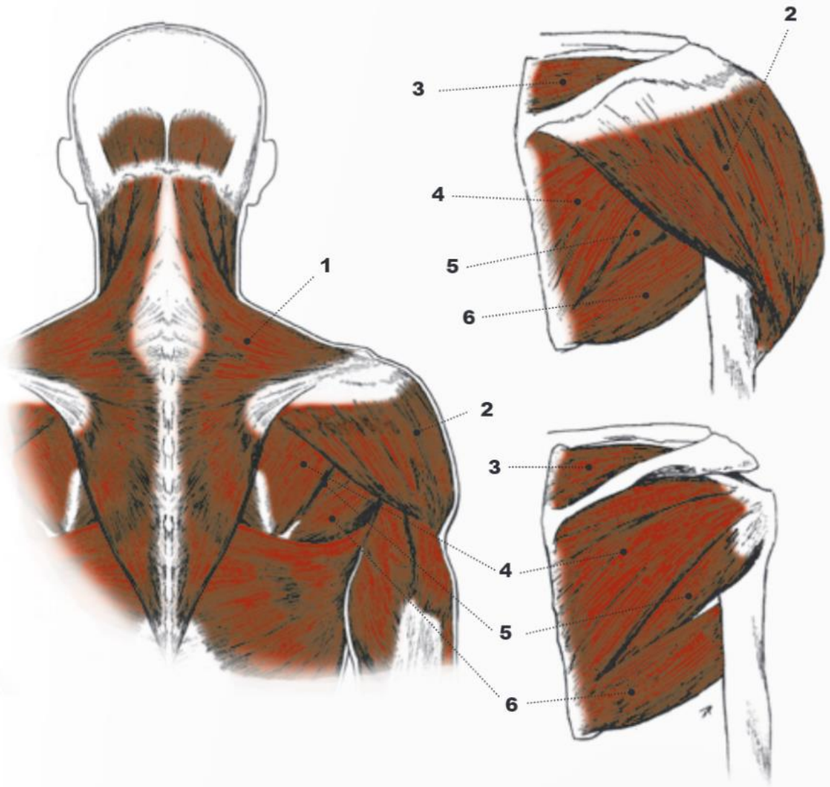
Normal end feel
Flexion: elastic, firm-bony contact
Abduction: elastic
Extension: firm
Internal/External : elastic / firm
Horizontal adduction: soft tissue
Horizontal abduction: firm/elastic

Abnormal end feel
Empty → subacromial bursitis
Hard capsular → frozen shoulder
Late myospasm → instability

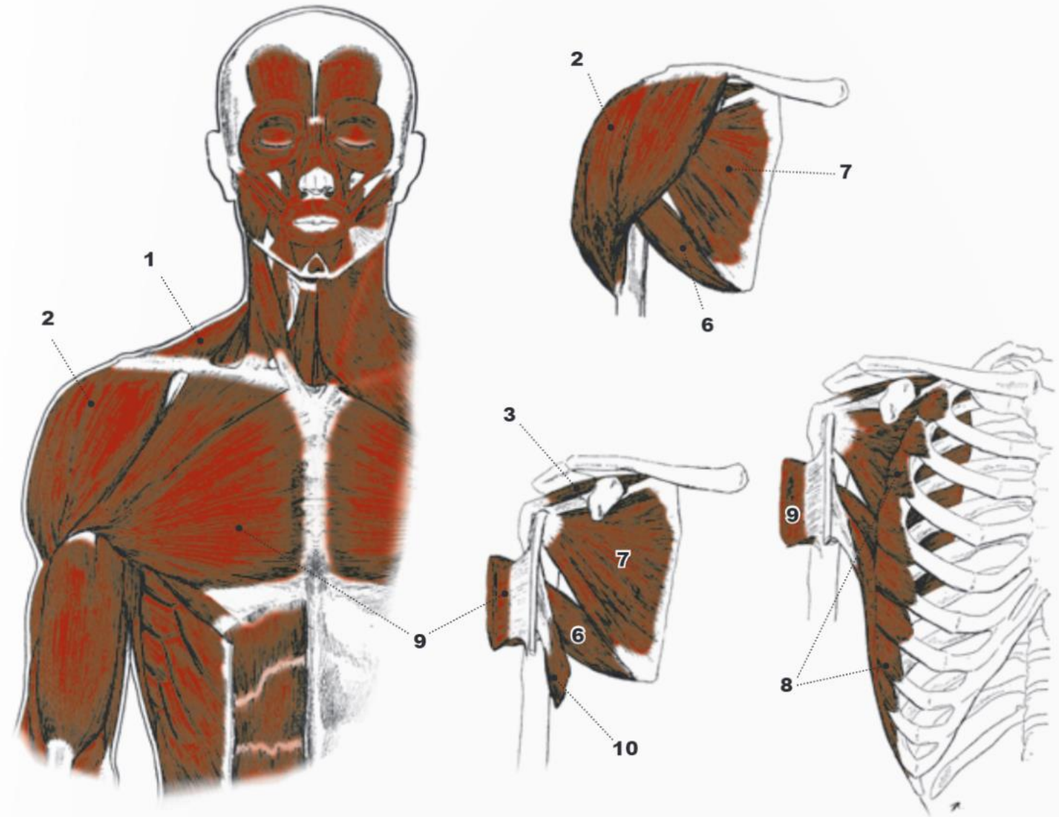
Capsular pattern of restriction
Glenohumeral: external rotation > abduction > internal rotation

Capsular pattern restrictions (detailed)
Posterior capsule: ↓ horizontal adduction, internal rotation & end range flexion, ↓ posterior glide
Posterior inferior capsule: ↓ elevation, internal rotation & horizontal adduction
Posterior superior capsule: ↓ internal rotation
Anterior superior capsule: ↓ end range flexion & extension, ↓ external rotation & horizontal abduction
Anterior capsule: ↓ abduction, extension, external rotation & horizontal adduction

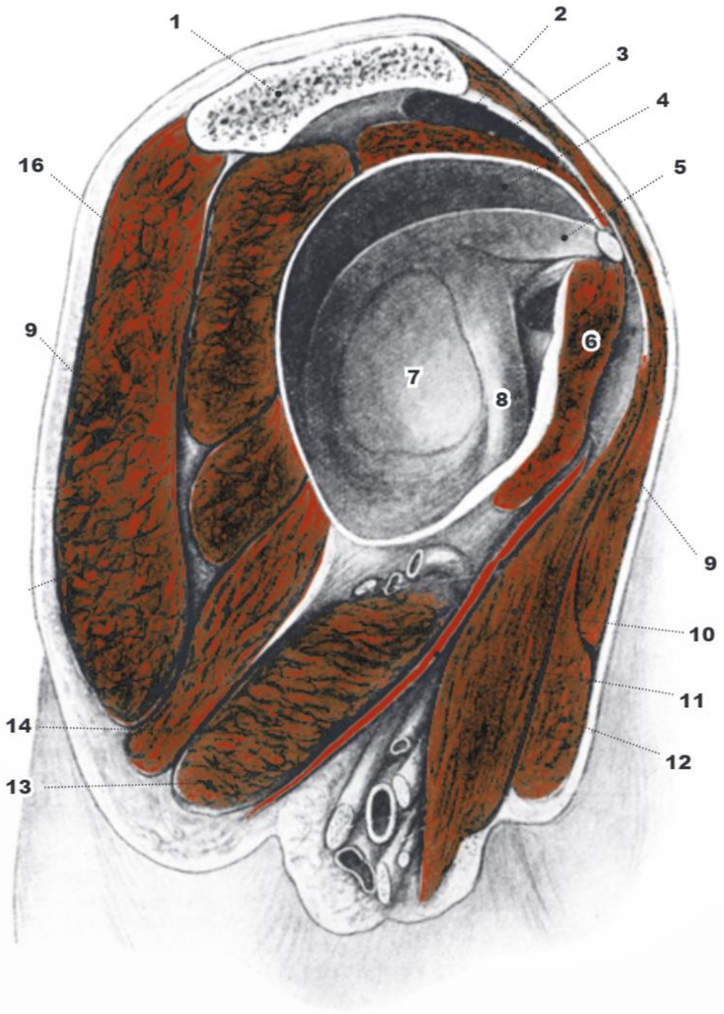




1. Trapezius
2. Deltoid
3. Supraspinatus
4. Infraspinatus
5. Teres minor
6. Teres major
7. Subscapularis
8. Serratus anterior
9. Pectoralis major
10. Latissimusdorsi

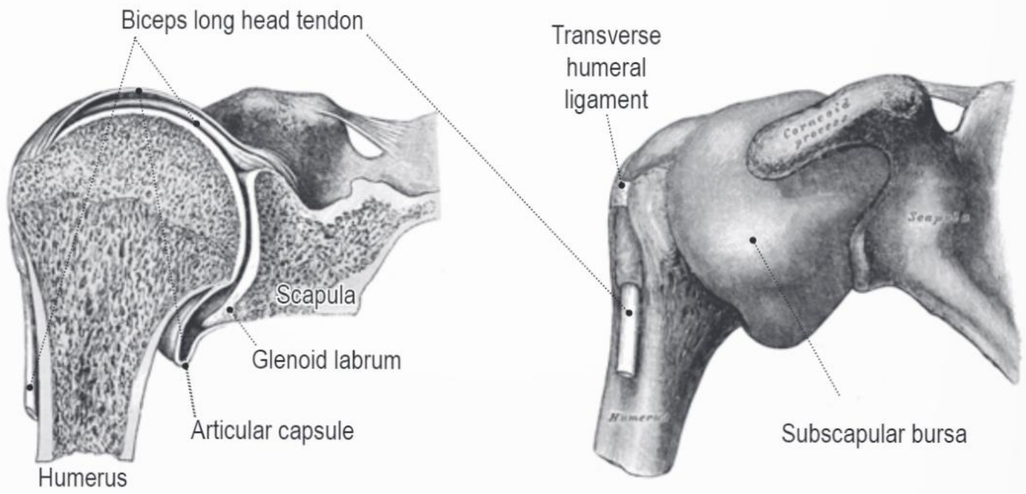


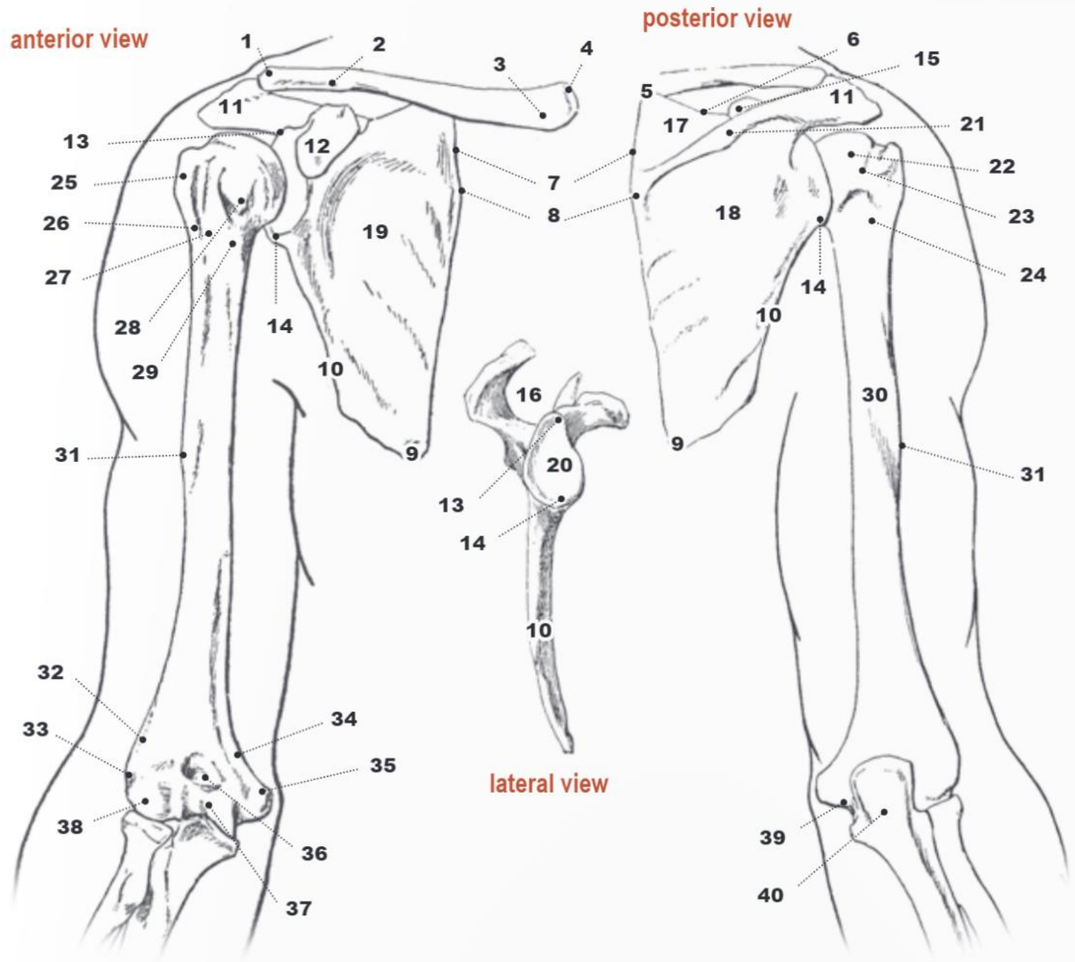
Lateral view of right shoulder



1. Acromion
2. Subacromial bursa
3. Supraspinatus
4. Articular capsule
5. Biceps brachii (long head)
6. Subscapularis
7. Glenoid fossa
8. Glenoid labrum
9. Deltoid
10. Biceps brachii (short head)
11. Latissimus dorsi
12. Pectoralis major
13. Teres major
14. Triceps (long head)
15. Teres minor
16. Infraspinatus

Anterior view of right shoulder





Clavicle

1. Acromial end
2. Conoid tubercle
3. Costal tubercle
4. Sternal end

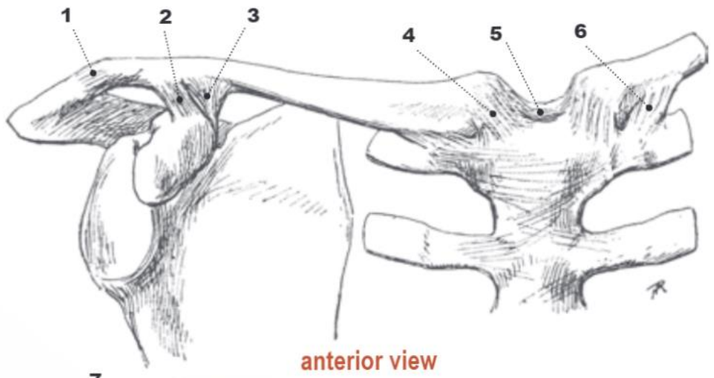
Scapula

5. Superior angle
6. Superior border
7. Medial (vertebral) border
8. Medial angle
9. Inferior angle
10. Lateral (axillary) border
11. Acromion
12. Coracoid process
13. Supraglenoid tubercle
14. Infraglenoid tubercle
15. Suprascapular notch
16. Spinoglenoid notch
17. Supraspinous fossa
18. Infraspinous fossa
19. Subscapular fossa
20. Glenoid fossa
21. Spine of the scapula

Humerus

22. Head
23. Anatomical neck
24. Surgical neck
25. Greater tubercle
26. Crest of greater tubercle
27. Intertubercular sulcus (bicipital groove)
28. Lesser tubercle
29. Crest of lesser tubercle
30. Radial/spiral groove
31. Deltoid tuberosity
32. Lateral supracondylar ridge
33. Lateral epicondyle
34. Medial supracondylar ridge
35. Medial epicondyle
36. Coronoid fossa
37. Trochlea
38. Capitulum
39. Notch for the ulnar nerve
40. Olecranon

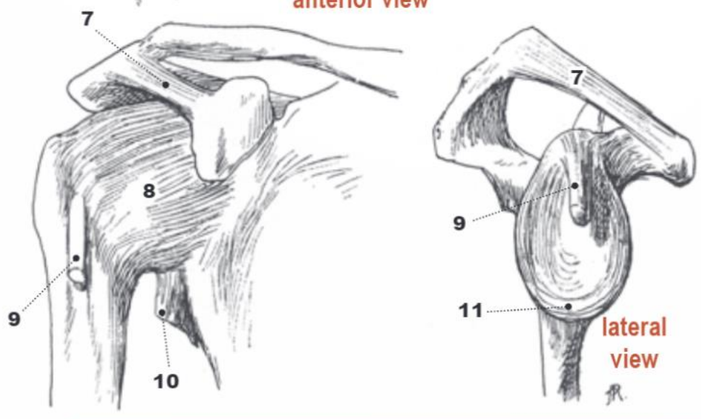
Shoulder Anatomy Review



1. **Acromioclavicular (AC) joint**
2. Trapezoid ligament
3. Conoid ligament

Sternoclavicular (SC) joint

4. Anterior SC ligament
5. Interclavicular ligament
6. Costoclavicular ligament

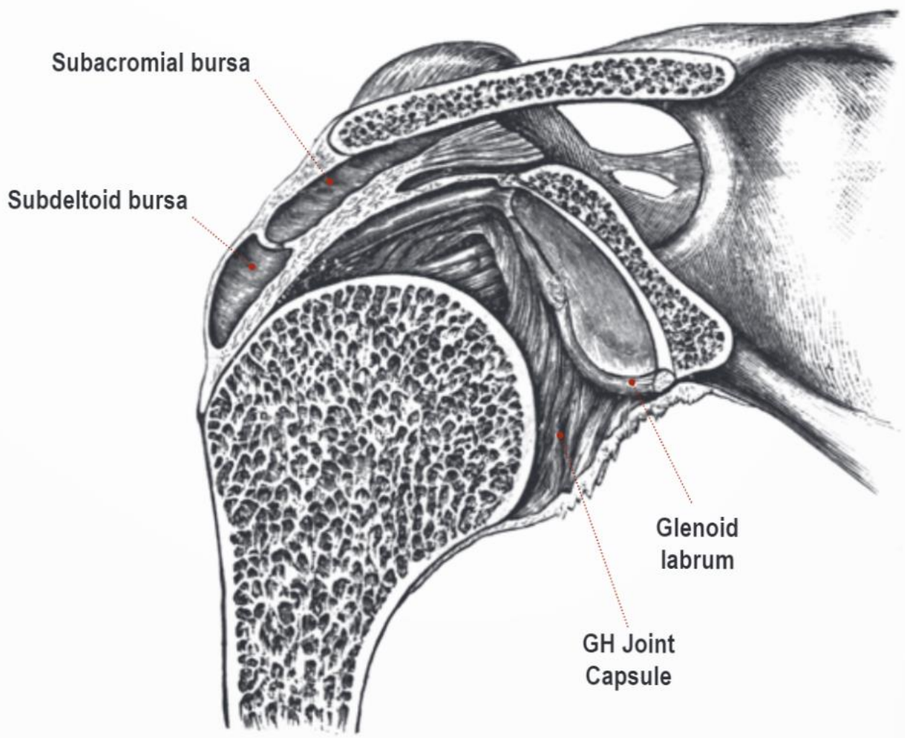


Glenohumeral (GH) joint

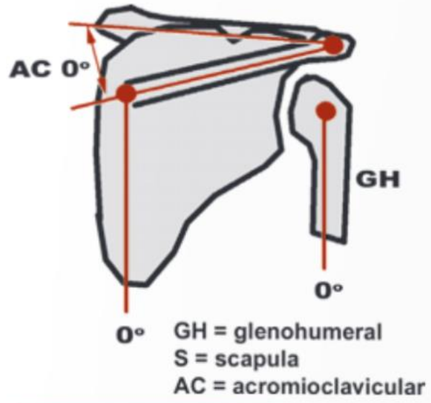
7. Coracoacromial ligament
8. Joint capsule
9. Biceps brachii long head tendon
10. Triceps brachii long head tendon
11. Glenoid labrum

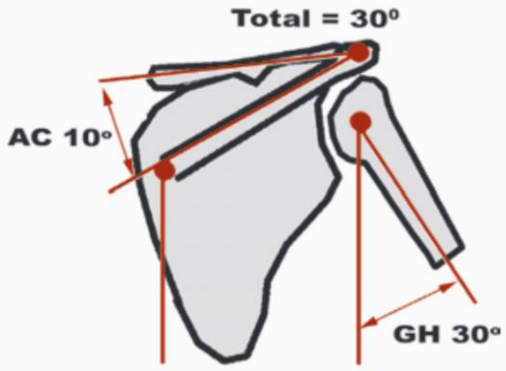
Scapulothoracic joint

Not considered a true joint, it is the space between the scapula & thoracic cage & consists of muscle, connective tissue & bursa that allow for gliding type motions



Scapulohumeral Rhythm





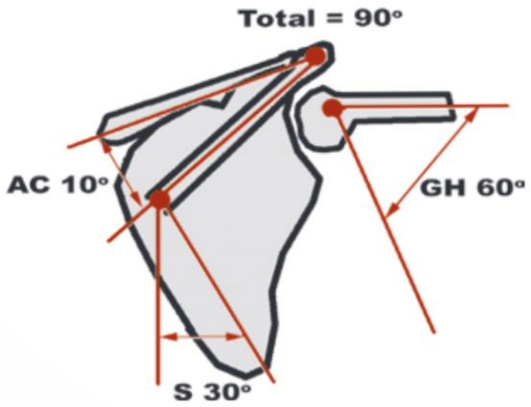
Resting phase (neutral)	Phase 1 (0°-30°)
Shoulder ROM is measured from standard anatomical position	Important abductors Deltoid (60%-70%) Supraspinatus (30%-40%) When arm is externally rotated, long head of biceps will help in abduction (coracobrachialis & biceps short head help with GH flexion when the arm externally rotated)
Shoulder hiking (elevation) in phase 1 may indicate shoulder pathology	**Rotator cuff as a group** Depresses humerus*, cancels superior translation by deltoid
GH: 120°	**GH:** 15°-20°, superior roll with inferior slide
Shoulder Girdle (Scap./SC/AC): 60°	**Scapula:** 10°-15°, external rotation Serratus anterior is the major stabilizer, at this point, of the shoulder girdle. Upper & lower trapezius are minor stabilizers at this point
Total Motion = 180°, 2:1 (GH:S)	**SC:** Distal end elevates 10°-15° Superior roll with inferior glide (same as GH) Upper trapezius is not very active
Clavicle follows the humerus	
The inferior capsule folds like an accordion, & unfolds for abduction, loss of this motion = *"frozen shoulder" or adhesive capsulitis*	
Most important shoulder girdle stabilizer is serratus anterior	
Rotator cuff = SITS muscles **S**upraspinatus **I**nfraspinatus **T**eres minor **S**ubscapularis	

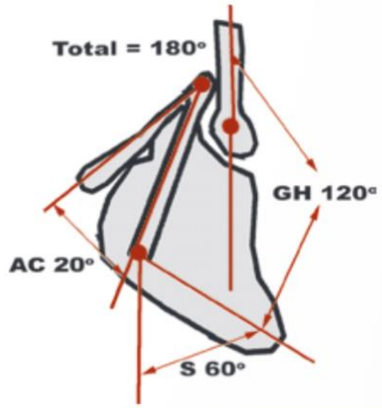
GH = glenohumeral joint, AC = acromioclavicular joint, SC = sternoclavicular joint

*note that the action of supraspinatus is not to directly depress the humerus, rather the space occupied by the muscle helps keep the humerus inferior, following a full supraspinatus rupture it is possible to observe the humerus in an elevated position relative to the glenoid fossa on MRI or X-ray

Scapulohumeral rhythm serves at least two purposes:

1. It preserves the length-tension relationships of the glenohumeral muscles; the muscles do not shorten as much as they would without the scapula's upward rotation, so they can sustain their force production through a larger portion of the range of motion
2. It prevents impingement between the humerus & the acromion. Because of the difference in size between the glenoid fossa & the humeral head, subacromial impingement can occur unless relative movement between the humerus & scapula is limited. Simultaneous movement of the humerus & scapula during shoulder elevation limits relative (arthrokinematic) movement between the two bones





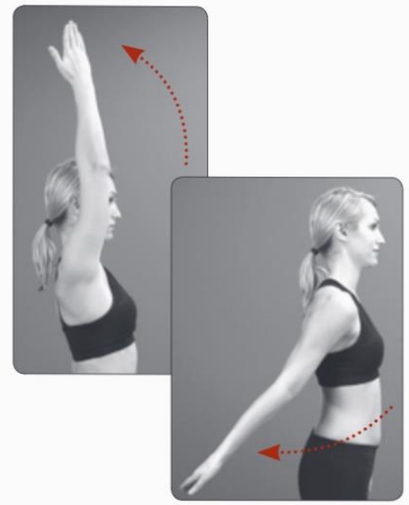
Phase 2 (30°-90°)	Phase 3 (90°-180°)
GH: 40°-45° (55°-65° total)	**GH:** 60° (120° total)
Superior roll with inferior slide	Deltoid & supraspinatus still active, but biceps join in after 90°; above 90° rotator cuff & ligaments act to depress, externally rotate & stabilize the joint
Deltoid & supraspinatus - abduction	Biceps also help depress the humerus
Rotator cuff - depress & externally rotate	Triceps long head tendon resists inferior translation
Greatest impingement: 70°-120°	Pectoralis major & subscapularis reinforce anterior capsule & resists anterior translation & dislocation
Scapula: 15°-20° (30° total)	Inferior glenohumeral ligament most important anterior capsule ligament
Externally rotates	Structures that resist abduction: inferior capsule, latissimus dorsi, pectoralis major, teres major, subscapularis, inferior GH ligament, long head of triceps (resist inferior translation)
Serratus anterior prevents winging	
Upper & lower trapezius - forces couple & cancel each other out	**Scapula:** 30° (60° total) upper more than lower trapezius, serratus anterior externally rotates scapula
SC: 15°-20° (30° total)	Structures that limit external rotation; rhomboids (esp. if tight), lower trapezius, upper trapezius
Elevation of distal clavicle due to superior roll & inferior glide	**SC:** rotates externally & points upwards
At end of 1st 30° the coracoclavicular ligaments (conoid & trapezoid) become taut & stop the superior roll & inferior slide that make up the hinge action, this will cause rotation in the 3rd phase	Crank-shaped clavicle allows elevation at distal end, while proximal rotates, this causes a 30° elevation at the distal clavicle due to taut coracoclavicular ligaments, which stop the hinge & cause rotation, this is resisted by costoclavicular ligaments from the 1st rib & eccentric contraction of the subclavius
AC: twisting/rotation: 0°-5° (10°-15° total) AC: 5°-10° scapula rotation	**AC:** 10° (20° total) final 10° rotation during phase 1-2
	the AC rotation is due to scapular rotation; the AC is the weak link in abduction

Shoulder Stability

Muscles provide a full 50% of the GH joint stability (bone shape, glenoid labrum & ligaments provide the other 50%)

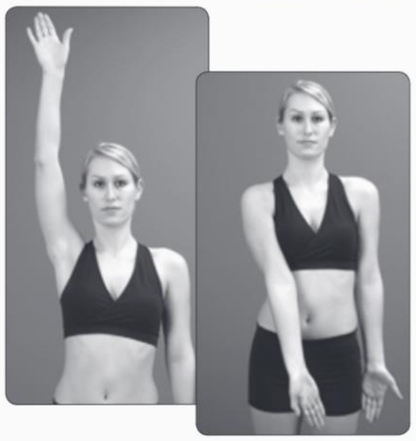
GH = glenohumeral joint, AC = acromioclavicular joint, SC = sternoclavicular joint

Compare bilaterally, examiner should make an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."



Flexion (160°-180°)
Muscles Activated: deltoid (anterior fibers), biceps brachii, pectoralis major & coracobrachialis (1st 60° only)
Tissue Stretched: latissimus dorsi, teres major, pectoralis major (lower fibers), triceps brachii (long head), inferior GH capsule, conoid ligament
Tissue Compressed: supraspinatus tendon, subdeltoid bursa, upper GH joint capsule

Extension (40°-60°)
Muscles Activated: deltoid (posterior fibers), latissimus dorsi, teres major/minor, infraspinatus, triceps brachii
Tissue Stretched: deltoid (anterior fibers), biceps brachii, pectoralis major, anterior GH capsule
Tissue Compressed: posterior GH capsule



Abduction (160°-180°)
Muscles Activated: supraspinatus, deltoid (middle fibers), trapezius, serratus anterior
Tissue Stretched: latissimus dorsi, teres major, pectoralis major (lower fibers), triceps brachii (long head), inferior GH capsule, conoid ligament
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Adduction (30°-40°)*
Muscles Activated: deltoid (anterior fibers), pectoralis major, latissimus dorsi, teres major, coracobrachialis, trapezius
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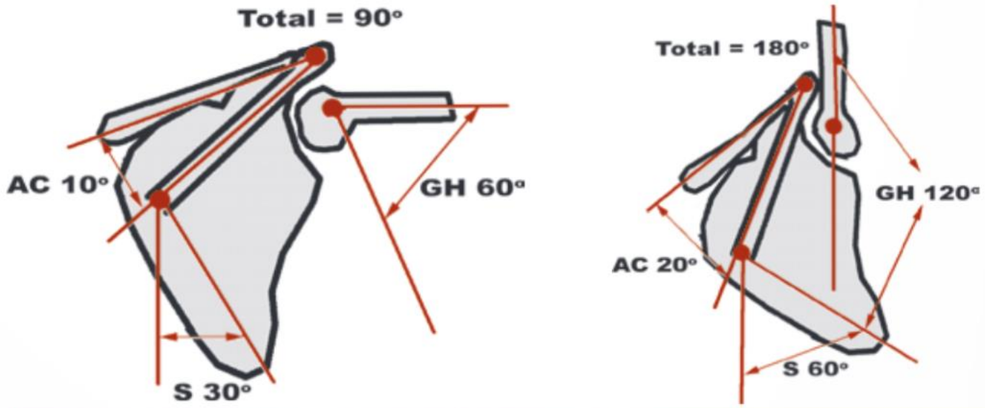


Lateral Rotation (80°-100°)**
Muscles Activated: infraspinatus, teres minor, posterior deltoid
Tissue Stretched: pectoralis major, subscapularis, anterior GH capsule
Tissue Compressed: posterior GH capsule

Medial Rotation (70°-90°)**
Muscles Activated: pec major, subscapularis, anterior deltoid, teres major, latissimus dorsi
Tissue Stretched: infraspinatus, teres minor, posterior deltoid posterior GH capsule
Tissue Compressed: anterior GH capsule

*Adduction may also be assessed with the patient moving the arm behind their back
**Medial & lateral rotation should be tested with the shoulder in neutral & again abducted 90°
Horizontal adduction & abduction & scapular movements may also be assessed as part of AROM

Scapulohumeral Rhythm



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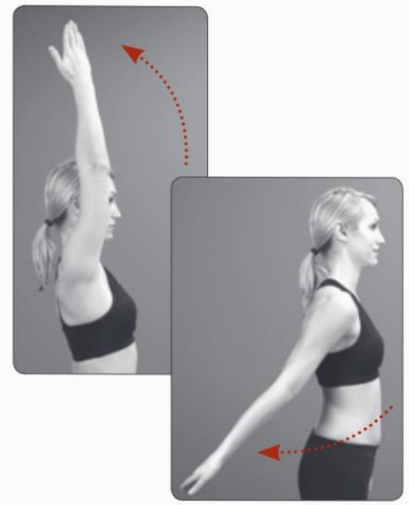
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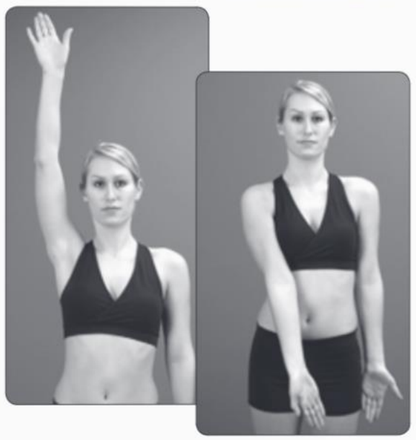
Shoulder AROM

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Extension (40°-60°)
Muscles Activated: deltoid (posterior fibers), latissimus dorsi, teres major/minor, infraspinatus, triceps brachii
Tissue Stretched: deltoid (anterior fibers), biceps brachii, pectoralis major, anterior GH capsule
Tissue Compressed: posterior GH capsule



Abduction (160°-180°)
Muscles Activated: supraspinatus, deltoid (middle fibers), trapezius, serratus anterior
Tissue Stretched: latissimus dorsi, teres major, pectoralis major (lower fibers), triceps brachii (long head), inferior GH capsule, conoid ligament
Tissue Compressed: supraspinatus tendon, subdeltoid bursa, upper GH joint capsule

Adduction (30°-40°)*
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Tissue Compressed: pectoralis major, AC & SC joint, anterior GH capsule



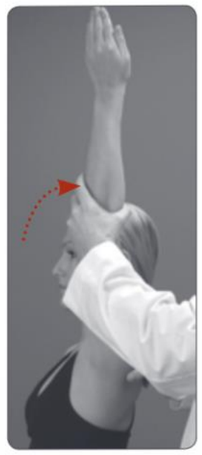
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Tissue Compressed: posterior GH capsule

Medial Rotation (70°-90°)**
Muscles Activated: pec major, subscapularis, anterior deltoid, teres major, latissimus dorsi
Tissue Stretched: infraspinatus, teres minor, posterior deltoid posterior GH capsule
Tissue Compressed: anterior GH capsule

*Adduction may also be assessed with the patient moving the arm behind their back
**Medial & lateral rotation should be tested with the shoulder in neutral & again abducted 90°
Horizontal adduction & abduction & scapular movements may also be assessed as part of AROM

Compare bilaterally; if possible palpate joint during PROM & use the shortest lever possible, start with unaffected; apply over pressure at end ROM; introduction statement:
"If any of the actions or movements are painful or uncomfortable please let me know."

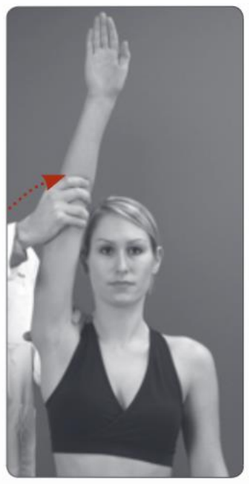
Flexion (> 160°-180°)
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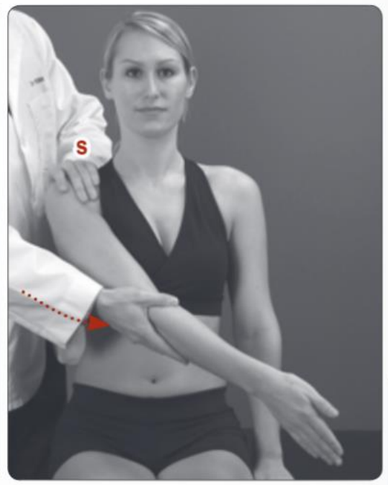




Extension (> 40°-60°)
Tissue Stretched: deltoid (anterior fibers), biceps brachii, pectoralis major, anterior GH capsule
Tissue Compressed: posterior GH capsule

Abduction (> 160°-180°)
Tissue Stretched: latissimus dorsi, teres major, pectoralis major (lower fibers), triceps brachii (long head), inferior GH capsule, conoid ligament
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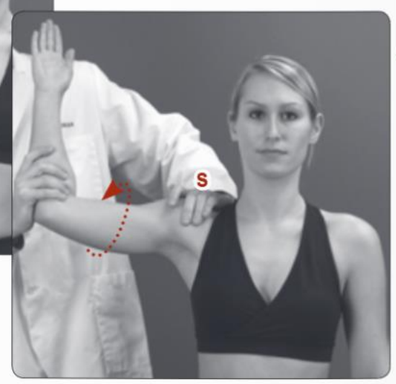




Adduction (> 30°-40°)
Tissue Stretched: deltoid (middle fibers), posterior GH capsule
Tissue Compressed: pectoralis major, AC & SC joint, anterior GH capsule

Medial Rotation (> 70°-90°)
Tissue Stretched: infraspinatus, teres minor, posterior deltoid posterior GH capsule
Tissue Compressed: anterior GH capsule





Lateral Rotation (> 80°-100°)
Tissue Stretched: pectoralis major, subscapularis, anterior GH capsule
Tissue Compressed: posterior GH capsule

*shoulder PROM may also be assessed with the patient supine

AC Shear Test ★★★★

Procedure
Patient seated, examiner cups hands over clavicle & spine of scapula then proceeds to apply a compressive force

Interpretation
(+) Pain or abnormal movement → AC joint pathology, AC ligament sprain

Clinical notes
Clinician's option: test may be modified to stress the coracoacromial ligaments, patient side lying on unaffected side, examiner stabilizes the clavicle & pulls inferior angle of scapula away from chest wall, procedure is then repeated with examiner pulling the medial border of the scapula away the chest wall



AC Resisted Extension Test ★★★★★

Procedure
Patient seated with elbow & shoulder flexed 90°; examiner stabilizes elbow & asks patient to horizontally adduct shoulder, examiner resists action

Interpretation
(+) Pain in AC joint → AC joint pathology

Clinical notes
Only one was found in our extensive literature review that indicates good diagnostic value (SN: 72 SP: 85 +LR: 4.8 -LR: 0.32)[14]



AC Joint Palpation ★★★★

Procedure
Patient seated with arm relaxed at side; examiner palpates the AC joint & observes for signs of pain

Interpretation
(+) Pain in AC joint → AC joint pathology

Clinical notes
Like all other forms of palpation, AC joint palpation is useful as a screening test to help rule out AC pathology (SN: 96 SP: 10 +LR: 1.1 -LR: 0.40)[63]



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Anterior Apprehension Test ★★★★★

Procedure

Patient seated or supine, shoulder abducted 90° elbow flexed 90°; examiner gently applies P-A pressure over the humerus & observes patient for signs of apprehension or discomfort (grimace or pulls away)

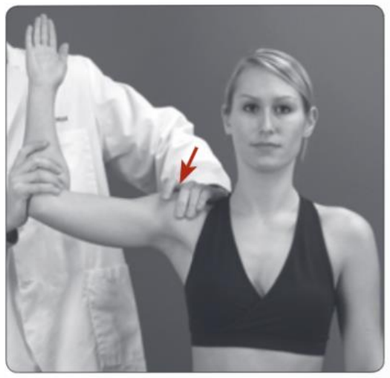
Interpretation

(+) Excessive anterior translation, dislocation or patient apprehension → anterior GH instability (SN: 53 SP: 99 +LR: 53 -LR: 0.47)[42, 57]

Clinical notes (grades of shoulder instability)

If the test is performed supine the examiner & better observe the patient's face for signs of apprehension

Grade	Description
Normal	0-25% translation
I	25-50% translation, humeral head riding up on glenoid labrum
II	50-75% translation, humeral head rides up & over glenoid labrum, but immediately reduces
III	> 75% translation & humeral head remains dislocated; in cases of severe instability diagnostic imaging should be an immediate follow-up (MRI, x-ray)

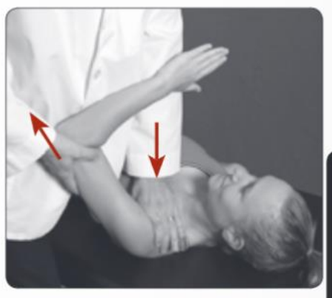


New Pain Provocation Test: examiner may choose to perform apprehension test action with forearm fully supinated & then forearm fully pronated (pronation increases stress on glenoid labrum & may show increase validity to rule in labral pathologies) - (SN: 100 SP: 90)[5]

Anterior Drawer ★★★★

Procedure

Patient supine, examiner grasps the patient's arm with one hand & palpates with the other hand over the coracoid process & posterior scapula (attempt to stabilize scapula); examiner then applies long axis distractions on the humerus



Interpretation

(+) ↑ motion or apprehension → Anterior glenohumeral instability

(+) Local pain → rotator cuff ligament damage

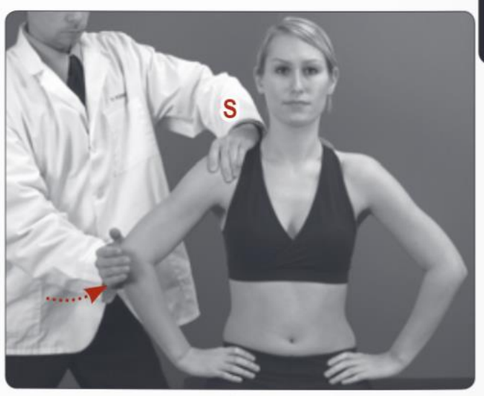
Clinical notes

A palpable click or clunk may be noted as the humerus subluxates in & out of the glenoid fossa

Anterior Slide Test ★★★★★

Procedure

Patient seated or standing, with hands on hips so thumb is posterior; examiner stabilizes shoulder (scapula & clavicle) & applies an anterior-superior force to the ipsilateral olecranon & asks patient to resist action



Interpretation

(+) Anterior shoulder pain, crepitus → SLAP lesion, GH osteoarthrosis

Clinical notes

(SN: 8-78 SP: 84-93 +LR: 0.5-9.8 -LR: 0.24-1.1)[35, 45, 52, 55]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Apley's Inferior/Superior Scratch ★★★★

Synonym: hand to shoulder blade test



Procedure

Patient seated or standing, examiner instructs patient to place hand behind back & touch middle back inferiorly, then repeat superiorly

Interpretation

(+) Pain & inability to perform motion → rotator cuff pathology (bicipital or supraspinatus tendinitis), external GH rotator tightness or pathology, labral pathology, AC arthritis, capsular/muscle contracture

Clinical notes

There is often less flexibility during this maneuver on the dominant arm

Outcome marker: examiner may choose to measure distance to T1 SP & recheck through treatment plan

Back Rub Test ★★★★

Procedure

Patient seated or standing, examiner instructs patient to place hand inferiorly behind their back & slide it horizontally as far as possible



Interpretation

(+) Pain & inability to perform motion → rotator cuff pathology, ipsilateral coracobrachialis MFTPs, glenoid labrum lesion

Clinical notes

Patients should be able to reach so their metacarpophalangeal joints slide past the midline of their back

Bear Hug Test ★★★★

Procedure

Patient seated, patient places palm of affected extremity on contralateral shoulder, examiner applies upward force while patient resists



Interpretation

(+) Examiner able to lift hand or pain → tear of at least 30% of subscapularis fibers

Clinical notes

Test test should be performed in 2 positions, shoulder flexed 45° tests upper fibers, shoulder flexed 90° tests lower fibers (SN: 60 SP: 92)[5, 68]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Biceps Load Test II ★★★★★



Procedure

Patient supine or seated, shoulder abducted ~120° & elbow flexed ~90°; examiner fully externally rotates shoulder then asks patient to flex elbow while resisting action

Interpretation

(+) Anterior shoulder pain → SLAP lesion (R: 0.82 SN: 90 SP: 97 +LR: 26.4 -LR: 0.11)[5, 37, 38]

Clinical notes: This test is very reliable (valid) test for the diagnosis SLAP lesions

Remember biceps tendon attaches to the superior labrum; when the examiner applies a resistive force to elbow flexion, biceps contracts & pulls on injured labrum

Clunk Test ★★★★★



Procedure

Patient seated or supine shoulder abducted ~150°; examiner rotates humerus externally & applies anterior pressure on the humeral head

Interpretation

(+) Shoulder pain & crepitus (grinding or popping) → glenoid labral lesion, anterior instability

Clinical notes

This test is also similar to the anterior apprehension test of the shoulder & may elicit similar symptomatology in patients with unstable shoulders

(SN: 44 SP: 68 +LR: 1.4 -LR: 0.82)[52]

Codman's Arm Drop Test ★★★★★

Procedure

Patient seated, examiner passively abducts shoulders to 90° with solid support, then suddenly let's go & asks patient to catch themselves

Interpretation

(+) Pain/weakness or "racheting" movement → "painful arc syndrome," bursitis, rotator cuff strain or tear, tendinitis/impingement

(+) Unable to catch self → (less than +3/5 muscle strength) → severe injury (grade 3 cuff strain)



Clinical notes

If grade 3 strain (full thickness tear) is suspected diagnostic imaging is warranted

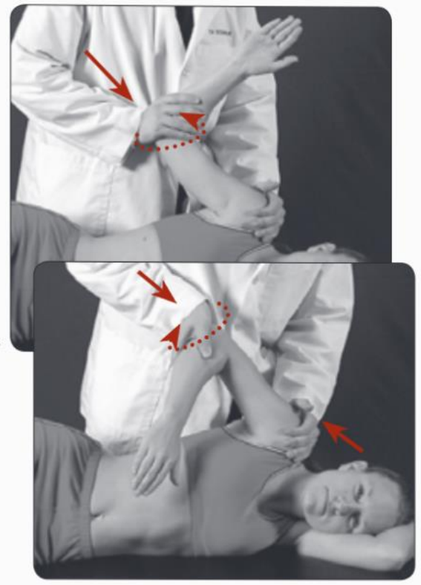
Examiner should be ready to catch patient's arms in case it is too painful for the patient to overcome gravity

Test is useful to rule in supraspinatus tear

(R: 0.28-0.66 SN: 8-27 SP: 88-100 PPV: 100 +LR: 2.6-5 -LR: 0.83-0.94)[5, 13, 40, 44, 46]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Compression-Rotation Test ★★★★



Procedure

Patient sidelying or supine, examiner flexes patient's elbow to 90° & abducts the patient's arm to ~30°; examiner then applies long axis compression to the humerus (pushes up on elbow) & rotates humerus internally, externally & circumducts

Interpretation

(+) Shoulder pain & crepitus (grinding or popping) → Glenoid labral lesion, GH DJD

Clinical notes

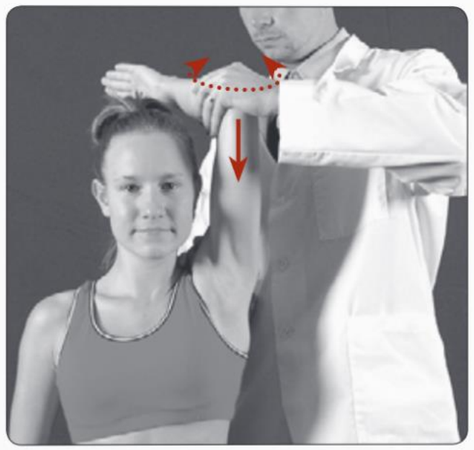
Labral lesions are also known as SLAP (Superior Labrum Anterior Posterior) or Bankhart lesion (SN: 24 SP: 76 +LR: 1 -LR: 1)[45]

Test is effectively a scour test for the GH joint

Patients with significant arthritis usually present with pain & loss of motion in the shoulder

Precipitating factors to GH degeneration may include trauma, RA, rotator cuff pathologies, osteonecrosis, infection

Crank Test ★★★★★



Procedure

Patient seated or supine with shoulder abducted ~180° & elbow flexed 90°; examiner applies long axis compression & rotates humerus internally & externally

Interpretation

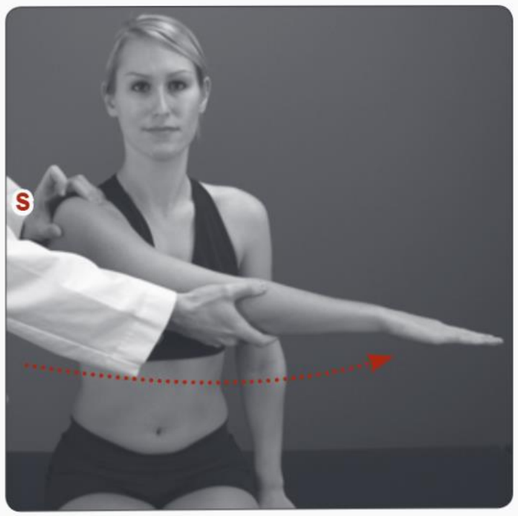
(+) Shoulder pain & crepitus (grinding or popping) → glenoid labral lesion

Clinical notes

Test shows good specificity for labral tears

(SN: 46-91 SP: 93 +LR: 1-7 -LR: 0.1-0.96)[41, 52, 61]

Cross-Body Test ★★★★★



Procedure

Patient seated with shoulder abducted ~90°; examiner stabilizes posterior shoulder & applies a horizontal adduction force over the patients elbow

Interpretation

(+) Superior shoulder pain → Acromioclavicular joint pathology

(+) Anterior shoulder pain → Subscapularis, supraspinatus &/or biceps long head pathology

(+) Posterior shoulder pain → Infraspinatus, teres minor &/or posterior joint capsule lesion

Clinical notes

This test is a good indicator of AC pathology

(SN: 23-90 SP: 29-82 +LR: 1.1-3.7 -LR: 0.29-0.93)[13, 14, 54, 56]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Dugas/Yochum's Test ★★★★



Procedure
Patient seated; examiner instructs patient to reach across body, place hand on opposite shoulder & elevate elbow

Interpretation
(+) Pain → Impingement - Yochum's test used in combination with Hawkin's & Neer's Test (SN: 65 SP: 73)[5]
(+) Inability to complete test → shoulder dislocation, GH contracture

Clinical notes
History should lead to diagnosis of shoulder dislocation; with shoulder dislocations there is **always** associated rotator cuff, capsule or glenoid labral damage

Empty Can Test ★★★★★



Procedure
Patient standing or seated, actively raises straight arm (palm up) to 120° in scaption (scapular) plane; at apex patient internally rotates arm (thumb down "empty can"), then lowers straight arm internally rotated slowly to the body

Interpretation
(+) Pain or weakness → injury or lesion of supraspinatus muscle (SN: 44-89 SP: 50-90 +LR: 1.8-4.2 -LR: 0.22-0.63)[29, 54, 56]

Clinical notes
Refer to scapulohumeral rhythm (page 64-65) for detailed shoulder abduction parameters
Clinician's option: both arms may be done simultaneously & examiner may apply over pressure at the apex of shoulder abduction or during entire motion

External Rotation Lag Sign ★★★★★



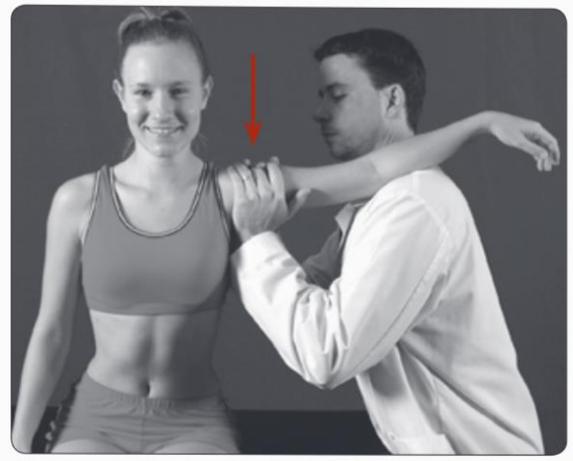
Procedure
Patient seated; examiner stabilizes patients elbow & wrist and place elbow at 90° & shoulder at 20° abduction, examiner then externally rotates shoulder to near end ROM & instructs patient to hold position then releases wrist stabilization

Interpretation
(+) Patient unable to maintain position → infraspinatus or supraspinatus tear

Clinical notes
Also see internal rotation lag test
(SN: 70-100 SP: 100)[26, 62]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Faegan's Test ★★★★

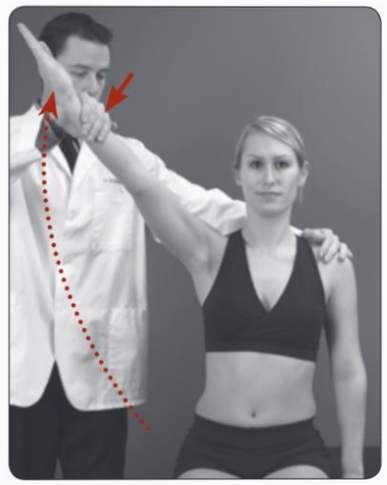


Procedure
Patient seated, shoulder abducted 90° with palm facing down & elbow resting on examiner's shoulder; seated examiner applies downward pressure on patient's arm near humeral head

Interpretation
(+) "Clunk" or excessive inferior translation → Inferior or multidirectional glenohumeral instability
(+) Local pain → rotator cuff ligament/tendon damage

Clinical notes
A palpable click or clunk may be noted if humerus subluxates out of the glenoid fossa

Full Can Test ★★★★★

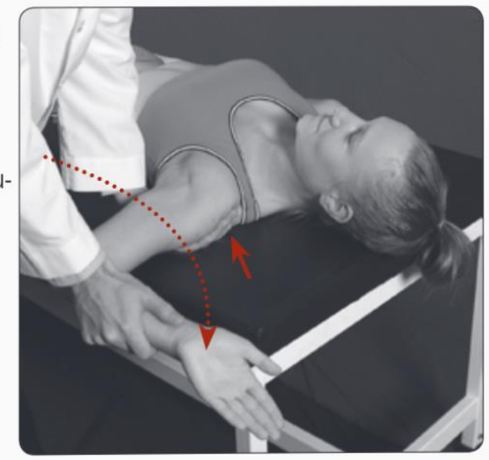


Procedure
Patient seated, actively raises straight arm (palm up) to ~120° in scaption (scapular) plane; at apex examiner applies downward pressure & notes patient strength

Interpretation
(+) Pain or weakness → injury or lesion of supraspinatus muscle

Clinical notes
Test is a less painful alternative to the empty can test, but does show relatively poor statistical value
(R: 0.45 SN: 86 SP: 57 +LR: 2 -LR: 0.25)[29, 33]

Fulcrum Test ★★★



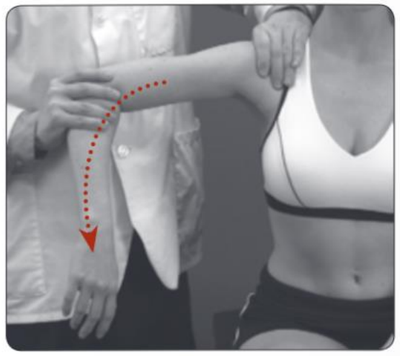
Procedure
Patient supine with shoulder abducted 90° & elbow flexed 90°; examiner places hand under glenohumeral joint & externally rotates the patient's arm over head

Interpretation
(+) Apprehension or increased motion → Anterior glenohumeral instability
(+) Local pain → Rotator cuff ligament/tendon damage

Clinical notes
A palpable click or clunk may be noted as the humerus subluxates in & out of the glenoid fossa
Test is effectively a supine anterior apprehension test

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Hawkins-Kennedy Test ★★★★★



Procedure

Patient seated shoulder abducted 90°, elbow flexed 90°; examiner internally rotates & horizontally adducts shoulder to pinch greater tuberosity of humerus against acromion

Interpretation

(+) Pain (anterolateral shoulder) → supraspinatus impingement (R: 0.18-0.43 SN: 50-100 SP: 44-76 +LR: 1.2-3.3 -LR: 0.18-0.75)[5, 10, 13, 44, 52], rotator cuff tear; crepitus may indicate osteoarthrosis

Clinical notes

This maneuver may also compresses the supraspinatus tendon against the coracoclavicular ligaments & the coracoid process

This test performed alone does not have good diagnostic accuracy; when clustered the following may be noted: 1. (+) hawkins-kennedy impingement sign, 2. (+) painful arc sign, and 3. weak or painful infraspinatus manual muscle test =

Cluster Diagnostic Accuracy:

- If all 3 tests are positive, the +LR increases to 10.56 & if all 3 tests are negative, the -LR is .17
- If 2/3 tests are positive, the +LR drops to 5.01; If 1/3 are positive +LR is .90

Hyperextension Test ★★★★



Procedure

Patient seated shoulder extended & elbow fully flexed; examiner passively extends patient's shoulder & straightens elbow

Interpretation

(+) Pain in shoulder with elbow flexed → shoulder joint/capsule issue, rotator cuff tear

(+) Pain in anterior shoulder with elbow extended → biceps tendinitis

Clinical notes

Patients with MFTPs in the biceps brachii may also demonstrate reduced motion &/or anterior shoulder

Internal Rotation Lag Sign ★★★★★



Procedure

Patient seated, affected arm behind back; examiner stabilizes patients elbow & wrist and lifts arm away from back, examiner instructs patient to hold position then releases wrist stabilization

Interpretation

(+) Patient unable to maintain position → Subscapularis tear

Clinical notes

Test shows excellent initial statistical value (SN: 97 SP: 96 +LR: 24 -LR: 0.03)[26]

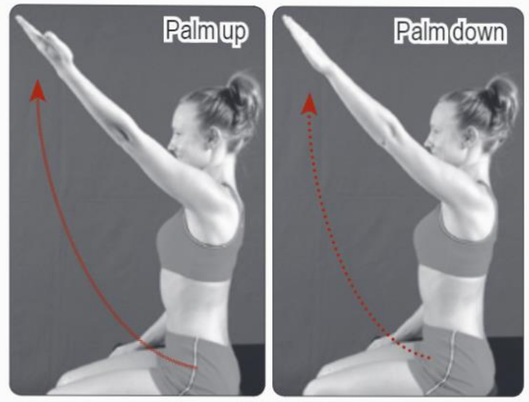
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Impingement Sign ★★★★

Procedure

Patient seated or standing, 2 parts:

1. Patient actively flexes shoulder with palm up (arm externally rotated)
2. Patient actively flexes shoulder with palm down (arm internally rotated)



Interpretation

(+) Pain during active flexion → shoulder impingement

(+) Pain →

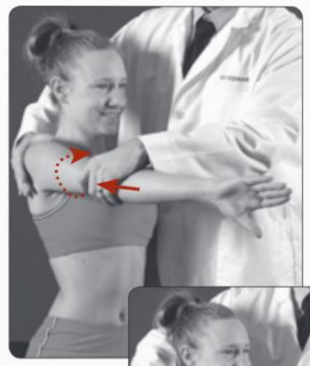
Internally rotated shoulder → supraspinatus impingement

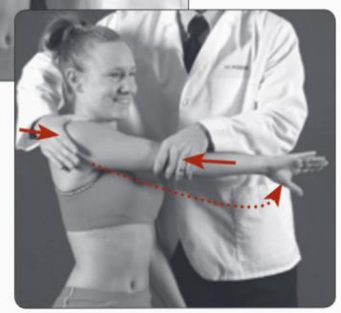
Externally rotated shoulder → biceps long head impingement

Clinical notes

Test should be followed up with Neer's impingement test (passive shoulder flexion)

Jerk Test ★★★★





Procedure

Patient seated, examiner flexes patient's arm to 90° & internally rotates glenohumeral joint, while applying long axis compression on the humerus; examiner then proceeds to horizontally adduct the shoulder across the front of the patient's body while maintaining the long axis compression

Interpretation

(+) Sudden jerk, clunk or patient apprehension as the arm is moved → Posterior GH instability or posterior labral lesion (SN: 25-73 SP: 80-98 +LR: 1.3-36.5 -LR: 0.27-0.94)[36, 39, 52]

Clinical notes

"Clunk" occurs as the humeral head slides posteriorly over the glenoid labrum (orthopedic subluxation), as the arm is returned to its original position the second clunk may be noted as the humeral head reduces

Clinicians option: it may be easier to develop long axis compression force with the patients elbow flexed 90° & pushing on the olecranon

Jobe/Apprehension-Relocation Test Modified ★★★★★

Procedure - Patient supine with shoulder abducted 120° & elbow flexed 90°; examiner externally rotates the patient's shoulder & applies a posterior force over the anterior humeral head & observes patient for pain or apprehension



Interpretation

(+) Apprehension or increased motion → Posterior glenohumeral instability

(+) ↓ Apprehension or pain → Anterior instability

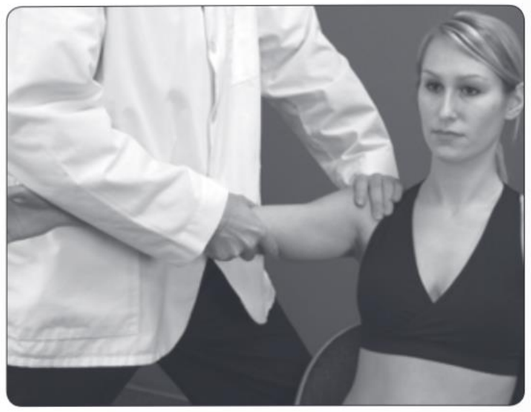
Clinical notes

The original Jobe test (Jobe et. al. 1989) had the shoulder abducted to 90° & showed poor statistical reliability [23, 42, 49, 52, 55, 60]

(SN: 92 SP: 100 +LR: 92 -LR: 0.08)[24]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Kim Test ★★★★★



Procedure - Patient seated with back supported; examiner stabilizes patient's elbow & middle humerus and flexes patient's shoulder in the scaption (scapular) plane, as shoulder flexion occurs examiner applies long axis compression to induce posterior-inferior glide of the humerus

Interpretation: (+) Pain in posterior shoulder → Posterior glenoid labrum pathology (SN: 80 SP: 94 +LR: 13.3 -LR: 0.21)[39]

Clinical notes:
Test induces similar forces to the Jerk test

Lippman's Test ★★★



Procedure - Patient seated with elbow flexed 90°, examiner grips forearm & palpates bicipital groove then internally & externally rotates humerus

Interpretation
(+) Tendon slipping out of groove → Torn transverse humeral ligament (bicipital instability)

Clinical notes
Many patients may have anatomical variations that result in a shallow bicipital groove which may predispose them to develop long head biceps brachii tendon subluxations

Lift-off Test ★★★★★



Procedure - Patient seated, standing or prone, patient rests dorsal surface of hand against sacrum/lumbar spine & attempts to move hand posteriorly; examiner may observe action or apply gentle resistance to motion - make sure the patient is rotating the shoulder & not extending shoulder! (consider stabilizing the elbow)

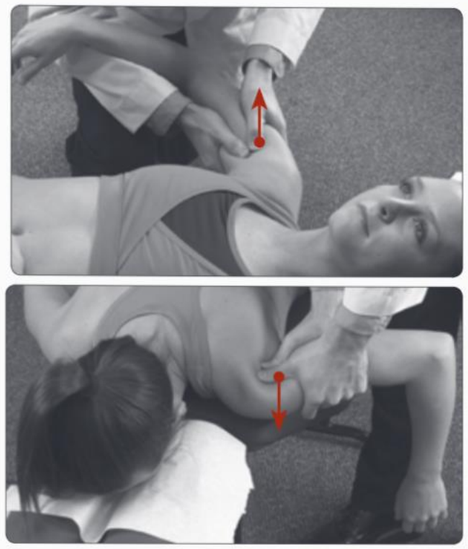
Interpretation
(+) Inability to lift hand off sacrum → Complete tear or paralysis on subscapularis muscle, subscapularis or rotator cuff lesion, subscapularis MFTP

Clinical notes
The lift off test mainly activates the lower fibers of the subscapularis (bear hug test activates mainly upper fibers) - consider measuring the distance from the patient's spine to the hand to get a quantitative outcome measure to evaluate treatment success

This test appears to be very specific to rule in the presence of a subscapularis tear, but may require ~70% muscle tear for (+) result (R: 0.32 SN: 62-92 SP: 100)[21, 26, 54]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Load & Shift Test ★★★★★



Procedure
Patient **supine**, prone or seated with shoulder near neutral; examiner applies pressure over humerus to "load" the GH joint while stabilizing shoulder, examiner then moves the shoulder anterior, posterior & inferior

Interpretation
(+) Excessive translation (should be < 25% anteriorly or < 50% posteriorly) → shoulder instability, labral tear, Bankart lesion (SN: 91 SP: 94)[5]
(+) Local pain → rotator cuff ligament/tendon damage

Clinical notes
A palpable click or clunk may be noted as the humerus subluxates in & out of the glenoid fossa
This test is difficult to perform on larger patients or by smaller clinicians

Ludington's Test ★★★

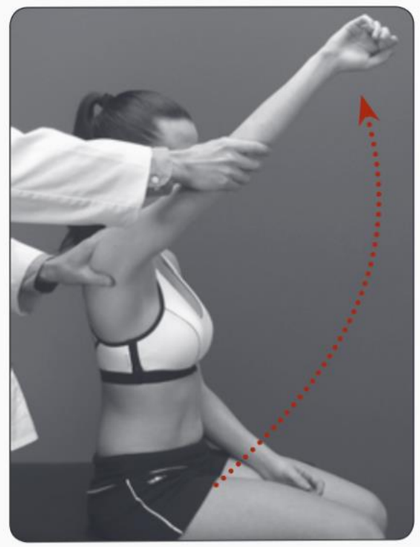


Procedure
Seated patient instructed to interlock fingers behind their head then asked to contract & relax biceps one at a time) examiner observes/palpates biceps

Interpretation
(+) No contraction either observed or palpated → Bicipital tendon rupture, paralysis of the musculocutaneous nerve

Clinical notes
With a biceps tendon rupture observation of the arm should reveal a balling of the biceps muscle, weakness with muscle testing & associated ecchymosis & edema

Neer's Test ★★★★★



Procedure
Patient seated with arms in dependent position; examiner first raises patient's straight arm through full range of flexion (passive ROM) with arm externally rotated (palm up), then motion repeated with arm internally rotated (palm down)

Interpretation
(+) Pain with internally rotated shoulder → supraspinatus impingement., subacromial bursitis
(+) Pain with externally rotated shoulder → biceps long head impingement

Clinical notes
There have been numerous studies with huge variations in both application & assessment, as such there is a huge span in the statistical data
(SN: 0-89 SP: 48-100 +LR: 0.83-2.2 -LR: 0.75-5.12)[5, 10, 13, 44, 52, 55, 56]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

O'Brien's / Active Compression Test ★★★★★

Procedure

Two-part test, patient seated shoulder flexed to 90° & arm adducted 10-20° (during both parts examiner pushes down on arm while patient attempts to maintain position)

1. Arm internally rotated (**thumb down**)
2. Arm & externally rotated (**palm up**)

DO NOT be fooled into thinking forearm supination/pronation = rotation at the shoulder - look at the cubital fossa to evaluate shoulder rotation





Interpretation

(+) GH pain or crepitus with internal rotation (thumb down) that is reduced or eliminated during external rotation (palm up) → anterior labral tear, SLAP lesion, AC pathology (superficial pain is correlated with AC joint pathology, deep pain or click is correlated with labral abnormalities in ~94% of patients)

(+) Linear anterior shoulder pain increased with palm up → biceps tendinopathy

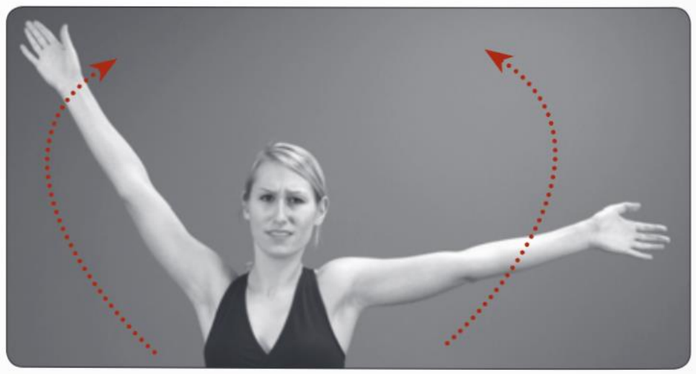
Clinical notes

According to O'Brien[53]: SN: 100% SP: 99% for labral tears
(SN: 16-88 SP: 13-90 +LR: 0.37-2.3 -LR: 0.28-5.14)[23, 45, 49, 51, 52, 55, 61]

- Arthroscopy revealed that test position (90° flexion, 10-15° adduction & maximum internal rotation) displaces long head biceps tendon medial & inferior putting tension on the bicipitallabral complex
- In unstable SLAP lesions, tension from biceps tendon from this shear, compression from capsular windup, or both creates an internal mechanical derangement & displacement that accounts for painful clicking that patients experience
- Positive test patient MUST report a significant decrease in symptoms in external rotated (palm up) test position. Cadaver studies (Parentis et al 2004) have clarified contact between lesser tuberosity, subscapularis tendon & superior aspect of glenoid labrum in the internally rotated position
- Follow-up should include Biceps load test II, Clunk, Crank and MRI for confirmation

Painful Arc Test ★★★★★

Procedure - Patient standing or seated; examiner asks patient to abduct shoulder(s) & observes patient for signs of discomfort or pain



Interpretation: (+) Shoulder pain → Rotator cuff or AC pathology, impingement syndrome

Clinical notes

This test is essential active shoulder ROM into abduction
(SN: 33-98 SP: 10-81 +LR: 1.1-3.9 -LR: 0.2-0.82)[13, 34, 40, 46]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Pectoralis Major Contracture Test ★★★

Procedure

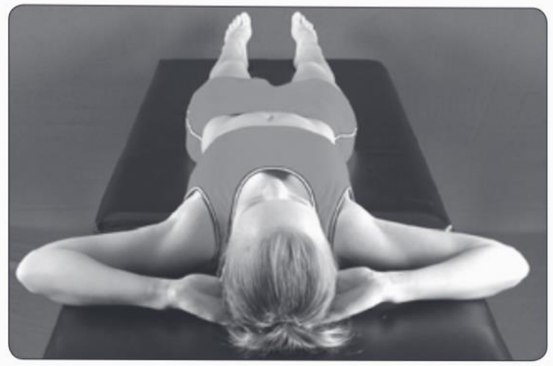
Patient supine, examiner instructs patient to interlock fingers together behind head, examiner then proceeds to apply downward pressure over the elbows

Interpretation

(+) Elbows do not reach examination table → Tight pectoralis major muscle (decreased flexibility), anterior capsule contracture

Clinical notes

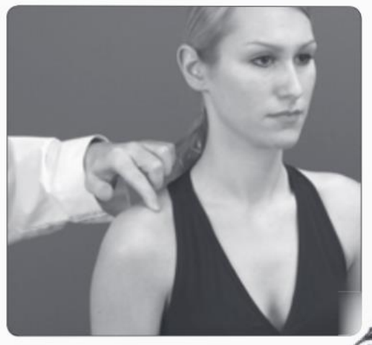
Imbalances of pectoralis major muscle may result in rolling forward of shoulders & is commonly seen in patients with prolonged poor postures (hyperkyphosis) or lack of stretching



Piano Key Sign ★★★

Procedure

Patient seated with arm relaxed at side; examiner applies inferior pressure over the patient's distal clavicle

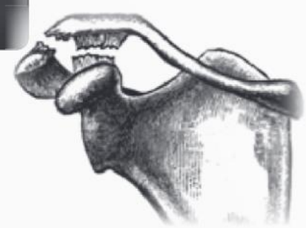


Interpretation

(+) Depression of clavicle with elevation following the release of pressure → AC joint instability, coracoclavicular ligament rupture

Clinical notes

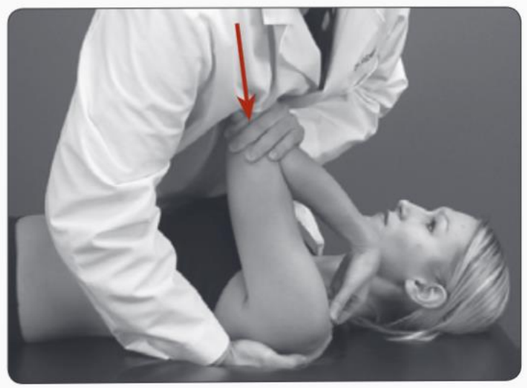
As with all other procedures, bilateral comparison is warranted



Posterior Apprehension / Drawer ★★★★

Procedure

Patient supine, shoulder flexed 90° & internally rotated, elbow flexed 90°; examiner applies A→P pressure over elbow while palpating glenohumeral joint



Interpretation

(+) Apprehension or increased motion → Posterior GH instability

(+) Local pain → rotator cuff ligament/tendon damage

Clinical notes

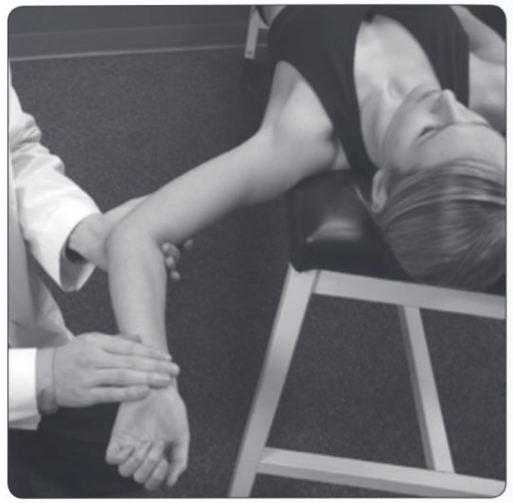
Clinician's option: test may be performed seated
Synonym: Posterior Drawer

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Posterior Impingement Test ★★★★★

Procedure

Patient supine, shoulder abducted 90°-110° & 10°-15° extended; examiner grasps wrist & elbow & slowly applies pressure into maximal external rotation



Interpretation

(+) Posterior shoulder pain → Rotator cuff or posterior labrum pathology (SN: 76 SP: 85 +LR: 5 -LR: 0.28)[47]

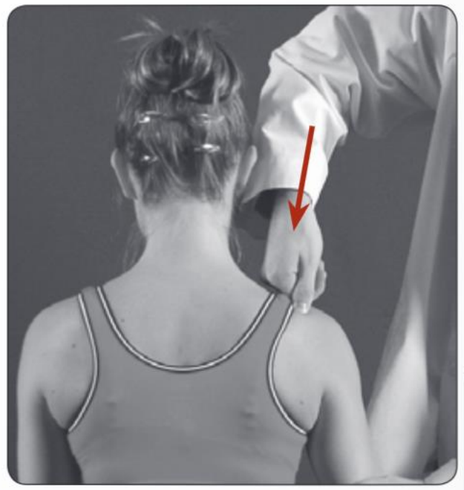
Clinical notes

This test simulates the late overhead cocking phase to acceleration phase of throwing or swinging athletes; the examiner may have the patient start internal rotation at the end of the test for active assessment

Push Button Sign ★★★

Procedure

Patient seated, examiner applies pressure inferiorly over the lateral muscle belly of supraspinatus



Interpretation

(+) Pain → supraspinatus tendon/muscle tear (test is effectively deep palpation)

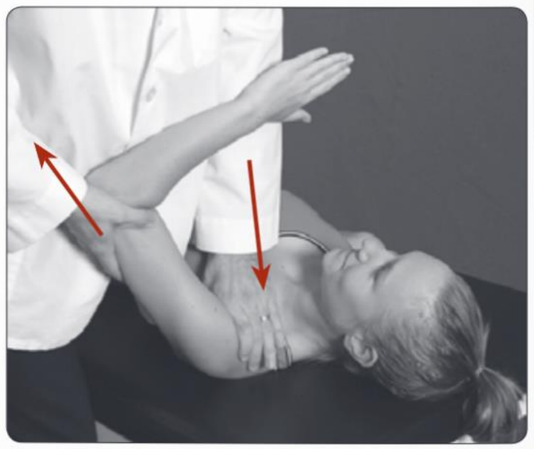
Clinical notes

Versions of this test may be applied to any muscle where a tear is suspected, simply palpate the muscle & apply pressure; a positive result is tenderness or pain to palpation

Push-Pull Test ★★★

Procedure

Patient supine with shoulder abducted 90°, elbow flexed 90°; examiner grasps just below humeral head & pulls up on wrist & pushes down on arm



Interpretation

(+) Apprehension or increased motion → Posterior glenohumeral instability

(+) Local pain → rotator cuff ligament/tendon damage

Clinical notes

A palpable click or clunk may be noted (palpated or audible) as the humerus subluxates in & out of the glenoid fossa

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

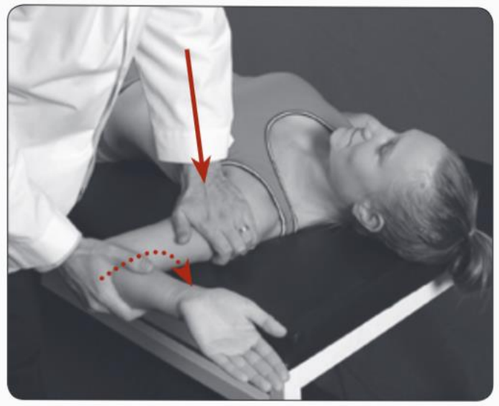
Relocation / Jobe Test ★★★★

Procedure

Patient supine, after attempting the anterior apprehension test the examiner proceeds to apply anterior to posterior pressure over the glenohumeral joint

Interpretation

(+) Decreased in pain or apprehension → Glenohumeral instability, anterior glenoid labrum tear



Clinical notes

Synonyms: Fowler test/sign, Jobe test

Pain reduction is a sign on normal glenohumeral orientation when the humeral head re-seats itself in the glenoid fossa

Rent Test ★★★★★

Procedure

Patient seated with arm relaxed & hand behind back; examiner palpates just lateral to acromion & flexes patient's elbow; examiner then internally & externally rotates shoulder (test is effectively PROM of shoulder rotation)



Interpretation

(+) Prominent greater tuberosity & depression (rent) → rotator cuff tear

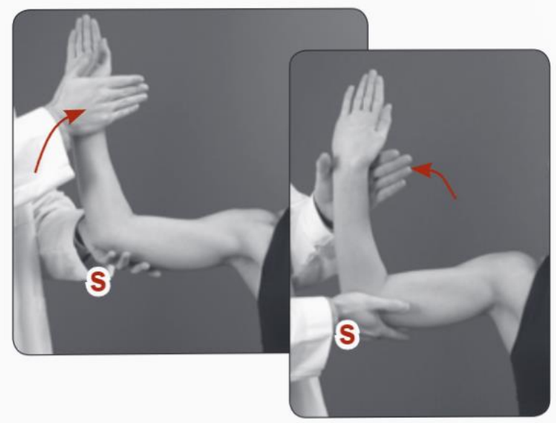
Clinical notes

Rent is defined as an opening made forcibly as by pulling apart (e.g. rotator cuff tear) (SN: 91-96 SP: 75-95 +LR: 3.6-32 -LR: 0.04-0.12)[15, 43, 64]

Resisted Rotation Strength Test ★★★★★

Procedure

Patient seated shoulder externally rotated & abducted 90°, elbow flexed 90°; examiner asks patient to hold position & applies external rotation pressure, then internal rotation pressure



Interpretation:

(+) Internal rotation weaker than external rotation → internal impingement (SN: 88 SP: 96 +LR: 22 -LR: 0.12)[66]

Clinical notes

This test is essentially initial general manual muscle testing

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Reverse Impingement Test ★★★★



Procedure

Patient supine with shoulder abducted ~95° & arm externally rotated, examiner pushes the head of the humerus inferiorly while applying a mild external rotatory force on the arm

Interpretation

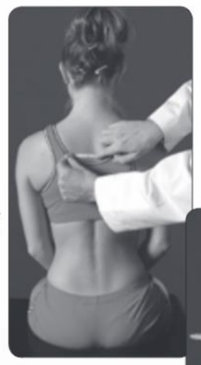
(+) Pain decrease or disappearance → Mechanical impingement under the acromion

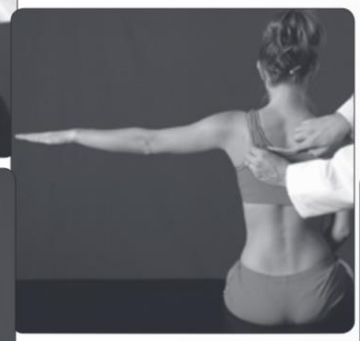
Clinical notes

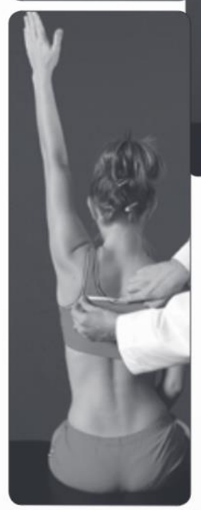
This maneuver decreases the compressive force between the supraspinatus tendon/greater tuberosity of the humerus & the acromion

Due to the similarity of the anterior apprehension test, extreme caution should be taken when dealing with unstable shoulders

Scapular Protraction Slide Test ★★★









Procedure

Patient seated or standing with arm resting at side, examiner measures the following distances:

- Superior angle of scapula to T1-2 spinous process
- Base of the spine of the scapula to T3 spinous process
- Inferior angle of scapula to T8 spinous process

Measurements are then retaken at varying degrees of shoulder abduction (45°, 90°, 120°, 150°, 180°)

Interpretation

Below 90° of shoulder abduction research suggests the scapula should not move more then 1.5 cm (0.75 in.) from the original starting position

Above the 90° of shoulder abduction, there may be increased distances as the scapula rotates during normal scapulohumeral rhythm

Clinical notes

Measurements provide a quantitative analysis of motion (useful a clinical outcome marker)

It is also clinically important to look for symmetry of motion, shoulder hiking & winging of the scapula from side to side

Clinician's option: examiner may choose to apply resistance to the abducted arm at measurements > 45°

Test shows poor statistical value[5] & is time consuming, but does provide a good quantitative outcome marker used to evaluate the effectiveness of care

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Scapular Winging ★★★★



Procedure

Standing patient performs a "wall push-up" while the examiner observes from behind

Interpretation

(+) Winging of the scapula →

Posterior medial winging → Serratus anterior (long thoracic nerve) lesion

Posterior lateral winging → Trapezius (CN XI) lesion

Clinical notes

See scapulohumeral rhythm at beginning of chapter

Image shows winging of left scapula

Shoulder Hiking ★★★★



Procedure

Patient seated or standing attempts to actively abduct shoulders bilaterally; examiner observes motion (scapulohumeral rhythm)

Interpretation

(+) Elevation of ipsilateral shoulder girdle & lateral flexion of spine to opposite side to compensate for inadequate glenohumeral mobility or weakness → frozen shoulder, rotator cuff tear, advanced osteoarthritis

Clinical notes

Note: subtle shoulder hiking may indicate a muscle imbalance involving overactive upper trapezius, weakness of rhomboids, lower trapezius and/or rotator cuff

Speed's Test ★★★★★



Procedure

Patient seated, forearm is extended & supinated (arm at side), patient actively flexes arm to 120°, examiner applies resistance to this motion while palpating the bicipital groove (note: deltoid contraction will 'hide' bicipital tendon)

Interpretation

(+) Pain → bicipital tendinitis, impingement syndrome, labral lesion or bursitis

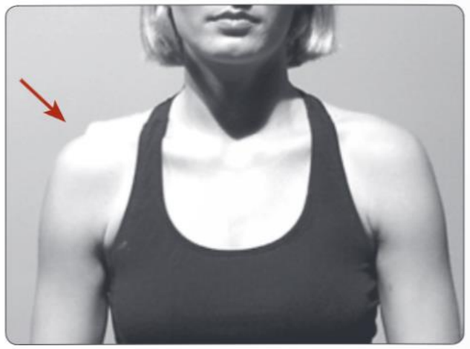
Clinical notes

Note: this test may also produce pain in the presence of a glenoid labral tear (SLAP)

(SN: 4-100 SP: 11-100 +LR: 0.35-2.2 -LR: 0.26-6.32)[5, 12, 13, 16, 23]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Step Defect (AC) ★★★★



Procedure

Patient seated or standing with arms hanging at sides; examiner observes from anterior

Interpretation

(+) Prominence of the distal clavicle in relation to the acromion → Acromioclavicular separation

Clinical notes

Synonym: step off deformity

Sulcus Sign (GH) ★★★★★

Procedure

Patient seated or standing with arm hanging at side; examiner observes from anterior

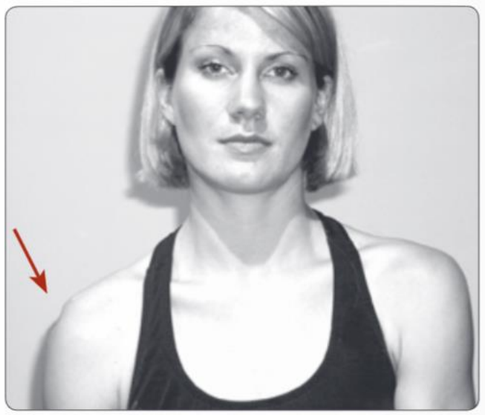
Interpretation

(+) Abnormal prominence of acromion & groove like depression below acromion → Inferior instability, GH dislocation, atrophy of deltoideus, superior labral tear

Clinical notes

Graded by measuring from inferior margin of acromion to humeral head

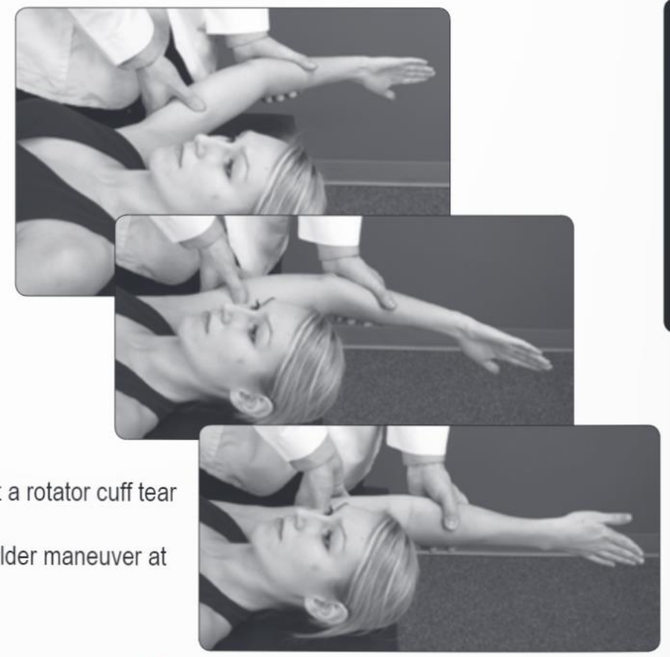
Grade	Description
I	< 1 cm inferior translation
II	1-2 cm inferior translation
III	> 2 cm inferior translation



Supine Impingement Test ★★★★★

Procedure

Patient supine with shoulder abducted 160°; examiner stabilizes patient's wrist & distal humerus & externally rotates the shoulder; then the shoulder is fully abducted toward patients ear; examiner then internally rotates shoulder



Interpretation

(+) Significant increase in shoulder pain → Rotator cuff tear, supraspinatus impingement

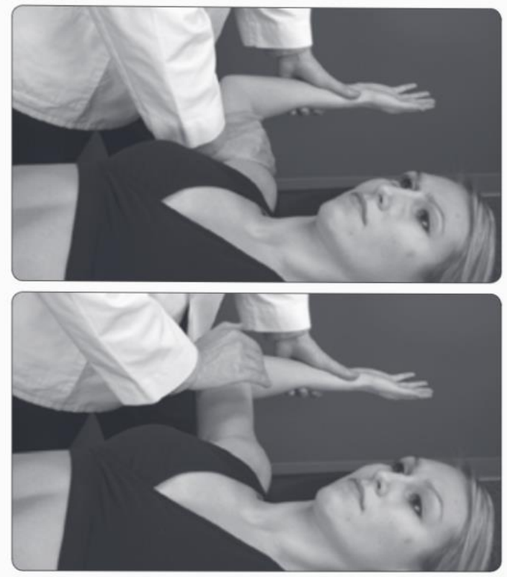
Clinical notes

Test is useful as a screen to help rule out a rotator cuff tear (SN: 97 SP: 9 +LR: 1.1 -LR: 0.33)[40]

Movement is very similar to Vizniak shoulder maneuver at end ROM

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Surprise/Anterior Release Test ★★★★★



Procedure

Patient supine with shoulder abducted 90° & fully externally rotated, elbow flexed 90°; examiner stabilizes patients wrist & applies a posterior force over the humeral head, examiner then quickly releases shoulder pressure (surprise!)

Interpretation

(+) Patient apprehension or pain → Anterior GH instability (SN: 64-92 SP: 89-99 +LR: 8.4-64 -LR: 0.08-0.36)[22, 42]

Clinical notes

The surprise test should be performed after the apprehension & relocation test

This test is contraindicated in patients with severe apprehension or instability

Sulcus Test ★★★★★

Procedure

Patient seated with arm hanging at side; examiner applies long axis distraction to the humerus

Interpretation

(+) Increased inferior ROM → Inferior instability (SN: 17 SP: 93 +LR: 2.4 -LR: 0.89)[42]

Clinical notes

Atrophy of the deltoid muscle may also give a false (+)

Graded by measuring from inferior margin of acromion to humeral head

Grade	Description
I	< 1 cm inferior translation
II	1-2 cm inferior translation
III	> 2 cm inferior translation



Supraspinatus Press Test ★★★★

Procedure

Patient seated with shoulder's abducted 90° in the scaption plane (30° forward) , examiner applies gentle downward pressure & observes patient



Interpretation

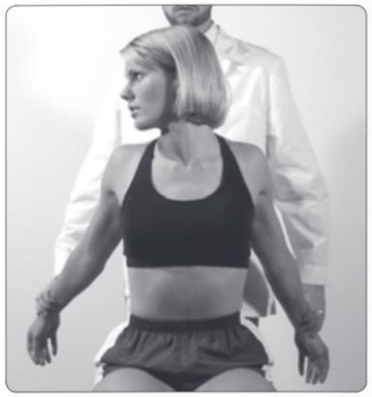
(+) Pain or muscle weakness → Supraspinatus tendon/muscle tear

Clinical notes

Versions of this test may be applied to any muscle where a tear is suspected, as it is resisted muscle testing

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Adson's Test ★★★★



Procedure

Patient seated, examiner palpates radial pulse bilaterally, patient is instructed to rotate head *toward* affected side; repeat looking *away* from affected side (*reverse Adson's/Halstead maneuver*)

Interpretation

(+) Decrease/loss of pulse → neurovascular compression (TOS) from a cervical rib, scalene muscle brachial compression

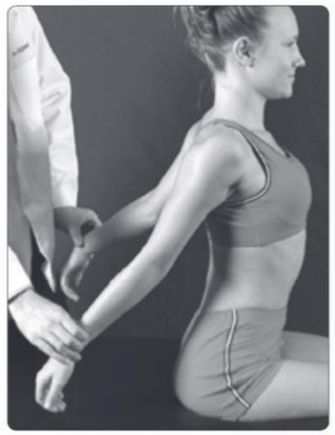
Clinical notes

Patient may be instructed to take a deep breath & hold it after the head is rotated to help apply further pressure to the brachial plexus nerve roots & subclavian vessels (SN: 50 SP: 74-100)[13, 17, 18]

Test shows false positive in ~42% of patients with carpal tunnel syndrome & 9-20% of general population

Costoclavicular Maneuver ★★★★

Synonym: Eden's Test, Military Brace Test



Procedure

Patient seated, examiner bilaterally palpates radial pulse & pulls patient's arms into extension ("exaggerated military posture") examiner may ask patient to roll shoulders back & take in a deep breath & hold

Interpretation

(+) Diminished pulse → costoclavicular TOS

(+) Arm pain, numbness, tingling → neurologic TOS (SP: 89-100)[17, 18]

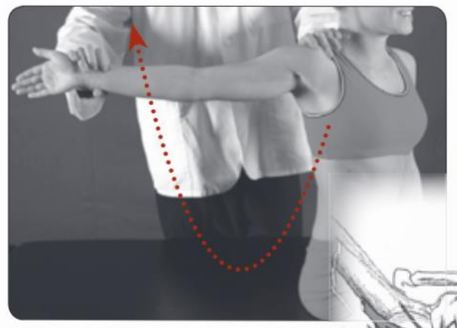
Clinical notes

Test provides particularly relevant information in patient's who display symptoms while wearing backpacks or other heavy items over shoulders

Wright's Hyperabduction Test ★★★★

Procedure

Patient seated or supine, examiner palpates radial pulse, then abducts patient's arm above head; repeat on opposite side (variation of test can be done by horizontally abducting the arm at 90°)



Interpretation

(+) Change in radial pulse or numbness, tingling, weakness → TOS secondary to compression under pectoralis minor muscle (SP: 38-90)[17, 18]

Clinical notes

Realize it is a normal finding for the radial pulse to change when the arm is held above the head (many false positives)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Roo's/EAST Test ★★★★★

Synonym: EAST (elevated arm stress test), Provocative Elevation Test



Procedure

Patient seated, shoulders 90° abducted, elbows flexed 90°, examiner instructs patient to open & close fists ~2x/sec for 3 minutes

Interpretation

(+) Inability to maintain action with associated numbness, tingling or weakness → TOS (SN: 82 SP: 100)[5, 12]

Clinical notes

Clinically 3 minute duration may not be required, typically one minute is usually enough time for patients to exhibit symptoms of TOS

Test may demonstrate many false positives (~47% in normal population)

Shoulder Compression ★★★★



Procedure

Patient seated with arms at sides, examiner applies downward pressure over lateral apex of acromion

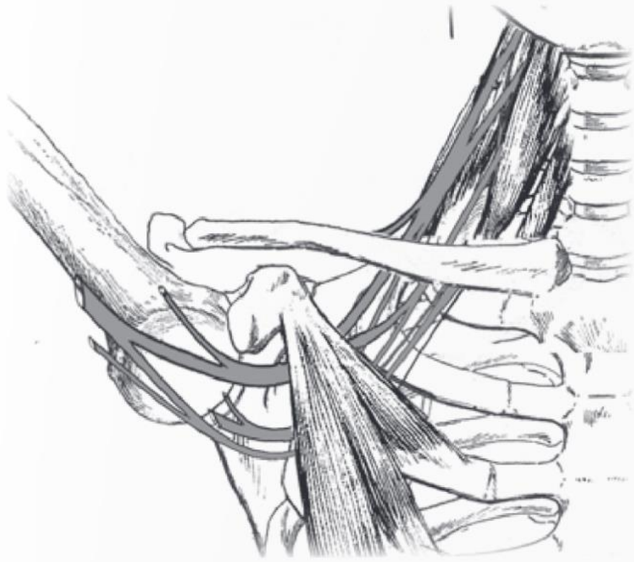
Interpretation

(+) Reproduction of symptoms consistent with either subclavian artery or brachial plexus compression → TOS

Clinical notes

Synonym: shoulder depression test

Shoulder





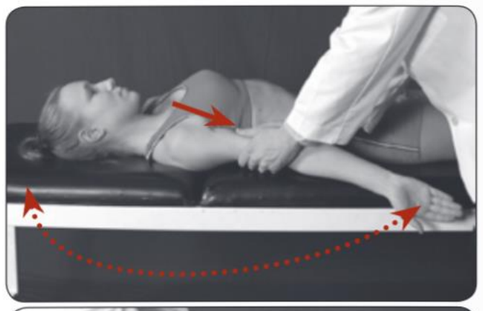
X-ray shows left C7 elongated transverse process & contralateral cervical rib (note well formed joint space)

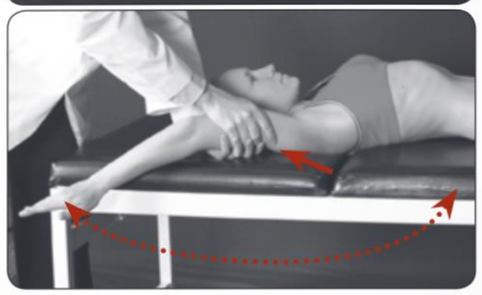
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Vizniak Shoulder Maneuver ★★★

Procedure

Patient supine with shoulder abducted 10°; examiner grasps just below humeral head, applies long axis distraction & fully abducts shoulder, first with the arm internally rotated & then repeats with arm externally rotated





Interpretation

(+) Apprehension or increased motion → GH instability
(+) Local pain → Rotator cuff ligament/tendon damage
(+) Decreased range of motion → Adhesive capsulitis

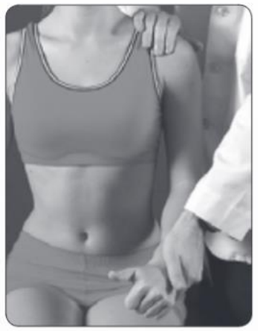
Clinical notes

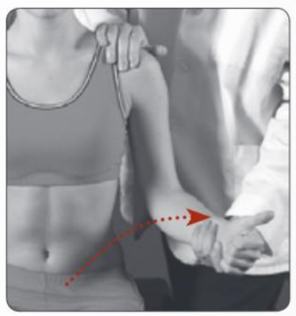
Test is also useful as the treatment method for adhesive capsulitis & shoulder impingement syndromes due to soft tissue contracture & adhesions - test is effectively joint ROM with the capsule in a tighten position (both internally & externally)

Yergason's Test ★★★★★

Procedure

Patient seated elbow flexed 90°, forearm pronated; examiner grips forearm & palpates biceps long head tendon while patient actively flexes & supinates forearm & externally rotates arm ("hitchhiker"); examiner resists patient motion





Interpretation

(+) Pain over bicipital groove → Tendonitis or strain
(+) Pain in shoulder → Glenoid labrum pathology
(+) Tendon slipping out of groove → torn transverse humeral ligament (bicipital instability)

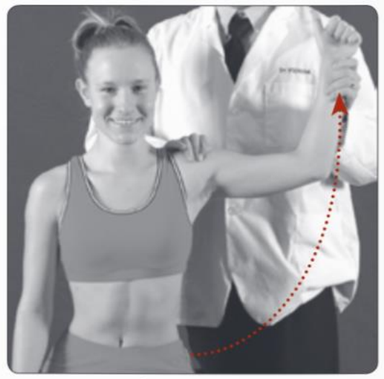
Clinical notes

Test shows good specificity for labral tears
(SN: 9-50 SP: 79-93 +LR: 1.3-3.0 -LR: 0.72-0.94)[5, 13, 23, 28, 54, 55]

Modified Yergason's / Bicipital Instability Test - patient abducts shoulder to 90°, externally rotates arm & supinates forearm while examiner provides resistance to motion & palpates bicipital groove (motion is similar to a baseball umpire saying "you're out!") - (+) Pain or tendon slipping out of groove → torn transverse humeral ligament (bicipital instability) - contraction of thedeltoid often makes it difficult to directly palpate the biceps long head tendon

Test cluster order for checking bicipital instability Lipman's, Yergason's then modified Yergason's (progress from least to most invasive)

Modified Yergason's



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Shoulder radiographic evaluation

B = Bone: evaluate film for fractures & dislocations, describe variations in cortices, medullary & subchondral bone, density, shape, size, trabecular patterns & relationship of osseous arrangements.

A = Alignment: analyze GH & AC alignment & posture, result of various measurements; misalignments

C = Cartilage: inspect the joint spaces, articular spaces for any abnormalities; pay attention to symmetry, continuity, widening or loss of joint space & calcification of cartilage

S = Soft Tissue: evaluate soft tissues; look for unusual calcifications, including in blood vessels, masses, displaced fascial lines & unusual gas distribution; note the presence of fat-pad signs ('sail sign') and soft tissue edema

Shoulder anatomical variants & anomalies

- Enlarged conoid tubercle
- Pseudotumor of humerus - radiolucency visible on internal rotation views

Film shows calcific tendonitis of the supraspinatus tendon



Acromioclavicular Joint Space

Normal: female (2.1-3.7 mm), male (2.5-4.1 mm), compare bilaterally
Interpretation: ↓ joint space → DJD
↑ joint space → AC separation, osteolysis in hyperparathyroidism, or RA following trauma



Glenohumeral Joint Space

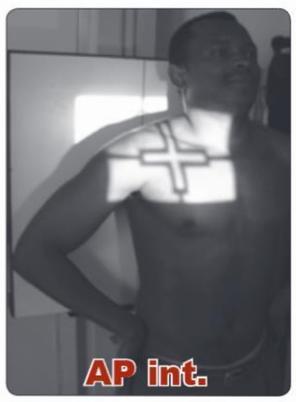
Normal: 4-5 mm
Interpretation: decreased joint space → DJD, CPPD & post traumatic arthritis, increased joint space → acromegaly & posterior humeral dislocation

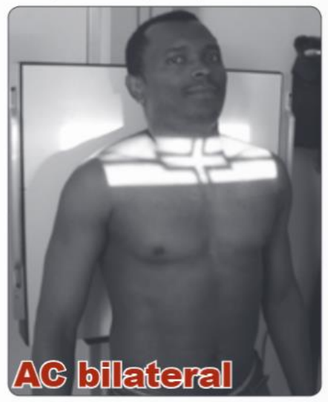


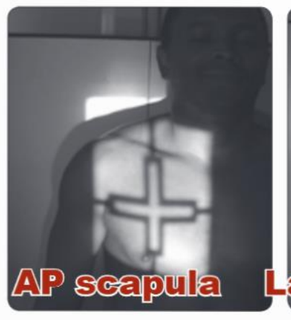
View Cassette, SID kV Range		Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker Shielding	Breathing Clinical notes
Shoulder	**AP** **Int/ext. rotation** 10x12, 40″ 75±5 kV	Coracoid process 0°, yes < film	Path of central ray Corner of film Thyroid, breast	Susp. expiration May be done upright or supine
	AC **Bilateral** 14x17, 72″ 70±5 kV	Suprasternal notch 0°, yes < film	Path of central ray Corner of film Thyroid, breast	Susp. expiration Consider weight bearing on each arm Can use 2-8x10 films
	Humerus **AP, Lateral** 14x17, 40″ 70±5 kV	Mid humerus 0°, yes < film	Path of central ray Corner of film Thyroid, breast	Susp. expiration Include both elbow & shoulder joint on film
Scapula	**AP** 10x12, 40″ 75±5 kV	Central scapula 0°, yes < film	Path of central ray Corner of film Thyroid, breast	Susp. expiration May be done upright or supine
	Lateral 10x12, 40″ 65±5 kV	Central scapula 0°, yes < film	Path of central ray Corner of film Thyroid, breast	Susp. expiration Patient's arm behind ba

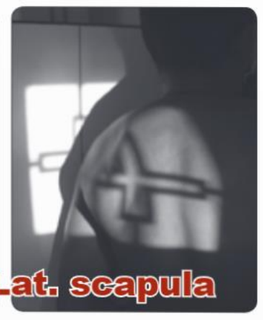
If area measures less than 10 cm in diameter choose no grid (non-bucky)
8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended,
F. spot = Focal Spot, Cr. = central ray, IVF = Intervertebral foramen, SID = Source Image Distance (inches)



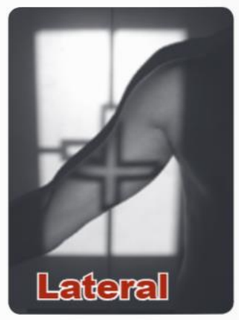








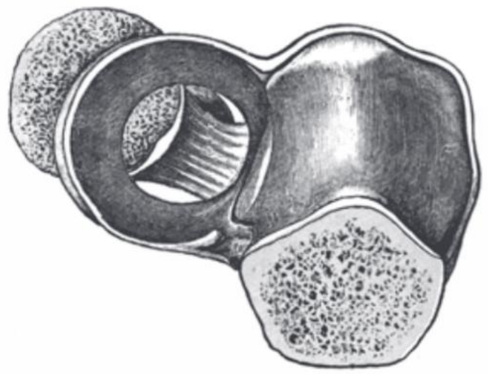




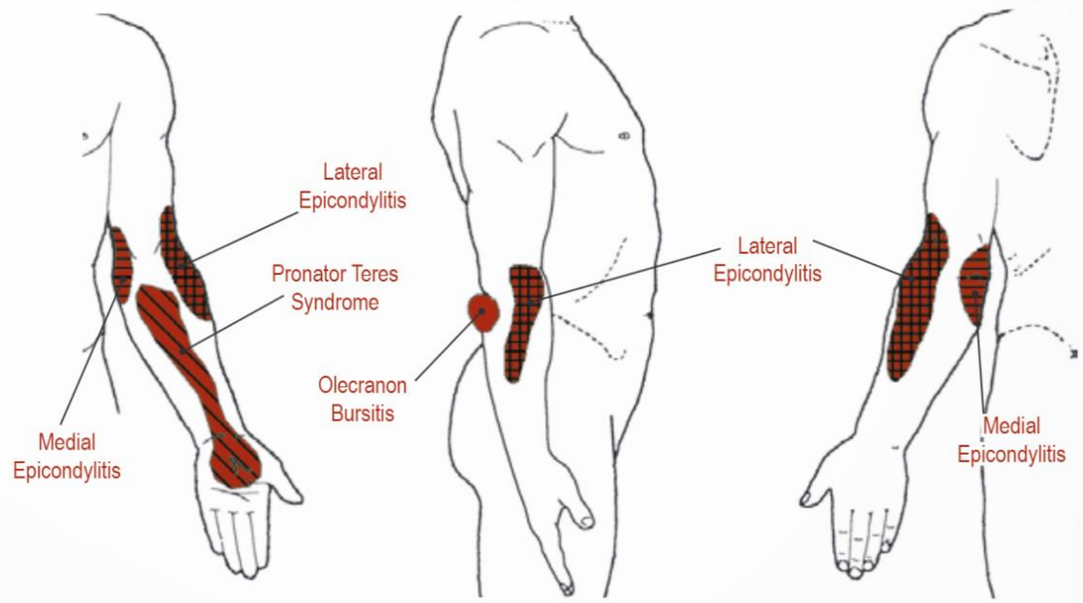
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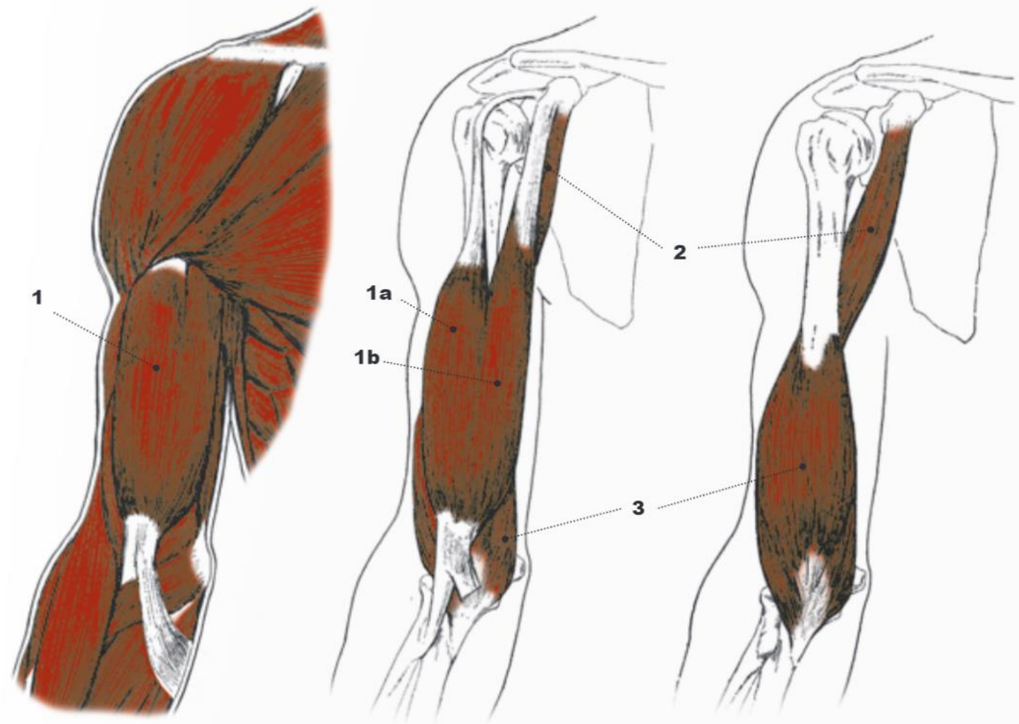
Selected Elbow Pain Referral Patterns

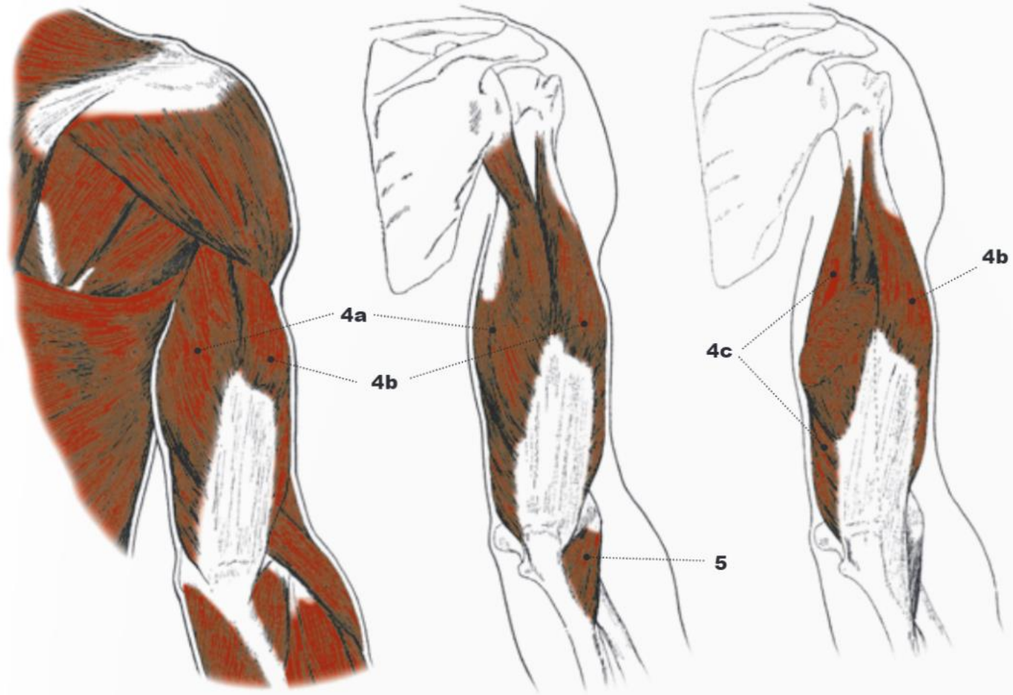


Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

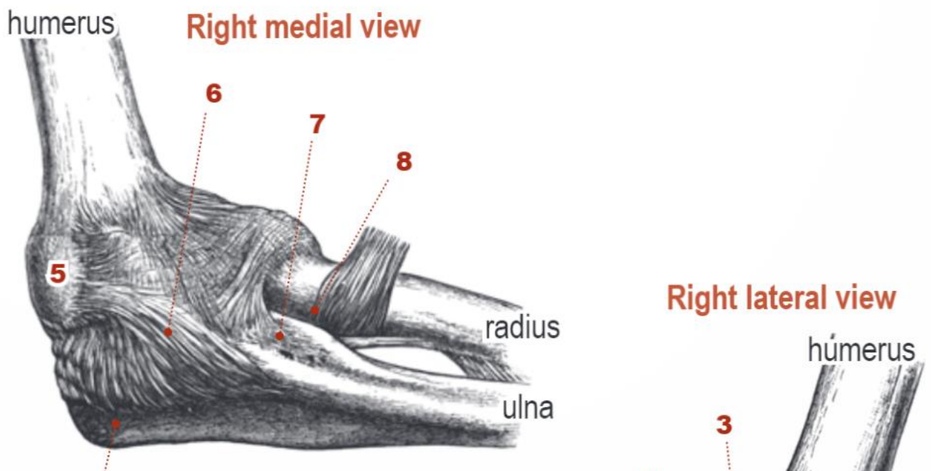
When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Arm Muscle Review

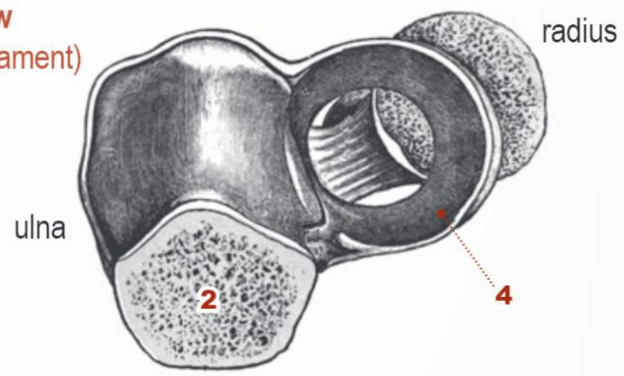




1. Biceps brachii
   a. Long head
   b. Short Head
2. Coracobrachialis
3. Brachialis
4. Triceps brachii
   a. Long head
   b. Lateral head
   c. Deep (medial) head
5. Anconeus



Posterior view right elbow
(radius removed from annular ligament)



Elbow joint

1. Lateral epicondyle
2. Olecranon
3. Radial collateral ligament
4. Annular ligament
5. Medial epicondyle
6. Ulnar collateral ligament
7. Ulnar tuberosity
8. Radial tuberosity

Follow HIP-MNRS
History, Inspection, Palpation - Motion, Neurovascular screen, Referred pain, Special tests

Special history considerations
- Specific mechanism of injury & forces involved?
  - Did you fall on outstretched hand?
- Any numbness, tingling or weakness?
- Type of work, typical posture?

Standing or sitting

Inspection
- Asymmetry, bruising, bumps, color, swelling, height, head tilt, winging of scapula
- Posture of neck, body, shoulder
- Carrying angle

Fracture screen (if indicated)
1. Older than 55? Torsion Test
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz)
4. Ultrasound

Palpation (may be done after ROM assessment)

medial epicondyle	extensor tendon
ulnar groove	anconeus
medial collateral lig.	brachioradialis
common flexor tendon	ext. carpi ulnaris
flexor carpi ulnaris	ext. carpi rad. longus
palmaris longus	ext. carpi rad. brevis
flexor carpi radialis	extensor digitorum
pronator teres	supinator
biceps tendon/aponeur	triceps tendon
head of radius	triceps muscle
radial tunnel	olecranon
lateral epicondyle	olecranon bursa
lateral collateral lig.	cubital fossa
brachial artery	brachialis

Functional assessment (ADLs)
- Elbow flexion extension

AROM
Flexion ..... 150°
Extension ..... 0° to -5°
Pronation ..... 90°
Supination ..... 90°

PROM & Joint Play (if lacking AROM in any motion)

Myotomes (resisted isometric movements)
- Shoulder elevation (C4, XI)
- Deltoid (**C5**, C6 - axillary)
- Brachioradialis (C5, C6 - radial)
- Biceps (C5, **C6** - musculocutaneous)
- Triceps (C6, **C7**, C8, T1 - radial)
- Wrist extensors (**C6**, C7, C8 - radial)
- Wrist flexors (C6, **C7** - median/ulnar)
- Finger flexors (C7, **C8**, T1 - ulnar/median)
- Interossei (C7, C8, **T1** - ulnar)

Neurovascular screen
- ***Sensory:*** light touch, two point discrimination, Vibration (3rd digit), Tinel's
- ***DTR's:***
  - Biceps (C5)
  - Brachioradialis (C6)
  - Triceps (C7)
- Girth measurements
- Grip strength (Dynamometer)
- Radial & brachial pulse, blanching, temperature

Orthopedic tests (as indicated)
Screening
- Valgus stress (0°) – forearm supinated
- Valgus stress (30°)
- Varus stress (0°) – forearm pronated
- Varus stress (30°)

Lateral epicondylitis
- Cozen's test
- Mill's Test
- Middle finger test
- Book lift test

Medial epicondylitis
- Reverse Cozen's
- Reverse Mill's

Pronator Teres/Median nerve
- Tinel's (wrist)
- Tinel's (elbow)
- Elbow flexion test
- Pronator stretch test
- Sustained flexion test

Wrist, shoulder & cervical spine screen

Diagnostic imaging (if indicated)

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Elbow Kinematic Review

Joint type: synovial
- Hinge (humeroulnar & humeroradial)
- Pivot (proximal radioulnar)

Articular surfaces
- **Humeroulnar:** *concave* (trochlear notch of ulna) *on convex* (trochlea of humerus)
- **Humeroradial:** *concave* (radial head) *on convex* (capitilum of humerus)
- **Proximal radioulnar:** *convex* (radial head) *on concave* (radial notch of ulna)

Active range of motion (elbow)
- **Flexion ..... 150°**
- **Extension ..... 0° to -5°**
- **Pronation ..... 80°-90°**
- **Supination ..... 90°**

Main muscle actions
- **Flexion:** brachialis, biceps brachii, brachioradialis
- **Extension:** triceps brachii, anconeus
- **Pronation:** pronator teres, pronator quadratus
- **Supination:** biceps brachii, supinator

Resting position
- **Humeroulnar:** 70° flexion
- **Humeroradial:** full extension & supination
- **Proximal radioulnar:** 70° flexion, 35° supination

Close packed position
- **Humeroulnar:** full extension
- **Humeroradial:** 90° flexion, 5° supination
- **Proximal radioulnar:** 5° supination, 90° flexion

Capsular pattern of restriction
- **Humeroulnar:** flexion > extension
- **Humeroradial:** flexion > extension
- **Proximal radioulnar:** supination = pronation limited

Normal end feel
- **Flexion:** soft tissue or bony approximation
- **Extension:** bony approximation
- **Pronation:** bony approx. or ligamentous
- **Supination:** ligamentous

Abnormal end feel
- **Boggy** → joint effusion
- **Early myospasm** → acute injury
- **Late myospasm** → instability
- **Springy block** → loose body (osteochondritis dissecans)

Open kinetic chain

Humeroulnar & humeroradial:
- *Flexion:* radius & ulna roll & glide posterior on humerus
- *Extension:* radius & ulna roll & glide anterior on humerus

Proximal radioulnar:
- *Pronation:* radius spins medially on ulna
- *Supination:* radius spins laterally on ulna

Closed kinetic chain

Humeroulnar & humeroradial:
- *Flexion:* humerus roll & glide anterior on radius & ulna
- *Extension:* humerus roll & glide posterior on radius & ulna

Proximal radioulnar:
- *Pronation:* ulna spins laterally on radius
- *Supination:* ulna spins medially on radius

Carrying angle of the elbow

Normal = 5°-15° - angle permits the forearms to clear the hips in swinging movements during walking & is important when carrying objects

Cubital valgus - angle greater than 15°

Cubital varus - angle less than 5°

S = stabilization (indifferent hand), ● = contact, →

Range of Motion	Ulnohumeral Joint uniaxial, hinge	Radiohumeral Joint uniaxial, hinge
Flexion .....150° Extension .....0° to -5° Pronation .....90° Supination .....90°	**Resting position** 70° flexion, 10° supination **Tight packed position** Extension with supination **Capsular pattern** Flexion, extension	**Resting position** Full extension & supination **Tight packed position** 90° flexion, 5° supination **Capsular pattern:** flexion, extension

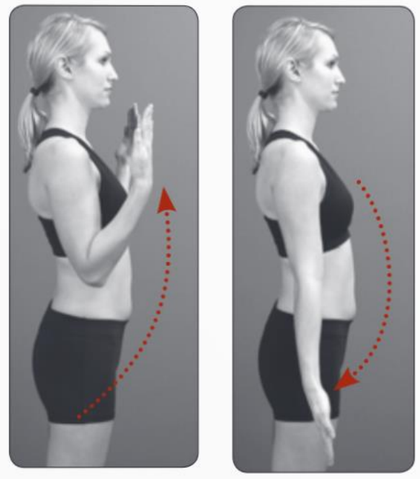
The proximal radioulnar joint is considered a uniaxial pivot joint

Elbow AROM

Compare bilaterally, examiner should make an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."

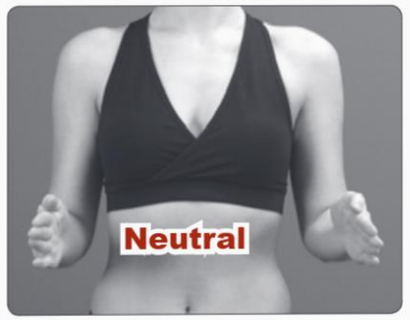
Flexion (150°-160°)
Muscles Activated: brachialis, biceps brachii, brachioradialis
Tissue Stretched: triceps brachii, posterior elbow joint capsule, ulnar nerve
Tissue Compressed: forearm flexors, median nerve, anterior joint capsule

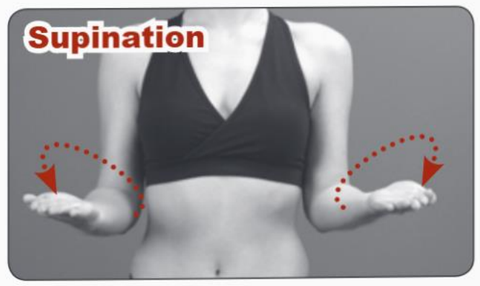
Extension (0° to -5°)
Muscles Activated: triceps brachii, anconeus
Tissue Stretched: brachialis, biceps brachii, brachioradialis, median nerve
Tissue Compressed: posterior joint capsule

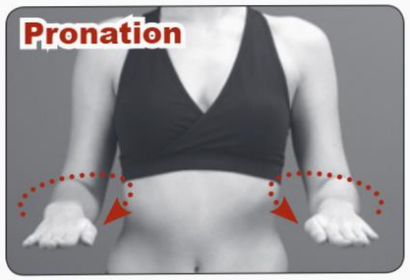


Supination (80°-100°)
Muscles Activated: biceps brachii, supinator
Tissue Stretched: pronator teres, pronator quadratus

Pronation (80°-100°)
Muscles Activated: pronator teres, pronator quadratus
Tissue Stretched: biceps brachii, supinator, brachioradialis



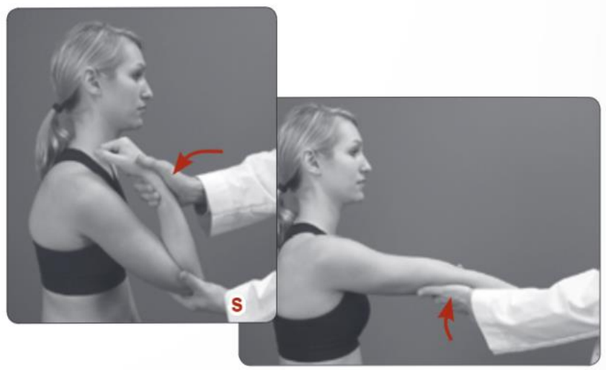




PROM

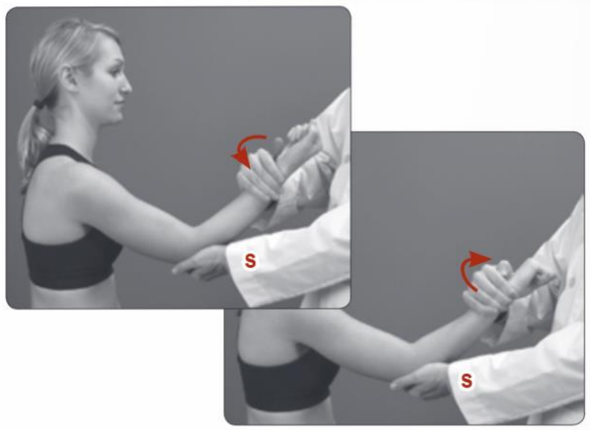
Flexion (> 150°-160°)
Tissue Stretched: triceps brachii, posterior elbow joint capsule, ulnar nerve
Tissue Compressed: forearm flexors, median nerve, anterior joint capsule

Extension (> 0° to -5°)
Tissue Stretched: brachialis, biceps brachii, brachioradialis, median nerve
Tissue Compressed: posterior joint capsule



Supination (> 80°-100°)
Tissue Stretched: pronator teres, pronator quadratus
Tissue Compressed:

Pronation (> 80°-100°)
Tissue Stretched: biceps brachii, supinator, brachioradialis
Tissue Compressed:



Elbow Muscle Testing

Flexion
Muscles Activated: brachialis, biceps brachii, brachioradialis

Extension
Muscles Activated: triceps brachii, anconeus

Supination
Muscles Activated: biceps brachii, supinator

Pronation
Muscles Activated: pronator teres, pronator quadratus





Cozen's Test ★★★★

Procedure
Patient seated, elbow fully flexed, forearm pronated & wrist extended ("waiter position"); examiner applies force in the direction of elbow extension & wrist flexion while stabilizing the patient's elbow with the other hand

Interpretation
(+) Pain or weakness → lateral epicondylitis

Clinical notes
Patients often describe pain felt with this test as sharp & shooting, this pain may also be reproduced with palpation over the radial nerve & common extensor tendon
Examiner may also individually muscle test extensor carpi radialis longus & brevis muscles





Elbow Extension Test ★★★★★

Procedure
Patient standing, seated or supine; examiner asks patient to fully extend elbow

Interpretation
(+) Inability to extend elbow → elbow fracture

Clinical notes
Docherty et al.[25] did report a single false positive with one patient able to fully extend their elbow with radiographic evidence of a non-displaced radial head fracture
(SN: 97 SP: 69 +LR: 3.1 -LR: 0.04)[25]

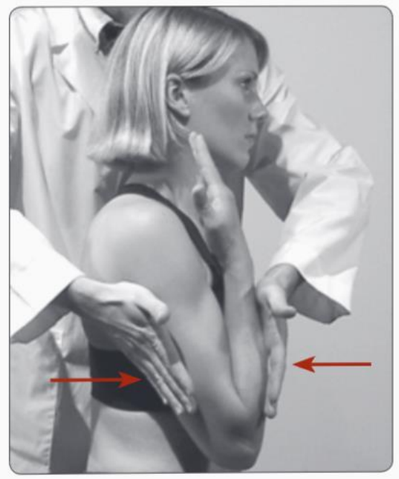


Elbow Flexion Test ★★★★★

Procedure
Patient seated with elbow fully flexed, examiner instructs patient to hold position for up to three minutes; examiner may observe or apply gentle over pressure to increase flexion

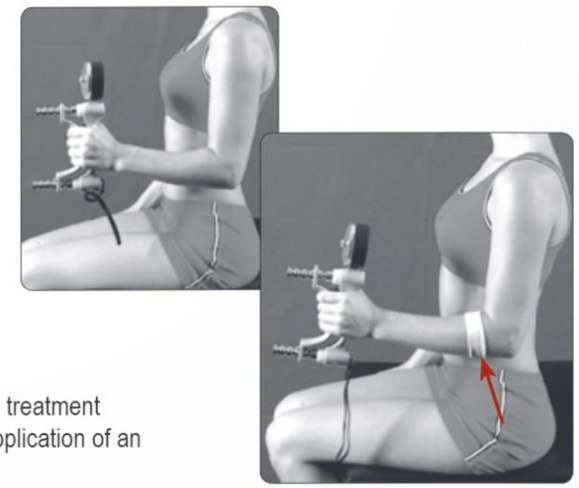
Interpretation
(+) Numbness, tingling, paresthesia in the ulnar nerve distribution → cubital tunnel syndrome, pronator teres syndrome

Clinical notes
This test may also produce "carpal tunnel-like" symptoms due to compression of the median nerve as it passes through the pronator teres
Clinically symptoms will usually appear within 1 minute
(SN: 75-93 SP: 99 +LR: 75 -LR: 0.25)[19, 61]



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Kaplan's Test ★★★★



Procedure

Patient seated with elbow flexed 90°, two-part test;

1. Grip strength assessed with dynamometer
2. Tennis elbow brace placed ~3 cm below elbow joint line, reassessment of grip strength

Interpretation

(+) Increased grip strength or decreased pain in the presence of an elbow brace → lateral epicondylitis

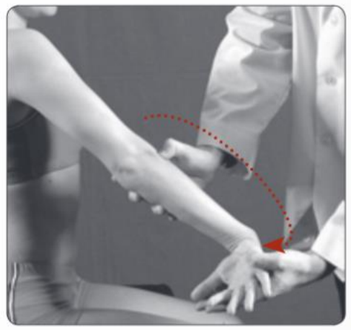
Clinical notes

The results of this test are very suggestive of the treatment parameters you should use to assist patient (application of an elbow brace)

Mill's Test ★★★★

Procedure

Patient seated, examiner extends & pronates patient's elbow while flexing the wrist (test stretches the common extensor tendon)



Interpretation

(+) Lateral elbow pain during test → lateral epicondylitis

Clinical notes

Clinician's option: consider flexing the fingers & applying pressure with your thumb over the common extensor tendon to further increase the sensitivity of this test

Patients may demonstrate restricted ROM which may suggest arthritis, capsular adhesions, or tendon contracture

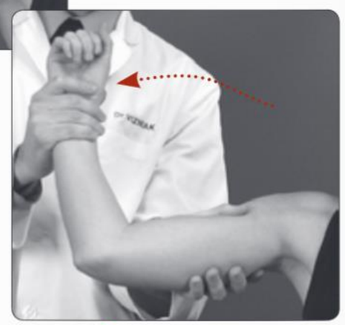
Mill's test may be used as a treatment for lateral epicondylitis (stretching of the common extensor tendon)

Moving Valgus Test ★★★★

Procedure

Patient seated or standing, with shoulder abducted 45° & elbow fully flexed; examiner stabilizes distal forearm & mid humerus & applies a valgus force to the elbow while extending it to ~30°





Interpretation

(+) Pain on medial elbow → ulnar collateral ligament sprain (SN: 100 SP: 75 +LR: 4 -LR: 0)[63]

Clinical notes

Pressure is applied through entire motion from 150°-30° of elbow flexion

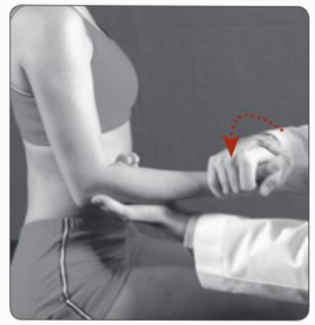
Less shoulder abduction is usually more comfortable for the patient & does not change stresses at the elbow

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Pronator Teres Syndrome Test ★★★★

Procedure

Patient seated with elbow flexed 90°, examiner instructs the patient to attempt pronation of the forearm with elbow extension, examiner strongly resist the pronation motion while the elbow is extended (examiner may compress muscle to increase nerve compression & test sensitivity)



Interpretation

(+) Tingling or paresthesia → median nerve compression at the pronator teres muscle, pronator teres syndrome

Clinical notes

Anatomically, the median nerve runs between the two heads of the pronator teres muscle, thus when pronation is resisted the increased compressive force from the contracted muscle may result in distal neurologic signs

Pressure Provocation Test ★★★★★

Procedure

Patient seated, supine or standing with elbow flexed ~80° & forearm supinated; examiner places finger over ulnar nerve just proximal to the cubital tunnel & hold pressure for ~60 seconds



Interpretation: (+) Numbness, tingling, paresthesia in the ulnar nerve distribution → cubital tunnel syndrome

Clinical notes

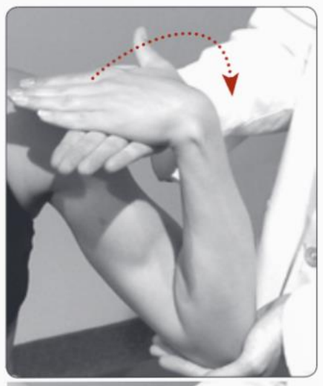
Pressure provocation tests may be applied to any location in the body where peripheral nerves are palpable

(SN: 89 SP: 98 +LR: 45 -LR: 0.11)[61]

Reverse Cozen's Test ★★★★

Procedure

Patient seated with elbow flexed 120°, forearm supinated, & wrist slightly flexed & deviated towards the ulna; examiner applies pressure on patient's palm with one hand while stabilizing elbow & palpating medial epicondyle with the other hand



Interpretation

(+) Localized pain at medial epicondyle or distal at common flexor tendon → medial epicondylitis (Golfer's Elbow)

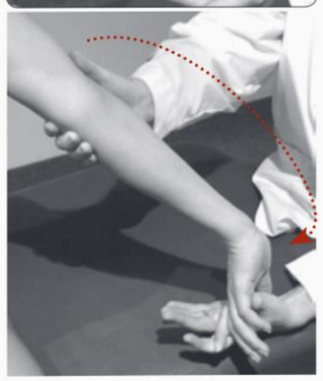
Clinical notes

This test is essentially muscle testing the common flexor tendon of the elbow

Reverse Mill's Test ★★★★

Procedure

Patient seated, examiner extends patient's elbow wrist & fingers to stretch common flexor tendon at medial epicondyle



Interpretation

(+) Localized pain at medial epicondyle or distal at common flexor tendon → medial epicondylitis (Golfer's Elbow)

Clinical notes

This test is essentially stretching the common flexor tendon

Synonym: Golfer's Elbow Test

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Tinel's Sign at Elbow ★★★★

Synonym: distal tingling on percussion (DTP) sign

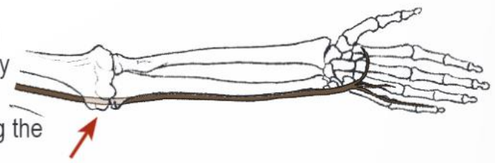


Procedure

Patient seated, examiner gently taps 4-6 times over cubital tunnel (groove between the olecranon process & medial epicondyle) with fingertips or reflex hammer

Interpretation

(+) Shooting electrical pain along the medial side of the forearm to medial hand → ulnar compressive neuropathy



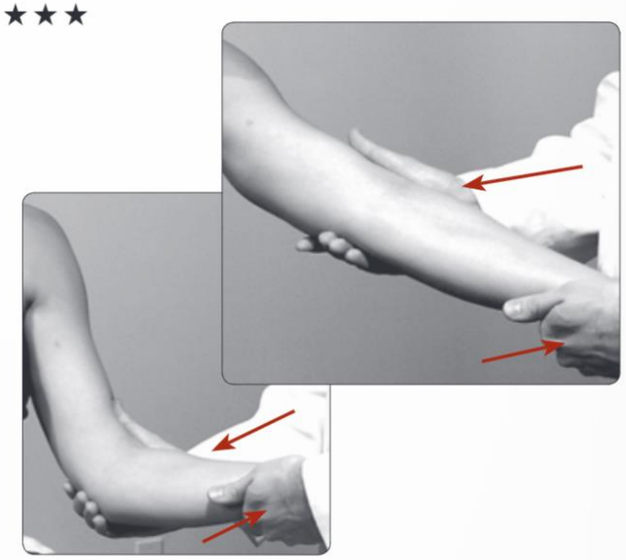
Clinical notes

This test demonstrates a high rate of false positives with asymptomatic elbows; hitting your "funny bone" is really rapid compression of the ulnar nerve at this location

This test may be repeated for the radial nerve by tapping the groove between the lateral epicondyle & olecranon

(SN: 70 SP: 98 +LR: 35 -LR: 0.31)[61]

Valgus Elbow Stress Test ★★★★



Procedure

Patient seated, two-part test;

1. Examiner applies valgus force with elbow fully extended
2. Examiner applies valgus force with elbow flexed 30° & forearm supinated

Interpretation

(+) Pain or excessive joint motion → medial elbow sprain or instability

Clinical notes

Due to the dynamic range of the elbow joint it is important to test the elbow ligament integrity in at least two positions

Varus Elbow Stress Test ★★★★



Procedure

Patient seated, two-part test;

1. Examiner applies varus force with elbow extended
2. Examiner applies varus force with elbow flexed 30° & forearm supinated

Interpretation

(+) Pain or excessive joint motion → lateral elbow sprain or instability

Clinical notes

Due to the dynamic range of the elbow joint it is important to test the elbow ligament integrity in at least two positions

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Shoulder radiographic evaluation

B = Bone: evaluate film for fractures & dislocations, describe variations in cortices, medullary & subchondral bone, density, shape, size, trabecular patterns & relationship of osseous arrangements.

A = Alignment: analyze alignment, results of various measurements; misalignments

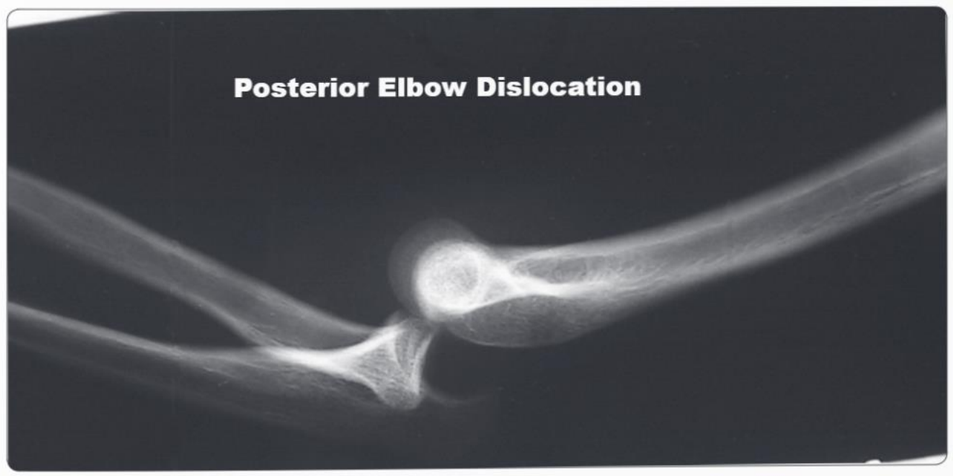
C = Cartilage: inspect the joint spaces, articular spaces for any abnormalities; pay attention to symmetry, continuity, widening or loss of joint space & calcification of cartilage

S = Soft Tissue: evaluate soft tissues; look for unusual calcifications, including in blood vessels, masses, displaced fascial lines & unusual gas distribution; note the presence of fat-pad signs ('sail sign') and soft tissue edema

Elbow anatomical variants & anomalies

- Pseudoperiarthritis - calcification of interosseus membrane between radius & ulna
- Supracondylar process - exostosis on anteriomedial humeral metaphysis





S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

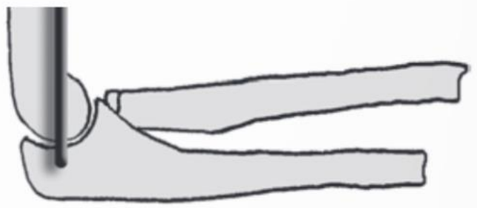
View Cassette, SID kV Range		Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker	Clinical notes
Elbow	**AP** ½-10x12, 40″ 60±5 kV	Mid elbow joint 0°, no Area of interest	Path of central ray Corner of film Apron	Consider AP & lateral on same film
	Lateral ½-10x12, 40″ 60±5 kV	Mid elbow joint 0°, no Area of interest	Path of central ray Corner of film Apron	Arm flexed 90°
	Tangential 8x10, 40″ 55±5 kV	Above olecranon tip 0°, no Area of interest	Path of central ray Corner of film Apron	Arm flexed 150° Synonym: Jones view

If area measures less than 10 cm iin diameter choose no grid (non-bucky)
8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended,
F. spot = Focal Spot, Cr. = central ray, IVF = Intervertebral foramen, SID = Source Image Distance (inches)



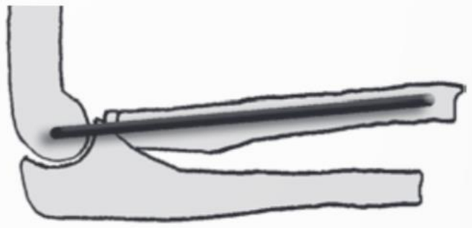
Anterior Humeral Line

Normal: line should pass through capitulum
Interpretation: posterior displacement of capitulum → fracture
Good for detecting supracondylar fractures
Note the presence of fat pads ('sail sign') due to edema, as fracture lines are often not visible



Radiocapitellar Line

Normal: line should pass through center of capitulum
Interpretation: line does not pass through capitulum → radial head subluxation (pulled elbow) or dislocation
Note the presence of fat pads ('sail sign') due to edema



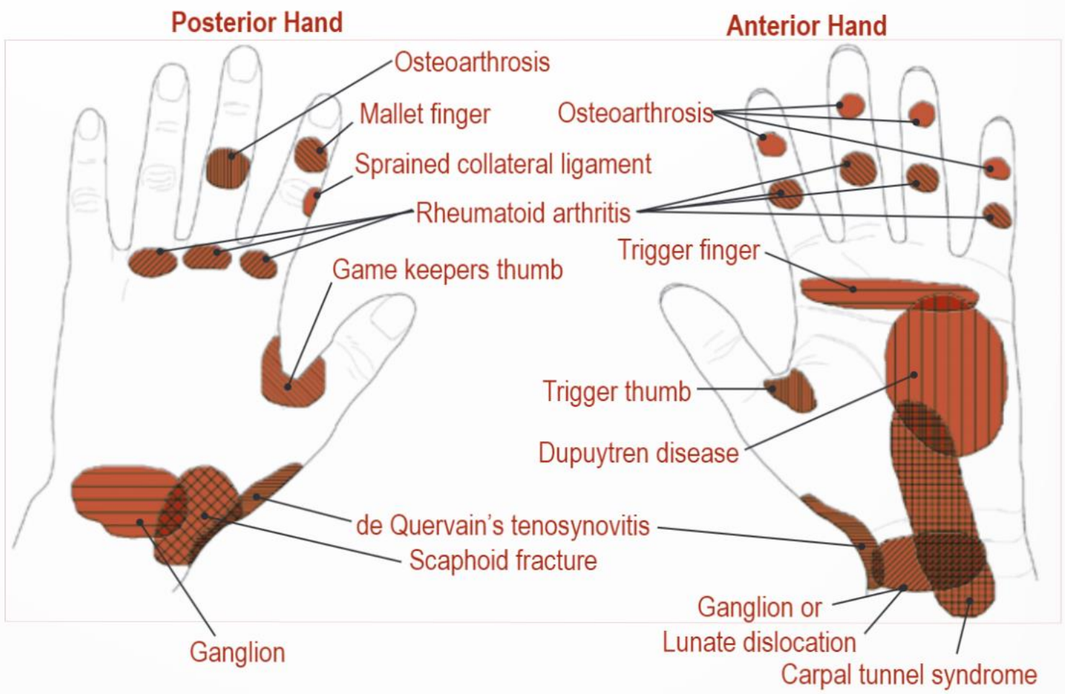
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

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Forearm Wrist & Hand Contents

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Selected Wrist & Hand Pain Referral Patterns



Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Wrist & Hand Exam Flow

prohealth

Follow HIP-MNRS
History, Inspection, Palpation - Motion, Neurovascular screen, Referred pain, Special tests

Special history considerations
- Specific mechanism of injury & forces involved? - Did you fall on outstretched hand (FOOSH)?
- Any numbness, tingling or weakness?
- Type of work, typical posture?

Inspection
- Asymmetry, bruising, bumps, color, swelling, height, head tilt
- Posture of neck, body, shoulder

Fracture screen (if indicated)
1. Older than 55? Isometric Test
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz), Ultrasound

Palpation (may be done after ROM assessment)

Wrist flexors	Middle finger (#3)
Pronator teres	Ring finger (#4)
Wrist extensors	Little finger (#5)
Supinator	Scaphoid
Thumb extensors	Lunate
Interossei	Triquetrum, Pisiform
Thenar pad	Lister's tubercle
Hypothenar pad	Hamate
Carpal tunnel	Capitate
Tunnel of Guyon	Trapezoid
Anatomic snuff box	Trapezium
Metacarpals	Ulnar/radial styloids
Thumb (#1)	Triangular fibrocartilage
Index finger (#2)	Collateral ligaments

Functional assessment (ADL)
- Handshake with grip strength

AROM
Wrist
Flexion ..... 80°
Extension ..... 70°
Ulnar Flexion ..... 30°
Radial Flexion ..... 20°
Fingers
Flexion (MP) ..... 90°
Extension (MP) ..... 40°
Abduction ..... 20°
Adduction ..... 20°

PIP joint
Flexion ..... 70°
Extension ..... 0°

DIP joint
Flexion ..... 80°
Extension ..... 20°

PROM & Joint Play (if lacking AROM in any motion)

Myotomes (resisted isometric movements)
- Brachioradialis (C5, C6 - radial)
- Biceps (C5, **C6** - musculocutaneous)
- Triceps (C6, **C7**, C8, T1 - radial)
- Wrist extensors (**C6**, C7, C8 - radial)
- Wrist flexors (C6, **C7** - median/ulnar)
- Finger flexors (C7, **C8**, T1 - ulnar/median)
- Interossei (C7, C8, **T1** - ulnar)

Neurovascular screen
- ***Sensory:*** light touch, two point discrimination, Vibration (3rd digit), Tinel's
- ***DTR's:*** Biceps (C5), Brachioradialis (C6)
  - Triceps (C7)
- Grip strength (Dynamometer)
- Radial & brachial pulse, blanching, temperature

Orthopedic tests (as indicated)
Carpal tunnel syndrome
- Phalen's
- Tinel's / Median nerve compression test
- Flick maneuver

Ulnar neuropathy
- Tinel's at wrist & elbow
- Froment's test
- Wartenberg's test

Vascular disorder
- Allen's test, capillary refill

Tenosynovitis
- Finkelstein's test

Instability
- Valgus/varus stress
- Lunatotriquitral ballotement
- Watson's test; Thumb abduction stress test

TFC tear
- Press test; TFC dorsal glide test

Contracture
- Bunnel-Littler test

Fracture
- Scaphoid fracture test

Elbow, shoulder & cervical spine screen

Diagnostic imaging (if indicated)

Elbow	Clinical notes
Lateral epicondylitis	*Hx:* repetitive motions (gripping, hammering, lifting, tennis backhand) *SSx:* tender to palpation over lateral epicondyle/common extensor tendon; ↑ elbow pain with resisted wrist extension; (+) Mill's, Cozen's Test *DDx:* cervical radiculopathy, posterior interosseous nerve entrapment
Medial epicondylitis	*Hx:* repetitive motions (gripping, lifting, golfing) *SSx:* tender to palpation over medial epicondyle/common flexor tendon; ↑ elbow pain with resisted wrist flexion; (+) reverse Mill's, reverse Cozen's Test *DDx:* cervical radiculopathy
Pulled (Toddler's) **Elbow**	*Hx:* child (age 1-4) swung by arms or arm tugged "hurry up Sally" *SSx:* pain & apprehension, child is unwilling to straighten elbow *DDx:* elbow or wrist fracture (usually more significant trauma)
Pronator teres syndrome	*Hx:* repetitive motions (gripping with pronation), tingling & weakness in hand *SSx:* tender to palpation over mid pronator teres; ↑ hand symptoms with palpation of pronator teres, weakness in wrist flexion; (+) Tinel's (possible) *DDx:* cervical radiculopathy, carpal tunnel syndrome
UCL rupture	*Hx:* prior elbow dislocation, throwing injury or chronic overload (throwing athlete) *SSx:* tenderness to palpation of UCL; (+) valgus stress test *DDx:* olecranon bursitis, osteocondritis dessicans, fracture

Wrist/Hand	Clinical notes
Carpal tunnel syndrome	*Hx:* insidious onset; paresthesia into hand; loss of digital dexterity *SSx:* (+) Tinel's, Phalen's test; ↓ sensation over median nerve distribution in hand *DDx:* pronator teres syndrome, thoracic outlet syndrome, C6-C7 radiculopathy
de Quervain's tenosynovitis	*Hx:* aching pain above radial styloid; worse with wrist & thumb movements *SSx:* (+) Finkelstein's test; audible squeaking sound with wrist movement *DDx:* scaphoid fracture, osteoarthrosis
Gamekeeper's thumb	*Hx:* traumatic extension or abduction of thumb; pain over ulnar side of MCP joint *SSx:* (+) thumb abduction test; UCL instability *DDx:* scaphoid fracture, Bennett fracture, osteoarthrosis
Wrist Sprain	*Hx:* traumatic extension or flexion of wrist (FOOSH) *SSx:* palpable tenderness over ligaments, limited AROM &PROM (+) bracelet test *DDx:* scaphoid fracture, TFC tear, rheumatoid or septic arthritis
Ganglion cyst	*Hx:* painful or painless lump or mass on wrist, weight bearing aggravates (push-up) *SSx:* palpable, solid mass, may be tender to palpation *DDx:* infection
Lunate dislocation	*Hx:* FOOSH (fall on out stretched hand) or impact trauma to hand *SSx:* tenderness in wrist in line with 3rd metacarpal; visible on x-ray (spilled tea cup) *DDx:* lunate or scaphoid fracture, osteoarthrosis
Scaphoid fracture	*Hx:* FOOSH (fall on out stretched hand) or impact trauma to hand *SSx:* pain in anatomical snuff box with radial flexion; (+) scaphoid fracture test *DDx:* lunate dislocation, osteoarthrosis
TFC Tear	*Hx:* FOOSH (fall on out stretched hand) or impact trauma to hand with twisting *SSx:* local pain with ROM; possible ↓ ROM & grip strength; (+) TFC dorsal glide *DDx:* lunate dislocation, ulnar styloid fracture, osteoarthrosis

↑ = increase, ↓ = decrease, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis, (+) = positive

Wrist & Hand Exam Form

Wrist/Hand Regional Examination

☑ Check normal, circle & describe abnormal

CC & significant history: _____

Patient: _____ date: _____
Insurance: _____ (dd/mm/yy)
Date of birth: _____ M/F

Fracture screen (tuning fork, percussion, torsion test, grip strength): □ WNL, □ Refer for X-ray: _____

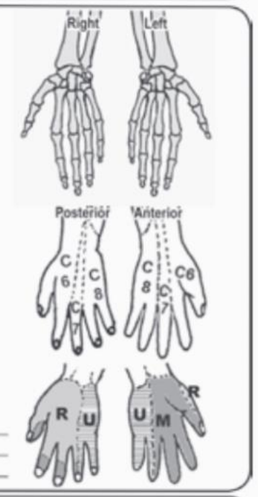
Observation: □ WNL

Development: □ good, □ fair, □ poor
□ Antalgia: _____
□ Skin (bruising, scars): _____
□ Asymmetry: _____

Observation □ WNL		L	R
Head position			
Shoulder position			
Elbow position			
Hand pronated/supinated			
Fingers flexed/extended			
Deformities	Boutonniere deformity		
	Swan neck deformity		
	Mallet finger		
	Heberden's nodes		
	Bouchard's nodes		
	Other:		

Palpation: □ WNL, texture, tenderness, pain referral

Palpation	L	R	Palpation	L	R
Wrist flexors			Middle finger (#3)		
Pronator teres			Ring finger (#4)		
Wrist extensors			Little finger (#5)		
Supinator			Scaphoid		
Thumb extensors			Lunate		
Interossei			Triquetrum		
Thenar pad			Pisiform		
Hypothenar pad			Hamate		
Carpal tunnel			Capitate		
Tunnel of Guyon			Trapezoid		
Anatomic snuff box			Trapezium		
Metacarpals			Ulnar/radial styloids		
Thumb (#1)			Triangular complex		
Index finger (#2)			Collateral ligaments		



ROM & Joint Play: □ WNL

ROM & Joint play		Active L	Active R	Passive L	Passive R
Wrist	Flexion (80°)				
	Extension (70°)				
	Ulnar flexion (30°)				
	Radial flexion (20°)				
MP joint	Flexion (90°)				
	Extension (40°)				
	Abduction (20°)				
	Adduction (20°)				
PIP	Flexion (70°)				
	Extension (0°)				
DIP	Flexion (80°)				
	Extension (20°)				
Thumb	MP flexion (60°)				
	MP extension (20°)				
	IP flexion (90°)				
	IP extension (20°)				

Joint Play	L	R
Distal radioulnar		
Individual carpals		

* Most joint play is done with passive ROM for the hand

Vascular Screen: □ WNL

Pulses (0-4)	L	R
Radial pulse		
Ulnar pulse		
Blanch test		
Allen's test		
Temperature		

Neurologic: □ WNL

Reflexes (0-5), □ WNL	L	R
Biceps (C5)		
Brachioradialis (C6)		
Triceps (C7)		
General grip strength		

Motor (0-5), □ WNL	L	R
Pronator teres (median)		
Pronator quadratus (median)		
Supinator (radial)		
Wrist extensors (C6)		
Wrist flexors (C7)		
Finger extensors (C7)		
Finger flexors (C8)		
Finger abductors (T1)		
Finger adductors (T1)		

*Atrophy, swelling, dominant vs. non-dominant
**General sensation is done through palpation

MP = metacarpophalangeal, PIP = proximal interphalangeal, DIP = distal interphalangeal, IP = interphalangeal, WNL = Within Normal Limits

Orthopedic: □ WNL

Neuro-injury	L	R	Other injury	L	R
Phalen's (median)			Scaphoid fracture test		
Wrist drop (radial)			Thumb abd. stress		
Froment's cone (uln)			Thumb grind test		
Opposition (median)			Finger stress test		
Thumb adduction			Bracelet test		
Pinch grip test			Lunotriquetral ballot.		
Tinel's (median)			Bunnel-Littler test		
Tinel's (ulnar)			Retinaculum test		
Tourniquet test			Finkelstein's		
Wartenberg's sign			Wringing test		

Dynamometer	L	R	L	R	L	R
Repeat 3 times						

Serial # _____ Setting: _____

Neck evaluation: _____
Shoulder eval: _____
Elbow evaluation: _____

DDx: _____

Signature: _____ Date: _____

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

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Joint type: synovial
Gliding (intercarpal)
Ellipsoid (radiocarpal & ulnocarpal)
Pivot (distal radioulnar)
Saddle (trapeziometacarpal)

AROM

Distal radioulnar
- Supination ..... 85°-90°
- Pronation ..... 85°-90°

Wrist
- Flexion ..... 80°
- Extension ..... 70°
- Ulnar Flexion ..... 30°
- Radial Flexion ..... 20°

Fingers
- Flexion (2-5 MCP) .. 90°
- Extension (MP) ..... 40°
- Abduction ..... 20°
- Adduction ..... 20°

PIP joint
- Flexion ..... 100°
- Extension ..... 0°

DIP joint
- Flexion ..... 80°
- Extension ..... 10°

Main muscle actions

Wrist flexion: flexor carpi radialis & flexor carpi ulnaris, palmaris longus
Wrist extension: extensor carpi radialis longus & brevis, extensor carpi ulnaris, extensor digitorum
Radial flexion (abduction): extensor carpi radialis longus/brevis, flexor carpi radialis
Ulnar flexion (adduction): flexor & extensor carpi ulnaris

Finger flexion: flexor digitorum profundus, superficialis, lumbricals
Thumb flexion: flexor pollicis longus & brevis
Finger extension: extensor digitorum
Thumb extension: extensor pollicis longus & brevis
Abduction: dorsal interossei
Adduction: palmar interossei

Normal joint end feels

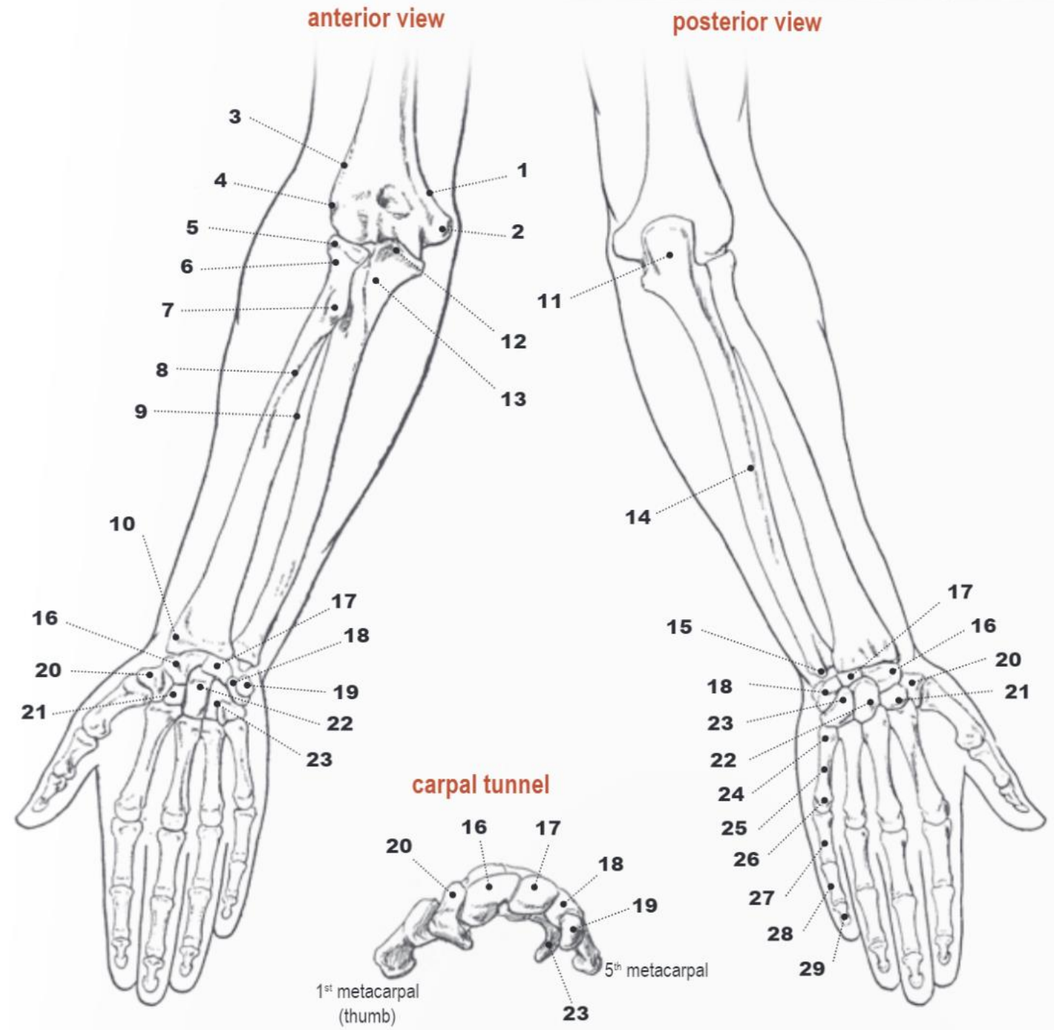
Radiocarpal flex/ext: firm ligamentous
Radiocarpal add/abd: bony

CMC thumb: elastic
MCP extension: elastic / ligamentous
MCP flexion: firm / ligamentous
MCP thumb: firm / bony

PIP flexion: firm / bony
PIP extension: firm / ligamentous
DIP flexion: firm / ligamentous / elastic
DIP extension: firm / ligamentous / elastic

Joint	Resting Position	Tight Packed Position	Capsular Pattern
Distal radioulnar	10° supination	5° supination	Supination = pronation
Radiocarpal	2° ulnar flexion	Extension	Flexion > extension
Intercarpal	2° flexion	Extension	None
Midcarpal	2° flexion	Extension, ulnar flexion	Flexion > extension
Thumb CMC	Midway of all motions	Full opposition	Abduction > extension
Fingers	Mid flexion & extension	Full flexion (fist)	Limits in all directions
MCP	2° flexion	Thumb: full opposition Fingers: full flexion (fist)	Flexion > extension
IP	2° flexion	Full extension	Flexion > extension

CMC = carpometacarpal, MCP = metacarpophalangeal, IP = interphalangeal, PIP = proximal interphalangeal, DIP = distal interphalangeal



Humerus
1. Medial supracondylar ridge
2. Medial epicondyle
3. Lateral supracondylar ridge
4. Lateral epicondyle

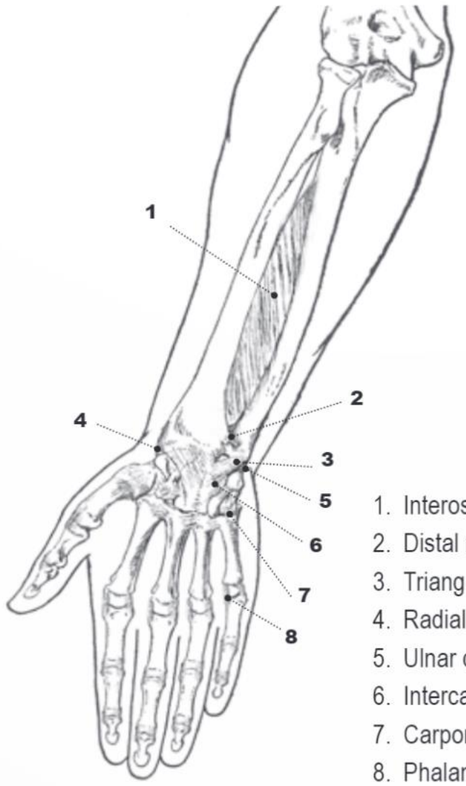
Radius
5. Head
6. Neck
7. Radial / bicipital tuberosity
8. Oblique line
9. Interosseous border
10. Styloid process

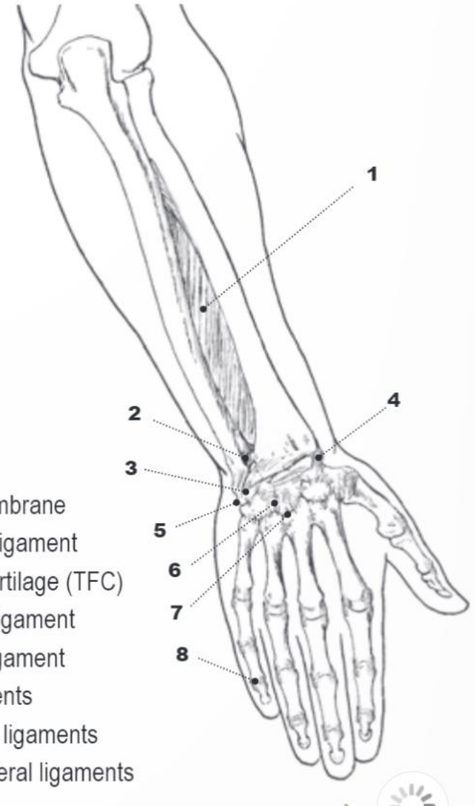
Ulna
11. Olecranon
12. Coronoid process
13. Ulnar tuberosity
14. Posterior border
15. Styloid process

Carpals
16. Scaphoid
17. Lunate
18. Triquetrum
19. Pisiform
20. Trapezium
21. Trapezoid
22. Capitate
23. Hamate

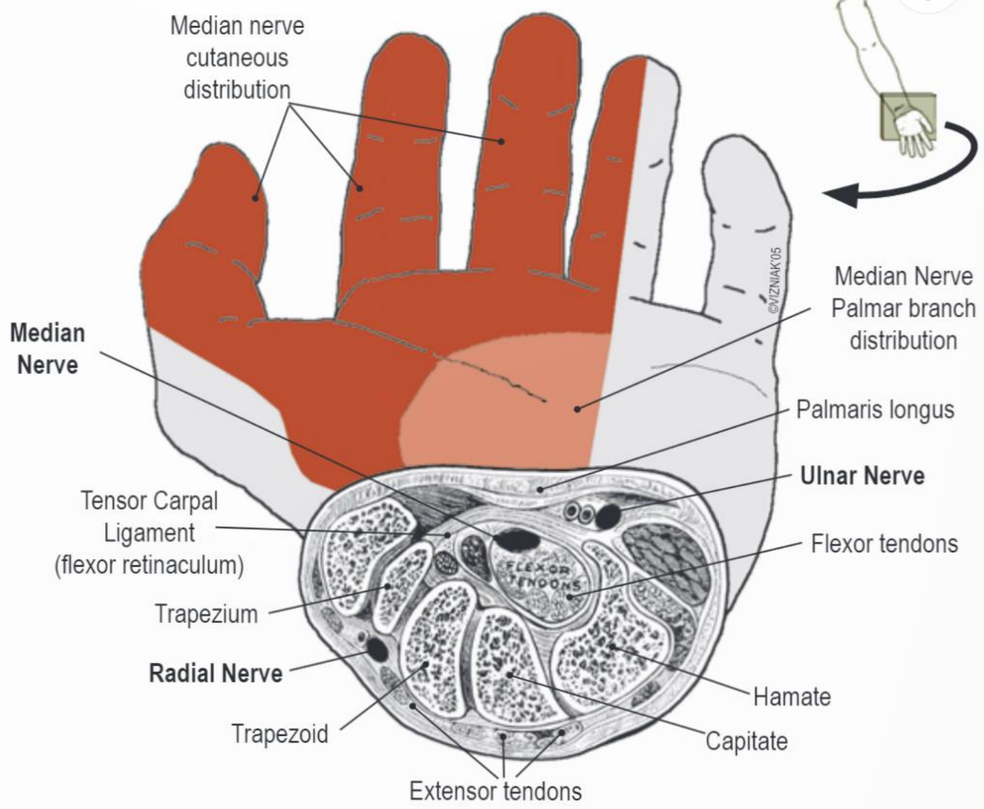
Metacarpals
24. Base
25. Body
26. Head

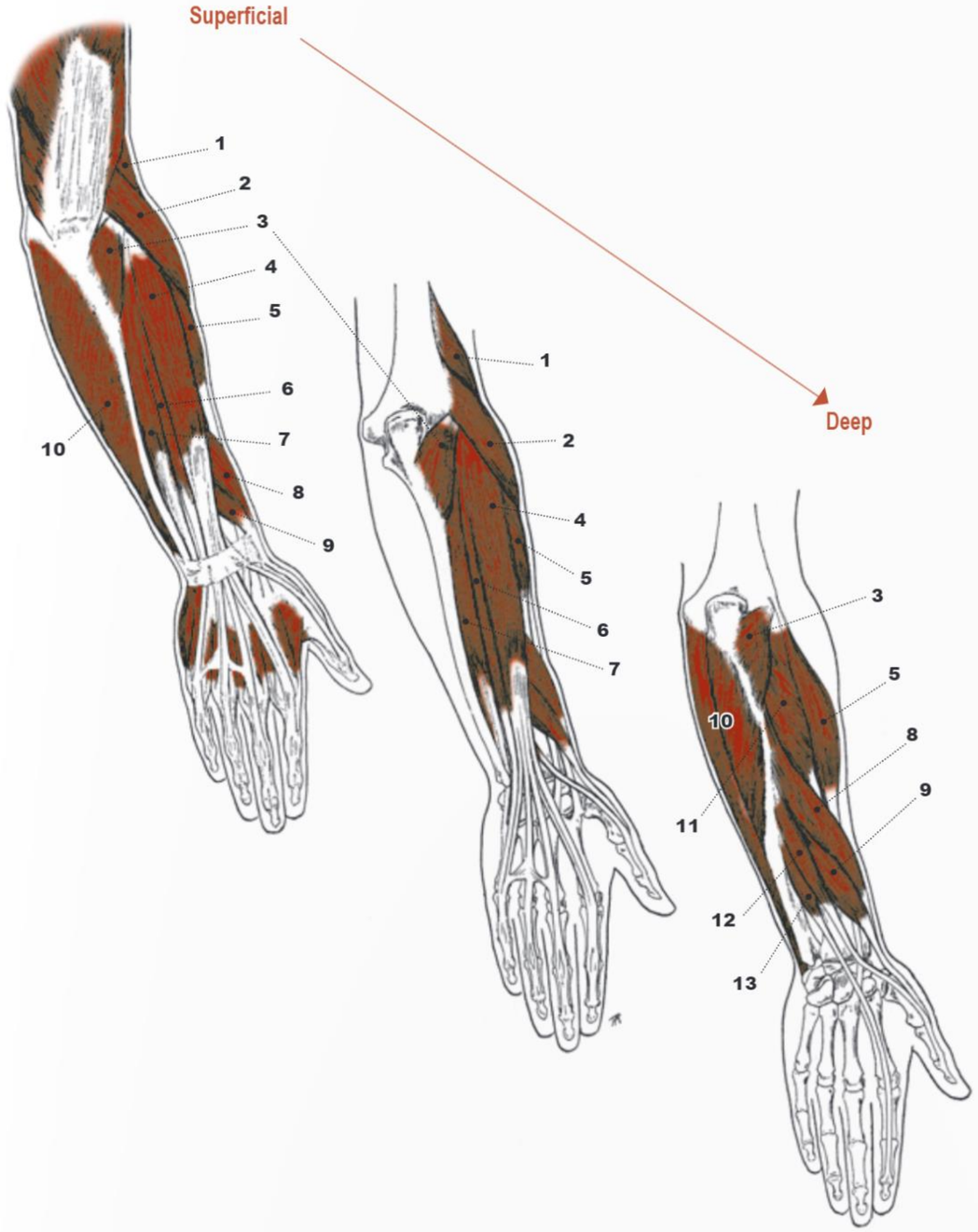
Phalanges
27. Proximal
28. Middle
29. Distal



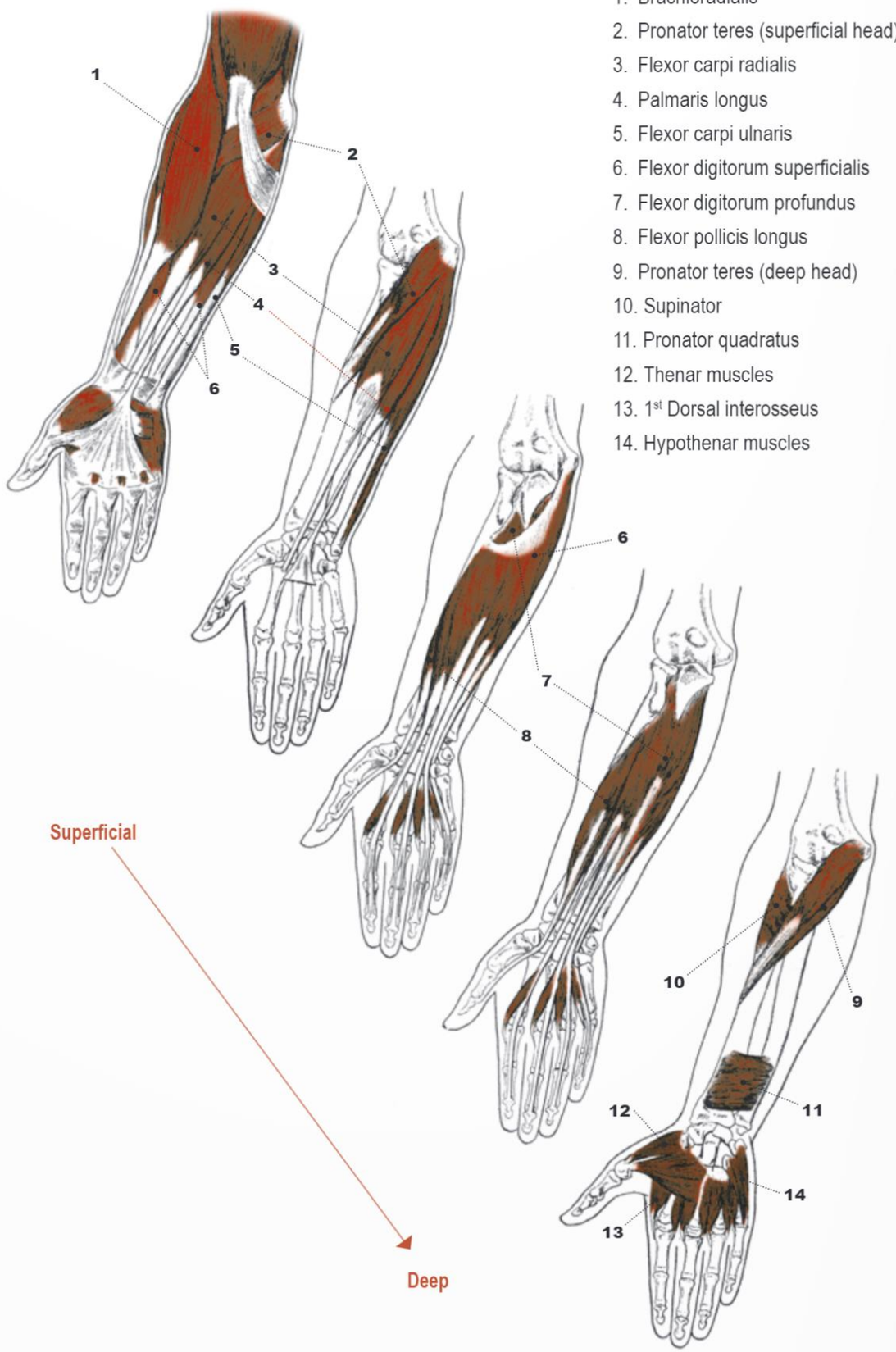


1. Interosseous membrane
2. Distal radioulnar ligament
3. Triangular fibrocartilage (TFC)
4. Radial collateral ligament
5. Ulnar collateral ligament
6. Intercarpal ligaments
7. Carpometacarpal ligaments
8. Phalangeal collateral ligaments





1. Brachioradialis
2. Extensor carpi radialis longus
3. Anconeus
4. Extensor digitorum
5. Extensor carpi radialis brevis
6. Extensor digiti minimi
7. Extensor carpi ulnaris
8. Abductor pollicis longus
9. Extensor pollicis brevis
10. Flexor carpi ulnaris
11. Supinator
12. Extensor pollicis longus
13. Extensor indicis



1. Brachioradialis
2. Pronator teres (superficial head)
3. Flexor carpi radialis
4. Palmaris longus
5. Flexor carpi ulnaris
6. Flexor digitorum superficialis
7. Flexor digitorum profundus
8. Flexor pollicis longus
9. Pronator teres (deep head)
10. Supinator
11. Pronator quadratus
12. Thenar muscles
13. 1st Dorsal interosseus
14. Hypothenar muscles

Ape Hand Deformity
Thenar atrophy with hyperextension of metacarpal-phalangeal joints; the thumb drops back in line with other fingers
Due to median nerve palsy (inability to oppose thumb)


Ape Hand

Bishop's Hand Deformity
Hypothenar & interossei atrophy & flexion contracture of ring & little finger – with lesser involvement of middle & index fingers
Due to ulnar nerve palsy, common injury sites are cubital tunnel & tunnel of Guyon
Similar to Dupuytren's contracture in appearance except no loss of passive extension


Bishop's Hand

Bouchard's Nodes
Osteocartilaginous enlargement at the PIP; may be associated with both RA & osteoarthritis (usually RA)

Boutonniere Deformity
'Button hole' deformity, rupture or splitting of the extensor tendon at the middle phalanx leading to hyperextension of MCP & DIP & hyper-flexion of PIP joint
May be seen in RA & following severe sprains/fractures of the finger

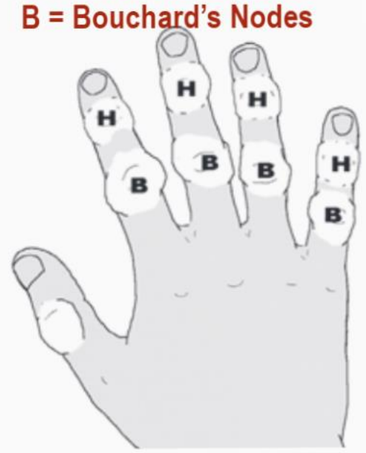

Boutonniere Deformity

Claw Hand/Claw Fingers
Flexion contracture of all 5 digits due to combined ulnar & median nerve palsy results in finger flexion contracture; may involve cords of brachial plexus or above
Lesions of the median nerve above the elbow can also produce claw hand


Claw Hand

Dupuytren's Contracture
Hypertrophic nodular fibroplasia of the palmar aponeurosis resulting in flexion contraction deformity of fingers most often involving ring & little fingers; familial trend; more common in males; there is a lose of passive extension of the affected digits
May look like ulnar neuropathy, however, there is less muscle wasting in the hypothenar eminence & no wasting of the interossei (webbing between the metacarpals)

H = Heberden's Nodes
B = Bouchard's Nodes



Heberden's Nodes
Small hard nodules at distal interphalangeal joints due to calcific spurring associated with osteoarthritis

Jersey Finger or Sweater Sign

Rupture of a flexor digitorum profundus tendon

Patient unable to bend the proximal finger & distal phalanges of injured finger when making a fist ('sweater sign') (usually involves 4th or 3rd finger)



Mallet Finger (baseball finger)

Rupture of extensor tendon from its insertion on distal phalanx (unable to extend distal phalanx)

Patient unable to extend the fingertip of injured finger



Seal Fin Deformity

Ulnar deviation of fingers (RA often seen in combination with deformity)

Haygarth's nodes & Bouchard's nodes also may be present



Swan Neck Deformity

Finger deformity where proximal interphalangeal joint is hyperextended & distal interphalangeal joint is flexed, due to splitting of the flexor sheath

Often seen in several fingers in RA



Trigger Finger

Fusiform swelling in the flexor digitorum superficialis tendon just proximal to its bifurcation & at proximal end of the tendon sheath

Initially snapping occurs during flexion-extension as the nodule passes in & out of the sheath

Later the nodule is unable to enter the sheath & the finger becomes locked in a flexed position

Often DJD, RA or direct tendon trauma.



Volkman's Ischemic Contracture

Ischemic contracture of anterior forearm muscles with varying degrees of neurologic deficit

Supracondylar humeral fracture (or other elbow fracture) common cause - brachial artery impaled by bone fragment

Other causes; swelling & severe compartment compression syndrome; improper fitting cast & swollen arm/forearm

5 "P's" (pain with stretch, paresis, pulseless, pale/pallor, paresthesia) are indications of vascular compromise



Wrist/Hand Regional Examination

☑ Check normal, circle & describe abnormal

Patient: _____ date: _____
Insurance: _____ (delivery)
Date of birth: _____ M/F

CC & significant history: _____

Fracture screen (tuning fork, percussion, torsion test, grip strength): □ WNL, □ Refer for X-ray: _____

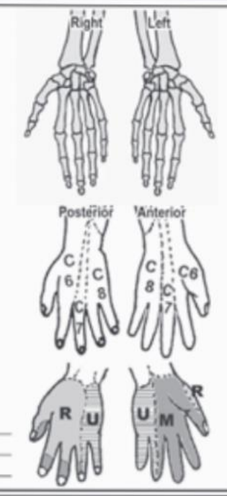
Observation: □ WNL

Development: □ good, □ fair, □ poor
□ Antalgia: _____
□ Skin (bruising, scars): _____
□ Asymmetry: _____

Observation □ WNL		L	R
Head position			
Shoulder position			
Elbow position			
Hand pronated/supinated			
Fingers flexed/extended			
Deformities	Boutonniere deformity		
	Swan neck deformity		
	Mallet finger		
	Heberden's nodes		
	Bouchard's nodes		
	Other:		

Palpation: □ WNL, texture, tenderness, pain referral

Palpation	L	R	Palpation	L	R
Wrist flexors			Middle finger (#3)		
Pronator teres			Ring finger (#4)		
Wrist extensors			Little finger (#5)		
Supinator			Scaphoid		
Thumb extensors			Lunate		
Interossei			Triquetrum		
Thenar pad			Pisiform		
Hypothenar pad			Hamate		
Carpal tunnel			Capitate		
Tunnel of Guyon			Trapezoid		
Anatomic snuff box			Trapezium		
Metacarpals			Ulnar/radial styloids		
Thumb (#1)			Triangular complex		
Index finger (#2)			Collateral ligaments		



ROM & Joint Play: □ WNL

ROM & Joint play		Active L	Active R	Passive L	Passive R
Wrist	Flexion (80°)				
	Extension (70°)				
	Ulnar flexion (30°)				
	Radial flexion (20°)				
MP joint	Flexion (90°)				
	Extension (40°)				
	Abduction (20°)				
	Adduction (20°)				
PIP	Flexion (70°)				
	Extension (0°)				
DIP	Flexion (80°)				
	Extension (20°)				
Thumb	MP flexion (60°)				
	MP extension (20°)				
	IP flexion (90°)				
	IP extension (20°)				

Joint Play	L	R
Distal radioulnar		
Individual carpals		

* Most joint play is done with passive ROM for the hand

Vascular Screen: □ WNL

Pulses (0-4)	L	R
Radial pulse		
Ulnar pulse		
Blanch test		
Allen's test		
Temperature		

Neurologic: □ WNL

Reflexes (0-5), □ WNL	L	R
Biceps (C5)		
Brachioradialis (C6)		
Triceps (C7)		
General grip strength		

Motor (0-5), □ WNL	L	R
Pronator teres (median)		
Pronator quadratus (median)		
Supinator (radial)		
Wrist extensors (C6)		
Wrist flexors (C7)		
Finger extensors (C7)		
Finger flexors (C8)		
Finger abductors (T1)		
Finger adductors (T1)		

*Atrophy, swelling, dominant vs. non-dominant
**General sensation is done through palpation

MP = metacarpophalangeal, PIP = proximal interphalangeal, DIP = distal interphalangeal, IP = interphalangeal, WNL = Within Normal Limits

Orthopedic: □ WNL

Neuro-injury	L	R	Other injury	L	R
Phalen's (median)			Scaphoid fracture test		
Wrist drop (radial)			Thumb abd. stress		
Froment's cone (uln)			Thumb grind test		
Opposition (median)			Finger stress test		
Thumb adduction			Bracelet test		
Pinch grip test			Lunotriquetral ballot.		
Tinel's (median)			Bunnel-Littler test		
Tinel's (ulnar)			Retinaculum test		
Tourniquet test			Finkelstein's		
Wartenberg's sign			Wringing test		

Dynamometer	L	R	L	R	L	R
Repeat 3 times						

Serial # _____ Setting: _____

Neck evaluation: _____
Shoulder eval: _____
Elbow evaluation: _____

DDx: _____

Signature: Date:

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

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Elbow	Clinical notes
Lateral epicondylitis	*Hx:* repetitive motions (gripping, hammering, lifting, tennis backhand) *SSx:* tender to palpation over lateral epicondyle/common extensor tendon; ↑ elbow pain with resisted wrist extension; (+) Mill's, Cozen's Test *DDx:* cervical radiculopathy, posterior interosseous nerve entrapment
Medial epicondylitis	*Hx:* repetitive motions (gripping, lifting, golfing) *SSx:* tender to palpation over medial epicondyle/common flexor tendon; ↑ elbow pain with resisted wrist flexion; (+) reverse Mill's, reverse Cozen's Test *DDx:* cervical radiculopathy
Pulled (Toddler's) **Elbow**	*Hx:* child (age 1-4) swung by arms or arm tugged "hurry up Sally" *SSx:* pain & apprehension, child is unwilling to straighten elbow *DDx:* elbow or wrist fracture (usually more significant trauma)
Pronator teres syndrome	*Hx:* repetitive motions (gripping with pronation), tingling & weakness in hand *SSx:* tender to palpation over mid pronator teres; ↑ hand symptoms with palpation of pronator teres, weakness in wrist flexion; (+) Tinel's (possible) *DDx:* cervical radiculopathy, carpal tunnel syndrome
UCL rupture	*Hx:* prior elbow dislocation, throwing injury or chronic overload (throwing athlete) *SSx:* tenderness to palpation of UCL; (+) valgus stress test *DDx:* olecranon bursitis, osteocondritis dessicans, fracture

Wrist/Hand	Clinical notes
Carpal tunnel syndrome	*Hx:* insidious onset; paresthesia into hand; loss of digital dexterity *SSx:* (+) Tinel's, Phalen's test; ↓ sensation over median nerve distribution in hand *DDx:* pronator teres syndrome, thoracic outlet syndrome, C6-C7 radiculopathy
de Quervain's tenosynovitis	*Hx:* aching pain above radial styloid; worse with wrist & thumb movements *SSx:* (+) Finkelstein's test; audible squeaking sound with wrist movement *DDx:* scaphoid fracture, osteoarthrosis
Gamekeeper's thumb	*Hx:* traumatic extension or abduction of thumb; pain over ulnar side of MCP joint *SSx:* (+) thumb abduction test; UCL instability *DDx:* scaphoid fracture, Bennett fracture, osteoarthrosis
Wrist Sprain	*Hx:* traumatic extension or flexion of wrist (FOOSH) *SSx:* palpable tenderness over ligaments, limited AROM &PROM (+) bracelet test *DDx:* scaphoid fracture, TFC tear, rheumatoid or septic arthritis
Ganglion cyst	*Hx:* painful or painless lump or mass on wrist, weight bearing aggravates (push-up) *SSx:* palpable, solid mass, may be tender to palpation *DDx:* infection
Lunate dislocation	*Hx:* FOOSH (fall on out stretched hand) or impact trauma to hand *SSx:* tenderness in wrist in line with 3rd metacarpal; visible on x-ray (spilled tea cup) *DDx:* lunate or scaphoid fracture, osteoarthrosis
Scaphoid fracture	*Hx:* FOOSH (fall on out stretched hand) or impact trauma to hand *SSx:* pain in anatomical snuff box with radial flexion; (+) scaphoid fracture test *DDx:* lunate dislocation, osteoarthrosis
TFC Tear	*Hx:* FOOSH (fall on out stretched hand) or impact trauma to hand with twisting *SSx:* local pain with ROM; possible ↓ ROM & grip strength; (+) TFC dorsal glide *DDx:* lunate dislocation, ulnar styloid fracture, osteoarthrosis

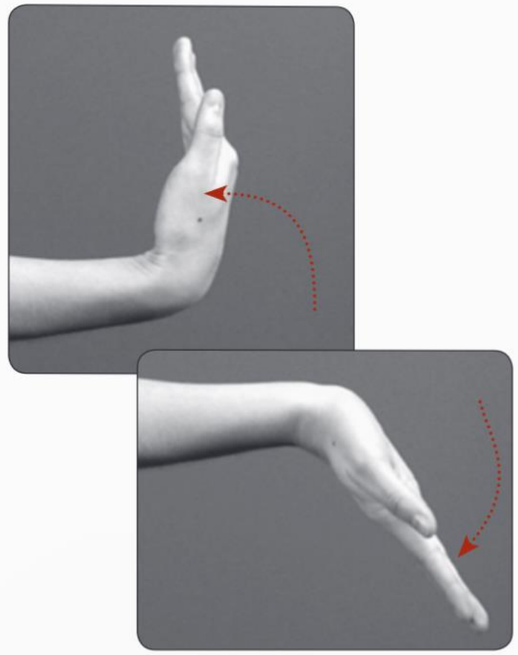
↑ = increase, ↓ = decrease, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis, (+) = positive

Wrist AROM & PROM

Compare bilaterally, start with unaffected side for PROM & MMT
Prior to assessing ROM the examiner should make an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."

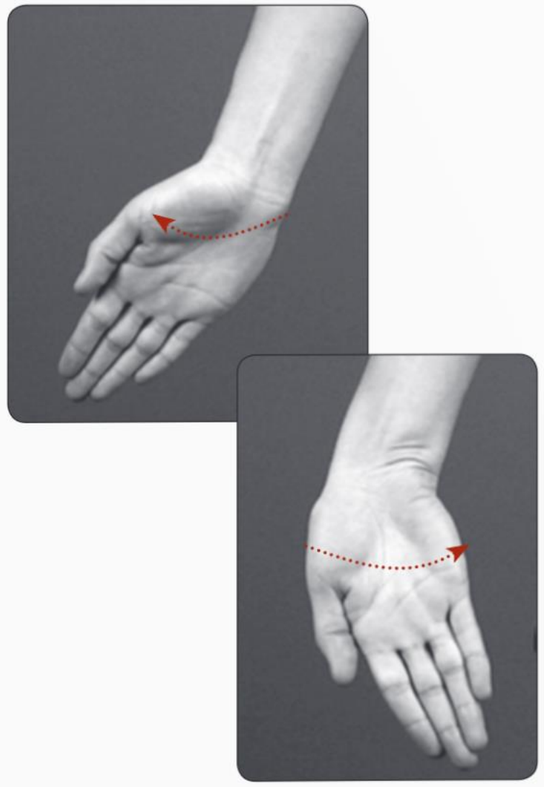
AROM

Flexion (75º-90º)
Muscles Activated: flexor carpi radialis & flexor carpi ulnaris, palmaris longus, flexor digitorum superficialis & profundus
Tissue Stretched: extensor carpi radialis longus & brevis, extensor carpi ulnaris, extensor digitorum, anterior carpal ligaments
Tissue Compressed: carpal tunnel & median nerve



Extension (70º-90º)
Muscles Activated: extensor carpi radialis longus & brevis, extensor carpi ulnaris, extensor digitorum
Tissue Stretched: flexor carpi radialis & flexor carpi ulnaris, palmaris longus, flexor digitorum superficialis & profundus
Tissue Compressed: posterior carpal ligaments

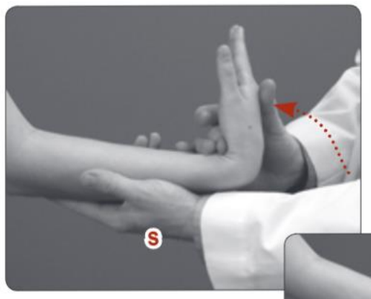
Abduction (radial flexion) (15º-25º)
Muscles Activated: extensor carpi radialis longus/ brevis, flexor carpi radialis
Tissue Stretched: flexor & extensor carpi ulnaris, medial carpal ligament, triangular fibrocartilage
Tissue Compressed: lateral carpal ligaments, scaphoid & trapezium



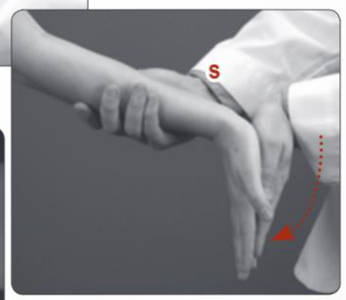
Adduction (ulnar flexion) (20º-35º)
Muscles Activated: flexor & extensor carpi ulnaris
Tissue Stretched: extensor carpi radialis longus/ brevis, flexor carpi radialis, lateral carpal ligaments
Tissue Compressed: medial carpal ligaments, hamate & triquetrum, TFC

PROM

Flexion (> 75°-90°)
Tissue Stretched: extensor carpi radialis longus & brevis, extensor carpi ulnaris, extensor digitorum, anterior carpal ligaments
Tissue Compressed: carpal tunnel & median nerve



Extension (> 70°-90°)
Tissue Stretched: flexor carpi radialis & flexor carpi ulnaris, palmaris longus, flexor digitorum superficialis & profundus
Tissue Compressed: posterior carpal ligaments



Abduction (radial flexion) (> 15°-25°)
Tissue Stretched: flexor & extensor carpi ulnaris, medial carpal ligament, triangular fibrocartilage
Tissue Compressed: lateral carpal ligaments, scaphoid & trapezium

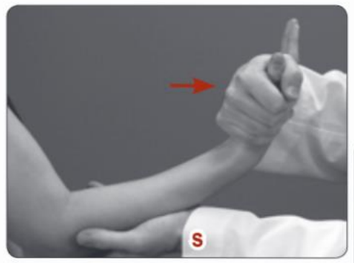


Adduction (ulnar flexion) (> 20°-35°)
Tissue Stretched: extensor carpi radialis longus/brevis, flexor carpi radialis, lateral carpal ligaments
Tissue Compressed: medial carpal ligaments, hamate & triquetrum, TFC (triangular fibrocartilage)



Muscle Testing

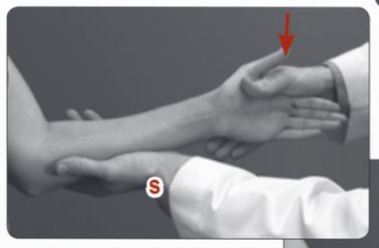
Flexion
Muscles Activated: flexor carpi radialis & flexor carpi ulnaris, palmaris longus, flexor digitorum superficialis & profundus



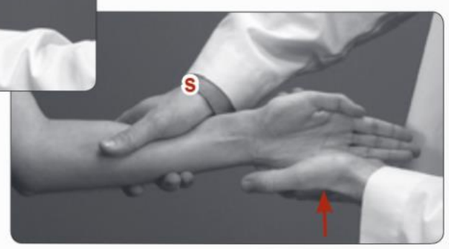
Extension
Muscles Activated: extensor carpi radialis longus & brevis, extensor carpi ulnaris, extensor digitorum



Abduction (radial flexion)
Muscles Activated: extensor carpi radialis longus/brevis, flexor carpi radialis



Adduction (ulnar flexion)
Muscles Activated: flexor & extensor carpi ulnaris

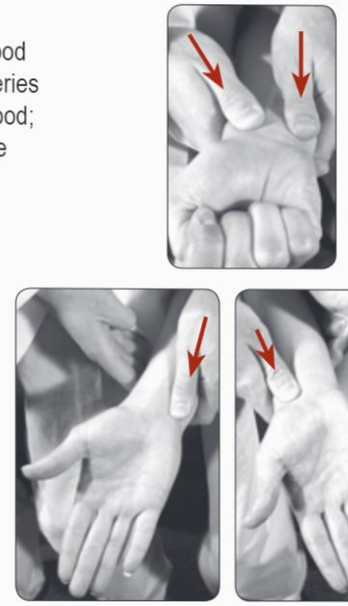


Allen's Test ★★★

Procedure
Seated patient instructed to make a fist (which helps remove blood from hands), examiner then compresses the ulnar & radial arteries & asks the patient to pump fist again to remove any excess blood; the examiner then releases one artery, test is repeated with the release of the other artery

Interpretation
(+) Skin remains blanched for greater than 5 seconds → Artery stenosis or occlusion (peripheral vascular disease)

Clinical notes
During compression the examiner may also apply pressure to underlying nerves which may result in carpal tunnel-like symptoms

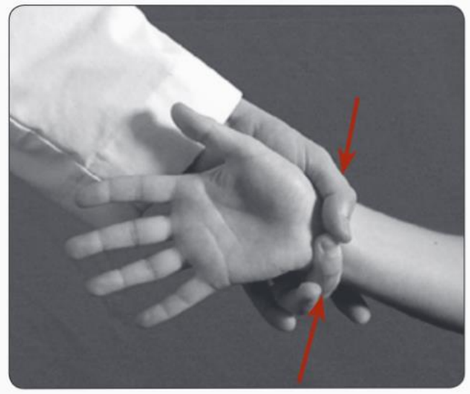


Bracelet Test ★★★

Procedure
Patient seated or standing, examiner applies lateral compressive force around the distal radius & ulna (at the location of patient wearing a bracelet)

Interpretation
(+) Forearm, wrist or hand pain → rheumatoid arthritis, OA/DJD at the wrist
(+) Abnormal ROM → ligament laxity, instability

Clinical notes
During wrist compression the focus is on articular structures; the examiner must be careful to avoid neurovascular compression which may produce carpal tunnel-like symptoms



Bunnel-Littler Test ★★★

Procedure
Patient seated, examiner extends MCP joint & attempts to flex PIP joint

Interpretation
(+) Decreased range of motion → Joint capsule contracture (osteoarthritis)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Cascade Sign ★★★



Procedure

Patient seated, elbow flexed 90°, & forearm supinated; examiner instructs patient to close hand without making a fist

Normally fingers converge over hypothenar muscles & scaphoid bone

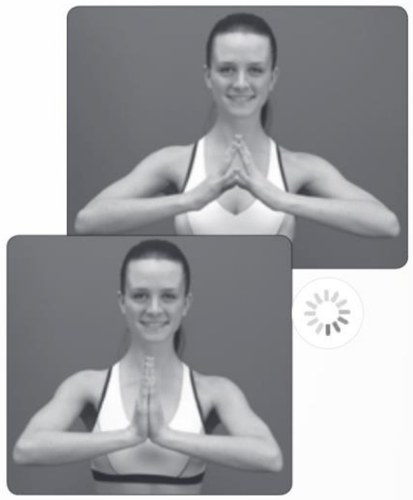
Interpretation

(+) Fingers overlapping or askew → metacarpal and/or carpal internal derangement (OA, RA, prior trauma)

Clinical notes

Due to faulty cascading of the fingers patients may have grip problems that will affect their activities of daily living, patient grip strength should also be assessed

Finger Extension Test ★★★



Procedure

Patient seated or standing with fingers spread & tips touching, examiner instructs patient to bring palms together

Interpretation

(+) Decreased ROM → Finger flexor tightness

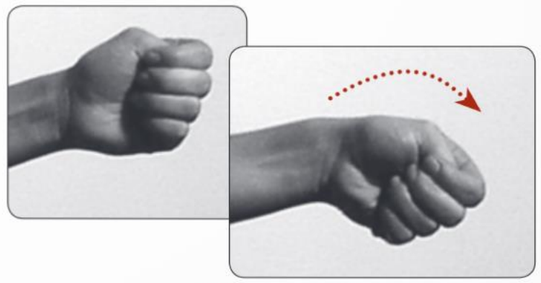
(+) Pain → Arthritis, tenosynovitis

Clinical notes

Clinician's option: to further stretch the finger flexors the patient may be instructed to keep the fingers together & push fingers into hyperextension, repeating the action for both hands (extending the metacarpophalangeal joints)

Test is similar to reverse phalen's

Finklestein's Test ★★★★★



Procedure - Patient seated or standing makes fist with thumb inside fingers & ulnar deviates the wrist; patient may actively move wrist or examiner may passively move wrist

Interpretation

(+) Pain on lateral wrist → tenosynovitis of the abductor pollicis longus & extensor pollicis brevis tendons (De Quervain's disease)

Clinical notes

Test may be performed actively by patient or passively by examiner

Pain is often described as "exquisite, sharp & localized"

False-positive Finkelstein test can result from 1st mcp joint pathology (SN: 81 SP: 50 +LR: 1.6 -LR: 0.38)[12, 32]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Flick Maneuver ★★★★★



Procedure

Patient vigorously shakes wrists & elbows to reduce symptoms of nerve compression

Interpretation: (+) Decreased symptoms with movement → Carpal tunnel syndrome, compressive neuropathy (SN: 37-93 SP: 30-96 +LR: 1.3-23 -LR: 0.1-0.9)[24, 39, 41, 69]

Clinical notes: This test is described in many different ways from just movement of wrists to full elbow movements, ultimately this movement will vary from person to person as it is a normal physiologic response to paresthesia in the upper extremity (shake out the pins & needles)

Froment's Test ★★★★



Procedure

Test has many variations;

1. Patient holds a piece of paper between any two fingers examiner attempts to remove
2. Patient opposes thumb & index finger, examiner attempts to pull digits apart
3. Patient touches all five fingers together forming a cone around examiner's finger (examiner evaluates strength of hand)

Interpretation

(+) Unable to hold paper or grip weakness → Ulnar nerve paralysis

Clinical notes

The earliest sign of ulnar nerve entrapment is a change in grip position from pad-to-pad to a tip-to-tip position; nerve conduction studies (NCS) are indicated in cases of peripheral neuropathies

Hand Elevation Test ★★★★★



Procedure

Seated patient is instructed to raise both hands above head & report time duration for onset of numbness & tingling in hands

Interpretation:

(+) Paresthesia, numbness, tingling →

Over median nerve distribution → median nerve pathology, CTS

Over ulnar nerve distribution → ulnar nerve pathology

Clinical notes

Outcome marker could include recording time for the onset of symptoms

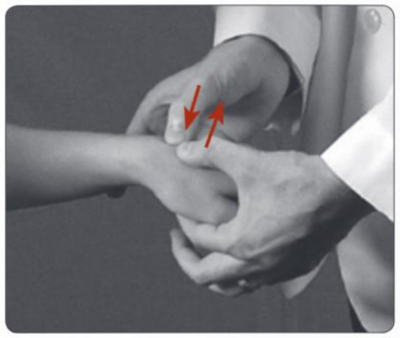
This test may also result in symptoms in patients with thoracic outlet syndrome (SN: 76-88 SP: 98-99 +LR: 44-76 -LR: 0.12-0.24)[10, 13]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Lunatotriquetral Ballottement ★★★★

Procedure **Synonym: Shuck Test, Reagan's Test**[72]

Patient seated, examiner grasps the triquetrum with one hand & lunate with the other, & moves the lunate anteriorly & posteriorly



Interpretation

(+) Pain, laxity or crepitus → Carpal instability, DJD, RA

Clinical notes

Note: the lunate is the most commonly dislocated carpal bone, this test may be used to evaluate the integrity between other carpal bones (stabilizing one carpal while moving the other carpal anteriorly & posteriorly)

Caution is warranted for compression of the median nerve with A-P pressure over the lunate

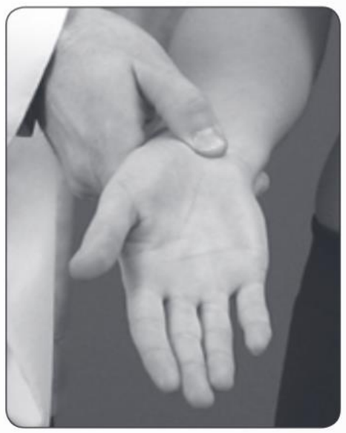
(SN: 64 SP: 44 +LR: 1.1 -LR: 0.82)[55, 72]

Median Nerve Compression Test ★★★★★

Synonym: pressure provocation test, carpal compression test

Procedure

Patient seated or standing; examiner places thumbs over median nerve as it passes through the carpal tunnel & applies pressure for 30-60 seconds



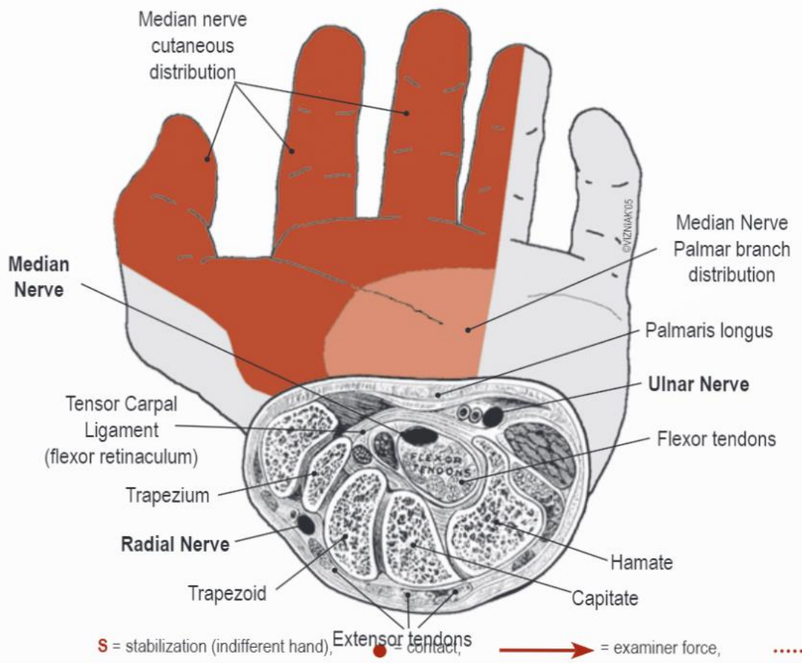
Interpretation

(+) Pain, numbness or tingling distal to compression site → carpal tunnel syndrome

Clinical notes

This test has also been demonstrated with the patient's wrist flexed 60°

(R: 0.92 SN: 42-100 SP: 92-100 +LR: 0.1-42 -LR: 0-0.7)[18, 20, 24, 26, 27, 29, 31, 38, 49, 51, 59, 66, 79, 80, 82, 83, 88, 89]



Phalen's Test ★★★★★

Procedure

Patient seated with wrists maximally flexed, two versions:

1. Patient places back of hands together in front of body so both wrists are fully flexed & maintains position for up to 1 minute
2. Examiner gently holds involve wrist in sustained flexion position for 1 minute



Interpretation

(+) Numbness or tingling over the distribution of the median nerve, increased anterior wrist pain or subsequent weakness of thumb opposition → carpal tunnel syndrome (R: 0.79 SN: 10-88 SP: 33-100 +LR: 0.7-41.5 -LR: 0.1-1)[5, 13, 17, 18, 20, 27, 24, 31, 33, 35, 37, 38, 39, 41, 42, 46, 51, 53, 59, 60,64, 68, 74, 79, 80, 83, 87, 88]

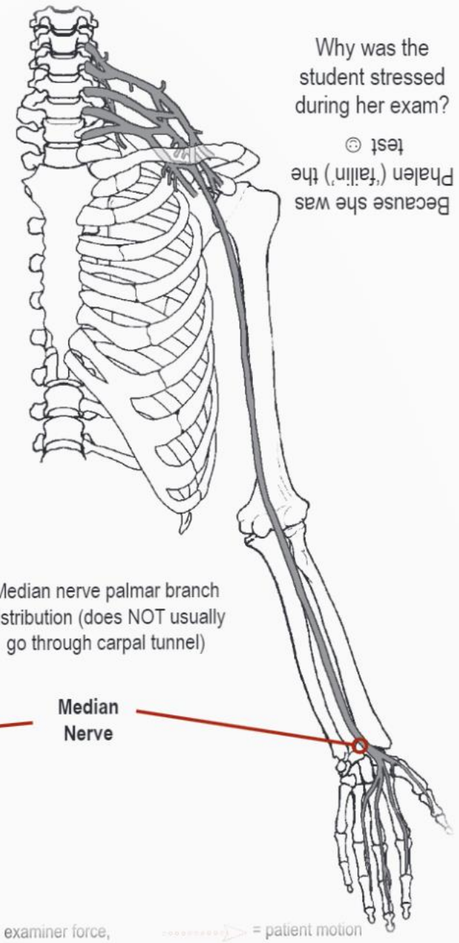
Clinical notes

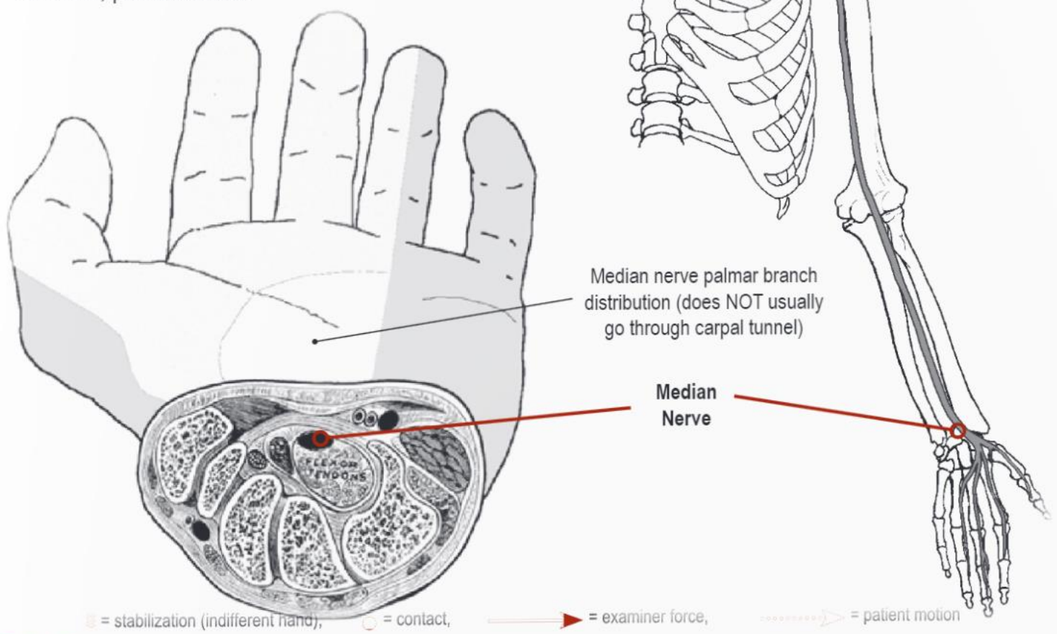
Best clinical test for carpal tunnel syndrome, remember there are many other potential sites that may contribute to compression of the median nerve or its roots (pronator teres, scalene muscles, intervertebral foramen - disc or osseous changes) - all of which must be investigated



Modified Phalens: same as above except examiner applies pressure with index & middle finger over the carpal tunnel while holding the wrist in flexion - (+) NTW → carpal tunnel syndrome - this variation procedure may be more sensitive than Phalen's Test alone (SN: 61 SP: 83)[5]

Note: symptoms felt in the palm of the hand indicate pathology proximal to the carpal tunnel, look for other sight of compression including intervertebral foramen, scalene muscles, cervical ribs, under clavicle or pectoralis minor, pronator teres

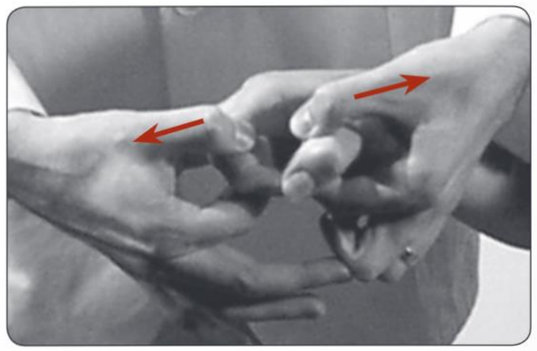




Pinch Grip Strength ★★★★

Procedure

Patient pinches index finger & thumb together (tip-to-tip); examiner may apply muscle resistance or have patient squeeze a pinch grip gauge



Interpretation

(+) Muscle weakness or pinch grip that is pad-to-pad (not tip-to-tip) → Anterior interosseous neuropathy (deep branch of median nerve)

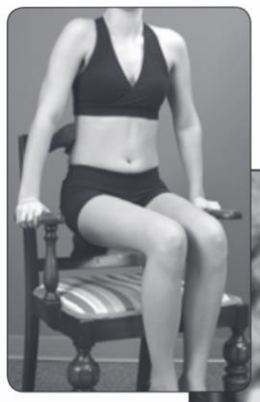
Clinical notes

Nerve conduction studies (NCS) should be considered in cases where peripheral neuropathies are suspected

Press Test ★★★★

Procedure

Patient seated in stable chair with arm rests; examiner instructs patient to hold body in air by pushing off with both hands



Interpretation

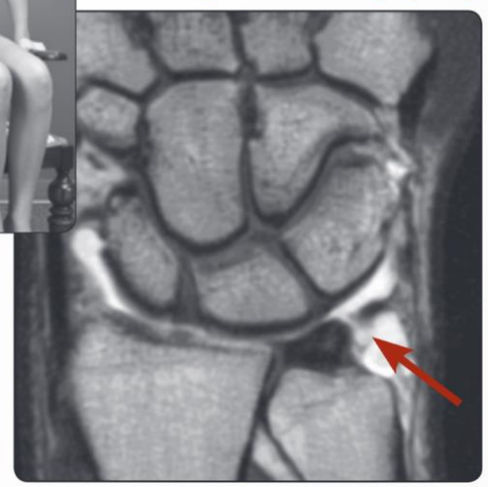
(+) Wrist pain when bearing weight → Triangular fibrocartilage (TFC) pathology

Clinical notes

This test may be difficult to perform in patients with decreased upper body strength (elderly & over-weight)

When compared with arthroscopic surgery test demonstrated 100% sensitivity & 79% sensitivity when compared to MRI findings

T1 MR arthrogram of full-thickness defect in the peripheral aspect of the triangular fibrocartilage (TFC)



Reverse Phalen's Test ★★★★★

Procedure

Patient seated with wrists extended, two versions:

1. Patient places palms of hands together in front of body so both wrists are extended ("praying position") & maintains position for up to one minute
2. Examiner gently holds involved wrist in sustained extension position for 1 minute



Interpretation

(+) Numbness or tingling over the distribution of the median nerve, increased anterior wrist pain or subsequent weakness of thumb opposition → carpal tunnel syndrome (SN: 45-75 SP: 55-96 +LR: 0.9-16 -LR: 0.3-1.1)[24, 57, 59], MFTP referral from forearm flexors

S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Scaphoid Fracture Test ★★★★

Procedure

Patient seated, examiner grips patient's thumb & applies pressure in patient's anatomical snuffbox (over scaphoid bone)



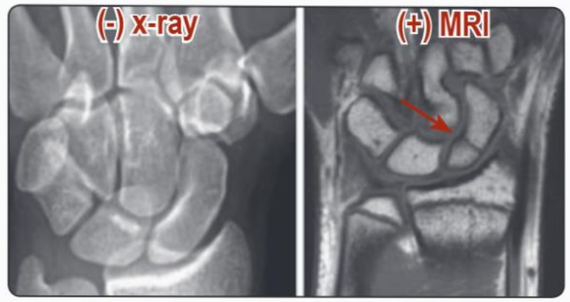
Interpretation

(+) Pain following injury → scaphoid fracture

Clinical notes

The most commonly fractured carpal is the scaphoid; with scaphoid fractures there is a risk of avascular necrosis (careful monitoring & secondary consultation are warranted)

Remember ~20% of x-rays for scaphoid fracture are false negatives!!!



Sweater Sign ★★★★★

Procedure

Patient seated or standing, examiner instructs patient to make a tight fist & observes flexion of the fingers



Interpretation

(+) Patient unable to bend the proximal finger & distal phalanges → rupture of a flexor digitorum profundus tendon

Clinical notes

Synonym: Jersey finger (when a player attempts to grab another player's jersey this injury can occur)

Diagnostic imaging is warranted to rule out fracture

TFC Dorsal Glide Test ★★★★

Procedure

Patient seated or standing; examiner places thenar eminence over posterior distal ulna & thumb over anterior pisiform/triquetrum, examiner then pushes the pisiform/triquetrum posteriorly & anteriorly



Interpretation

(+) Pain or laxity in lateral ulnocarpal joint → triangular fibrocartilage (TFC) tear (SN: 66 SP: 64 +LR: 1.8 -LR: 0.5)[55] or triquetral instability

Clinical notes

Ulnar deviation with over pressure may also compress TFC & cause symptom reproduction

S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Thumb Abduction Stress Test ★★★★★

Procedure

Patient seated, examiner grips patient's thumb while stabilizing patient's metacarpal phalangeal joint, examiner then abducts patient's thumb

Interpretation

(+) Pain over ulnar collateral ligament of thumb or valgus movement > 35° → Sprain due to hyperabduction/hyperextension injury (Game Keeper's Thumb or Skier's Thumb)

(+) Empty end feel and/or excessive motion → Grade IV sprain, joint instability or Stenner lesion



Clinical notes

Synonyms: Ulnar Collateral Ligament (UCL) Test

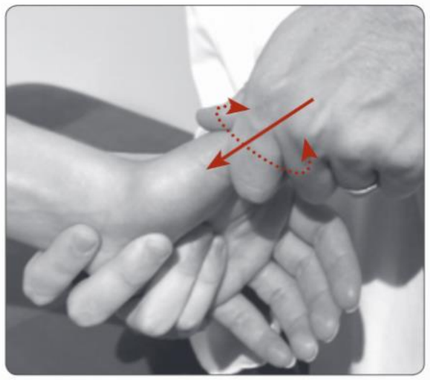
Typical patient history for ulnar collateral ligament of thumb damage includes a traumatic injury mechanism (falling while skiing, basketball, football)

If a palpable mass is noted proximal to the MCP joint, Heyman et al.[43] noted SN: 100 SP: 46 for a complete UCL rupture

Thumb Grind Test ★★★★

Procedure

Patient seated, examiner grips & stabilizes patient's wrist & thumb; then examiner applies long axis compression while circumducting the thumb



Interpretation

(+) Pain or crepitus → Trapeziometacarpal arthritis or DJD, scaphoid fracture

Tinel's at Wrist ★★★★★

Procedure

Patient seated, examiner gently taps over the carpal tunnel & ulnar tunnel with fingertips or reflex hammer



Interpretation

(+) Paresthesia (numbness, tingling, shooting electrical pain)

Median nerve distribution → Median neuropathy

Ulnar nerve distribution → Ulnar neuropathy



Clinical notes

Tinel's test (tapping over a peripheral nerve) may be applied to any region in the body where a peripheral nerve is near the surface & may be compressed

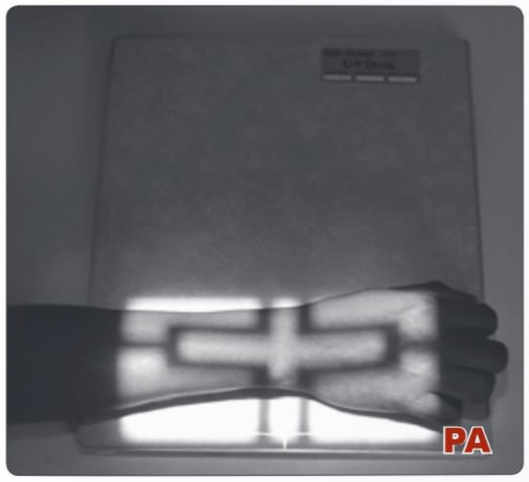
Examiner may choose to use a reflex hammer to perform taps, although it is more clinically efficient to just use your finger tips

Many studies on reliability use EMG/NCV as inclusion criteria (R: 0.5-0.8 SN: 23-97 SP: 53-100 +LR: 0.7-11 -LR: 0.03-1)[5, 10, 13, 17, 18, 24, 27, 33, 34, 35, 37, 38, 39, 41 42, 46, 51, 53, 57, 59, 60, 64, 75, 77, 79, 80, 83, 84, 87, 88]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

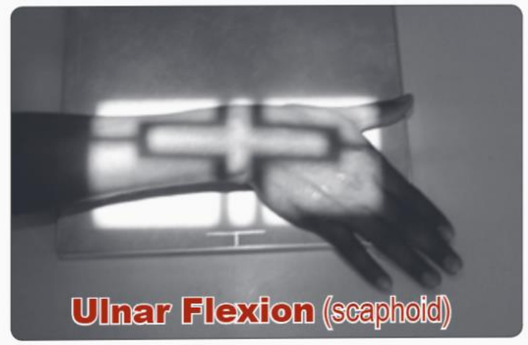
View Cassette, SID kV Range	Central Ray Tube ang., Grid Collimation	Measure Marker Shielding	Clinical notes
Wrist			
PA ½-10x12, 40″ 55±5 kV	Mid carpals 0°, no Area of interest	Path of central ray Corner of film Apron	Show multiple views on each film for comparison
Oblique ½-10x12, 40″ 55±5 kV	Mid carpals 0°, no Area of interest	Path of central ray Corner of film Apron	Use padding to maintain position
Lateral ½-10x12, 40″ 55±5 kV	Mid carpals 0°, no Area of interest	Path of central ray Corner of film Apron	Use padding to maintain position
Ulnar flexion ½-10x12, 40″ 55±5 kV	Mid carpals 0°, no Area of interest	Path of central ray Corner of film Apron	Best view for scaphoid fracture

8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended, F. spot = Focal Spot, Cr. = central ray, SID = Source Image Distance (inches), MP = metacarpophalangeal joint





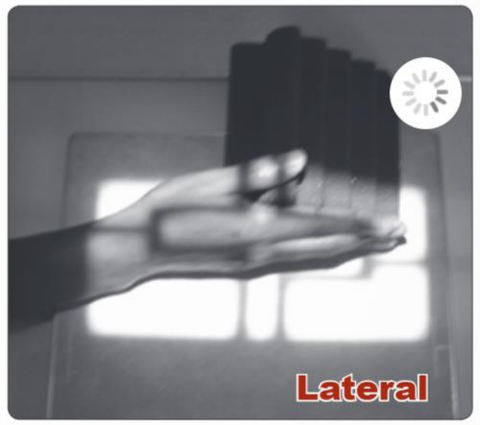




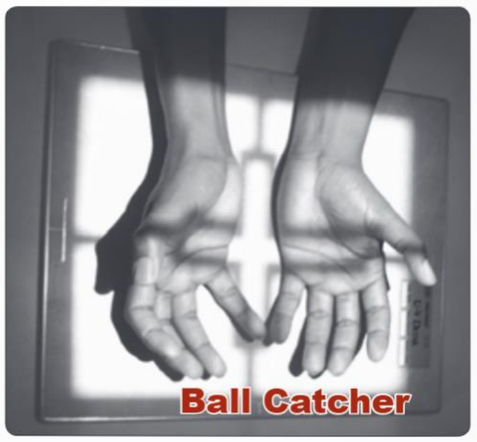
View Cassette, SID kV Range		Central Ray Tube ang., Grid Collimation	Measure Marker	Clinical notes
Hand	**PA** 8x10, 40″ 55±5 kV	3rd MP joint 0°, no Hand size	Path of central ray Corner of film Apron	Ensure digits are separated
	Oblique 8x10, 40″ 55±5 kV	2nd MP joint 0°, no Hand size	Path of central ray Corner of film Apron	Splay fingers to avoid overlap
	Lateral 8x10, 40″ 55±5 kV	1st MP joint 0°, no Hand size	Path of central ray Corner of film Apron	Use padding to maintain position
	Ball catcher 10x12, 40″ 55±5 kV	Between hands 0°, no Hand size	Hand thickness Corner of film Apron	Good for bilateral comparison

8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended, F. spot = Focal Spot, Cr. = central ray, SID = Source Image Distance (inches), MP = metacarpophalangeal joint



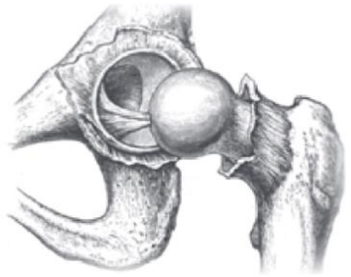






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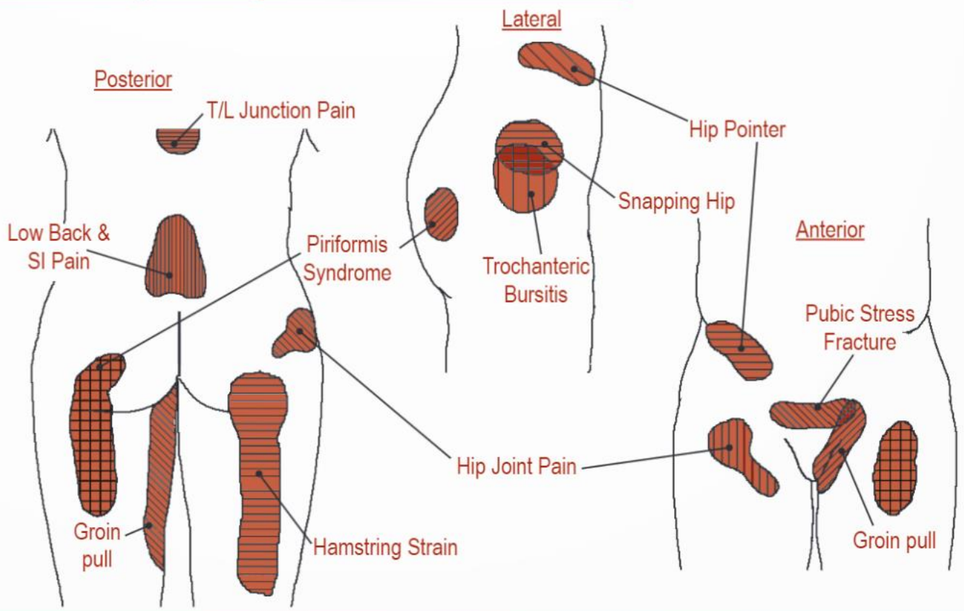
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Selected Hip & Thigh Pain Referral Patterns



Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Hip Exam Flow

prohealth

Follow HIP-MNRS
History, Inspection, Palpation - Motion, Neurovascular screen, Referred pain, Special tests

Special history questions
- Specific mechanism of injury & forces involved?
- Any numbness, tingling or weakness?
- Any snapping, popping or grinding? (OA)
- Puncture wounds to lower limb? (septic arthritis)
- Type of work, typical posture, sleeping posture?
- Review of systems (GI, urinary, cardiovascular)

Inspection
- Asymmetry, bruising, bumps, color, swelling, iliac crest height
- Posture

Fracture screen (older than 55?)
1. 4 step test, torsion test
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz), ultrasound

Palpation (may be done after ROM assessment)

ASIS/iliac crest	Anterior thigh
TFL/ITB	Iliopsoas
SI joint	Pubic symphysis
Sacrotuberous lig.	Inguinal lig./nodes
Greater trochanter	Femoral triangle
L-spine/sacrum	Greater saph. vein
Hip joint/capsule	Adductor muscles
Gluteus max./med.	Pubic symphysis
Piriformis	Ischial tuberosity
Sciatic nerve	Hamstrings

Functional assessment (ADLs)
- Toe touch or squat & rise

AROM
Flexion ..... 80°-90° (straight leg*)
Extension ..... 30°
Internal rotation ..... 40°
External rotation ..... 50°
Abduction ..... 50°
Adduction ..... 30°
*Bent knee hip flexion should approach 130°

PROM & Joint Play (if lacking AROM in any motion)

Myotomes (resisted isometric movements)
- Hip flexion (L1-L3, femoral n.)
- Knee extension (L3-L4; femoral n.)
- Knee flexion (L4-S2, sciatic n.)
- Ankle dorsiflexion (**L4**, L5 - deep peroneal),
- Ankle inversion (L5, **S1** - sup. peroneal)
- Ankle eversion (**S1** - sup. peroneal)
- Big toe extension, (L4, **L5**, S1; deep peron.)
- Big toe flexion (L5-S1, tibial nerve)

Leg length measurements
- Greater trochanter to lateral malleolus
- Pubic symphysis to medial malleolus
- Umbilicus to medial malleolus

Neurovascular screen
Sensory: Light touch, sharp/dull or pinwheel
Vibration (DIP, 3rd digit)
UMNL: Babinski (L1 & above)
- ***DTR's:*** patella (L4), hamstring (L5), Achilles (S1)
- ***Pulses:*** femoral, tibial, dorsal pedal
- Nail bed blanching
- Buerger's claudication test

Orthopedic tests (if indicated)

Screening
- Heel walk, toe walk
- Trendelenberg
- Anvil test

Hip DJD
- Scour test
- FABERE

Lumbar Radiculopathy
- SLR, Well leg raise (also assess hamstring length)
- Braggard's test

Hip flexor length
- Thomas test
- Gaenslen's test
- Rectus femoris contracture test

Piriformis syndrome
- Sign of the buttock

Instability
- Hip telescoping

Lumbar spine, SI & knee screen

Diagnostic imaging (if indicated)

Hip & Thigh Rapid Review DDx

Condition	Clinical notes
Avascular necrosis hip	*Hx:* repetitive hip trauma, corticosteroids, alcohol, diabetes, sickle cell anemia atherosclerosis *SSx:* pain/stiffness in hip joint, pain persists with rest, antalgic limp, limited ROM *DDx:* OA, osteoporosis, hip dislocation, femoral neck fracture
Acetabular labral tear	*Hx:* prior trauma, deep hip/groin pain, worse with fill hip flexion, possible locking *SSx:* audible click with motion, pain with full passive hip flexion (bent knee) *DDx:* internal or external snapping hip, DJD,
Hernia (inguinal or femoral)	*Hx:* M>F (9:1); prior heavy, lifting with valsalva causes more pain *SSx:* palpable protrusion worse with valsalva - **Red flags:** nausea, fever, vomiting, discoloration indicative of strangulated hernia = medical emergency *DDx:* groin strain, testicular torsion
Hip DJD	*Hx:* groin pain worse with weight bearing or cold weather, morning stiffness *SSx:* antalgic gait, (+) scour test, visible on x-ray (sclerosis, ↓ joint space) *DDx:* avascular necrosis
Legg-Calvé-Perthes	*Hx:* pain in groin, medial thigh or knee (without knee pathology) *SSx:* antalgic gait, ↓ ROM, (remember the hip may refer pain down to the knee) *DDx:* osteoarthrosis, avascular necrosis (visible on x-ray)
Muscle strain (hamstring, quads, groin)	*Hx:* sudden onset of pain associated with muscle contraction *SSx:* antalgic gait, local tenderness to palpation, ↓ AROM *DDx:* avulsion fracture
Piriformis syndrome	*Hx:* possible pain down back of leg, worse when sitting on hard surface *SSx:* tender to palpation, (+) SLR, sign of the buttock, (+) piriformis test *DDx:* lumbar radiculopathy, disc herniation, lumbar sprain/strain, stenosis
Septic Arthritis	*Hx:* rapid onset of severe hip pain, prior infection possible (respiratory or other) *SSx:* fever, mincing/painful gait, extremely limited ROM, puncture wound in skin *DDx:* rheumatoid arthritis
SCFE	*Hx:* 10-16 yrs old, mild hip pain referral to medial thigh/knee; worse with activity *SSx:* ↓ abduction & internal rotation ROM; mild limp or awkward gait *DDx:* visible on x-ray, groin strain, Legg-Calve-Perthes disease, septic arthritis
Snapping hip	*Hx:* patient may feel a repeatable 'pop' of ITB over greater trochanter *SSx:* tender to palpation over greater trochanter, (+) Ober's test *DDx:* may cause trochanteric bursitis
Trochanteric bursitis	*Hx:* patient may feel 'pop' of ITB or direct trauma to greater trochanter *SSx:* tender to palpation over greater trochanter, (+) Ober's test *DDx:* snapping hip

↑ = increased, ↓ = decreased, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis, SCFE = slipped capital femoral epiphysis

Hip & Thigh

Hip Kinematic Review

prohealth

Joint type: synovial
- Symphysis (pubic symphysis)
- Ball & socket (acetabulofemoral)

Articular surfaces
- **Acetabulofemoral:** *convex* (head of femur) on *concave* (acetabulum)

Hip active range of motion
Flexion (straight leg).....**90°**
Flexion (bent knee).....**120°**
Extension .....**30°**
Abduction .....**50°**
Adduction .....**30°**
Lateral (internal) rotation ..**40°**
External (medial) rotation .**50°**

Main muscle actions
- **Flexion:** iliopsoas, rectus femoris, sartorius
- **Extension:** gluteus maximus, hamstrings
- **Abduction:** gluteus medius & minimus, tensor fasciae latae
- **Adduction:** adductor magnus, gracilis, adductor longus & brevis
- **Internal rotation:** tensor fasciae latae, gluteus medius & minimus
- **External rotation:** piriformis, quadratus femoris, superior & inferior gemellus, obturator internus & externus

Resting position
- **Acetabulofemoral:** 30° abduction, 30° flexion & slight external rotation

Close packed position
- **Acetabulofemoral:** full extension, abduction & internal rotation

Capsular pattern of restriction
- **Acetabulofemoral:** internal rotation > extension > abduction

Normal end feel
- **Flexion & adduction:** elastic or tissue approx.
- **Straight leg raise:** elastic
- **Extension & abduction:** elastic / firm
- **Internal/external rotation:** elastic / firm

Abnormal end feel
- **Bony** = osteoarthritis
- **Late myospasm** = instability

Hip arthrokinematics
- **Flexion:** femur rolls superior & glides inferior on acetabulum
- **Extension:** femur rolls inferior & glides superior on acetabulum
- **Abduction:** femur rolls lateral/superior & glides inferior on acetabulum
- **Adduction:** femur rolls medial/inferior & glides superior on acetabulum
- **Internal rotation:** femur rolls medial & glides lateral on acetabulum
- **External rotation:** femur rolls lateral & glides medial on acetabulum

Hip joint forces
- **Standing:** 0.3x body weight
- **Standing one leg:** 2.5x body weight
- **Walking:** 3x body weight
- **Running:** > 4.5x body weight

"Q" angle
- A line drawn from the anterosuperior iliac spine through the center of the patella & a line drawn from the center of the patella to the center of the tibial tuberosity
- The term 'Q' is used to represent the main pull of the quadriceps muscle group
- The "Q" angle is greater in women as the hips are set wider apart
- **Women:** should be less than 22° with the knee extended and less than 9° with the knee in 90° of flexion
- **Men:** should be less than 18° with the knee extended and less than 8° with the knee in 90° of flexion
- A large "Q" angle may predispose to osteoarthritis of the knee and/or patellar dislocation



Hip Regional Examination

☑ Check normal, circle & describe abnormal

CC & significant history: _____

Patient: _____ date: _____ (dd/mm/yy)
Insurance: _____
Date of birth: _____ M/F

Fracture screen (tuning fork, percussion, torsion test, 5-step test): □ **WNL** □ **Refer for X-ray:** _____

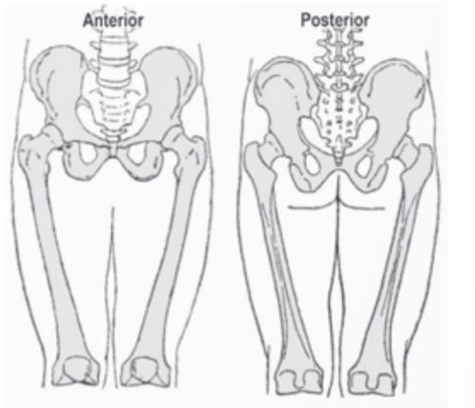
Observation: □ WNL

Development: □ good, □ fair, □ poor
□ Posture: _____
□ Skin (bruising, scars): _____
□ Asymmetry: _____

Observation □ WNL	L	R
Leg length		
Q-angle		
Genu varum		
Genu valgum		
Iliac crest height		
Gluteal fold height		
Lumbar lordosis		
Lumbar scoliosis		
Toe in/out		
Femur int/external rotation		
Gait analysis		

Palpation: □ WNL

Mark on drawing □ pain (circle), □ spasm (s), □ edema (e), □ fibrotic (f), □ MFTP (x), □ ache (a), □ burning (b), □ tingling (t)



Palpation	L	R
ASIS/iliac crest		
TFL/ITB		
SI joint		
Sacrotuberous lig.		
Greater trochanter		
L-spine/sacrum		
Hip joint/capsule		
Gluteus max./med.		
Piriformis		
Sciatic nerve		
Ischial tuberosity		
Hamstrings		
Anterior thigh		
Iliopsoas		
Pubic symphysis		
Inguinal lig./nodes		
Femoral triangle		
Greater saph. vein		
Adductor muscles		

ROM & Joint Play: □ WNL

□ Pain at end ROM: _____
□ Abnormal motion: _____

ROM	Active		Passive	
	L	R	L	R
Flexion (120°) bent knee				
Flexion (80°-90°) SLR				
Extension (30°)				
Abduction (50°)				
Adduction (30°)				
Internal rotation (40°)				
External rotation (50°)				

Joint Play*	L	R	Comments
Long axis distraction			
Internal rotation (40°)			
External rotation (50°)			
SI joint			

*Most joint play is done with passive ROM

Vascular Screen: □ WNL

Pulses (0-4)	L	R
Femoral pulse		
Tibial pulse		
Dorsal pedial		
Blanch test		

Neurologic: □ WNL

Reflexes (0-5), □ WNL	L	R
Patellar (L4)		
Hamstring (L5)		
Patellar (S1)		
Babinski		

Motor (0-5), □ WNL	L	R
Hip flexion (L2)		
Hip extension (L3-S1)		
Abduction (L4-S1)		
Adduction (L2-L4)		
Ext. rotation (L4-S1)		
Int. rotation (L4-S1)		
Knee flexion (L4-S1)		
Knee extension (L2-L4)		

*sensation is done through general palpation

Orthopedic: □ WNL

	L	R		L	R
Trendelenburg			SLR active		
Heel walk (L5)			SLR passive		
Toe walk (S1)			Bragard's		
Toe touch			SLR maximal		
Squat & rise			Valsalva		
Alli's sign			Ober/Nobel/Rinné		
Anvil			Thomas/Gaenslen's		
Patrick FABERE			Nachlas		
Laguere			Ely's		
Scour			Hibb's		
SI distraction			Yoeman's		
SI compression			Kemp's		

Additional procedures: □ WNL

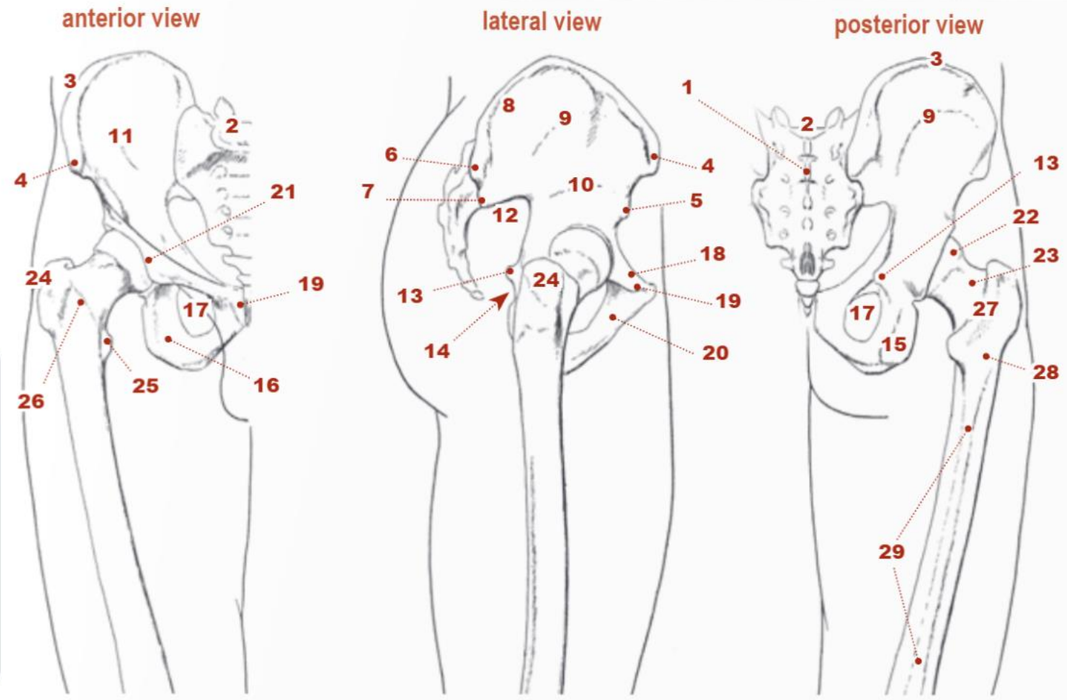
□ Abdominal exam: _____
□ Knee exam: _____
□ Lumbosacral exam: _____

DDx: _____

Signature: **Date:**

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. **www.prohealthsys.com** ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

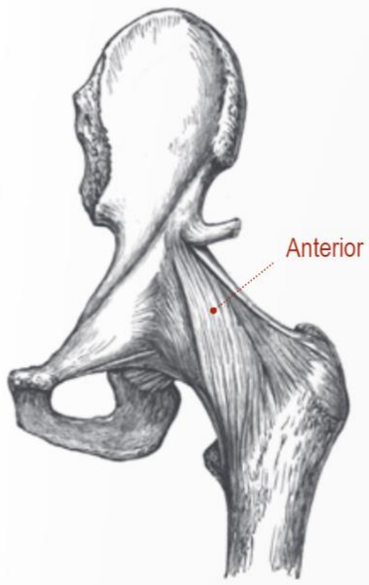
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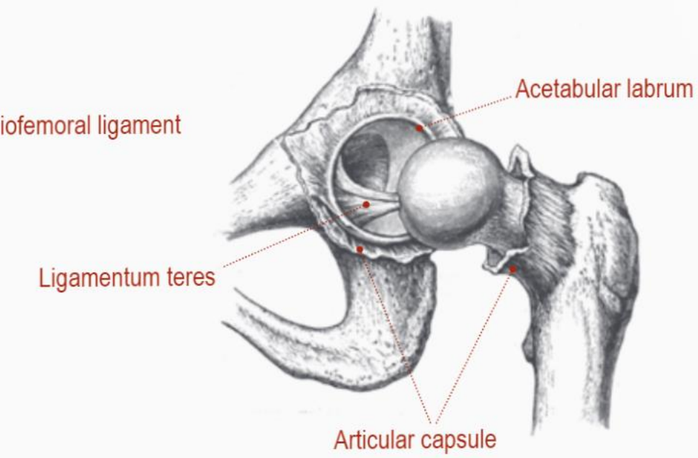


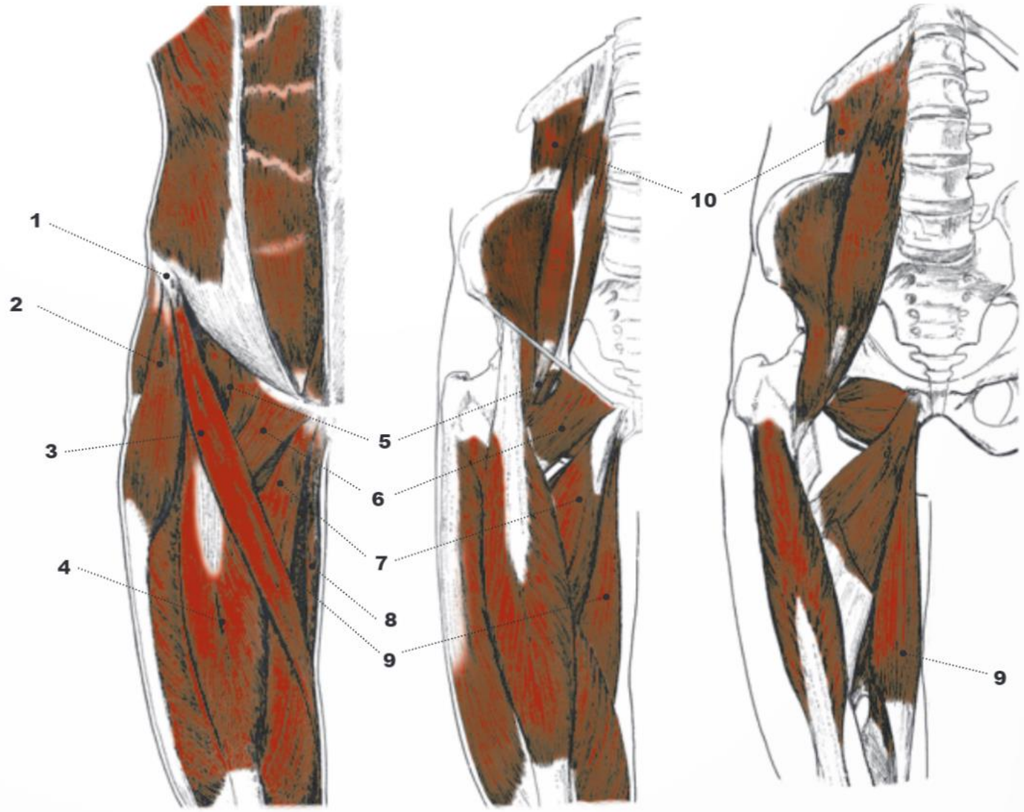
Sacrum
1. S2 tubercle
2. Sacral base

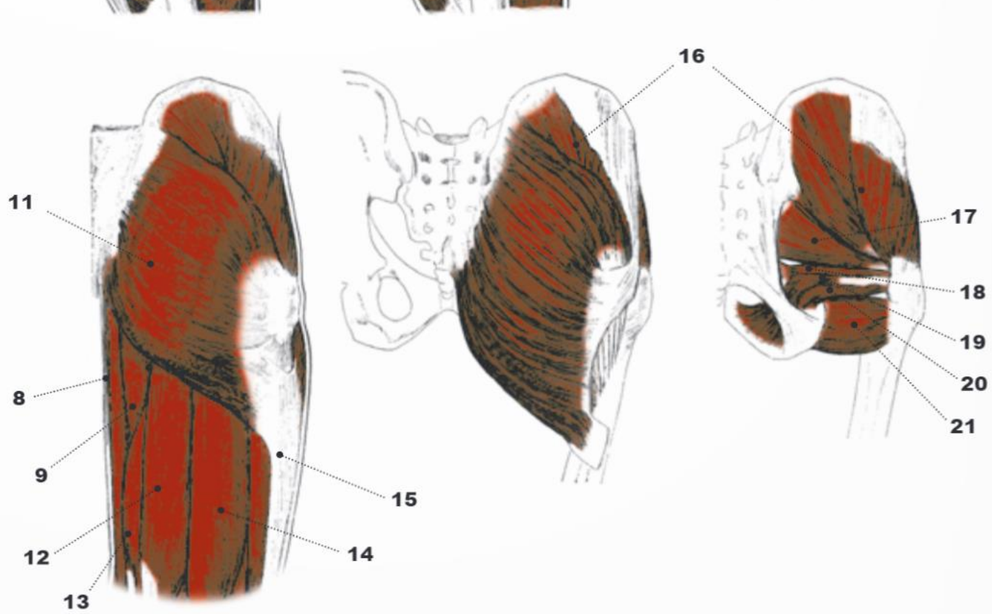
Os Coxae (ilium, ischium & pubis)
3. Iliac crest
4. Anterior superior iliac spine
5. Anterior inferior iliac spine
6. Posterior superior iliac spine
7. Posterior inferior iliac spine
8. Posterior gluteal line
9. Anterior gluteal line
10. Inferior gluteal line
11. Iliac fossa
12. Greater sciatic notch
13. Ischial spine
14. Lesser sciatic notch
15. Ischial tuberosity
16. Ramus of ischium
17. Obturator foramen
18. Superior pubic ramus
19. Pubic tubercle
20. Inferior pubic ramus
21. Acetabulum

Femur
22. Head
23. Neck
24. Greater trochanter
25. Lesser trochanter
26. Intertrochanteric line
27. Intertrochanteric crest
28. Gluteal tuberosity
29. Linea aspera







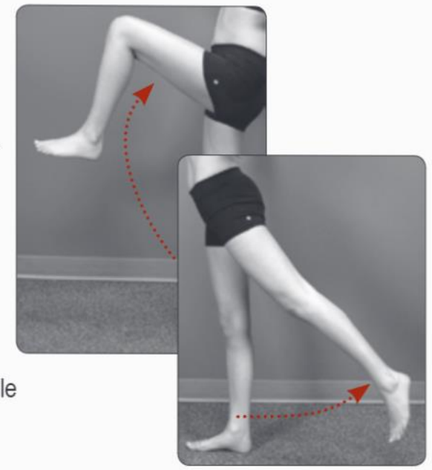


1. ASIS
2. Tensor fascae latae
3. Sartorius
4. Rectus femoris
5. Iliopsoas
6. Pectineus
7. Adductor longus
8. Gracilis
9. Adductor magnus
10. Quadratus lumborum
11. Gluteus maximus
12. Semitendinosus
13. Semimembranosus
14. Biceps femoris (long head)
15. Iliotibial band
16. Gluteus medius
17. Piriformis
18. Superior gemellus
19. Obturator internus
20. Inferior gemellus
21. Quadratus femoris

Hip AROM

Compare bilaterally; prior to ROM examiner should make an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."

Flexion (115º-125º bent knee, 80º-90º straight knee)
Muscles Activated: iliopsoas, rectus femoris, sartorius
Tissue Stretched: gluteus maximus, hamstrings , sciatic nerve
Tissue Compressed: anterior hip muscles, anterior joint capsule, inguinal ligament, femoral artery, femoral nerve



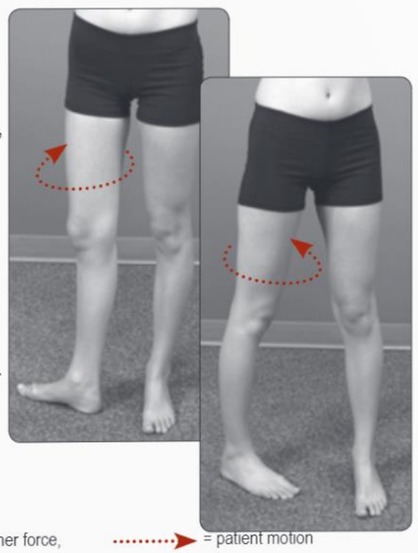
Extension (20º-30º)
Muscles Activated: gluteus maximus, hamstrings
Tissue Stretched: iliopsoas, rectus femoris, sartorius, anterior iliofemoral ligament & joint capsule, femoral nerve
Tissue Compressed: posterior hip muscles, posterior joint capsule

Abduction (40º-50º)
Muscles Activated: gluteus medius & minimus, tensor fasciae latae
Tissue Stretched: adductor magnus, gracilis, adductor longus & brevis, medial hip joint capsule
Tissue Compressed: lateral hip structures (joint capsule, lateral acetabular labrum)



Adduction (15º-30º)
Muscles Activated: adductor magnus, gracilis, adductor longus & brevis
Tissue Stretched: gluteus medius & minimus, tensor fasciae latae, iliotibial band
Tissue Compressed: medial hip structures

Lateral Rotation (25º-50º)
Muscles Activated: piriformis, quadratus femoris, superior & inferior gemellus, obturator internus & externus
Tissue Stretched: tensor fasciae latae, gluteus medius & minimus, anterior joint capsule
Tissue Compressed: posterior hip structures



Medial Rotation (35º-50º)
Muscles Activated: tensor fasciae latae, gluteus medius & minimus
Tissue Stretched: piriformis, quadratus femoris, superior & inferior gemellus, obturator internus & externus, posterior joint capsule
Tissue Compressed: anterior joint capsule

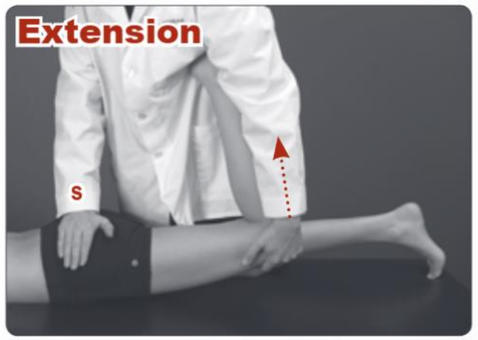
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Compare bilaterally; if possible palpate joint during PROM & use the shortest lever possible; apply over pressure at end ROM; introduction statement:
"If any of the actions or movements are painful or uncomfortable please let me know."

Flexion (> 115°-125° bent knee, 80°-90° straight knee)
Tissue Stretched: gluteus maximus, hamstrings , sciatic nerve
Tissue Compressed: anterior hip muscles, anterior joint capsule, inguinal ligament, femoral artery, femoral nerve

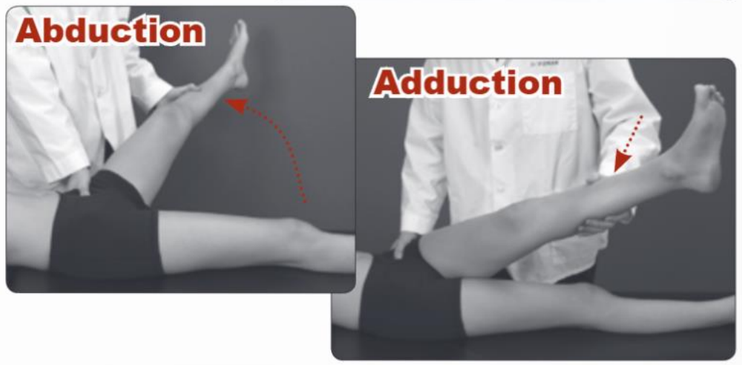


Extension (> 20°-30°)
Tissue Stretched: iliopsoas, rectus femoris, sartorius, anterior iliofemoral ligament & joint capsule, femoral nerve
Tissue Compressed: posterior hip muscles, posterior joint capsule



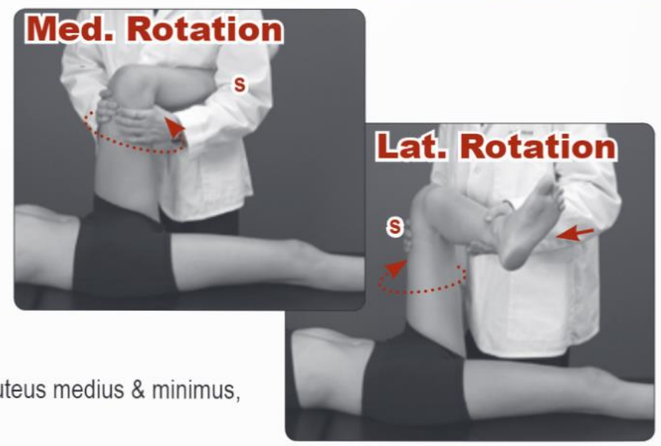
Abduction (> 40°-50°)
Tissue Stretched: adductor magnus, gracilis, adductor longus & brevis, medial hip joint capsule
Tissue Compressed: lateral hip structures (joint capsule, lateral acetabular labrum)

Adduction (> 15°-30°)
Tissue Stretched: gluteus medius & minimus, tensor fasciae latae, iliotibial band
Tissue Compressed: medial hip structures



Medial Rotation (> 35°-50°)
Tissue Stretched: piriformis, quadratus femoris, superior & inferior gemellus, obturator internus & externus, posterior joint capsule
Tissue Compressed: anterior capsule

Lateral Rotation (> 25°-50°)
Tissue Stretched: tensor fasciae latae, gluteus medius & minimus, anterior joint capsule



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Allis' Sign ★★★★

Synonym: Galeazzi's Sign, Knee Skyline Test



Procedure
Patient supine with hips flexed 45° in knees flexed 90°, examiner observes the height of the patellas from the foot of the table for tibial length discrepancies, then examiner observes laterally for femoral length discrepancies

Interpretation
(+) One knee higher (tibia) or more anterior (femur) to the other → Leg length inequality (anisomelia)

Clinical notes
Potential causes of leg length inequality include; congenital, poor fracture healing, bone growth disorders, degenerative joint disease; a positive test should be followed with leg length measure &/or scanogram

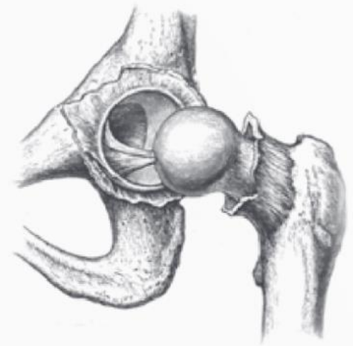
Anvil Test ★★★★



Procedure
Patient supine, examiner flexes patient's straight leg to 15-30°, then applies gentle long axis compression to the leg & strikes the patient's heel

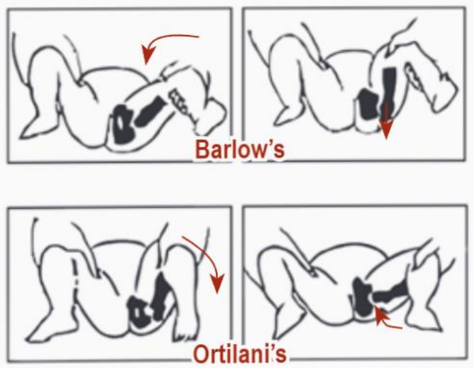
Interpretation
(+) Hip pain → hip joint pathology, arthritis, femoral neck or head fracture, infection
(+) Local femoral, tibial, fibular or calcaneal pain → fracture in the region corresponding to the pain

Clinical notes
Clinician's option: examiner may choose to repeatedly strike the heel with increasing force each time for up to 3 percussions (start lightly then gradually increase force - least to most invasive)
Prior to having patient lay down the clinician may choose to have the patient attempt to hop on one foot as a more functional test for the lower extremity



Barlow's & Ortilani's Test ★★★★★

Procedure
Infant patient supine, examiner grasps thigh at the level of the lesser & greater trochanter between thumb & fingers, examiner then fully flexes infant's thigh & applies
Ortilani's test: upward pressure to the greater trochanter (attempting to dislocated the hip forward), then examiner applies
Barlow's Test: posterior pressure to the medial thigh (attempting to reduce the dislocation)

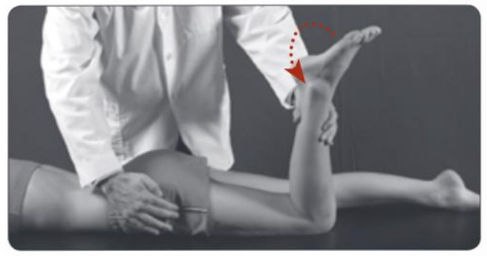


Interpretation
(+) Palpable or audible click → congenital hip dysplasia (displacement of the femoral head into & out of the shallow acetabulum), instability - can predispose to early DJD onset

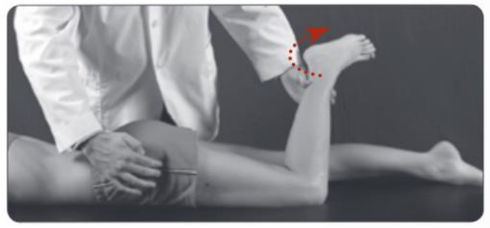
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Craig's Test ★★★

Procedure
Patient prone with knee flexed 90°, examiner palpates greater trochanter then proceeds to internally or externally rotate the femur until the greater trochanter is parallel with the examination table



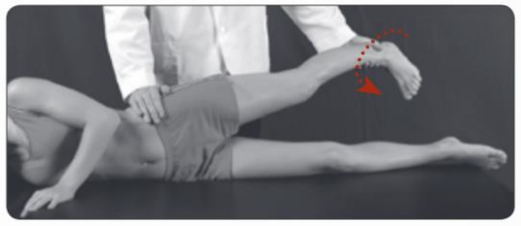
Interpretation
The degree of anteversion can be estimated based on the angle of the lower limb to the vertical plane
Adult anteversion angle should be between 8°-15°



Clinical notes
Synonyms: Ryder Method, Anteversion Test
(anteversion = anterior torsion of the femoral neck; retroversion = posterior torsion of the femoral neck); femoral anteversion occurs 2:1 female:male

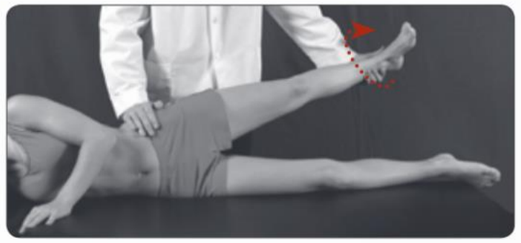
Dial (log roll) Test ★★★

Procedure
Patient supine or side lying examiner carefully rotates the thigh internally & externally & observes the patient for signs of discomfort, pain or excessive ROM, compare other side



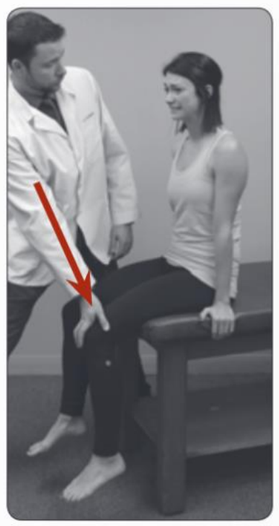
Interpretation
(+) Excessive motion → hip joint capsule laxity (instability)

Clinical notes
With the patient supine the test is usually easier to perform in acute presentations - test is effectively passive rotation ROM



Femoral Neck Stress Fracture Test ★★★★

Procedure
Patient seated with mid femur & knee hanging off edge of table, examiner applies pressure down on the distal knee & observes the patient for signs of pain/discomfort (mid thigh should be at edge of table)



Interpretation
(+) Pain → femoral neck stress fracture

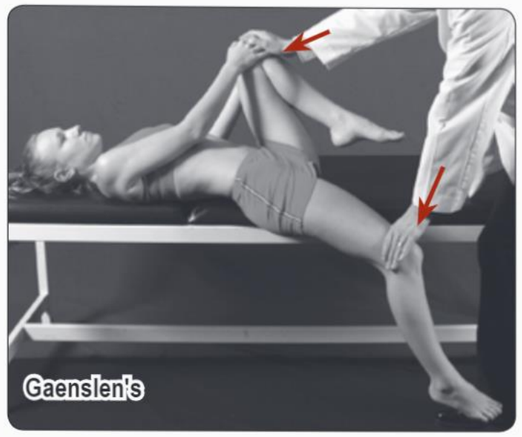
Clinical notes
Very useful test the put little pressure on the joint cartilage surface or capsule to DDx femoral neck stress fracture

Also look for history of the female athletic triad
1. Excessive exercise (repetitive trauma)
2. Decreased bone density (osteopenia/porosis)
3. Eating disorder or amenorrhea

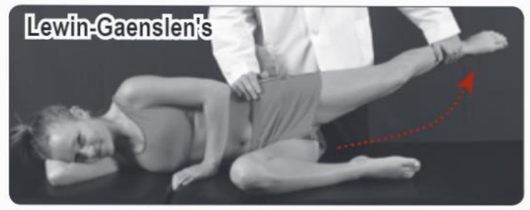
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Gaenslen's Test ★★★★★

Procedure
Patient supine, examiner flexes knee & thigh of affected leg to patient's abdomen, then examiner slowly hyperextends the opposite leg & observes the patient for signs of discomfort or pain, the test is then repeated on the opposite extremity

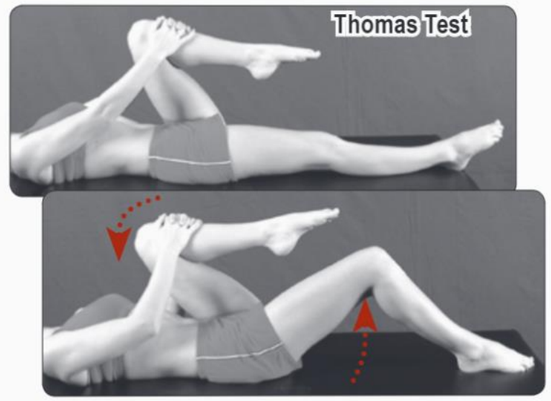


Interpretation
(+) Sacroiliac or anterior thigh pain → sacroiliac joint pathology (ligamentous sprain, instability) (R: 0.6-0.72 SN: 50-71 SP: 26-77 +LR: 1-2.2 -LR: 0.65-1.1)[21, 27, 28, 29]
(+) Elevation of extended hip → iliopsoas contracture
(-) No sacroiliac pain → possible lumbar or hip pain origination (if the leg hanging off the table starts to straighten look for iliopsoas contracture)



Clinical notes
Clinician's option: examiner may have patient bring the knee to chest & hyperextend the straight leg off the lateral edge of the examination table

Lewin-Gaenslen's Test - patient side-lying on unaffected side & brings unaffected knee towards chest, examiner then applies gentle over pressure attempting to hyperextended the affected thigh



Thomas Test / Knee to Shoulder Test - patient supine, examiner flexes affected knee & hip to 90°, then examiner pushes flexed knee toward the opposite shoulder (+) Elevation of the straight leg → hip contracture, tight iliopsoas (R: 0.91)[5] or rectus femoris

Hamstring Contracture Test ★★★★

Procedure
Patient seated on examination table with one hip abducted & knee fully flexed & the other leg straight, examiner instructs patient to flex trunk & touch toes of straight leg; test is repeated bilaterally



Interpretation
(+) Inability to touch toes → Tight hamstring muscle group (contracture)

Clinical notes
Some individuals have a genetic predisposition towards congenitally shortened hamstring muscles & will perform poorly on this test
Hamstring contracture is commonly associated with many causes of low back pain

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Hip Telescoping Test ★★★

Synonyms: Piston Test, Dupuytren's Test, Axial Distraction



Procedure

Patient supine with hip & knee flexed 90°, examiner first applies downward pressure towards the examination table, then examiner applies long axis distraction on the femur lifting the leg from the examination table

Interpretation

(+) Excessive motion, pain or apprehension → Hip dislocation, instability, ligament damage

Clinical notes

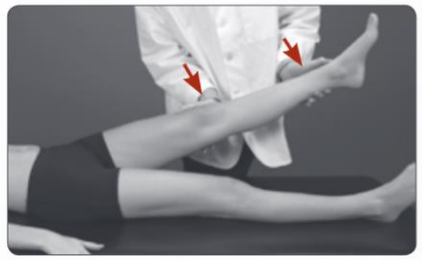
Test is often described as a pediatric orthopedic test but it does have similar application in adults

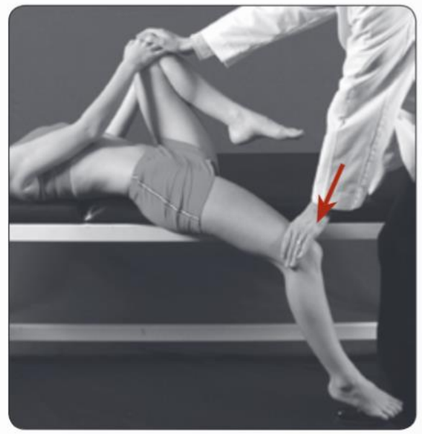
Labral Tear Tests ★★★★

Procedure

Patient supine, 3 parts to test

1. Examiner applies P-A force over distal thigh & asks patient to flex hip (rectus femoris originates from the anterior acetabulum & if the anterior labrum is torn the pull from contraction may cause pain - similar to O'brien's or Biceps load test II in the shoulder - both of which show excellent statistical values)
2. Patient in Gaenslen's test position, examiner pushes hanging leg into extension (compression of the posterior labrum may cause pain if damaged)
3. With patients knee bent, examiner flexes patient hip into full flexion & internal rotation with over pressure (SN: 94-98 SP: 8-25 +LR: 1.1-1.3 -LR: 0.12-0.46)[21]



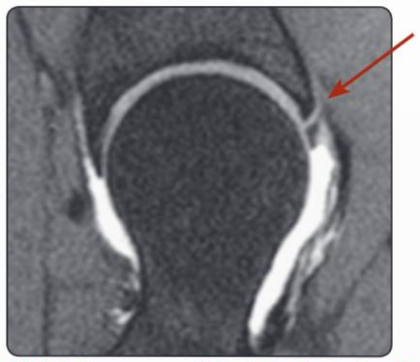


Interpretation

(+) Pain or apprehension → acetabular labral teat, joint capsule impingement

Clinical notes

MRI is the confirmatory test for acetabular labral tears



MRI Arthrogram of Acetabular Labral Tear
(see arrow - grey line disruption through labrum)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

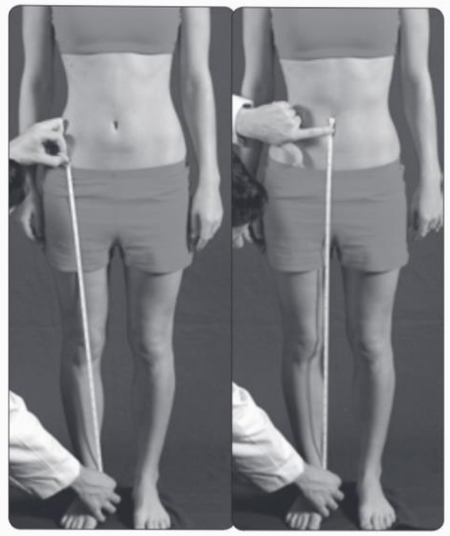
Leg Length Evaluation ★★★★

Procedure

Patient supine or standing with leg straight & feet together, two different procedures:

Actual leg length test (more accurate): examiner measures bilaterally from the ASIS to the most inferior point of the medial malleolus

Apparent leg length test: examiner measures bilaterally from umbilicus or xiphoid process to the most inferior point of the medial malleolus



Interpretation

(+) Leg length inequality → congenital bone growth discrepancy (tibia, femur), sacroiliac joint dysfunction (anterior or posterior tilt of the ilium), coxa vara, coxa valga, SCFE, Legg-Calves-Perthes disease, loss of articular cartilage (DJD, infection, arthritis), femoral neck fracture, femoral dislocation

Clinical notes

Standing scanogram (x-ray of hips, knees & ankles) is a more accurate way to examine actual leg length discrepancies

Standing leg length evaluation is a more functional assessment, as leg length inequality only becomes an issue with lower extremity weight bearing ambulation

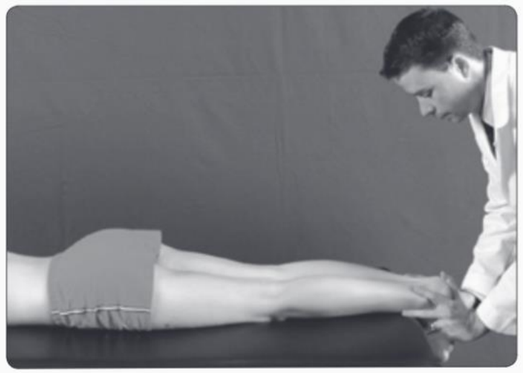
A supine leg length inequality (LLI) does not always correlate into a standing LLI

Clinician's option: if clinical symptoms are present consider follow up with individual bone length measurements or a scanogram

Prone Leg-Length Evaluation ★★★★

Procedure

Patient prone with legs straight, examiner first observes apparent leg length, then examiner grasps feet around heels & applies inferior to superior pressure, then examiner bilaterally flexes knees to 90° & compares heel or malleoli height



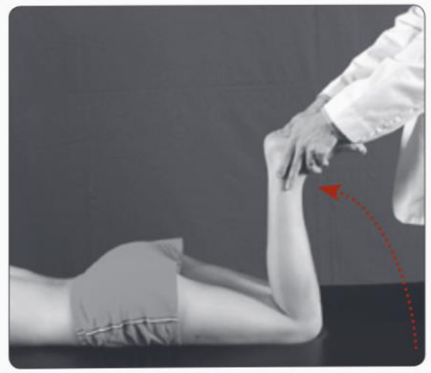
Clinical notes

Clinician's option: examiner may choose to use a number of reference points in the evaluation of leg length

Barefoot patient: medial malleolus or heels are valid reference points

Shoes on: medial malleolus, if visible, or superior portion of the soles of the shoes, the bottom of the soles of the shoes at the heel are poor reference points because they may show uneven ware patterns in patients with non-symmetrical gaits & thus give a false positive evaluation of leg length

However, shoe wear patterns are extremely useful clinically in the diagnosis of gait pathology & the prescription of corrective orthotics

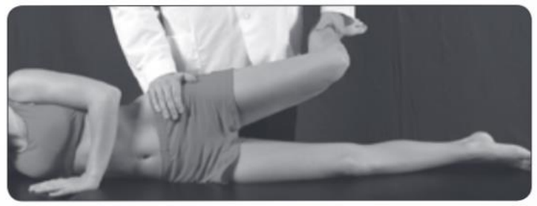


S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Ober's Test ★★★★★

Procedure

Patient side-lying with affected lower extremity up, examiner stabilizes pelvis with one hand & grasps ankle & flexes patient's knee to 90°, slightly abducts & extends hip, examiner then proceeds to internally rotate the hip (lift the ankle up)





Interpretation

(+) Hip pain → Hip joint pathology
(+) Trochanteric pain → Trochanteric bursitis (R: 0.94)[22, 23]

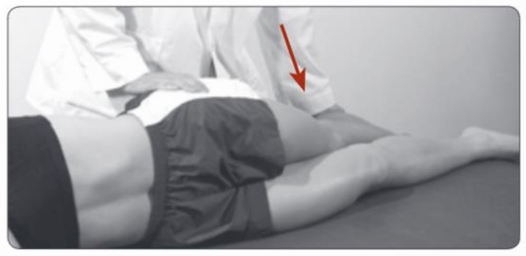
Clinical notes

Clinicians should use caution when performing this test on individuals with known knee pathologies as this test may increase stress on the knee
Clinician's option: examiner may also palpate the greater trochanter while rotating the thigh to possibly further irritate the trochanteric bursa

Ober's Test Modified ★★★★

Procedure

Patient side-lying with affected lower extremity up, examiner stabilizes the patient's pelvis & adducts affected leg behind opposite leg, observing for pain, discomfort, ROM and end feel



Interpretation

(+) Hip pain → Hip joint pathology
(+) Trochanteric pain → Trochanteric bursitis
(+) Decreased ROM → ITB contracture

Clinical notes

Synonym: Posterior Adduction Test, ITB stretch test; this maneuver may also be used as a stretch for the ITB

Patellar Pubic Percussion Test ★★★★

Procedure

Patient supine; examiner places stethoscope over patient's pubic symphysis, examiner taps or places tunning fork on patient's patella & notes presence of sound, test is repeated on opposite side



Interpretation

(+) Decreased sound, pain with percussion → Hip or femur fracture

Clinical notes

Test is essentially part of a normal fracture screen, patient history & initial presentation should point the examiner toward the diagnosis of fracture (R: 0.89 SN: 89-96 SP: 82-95 +LR: 5-20 -LR: 0.06-0.8)[10, 13, 24, 28]

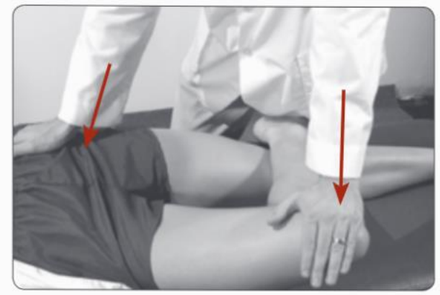
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Patrick's / FABERE Test ★★★★

Synonyms: Figure-4 Test, Jansen's Test

Procedure

Patient supine, examiner instructs patient to cross legs into a "figure 4" position (ankle placed above contralateral knee, ipsilateral knee flexed 90°, ipsilateral hip abducted & externally rotated), examiner then stabilizes pelvis & applies gentle downward pressure over the flexed knee



Interpretation

(+) Pain or inability to perform motion → hip joint pathology, severe arthritis, sprain/strain, fracture, tight hip adductors

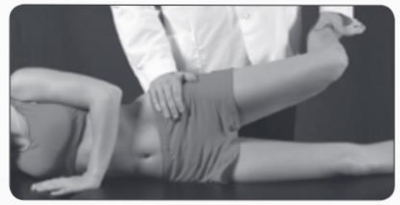
Clinical notes

FABERE is an acronym for Flexion, Abduction, External Rotation & Extension of the hip joint (good general screening test) (SN: 50 SP: 29 +LR: 0.7 -LR: 1.72)[28]

Piriformis / FAIR Test ★★★★★

Procedure

FAIR stands for flexion, adduction & internal rotation
Patient side lying or supine with hip neutral & knee flexed ~60-90°; examiner stabilizes hip & passively flexes hip to ~60° & internally rotates femur (test is effectively a stretch of piriformis)



Interpretation

(+) pain in sciatic/gluteal area → sciatic nerve compression, hip joint pathology, femoral acetabular impingement, hip fracture

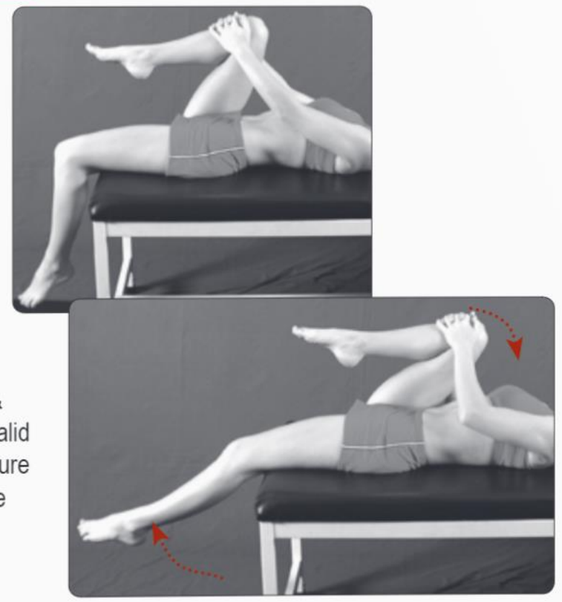
Clinical notes

Anterior thigh pain can result from femoral acetabular impingement (be sure to ask where the patient feels pain)
(SN: 88 SP: 83 +LR: 5.2 -LR: 0.14)

Rectus Femoris Contracture Test ★★★★

Procedure

Supine patient, with leg off end of table, flexes one knee to chest while keeping the other hip straight & knee flexed 90°, examiner observes for straight hip knee extension



Interpretation

(+) Extension of the knee → Rectus femoris muscle contracture
Abduction of the hip may also be noted in the presence of ITB tightness or contracture

Clinical notes

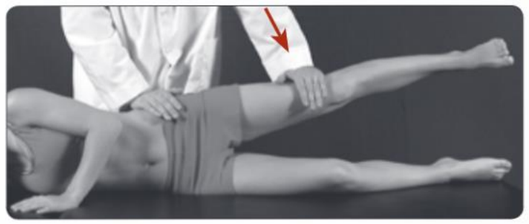
The patient must have their lower leg flexed 90° & hanging off the table in order for this test to be valid
Clinician's option: examiner may apply over pressure on the upper knee & lower leg to further evaluate muscle tightness
(R: 0.94)[5]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Sacroiliac Resisted-Abduction ★★★★

Procedure

Patient side-lying with the unaffected side down & knee flexed for stability, the affected leg is straight, slightly extended & abducted; examiner applies downward pressure against the patient's resistance on the abducted leg, test is then repeated on the opposite lower extremity



Interpretation

(+) Pain near the PSIS → SI joint dysfunction, ligamentous sprain

(+) Abductor muscle weakness → Muscle deconditioning, muscle strain (gluteus medius) (R: 0.63 SN: 73 SP: 46 +LR: 1.4 -LR: 0.6)[14]

Clinical notes

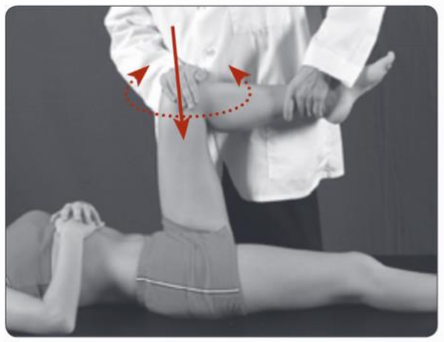
Test is essentially resisted muscle test of hip abduction

Scour (Quadrant) Test ★★★★★

Procedure

Patient supine, examiner flexes patient's hip to 90° & flexes knee, 3 parts

1. Take patient through passive hip ROM (circumduction & rotation) without compression
2. Examiner then applies mild long axis compression over the femur and repeats
3. If tolerated, examiner repeats test with more pressure



Interpretation

(+) Pain or crepitus → Hip joint pathology, osteoarthritis, transient hip synovitis, capsulitis, labral tear, acetabular impingement syndrome, SCFE, fracture

Clinical notes

This test approximates acetabulofemoral joint structures which may be irritated in the presence of hip pathologies (SN: 75-91 SP: 43 +LR: 1.3 -LR: 0.58)[20, 21, 25, 26]

Thomas Test ★★★★

Procedure

Supine patient flexes one knee to chest while keeping the other leg straight, examiner observes for straight leg elevation

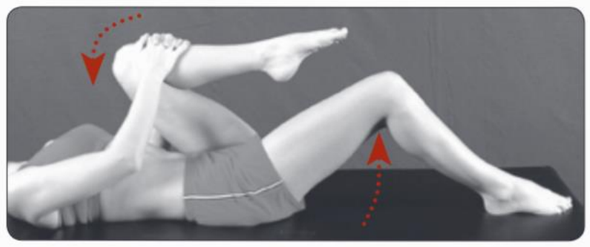


Interpretation

(+) Elevation of the straight leg → Hip contracture, tight iliopsoas or rectus femoris

Clinical notes

Clinician's option: examiner may choose to apply gentle overpressure to both flexed leg & straight leg in order to evaluate joint play & muscle tightness (R: 0.91)[5]



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

B = Bone: evaluate film for fractures & dislocations, describe variations in cortices, medullary & subchondral bone, density, shape, size, trabecular patterns & relationship of osseous arrangements.

A = Alignment: analyze femoral alignment, result of various measurements; misalignments

C = Cartilage: inspect the joint spaces, articular spaces for any abnormalities; pay attention to symmetry, continuity, widening or loss of joint space & calcification of cartilage

S = Soft Tissue: evaluate soft tissues; look for unusual calcifications, including in blood vessels, masses, displaced fascial lines & unusual gas distribution; note the presence of fat-pad signs ('sail sign') and soft tissue edema

Hip anatomical variants & anomalies

- Os acetabuli - accessory ossicle on superior rim of acetabulum
- Pitt's pit of femoral neck - radiolucency in femoral neck
- Chandler's disease - avascular necrosis adult femoral head

Femoral Angle

Normal: 120°-130°

Interpretation:

- < 120° = coxa vara
- > 130° = coxa valga

Note: radiograph should be taken with thigh internally rotated 15°



Iliofemoral Line

Normal: smooth, bilaterally symmetrical line

Interpretation: disruption in line → congenital dysplasia, slipped capital femoral epiphysis (SCFE), dislocation, fracture



Klein's Line

Normal: compare bilaterally, should be the same amount of overlap side to side over femoral head

Interpretation: failure of femoral head overlap in relation to line or asymmetry → SCFE



Shenton's Line

Normal: smooth, continuous bilaterally symmetrical line

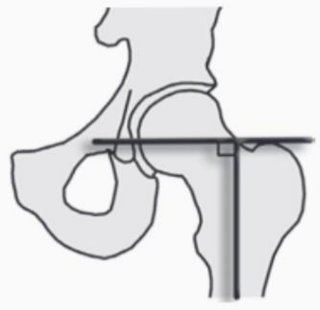
Interpretation: disruption of line → hip dislocation, femoral neck fracture, slipped femoral capital epiphysis



Skinner's Line

Normal: fovea capitis above or at level of the line

Interpretation: if fovea is below line → superior displacement femur → fracture, conditions causing coxa vara



Hip Joint Space Width

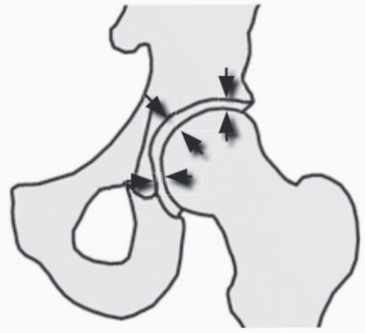
Normal: Superior (3-6 mm), Axial (3-7mm), Medial (4-13 mm)

Interpretation: ↓ superior space → osteoarthritis

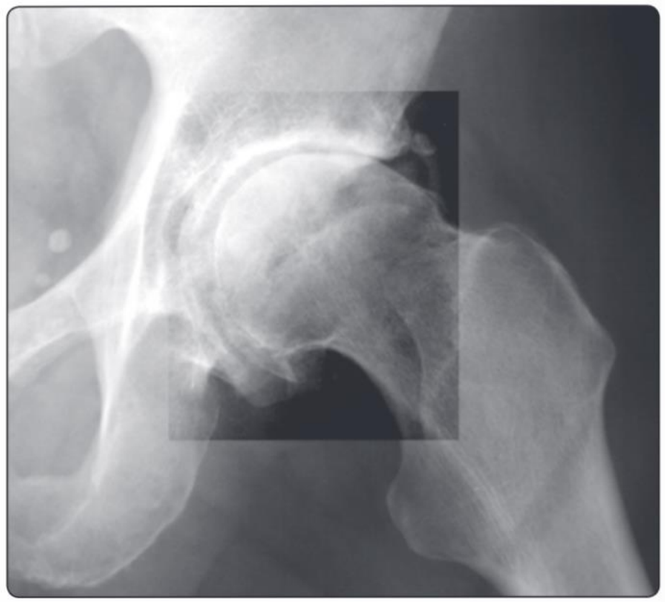
↓ axial space → DJD, RA

↓ medial space → DJD, RA

↑ medial space → hip joint effusion or lateral shift of femur (Waldenstrom's sign)







Above: Hip DJD - note reactive sclerosis, joint space loss & osteophyte formation

Left: Hip dislocation

Hip & Thigh

	View	Central Ray	Measure	Breathing
	Cassette, SID kV Range	Tube ang., Grid Collimation, F. spot	Marker Shielding	Clinical notes
Hip	**AP** 10x12, 40″ 80±5 kV	Midpoint between ASIS & pubic symphysis 0°, yes < film, small	Path of central ray Anatomically Gonad	Susp. inspiration Rotate leg internally 15°
	Frog Leg 10x12, 40″ 80±5 kV	Midpoint between ASIS & pubic symphysis 0°, yes < film, small	Path of central ray Anatomically Gonad	Susp. inspiration Rotate leg externally & cross foot over opposite knee (“figure 4”)

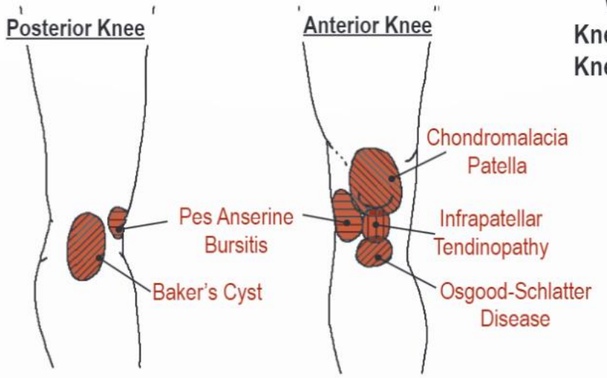
8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended, F. spot = Focal Spot, Cr. = central ray, SID = Source Image Distance (inches), MP = metacarpophalangeal joint



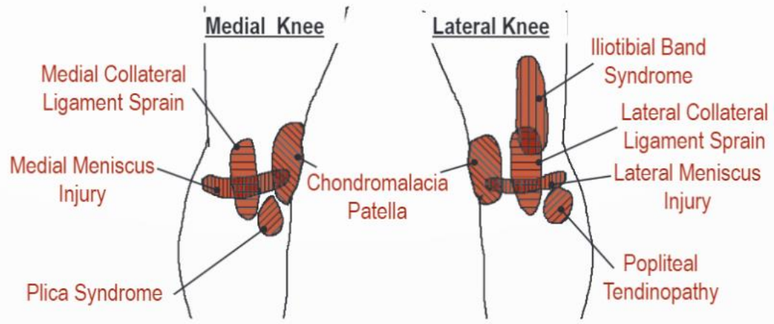


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Selected Knee Pain Referral Patterns



Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Special history questions
- Specific mechanism of injury & forces involved? - did you hear a "popping" sound?
- Age? (teenagers = plica syndrome)
- Do you have pain going up/down stairs?
- Any swelling? (Onset - sudden/slow)
- What type & age of shoes? Running surface?

Inspection
- Asymmetry, bruising, bumps, color, swelling, iliac crest height
- Posture

Fracture screen (older than 55?)
1. 4 step test, torsion test
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz)

Palpation (may be done after ROM assessment)

Quadriceps	Saphenous vein
Patella (facets, bursa)	Popliteal fossa
Patellar ligament	Gastrocnemius heads
Tibial tuberosity	Baker's cyst
Retinaculum/plica	Lateral hamstrings
Adductor canal	Iliotibial band (ITB)
Pes anserine	Popliteus
Med. joint/meniscus	Lateral collateral lig.
Med. femoral condyle	Lateral joint/meniscus
MCL & capsule	Lat. femoral condyle
Medial hamstrings	Lat. tibial condyle

Functional assessment (ADLs)
- Squat & rise

AROM
Flexion ..... 150°
Extension ..... 0° to -5°
Internal rotation* ..... 5°
External rotation* ..... 5°
*Knee must be flexed 90° to assess rotation

PROM & Joint Play (if lacking AROM in any motion)

Myotomes (resisted isometric movements)
- Hip flexion (L1-L3, femoral n.)
- Knee extension (L3-L4; femoral n.)
- Knee flexion (L4-S2, sciatic n.)
- Ankle dorsiflexion (**L4**, L5 - deep peroneal),
- Ankle inversion (L5, **S1** - sup. peroneal)
- Ankle eversion (**S1** - sup. peroneal)
- Big toe extension, (L4, **L5**, S1; deep peron.)
- Big toe flexion (L5-S1, tibial nerve)

Neurovascular screen
Sensory: Light touch, sharp/dull or pinwheel
Vibration (DIP, 3rd digit)
UMNL: Babinski (L1 & above)
- ***DTR's:*** patella (L4), hamstring (L5), Achilles (S1)
- ***Pulses:*** femoral, tibial, dorsal pedal
- Nail bed blanching
- Buerger's claudication test

Orthopedic tests (as indicated)

Screening
- Heel walk, toe walk
- Disco test

Patella
- Ballottement (A-P)
- Bulge/sweep, AP grinding
- Facet (medial/lateral apprehension test)
- Modified Clark's (hold pat, contract quad)
- Step-up test, Rinne (Nobel)

Plica
- Active stutter (sitting active flex)
- Houston's plica test (medial apprehension while passive flex, supine)

Meniscus
- Wilson's, Steinman's, McMurray's
- Apley's compression & hyperflexion
- Apley's distraction
- Bounce home (hand on popliteal fossa)

Ligament stress
- Valgus/varus stress (30° & 0°)
- Wobble test
- Posterior sag sign
- Recurvatum (hyperextension)
- Anterior & posterior drawer
- Lachman's
- Macintosh (pivot-shift) test

Lumbar spine, SI, hip & ankle screen

Diagnostic imaging (if indicated)

Condition	Clinical notes
ACL tear	*Hx:* direct trauma with valgus or hyperextension stress, audible "pop"; playing sport with quick stops or sharp cutting on non-slip surface (b-ball, soccer) *SSx:* severe joint effusion (+) anterior drawer, Lachman's *DDx:* often associated with MCL & medial meniscus injury
MCL tear	*Hx:* direct trauma with valgus stress, audible "pop", medial knee pain *SSx:* local tenderness to palpation, (+) valgus stress test *DDx:* often associated with ACL & medial meniscus injury
LCL tear	*Hx:* direct trauma with varus stress, audible "pop", lateral knee pain *SSx:* local tenderness to palpation, (+) varus stress test *DDx:* ITB friction rub
PCL tear	*Hx:* direct trauma with posterior to anterior stress, audible "pop" *SSx:* (+) posterior drawer, reverse Lachman's *DDx:* often associated with ACL & meniscus injury
Chondromalacia patellae	*Hx:* prior trauma, retropatellar pain, worse with prolonged walking, going down stairs, positive Movie/theater sign, crepitus/grinding in knee *SSx:* (+) patellar grind, abnormal tracking *DDx:* condition is effectively patellofemoral DJD, meniscus tear, knee DJD
Menicus tear	*Hx:* painful click or snapping, deep joint line pain, joint locking *SSx:* local tenderness to palpation, (+) McMurray's, Apley's compression/ distraction (+) Thessaly test (disco test) *DDx:* MCL & ACL tear (may occur in conjunction)
Osgood-Schlatter's	*Hx:* active pre-teen/teens - insidious onset or after intense activity *SSx:* focal tenderness, swelling, red, pain with RROM, pain brought on by activity, will be able to point to the pain DDx: osteochondroma,
ITB friction rub	*Hx:* recent ↑ in running distance, intensity, frequency or duration, lateral knee pain *SSx:* local tenderness, (+) Noble's, Ober's *DDx:* LCL tear, pes planus & genu varum may predispose to condition
Plica syndrome	*Hx:* pain over lateral or medial condyle, snapping sensation *SSx:* tender band or cord from patella to condyle, (+) active stutter, Houston's test *DDx:* ITB friction rub, arthroscopy is the gold standard for diagnosis

↑ = increase, ↓ = decrease, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis, (+) = positive

Knee/Thigh Regional Exam

☑ Check normal, circle & describe abnormal

Patient: _____ date: _____
Insurance: _____ (dd/mm/yy)
Date of birth: _____ M/F

CC & significant history: _____

Fracture screen (tuning fork, percussion, torsion test, 5-step test): □ WNL □ Refer for X-ray: _____

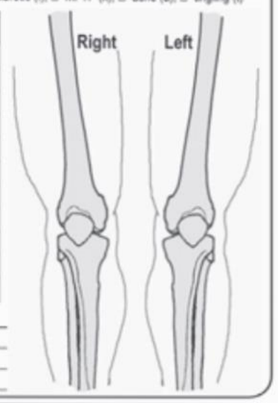
Observation: □ WNL

Development: □ good, □ fair, □ poor
□ Posture: _____
□ Skin (bruising, scars): _____
□ Swelling: _____
□ Asymmetry: _____

Observation □ WNL	L	R
Toe in / out		
Arch low / high		
Patella position (med, lat, ↑, ↓)		
Q-angle		
Genu varum / valgum		
Femur rotated int. / ext.		
Iliac crest height		
Lumbar hyper / hypolordosis		
Knee hyperextended		
Leg length		
Gait analysis		

Palpation: □ WNL, □ pain (circle), □ spasm (s), □ edema (e), □ fibrotic (f), □ MFTP (x), □ ache (a), □ tingling (t)

Palpation	L	R	Palpation	L	R
Quadriceps			Saphenous vein		
Patella (facets, bursa)			Popliteal fossa		
Patellar ligament			Gastrocnemius heads		
Tibial tuberosity			Baker's cyst		
Retinaculum/plica			Lateral hamstrings		
Adductor canal			Iliotibial band (ITB)		
Pes anserine			Popliteus		
Med. joint/meniscus			Lateral collateral lig.		
Med. femoral condyle			Lateral joint/meniscus		
MCL & capsule			Lat. femoral condyle		
Medial hamstrings			Lat. tibial condyle		



ROM & Joint Play: □ WNL

□ Pain at end ROM: _____
□ Abnormal motion: _____

ROM	Active L	Active R	Passive L	Passive R
Flexion (150°)				
Extension (0°)				
Internal rotation				
External rotation				

Joint Play	L	R	Comments
Anterior glide			
Posterior glide			
Medial tilt			
Lateral tilt			
Patella			
Internal rotation			
External rotation			
A↔P tibia/fibula			
Superior tib/fib			
Hamstring stretch			
Quadricep stretch			

Vascular Screen: □ WNL

Pulses (0-4)	L	R
Popliteal pulse		
Tibial pulse		
Dorsal pedal		
Blanch test		

Neurologic: □ WNL

Sensation, □ WNL	L	R
Light touch		
Sharp/dull		

Reflexes (0-5), □ WNL	L	R
Patellar (L4)		
Hamstring (L5)		
Patellar (S1)		
Babinski		

Motor (0-5), □ WNL	L	R
Med. hamstrings (L4-S1)(sciatic)		
Lat. hamstrings (L4-S2)(sciatic)		
Popliteus (L4-S1)(tibial)		
Hip adductors (L2-L4)(obturator)		
Sartorius (L2-L3)(femoral)		
TFL (L4-S1)(superior gluteal)		
Rectus femorus (L2-L4)(femoral)		
Vastus intermed. (L2-L4)(femoral)		
Vastus medialis (L2-L4)(femoral)		
Vastus lateralis (L2-L4)(femoral)		
other:		

Orthopedic: □ WNL

	L	R		L	R
Ballotment/buldge			Varus stress 0°		
Bounce home			Varus stress 30°		
McMurray's			Pivot shift		
Steinmann's			Patellar apprehen.		
Anterior drawer			Plica tests		
Posterior drawer			Pat-femoral grind		
Slocum's			Clarke's test		
Lachman's			Genu recurvatum		
Ober/Renne			Apley compression		
Valgus stress 0°			Apley distraction		
Valgus stress 30°			Hyperflexion test		

Additional procedures: □ WNL

□ Hip exam: _____
□ Ankle exam: _____
□ Lumbosacral: _____

DDx: _____

Signature: Date:

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

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Joint type: synovial
- Modified hinge (tibiofemoral) - largest & most complex joint in body
- Gliding (patellofemoral)

Articular surfaces
- **Tibiofemoral:** *concave* (tibial plateau) *on convex* (femoral condyles)

Active range of motion
Flexion ..... **150°**
Extension ..... **0° to -5°**
Internal rotation* ..... **5°**
External rotation* ..... **5°**
* knee must be flexed 90° to allow rotation

Main muscle actions
- **Flexion:** semitendinosus, semimembranosus, biceps femoris (hamstrings)
- **Extension:** vastus medialis, vastus lateralis, vastus intermedius, rectus femoris (quadriceps)
- **Internal rotation** (tibia)**:** popliteus with pes anserine muscles (knee flexed)
- **External rotation** (tibia)**:** biceps femoris

Resting position
- **Tibiofemoral:** 25° flexion
- **Patellofemoral:** full extension (straight leg)

Close packed position
- **Tibiofemoral:** full extension & external tibial rotation
- **Patellofemoral:** full flexion

Capsular pattern of restriction
- **Tibiofemoral:** flexion > extension

Normal end feel
- **Flexion:** soft tissue or bony approximation
- **Extension:** elastic/firm
- **SLR:** elastic

Abnormal end feel
- **Boggy** = joint effusion; ligamentous pathology
- **Springy block** = loose body (displaced meniscus)

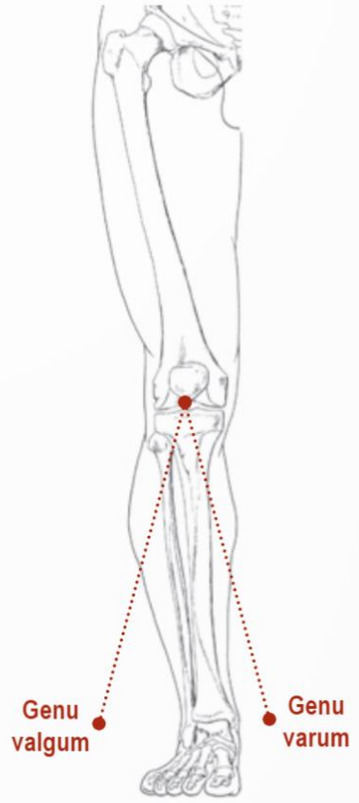
Open kinetic chain
- **Tibiofemoral:**
  Flexion: tibia rolls & glides posterior on femur
  Extension: tibia rolls & glides anterior on femur
- **Patellofemoral:**
  Flexion: inferior patellar glide on femur
  Extension: superior patellar glide on femur

Closed kinetic chain
- **Tibiofemoral:**
  Flexion: femur rolls & glides posterior on femur (squatting)
  Extension: femur rolls & glides anterior on femur (moving from seated to standing)

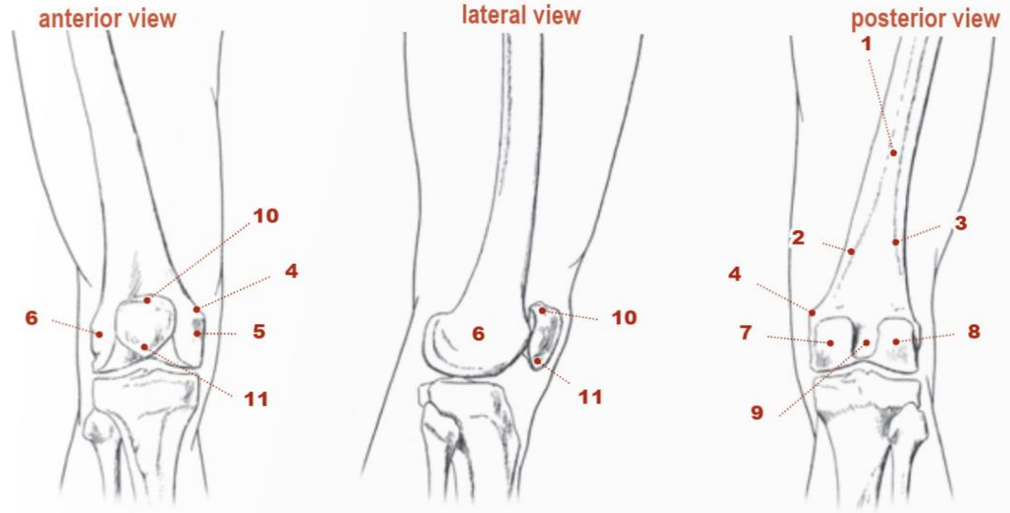
Osteokinematics
- Femoral condyles begin to contact patella at 20° flexion; then progress superior to 90° & medial/lateral at 135° of knee flexion
- Medial meniscus is attached to medial collateral ligament & semimembranosus muscle
- Lateral meniscus is attached to posterior cruciate ligament & popliteus muscle

Patellofemoral loading forces
- **Walking:** 0.3x body weight
- **Up stairs:** 2.5x body weight
- **Down stairs:** 3.5x body weight
- **Squatting:** 7x body weight

Genu valgum, varum & recurvatum
- **Genu valgum:** Q angle > 22° (women), 18° (men)
  - Also known as "knocked knees"
- **Genu varum:** Q angle < 0° (distal tibia points medially) - also known as "bow legs"
- **Genu recurvatum:** hyperextension of knee > -5°



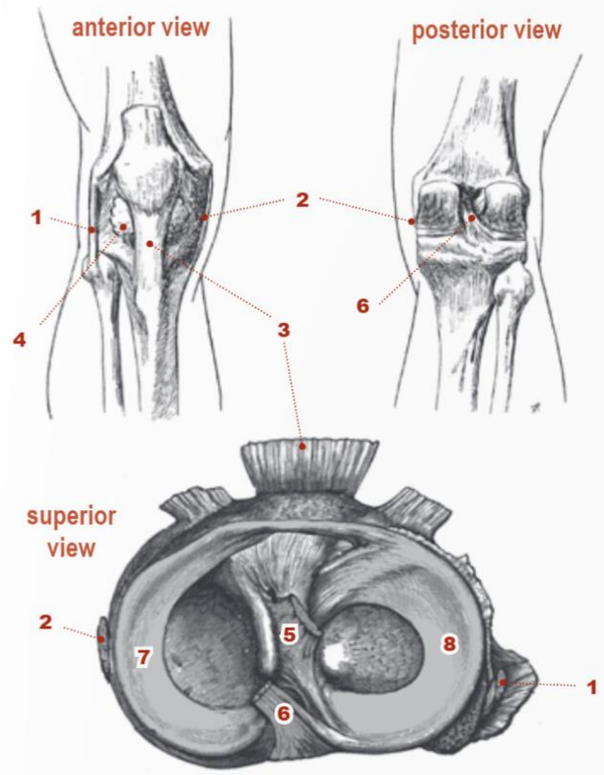
Bones



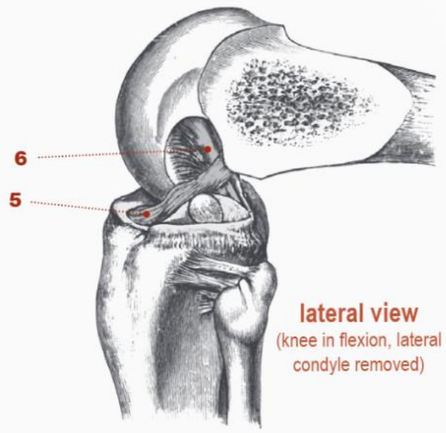
1. Linea aspera
2. Medial supracondylar ridge
3. Lateral supracondylar ridge
4. Adductor tubercle
5. Medial epicondyle
6. Lateral epicondyle
7. Medial condyle
8. Lateral condyle
9. Intercondylar fossa

Patella
10. Base
11. Apex

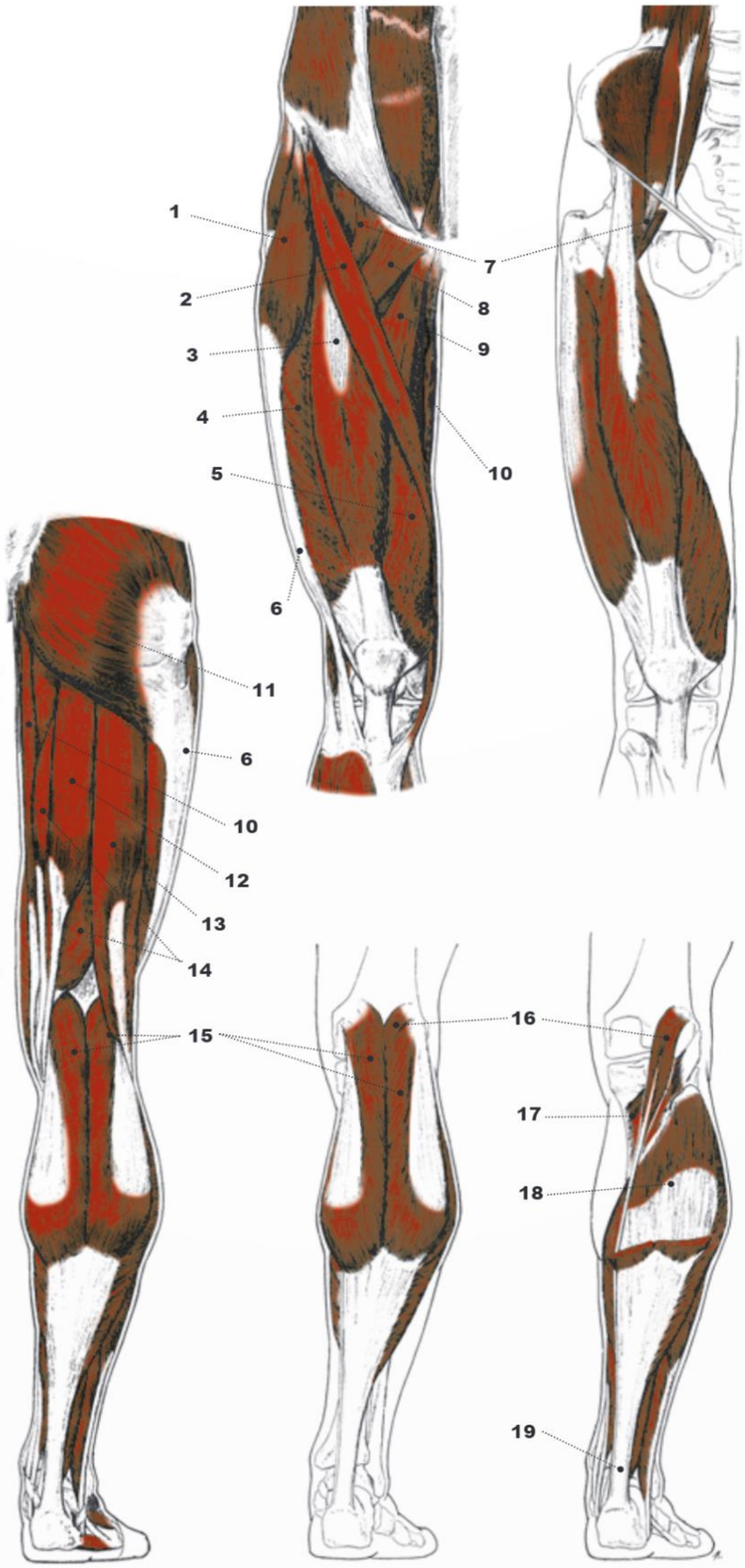
Ligaments & Menisci



Knee
1. Lateral (fibular) collateral ligament
2. Medial (tibial) collateral ligament
3. Patellar ligament (infrapatellar tendon)
4. Infrapatellar fat pad
5. Anterior cruciate ligament
6. Posterior cruciate ligament
7. Medial meniscus
8. Lateral meniscus



lateral view
(knee in flexion, lateral condyle removed)



1. Tensor fascae latae
2. Sartorius
3. Rectus femoris
4. Vastus lateralis
5. Vastus medialis
6. Iliotibial band
7. Iliopsoas
8. Pectineus
9. Adductor longus
10. Gracilis
11. Gluteus maximus
12. Semitendinosus
13. Biceps femoris
14. Semimembranosus
15. Gastrocnemius
16. Plantaris
17. Popliteus
18. Soleus
19. Achilles tendon

Compare bilaterally, start with unaffected side for PROM & GMMT
Prior to assessing ROM the examiner should make an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."

AROM

Flexion (130°-150°)
Muscles Activated: semitendinosus, semimembranosus, biceps femoris (hamstrings), popliteus
Tissue Stretched: quadriceps, femoral nerve
Tissue Compressed: popliteal fossa structure (popliteal artery, tibial nerve). patella compressed into femoral condyles

Extension (0° to -5°)
Muscles Activated: vastus medialis, vastus lateralis, vastus intermedius, rectus femoris (quadriceps)
Tissue Stretched: semitendinosus, semimembranosus, biceps femoris (hamstrings), popliteus, gastrocnemius, sciatic nerve
Tissue Compressed: anterior knee structures

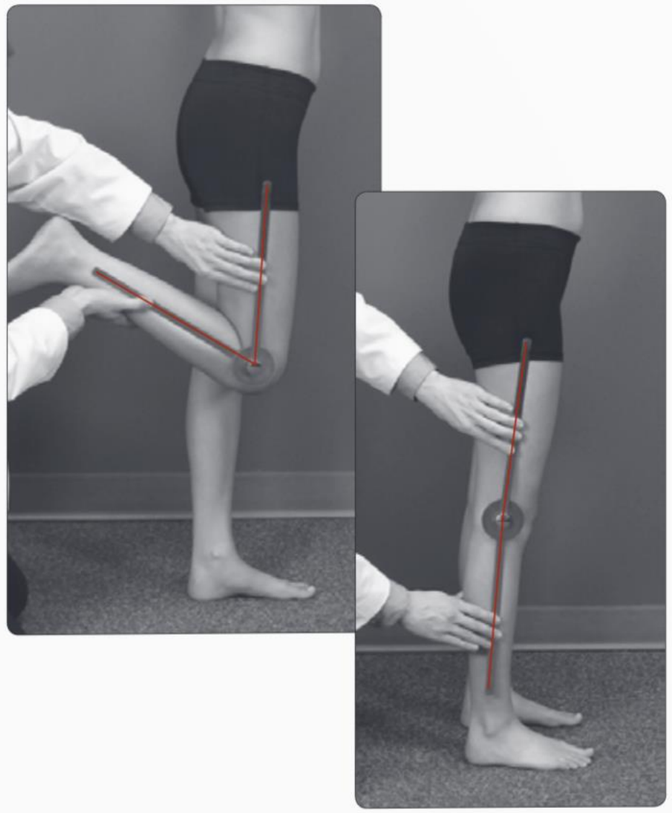


Goniometry

Flexion (normal 130°-150°)
- Patient prone or standing with knees straight (0°)
- Fulcrum aligned with the lateral femoral epicondyle
- Stationary arm in line with greater trochanter; moving arm in line with lateral malleolus
- Ask patient to flex knee

Extension (normal: 0° to -5°)
- Patient prone with a towel under the ankle to assess full extension
- Fulcrum aligned with the lateral femoral epicondyle
- Stationary arm in line with greater trochanter; moving arm in line with lateral malleolus
- Ask patient to extend knee

- If the patient cannot stand on one leg these measurements can also be done in the prone position



PROM

Flexion (> 130°-150°)
Tissue Stretched: quadriceps, femoral nerve (if done with hip straight)
Tissue Compressed: popliteal fossa structure (popliteal artery, tibial nerve). patella compressed into femoral condyles



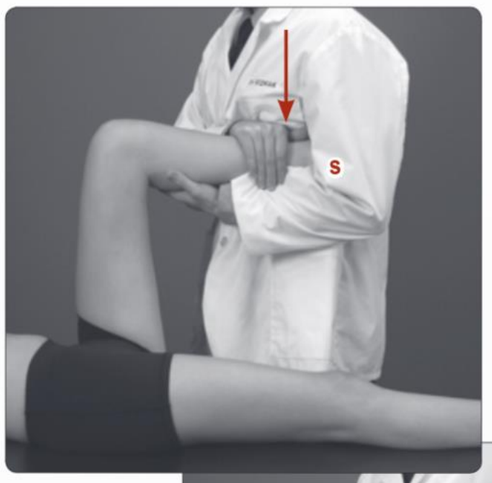
Extension (> 0° to -5°)
Tissue Stretched: semitendinosus, semimembranosus, biceps femoris (hamstrings), popliteus, gastrocnemius, sciatic nerve
Tissue Compressed: anterior knee structures



Muscle Testing

Resisted Extension

Muscles Activated: vastus medialis, vastus lateralis, vastus intermedius, rectus femoris (quadriceps)



Resisted Flexion

Muscles Activated: semitendinosus, semimembranosus, biceps femoris (hamstrings), popliteus



Active Posterior Drawer ★★★★★

Procedure

Patient seated with knees flexed 90°, examiner instructs patient to isometrically contracted hamstrings while the examiner stabilizes the foot & palpates knee joint line



Interpretation

(+) Posterior subluxation of the tibial plateau → posterior knee instability, PCL rupture (SN: 54 SP: 97 +LR: 18 -LR: 0.47)[38, 55]

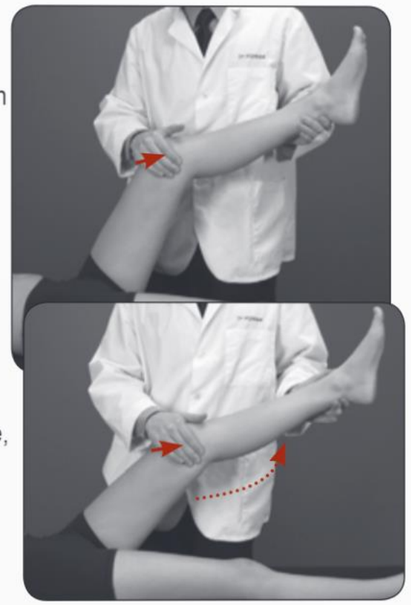
Clinical notes

Clinician's option: modifications of this test may include the patient being instructed to contract lateral hamstrings (posteriolateral instability) or medial hamstrings (posteriomedial instability)

Anderson Medial-Lateral Grind ★★★★

Procedure

Patient supine hip flexed 90° & knee flexed 90°, examiner palpates anterolateral & medial joint lines at knee, examiner then passively flexes knee while applying a valgus stress, examiner then proceeds to passively extend the knee while applying a varus stress (movement should be circular in nature with a gradual increase in varus & valgus stress with succesion)



Interpretation

(+) Pain with valgus force → Lateral meniscus lesion, medial collateral ligament strain
(+) Pain with varus force with → Medial meniscus lesion, lateral collateral ligament strain
(+) Pain or crepitus with all motions → Degenerative joint disease, osteoarthrosis, severe knee internal derangement, sprain/strain

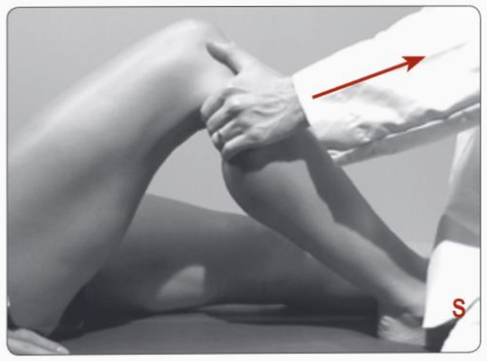
Clinical notes

This test provides a dynamic range in which to test knee joint stability & meniscal integrity (similar to McMurray's test)

Anterior Drawer Test ★★★★★

Procedure

Patient supine with knee bent 90°, examiner stabilizes foot with hip & places thumbs over the anterior knee joint line & pulls the tibia anteriorly



Interpretation

(+) Pain → Anterior cruciate ligament sprain
(+) Excessive motion → Anterior cruciate rupture

Clinical notes

Degrees of knee joint instability

Grade	Description
I	mild, < 5 mm of translation
II	moderate, 5-10 mm of translation
III	severe, > 10 mm translation

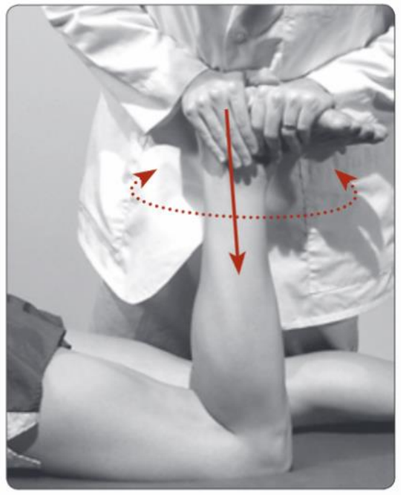
This test shows higher sensitivity values when performed on non-acute knee injuries[54]
(SN: 18-95 SP: 86-100 +LR: 1.8-8.3 -LR: 0.1-0.5)[2, 5, 17, 23, 24, 25, 32, 44, 54, 65, 66, 113, 114, 115]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Apley's Compression Test ★★★★★

Procedure

Patient prone with knee flexed 90°, examiner applies downward force on the foot & rotates internally/externally



Interpretation

(+) Pain or crepitus with compression & rotation, which is relieved by knee distraction → Meniscal damage (R: 0.95 SN: 13-16 SP: 86-100 +LR: 0.8-5.9 -LR: 0.63-1.1)[38, 55, 60, 89]

Clinical notes

Signs of a meniscal lesion:

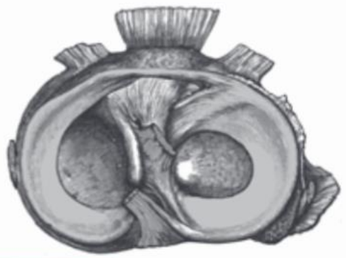
1. Knee joint line pain
2. Popping or grating (crepitus) soundésensation with movement
3. "Locking" of the knee (inability to fully extended)

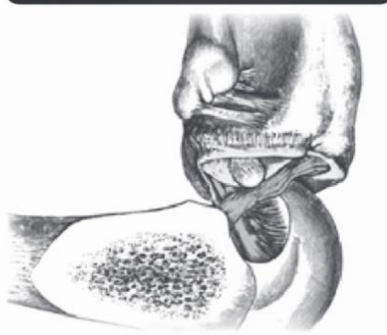
Apley's compression test should be followed with a hyperflexion compression test if a meniscal lesion is suspected

Hyperflexion Test - same as Apley's compresion except knee flexed 130°-150° - test is more specific for the location of posterior horn meniscal tears missed by the standard Apley's compression test

Squat Walk Test - if possible, have patient get into a low squat and 'walk' forward - this is a better variation for to increase pressure on knee using patient's own body weight - (+) joint line pain or inability to perform task → meniscal damage



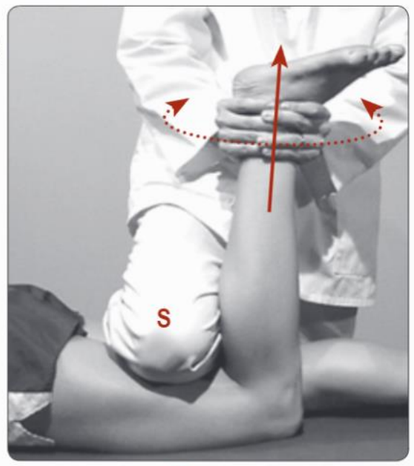




Apley's Distraction Test ★★★★★

Procedure

Patient prone with knee flexed 90°, examiner stabilizes patient's thigh by placing knee over the patient's distal posterior thigh, examiner then applies long axis distraction above the malleoli at the ankle (pulls up) & internally & externally rotates leg



Interpretation

(+) Pain with distraction → Capsule/ligamentous lesion at the knee, collateral ligament sprain

(+) Decreased pain following distraction → meniscal lesion

Clinical notes

See signs of meniscal lesion above

(R: 0.95 SN: 13-16 SP: 86-100 +LR: 0.8-5.9 -LR: 0.63-1.1)[38, 55, 60, 89]

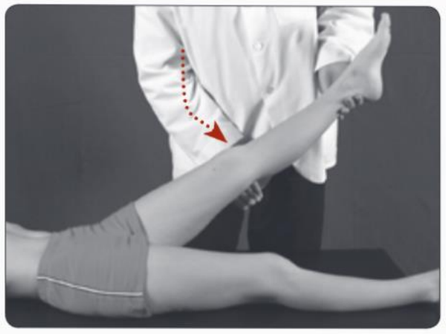
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Bounce Home Test ★★★★★

Procedure

Patient supine & relaxed, examiner lifts straight leg & bends knee to approximately 20° by placing a hand behind the popliteal fossa, examiner then proceeds to remove support from the posterior knee allowing it to drop into full extension (bounce home)





Interpretation

(+) Joint line pain → Meniscal tear

(+) Inability to fully extend knee:

1. Spongy end-feel → Swelling/edema
2. Rubbery end-feel / pain → Meniscal tear (R: 0.07-0.29 SN: 38-47 SP: 67-85 +LR: 1.2-2.9 -LR: 0.0.7-0.9)[31, 38, 60]
3. Hard end-feel → intra-articular fragment ("joint mice"), osteochondritis dissecans

Clinical notes

Examiner should not fully remove hand from popliteal fossa, instead the examiner should simply stop supporting knee & be ready to catch the knee if signs of severe pain are noted

Clarke's Test Modified ★★★★

Procedure

Patient supine with leg straight, examiner compresses the quadriceps muscle 2 cm (1 inch) above the superior pole of the patella, the patient is then instructed to contract the quadriceps muscle



Interpretation

(+) Retropatellar pain → Chondromalacia patella, degeneration of the patellofemoral joint

Clinical notes

Contraction of the quadriceps compresses the patella against the femoral condyles

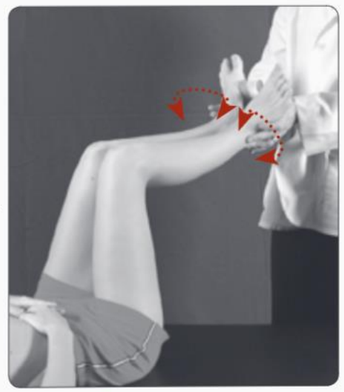
Chondromalacia patella causative factors; recurrent patellar dislocation, patella alta & other congenital anomalies, quadriceps muscle imbalance, increased Q-angle at the knee, direct patellar trauma

Dial Test / Loomer's Test ★★★

Synonym: Bousquet External Hypermobility Test

Procedure

Patient supine with hips flexed 90° and knees flexed 90°, examiner grasps the patient heels and maximally laterally rotates the tibias



Interpretation

(+) Excess of lateral tibial rotation and posterior sag of the tibial tuberosity → posteriolateral instability

Clinical notes

Clinician's option: examiner may also perform maximal internal tibial rotation to check internal rotational stability

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Duck Waddle / Ege's Test ★★★★★

Procedure

Patient standing with feet approximately ~30 cm apart & legs maximally internally rotated, patient then attempts a full squat; maneuver is repeated with patient's legs externally rotated



Interpretation

(+) Pain, inability to perform test, audible "clicking" or crepitus →
With internal rotation → Lateral meniscus tear
With external rotation → Medial meniscus tear

Clinical notes

Procedure provides functional weight bearing assessment of potential knee pathologies (SN: 64-67 SP: 81-90 +LR: 3.5-6.4 -LR: 0.4)[5, 12]

Hughston's Plica Test ★★★

Procedure

Patient supine with leg straight, examiner flexes & medially rotates the leg while applying a medial to lateral force on the patella with the heel of the hand, & palpates the medial femoral condyles with fingers; examiner applies force the patella while flexing & extending the knee & observing for the presence of patellar "popping" or "shutter"



Interpretation

(+) "Popping" or "shutter" → Plica inflammation

Clinical notes

Plica: remnant of an embryonic septum that makes up knee joint capsule - incidence of patellar plica varies from ~15% -50% of the population

J-sign ★★★★

Procedure

Patient seated with knee bent 45°, examiner instructs patient to straighten knee while observing patellar tracking



Interpretation

(+) Patellar deviation laterally in the shape of a "J" with knee extension → Patellar tracking dysfunction, vastus medialis oblique deficiency, increased Q-angle

Clinical notes

Etiologies associated with patellofemoral disorders; vastus medialis oblique deficiency, Q-angle, lateral retinacular tightness/plica, patella alta or baja, patellofemoral groove depth, abnormal patellar tracking

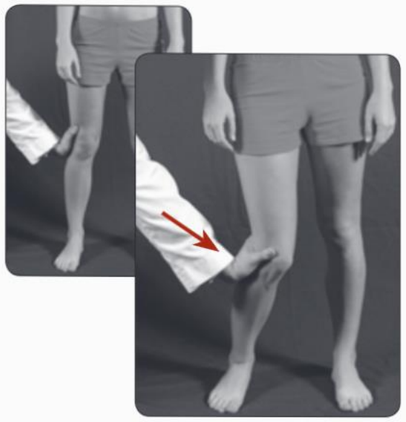
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Knee Knee

Jakob Test ★★★

Procedure

Patient standing with weight equally distributed on both feet, examiner applies a valgus force to involved knee while slowly flexing the knee



Interpretation

(+) Jerking of the knee, tibia shifts posteriorly, "giving way" phenomenon → Posteriolateral instability, MCL injury

Clinical notes

Damaged structures that may lead to positive test include; posterior cruciate ligament, medial collateral ligament, semimembranosus muscle strain, anterior cruciate ligament

Lachman's Test ★★★★★

Procedure

Patient supine with knee bent 15°-30°,
Lachman's Anterior: examiner stabilizes the patient's femur with one hand & then pulls the tibia anteriorly with the other hand
Lachman's Posterior: same procedure except repeated with the examiner pushing the tibia posteriorly



Interpretation

(+) Pain with normal anterior translation → ACL sprain
(+) Pain with increased anterior translation → ACL rupture
(+) Pain with normal posterior translation → PCL sprain
(+) Pain with increased posterior translation → PCL rupture

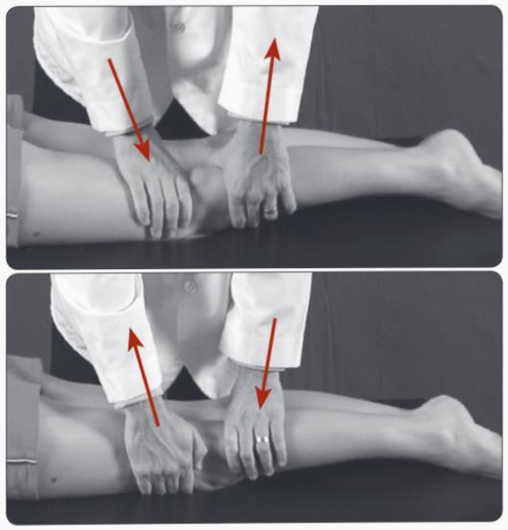


Clinical notes

This procedure is considered the gold standard for the evaluation of anterior cruciate & posterior cruciate knee ligament damage (R: 0.38 SN: 63-99 SP: 42-100 +LR: 2.15 -LR: 0.23)[23, 24, 27, 32, 44, 65, 66, 93, 113]

Test may be difficult for smaller clinicians to perform on larger patients

Reverse Lachman's - patient *prone* with knee flexed 30°, examiner stabilizes posterior distal thigh (ensure the hamstring muscles are relaxed), examiner then proceeds to apply an upward pressure on the proximal tibia (+) Pain or increase translation → PCL strain or rupture (SN: 62 SP: 89 +LR: 5.6 -LR: 0.43)[93]

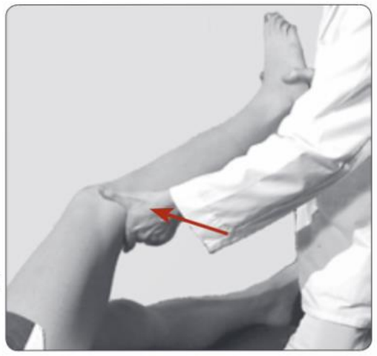


S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Losee's Test ★★★★

Procedure

Patient supine with hip flexed 45°, examiner externally rotates patient's leg & flexes the knee to 30°, examiner places thumb behind the fibular head & applies a valgus force to the knee, examiner then proceeds to extend the knee while applying forward pressure with the thumb on the fibular head (causing medial rotation of the leg)



Interpretation

(+) "Clunk" just before full knee extension is reached → Anterolateral rotational instability, anterior cruciate ligament sprain, lateral collateral ligament sprain, iliotibial band lesion, capsule damage

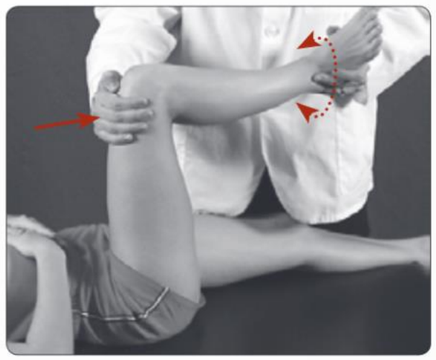
Clinical notes

This test is a variation of the pivot shift test; patients with knee instability typically have a history of knee joint injury &/or repetitive stress

McMurray's Test ★★★★★

Procedure

Patient supine or side-lying with hip flexed at 90° & knee flexed 90°, examiner stabilizes patient's knee over distal quadriceps muscles & grips patient's heel with the other hand & applies long axis compression; examiner then rotates the tibia internally while applying a varus force, examiner then rotates the tibia laterally while applying a valgus force



Interpretation

(+) Pain or crepitus → Meniscal lesion
Valgus force with external rotation → Lateral meniscus
Varus force with internal rotation → Medial meniscus

Clinical notes

Signs of a meniscal lesion: knee joint line pain, crepitus sensation with movement, "locking" of the knee
Surgical confirmation of McMurray's test has show that it can be less than 75% accurate. Beware false positives or negatives & cluster with other tests
This test is difficult to perform correctly & takes lots of practice & regular use to be proficient
(R: 0.16-0.35 SN: 16-67 SP: 69-98 +LR: 1.5-9.3 -LR: 0.38-0.86)[2, 5, 12, 23, 28, 31, 34, 38, 55, 60, 84, 89, 94]

Medial Patellar Plica Test ★★★

Procedure

Patient supine with legs straight, examiner passively flexes knee to 30° while applying a lateral to medial force on the patella with the other hand (attempting to move the patella medially)



Interpretation

(+) Medial knee pain → Plica inflammation, osteochondritis dissecans

Clinical notes

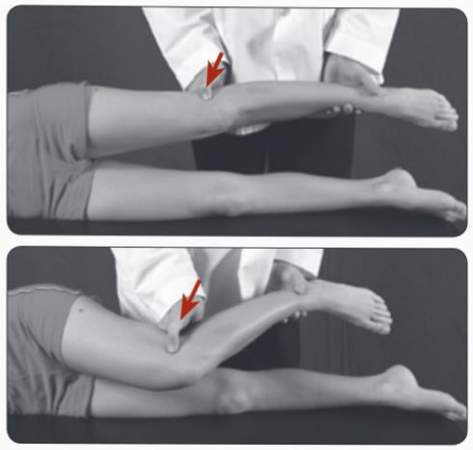
By flexing the knee & moving the patella medially an inflamed plica may cause tension between the patella & the medial femoral condyle, which may cause pain or discomfort

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Nobel Compression Test ★★★★

Procedure

Patient supine or side-lying, examiner applies lateral to medial pressure over the patient's lateral epicondyle with thumb & slowly flexes & extends the leg (3-4 times)



Interpretation

(+) Pain over the lateral femoral epicondyle or palpable tendon snapping → Iliotibial band syndrome

Clinical notes

Etiologic factors in ITB syndromes:

- Pelvic tilt, running or cycling on an oblique surface
- Increased activity, sudden increase in running or cycling distance; Varus knee deformity, overpronation
- Leg length inequality (may be related to pelvic tilt)

Patellar Apprehension/Fairbank's Test ★★★★★

Procedure

Patient supine with legs straight & quadriceps muscles relaxed, examiner gently & slowly pushes the patella laterally & observes the patient for signs of verbal & nonverbal apprehension or reflex quadriceps contraction

Interpretation

(+) Apprehension or reflex quadriceps muscle contraction → Patellar instability, subluxation, tracking disorder, patellofemoral dysfunction



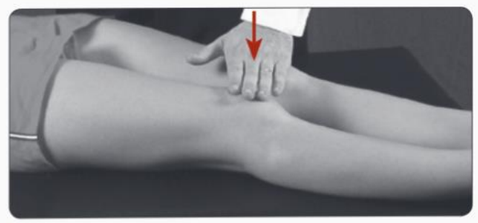
Clinical notes

Some clinicians suggest having the knee flexed 30° during this maneuver; with the knee flexed, the patella is much more stable in the patellar groove of the femur (increasing of a false negative), testing with leg straight increases the clinically validity of the test (patient in photo is demonstrating an exaggerated response ☺)
(SN: 7-37 SP: 86-100 +LR: 0.9-2.3 -LR: 0.8-1)[43, 81, 82]

Patellar Ballottement Test ★★★★

Procedure

Patient supine with leg straight examiner applies anterior to posterior pressure over the patella & gently oscillates the patella, palpating for motion



Interpretation

(+) Increased motion or spongy joint feel → Intra-articular knee swelling

Clinical notes

Normally the patella should move approximately 1 mm, in the presence of joint swelling the anterior to posterior motion will be increased as local edema raises the patella further off the femur
Trauma is the most common cause of joint effusion at the knee (internal derangement, ligament sprain or rupture, vascular damage, fracture)

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Patellar Facet Pinch Test ★★★

Procedure

Patient supine with legs straight & quadriceps muscles relaxed, examiner gently & slowly pushes the patella laterally & palpates the facets, the test is then repeated with the examiner pushing the patella medially



Interpretation

(+) Facet tenderness → Chondromalacia patella

Clinical notes

Perkin's Sign: peripheral patellar tenderness upon medial & lateral displacement

Patellar Sweep / Stroke Test ★★★★

Procedure

Patient supine with leg straight, the examiner strokes the medial side of patella upward while simultaneously stroking the lateral side of patella downward with the opposite hand, this procedure is repeated two or three times



Interpretation

(+) Fluid accumulation at the inferior medial border of the patella (bulge) → Internal derangement, ligament sprain or rupture, vascular damage, fracture

Clinical notes

The most common cause of knee swelling results from edema secondary to intra-articular trauma

Patellofemoral Grind Test ★★★★★

Synonym: Patellar Grind Test, Clarke's Sign

Procedure

Patient supine legs straight, examiner "cups" hand over patella & applies a downward force (compressing the patella against the femur), examiner then proceeds to move the patella laterally, medially, superiorly, inferiorly, & in a twisting motion ("twist & grind")



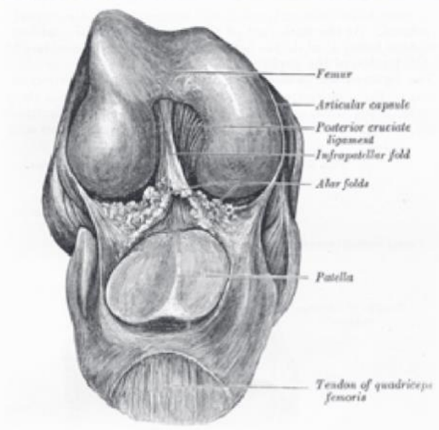
Interpretation

(+) Pain and/or crepitus → Chondromalacia patella, DJD, osteochondritis of the patella, patellar fracture
(SN: 29-49 SP: 67-75 +LR: 0.9-1.9 -LR: 0.7-1.1)[73, 81, 82, 71]

Clinical notes

Compression of the patella on the femur may cause pain due to aggravation of inflamed or damaged tissues

Many patients may have a feeling of nausea or apprehension (warn patient ahead of time)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Payr's Test ★★★★

Procedure

Patient seated with feet & ankles crossed, examiner applies a downward pressure on the knee & observes the patient for signs of pain or discomfort



Interpretation

(+) Medial knee joint line pain → Medial meniscus tear

Clinical notes

Downward force applied to crossed legs in this patient position increases medial knee compression & may aggravate a damage or inflamed medial meniscus

Test shows no diagnostic value in the detection of meniscus tear (SN: 54 SP: 44 +LR: 0.96 -LR: 1.1)[53]

Pivot Shift Test ★★★★★

Synonym: McIntosh Pivot Shift

Procedure

Patient supine with leg straight, examiner flexes patient's knee approximately 5° & applies valgus force, with the other hand the examiner attempts to maintain a medial rotational force at the knee with the thumb behind the fibular head & internally rotating the fibula, tibia & ankle; the examiner, while maintaining the internal rotatory & valgus force, proceeds to flex the



Interpretation

(+) Repeatable "clunk" or the patient feels like the knee is "giving way" → Anterolateral rotational instability, anterior cruciate ligament sprain, lateral collateral ligament sprain, iliotibial band lesion, posterior capsule damage

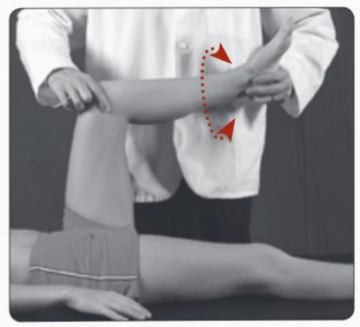
Clinical notes

Patients with knee instability often have a history of knee joint injury &/or repetitive stress activities
(SN: 9-71 SP: 89-100 +LR: 10 -LR: 0.71)[17, 23, 24, 44, 66, 93, 95, 113]

Reverse Pivot Shift: perform opposite action back to the starting position of pivot shift; patient supine with hip & knee flexed; examiner applies a varus force at the knee, with the other hand the examiner attempts to maintain a lateral rotational force at the knee with the thumb in front of the fibular head & externally rotating the fibula, tibia & ankle; the examiner, while maintaining the externally rotatory & varus force, proceeds to extend the patient's knee to 5°

Interpretation: same as regular pivot shift except it indicates posterior or posteriolateral pathologies
(SN: 23-58 SP: 94-95 +LR: 5-9.7 -LR: 0.5-0.8)[39, 52, 62, 93, 99]

Retreating Meniscus Sign - Patient supine with hip flexed 90° & knee flexed 90°, examiner palpates the medial joint line anterior to the medial collateral ligament & with the opposite hand, rotates the leg internally & externally by twisting the ankle; examiner observes for the presence or disappearance of the meniscus



(+) Meniscus does not disappear while rotating the leg → Meniscal lesion, tear - this test works on the premise that with the knee flexed 90° to motion of the meniscus should follow the tibia & the meniscus should become more or less prominent with internal or external rotation

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Posterior Drawer Test ★★★★★

Procedure

Patient supine with knee bent 90°, examiner places thumbs over the anterolateral & anteromedial knee joint line & pushes the tibia posteriorly

Interpretation

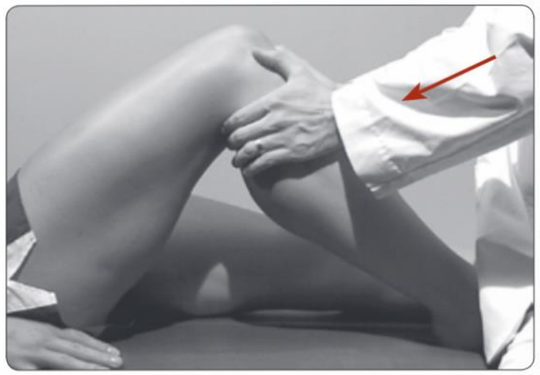
(+) Pain or increased motion → PCL sprain or rupture

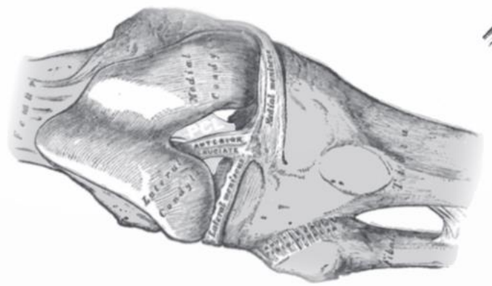
Clinical notes

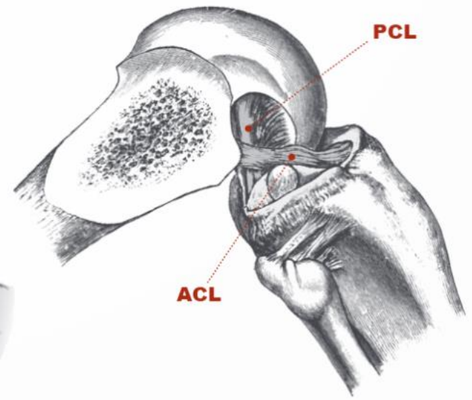
Degrees of knee joint instability

Grade	Description
I	mild, < 5 mm of translation
II	moderate, 5-10 mm of translation
III	severe, >10 mm translation

(SN: 22-100 SP: 99 +LR: 90 -LR: 0.1)[26, 39, 46, 47, 48, 69, 93]







Posterior Sag Sign / Gravity Test ★★★★★

Procedure

Patient supine with knees flexed 90° and hips flexed approximately 45° examiner compares prominence of tibial tuberosities bilaterally

Interpretation

(+)Tibia "sags back" or "drops back" on the femur → Posterior cruciate ligament tear (posterior translation knee instability) (SN: 83-100 SP: 100)[5, 26, 39, 93, 106]

Clinical notes

Active PCL Test / Godfrey Test - patient flexes hips 90° & knees 90°, examiner observes for posterior shift of tibia - (+) Posterior subluxation of the tibial plateau → posterior knee instability, PCL rupture (SN: 54 SP: 97 +LR: 18 -LR: 0.47)[38, 55]





S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Q-Angle Test ★★★★

Procedure

The Q-angle of the knee is measured with patient standing, one line is drawn from the ASIS through the midpoint of the patella, & the other line is drawn from the tibial tuberosity through the midpoint of the patella; the Q-angle is formed by the intersection of these two lines

Interpretation

< 13° → Genu varum, patella alta, lateral collateral ligament injury, surgical removal of the medial meniscus, femoral retroversion, internal tibial torsion

> 18° → Genu valgum, patella baja, medial collateral ligament injury, over-pronation syndrome, femoral anteversion, lateral tibial torsion

Clinical notes

- **Genu valgum** 'knocked knees': Q angle > 22° (women), 18° (men)
- **Genu varum 'bow legs'**: Q angle < 0° (distal tibia points medially)
- **Genu recurvatum:** hyperextension of knee > -5°





Rinne ITB Test ★★★

Procedure

Patient standing, examiner applies pressure over the patient's lateral epicondyle with thumb & instructs patient to squat & rise or step up on to a bench

Interpretation

(+) Pain over the lateral femoral epicondyle or palpable tendon snapping → Iliotibial band syndrome

Clinical notes

This maneuver provides a more functional weight bearing assessment of the iliotibial band, but it should be noted that the net movement at the knee is the same as Noble's compression test performed with the patient side-lying or supine

Do NOT confuse this test with the Rinne test for hearing function (see ear exam)



Single Leg Hop ★★★★

Procedure

Patient standing on one leg, examiner instructs patient to hop in place, examiner observes for signs of pain or discomfort

Interpretation

(+) Hip pain → Hip joint pathology, arthritis, femoral neck or head fracture

(+) Local femoral, tibial, fibular or calcaneal pain → Pathology in the region corresponding to the pain

Clinical notes

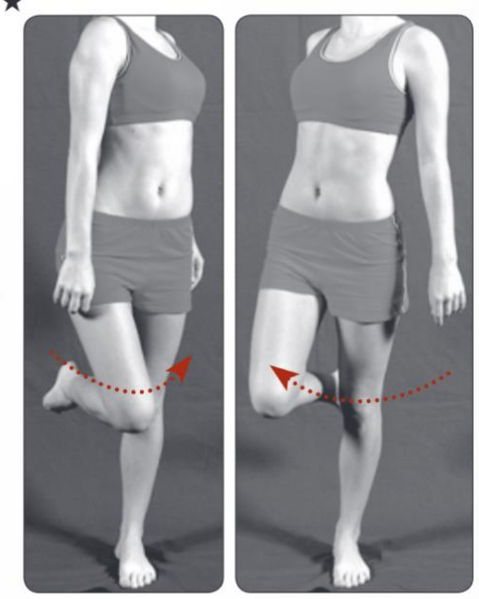
This maneuver is useful as a general screen to help localize the specific location for a detailed regional physical exam



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Single Leg Twist/Disco Test ★★★★★

Synonym: Thessaly Test



Procedure

Patient standing on a single leg near wall, examiner instructs patient to twist from side to side, test may be repeated with support & weight bearing knee flexed 5° & again at 20° flexion

Interpretation

(+) Pain, inability to perform maneuver, audible "clicking" or crepitus on weight bearing knee → Knee joint pathology, arthritis, meniscal lesion, ligamentous strain, internal derangement

Clinical notes

Examiner should provide patient with some support (hold hands) or be ready to catch the patient should they lose their balance

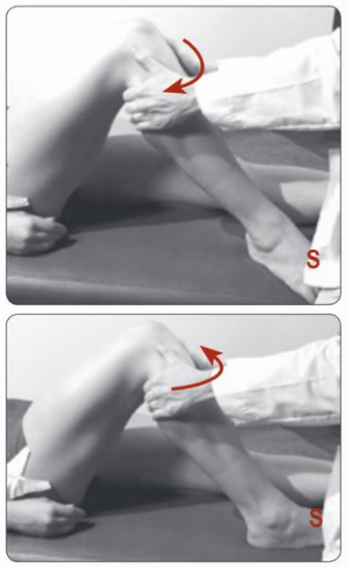
Increased knee flexion may improve diagnostic accuracy (R: 0.95 SN: 66-92 SP: 91-97 +LR: 9-30 -LR: 0.08-0.35)[55]

Slocum's Test ★★★★

Procedure

Patient seated with hip flexed at 45° & knee flexed 90°, 2 parts;

1. Examiner externally rotates tibia 15° & pulls the tibia anteriorly
2. Examiner then internally rotates the tibia 30° & pulls it anteriorly



Interpretation

(+) Increased motion with external rotation of the tibia → Anteromedial instability, medial collateral ligament tear and/or anterior cruciate ligament tear, arcuate-popliteus complex

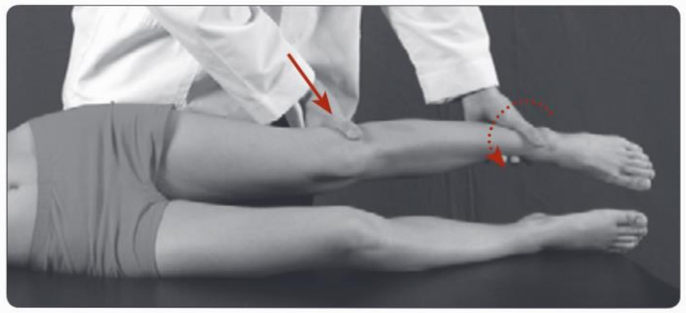
(+) Increased motion with internal rotation of the tibia → Anterolateral instability, lateral collateral ligament tear, posterior cruciate ligament tear, iliotibial band lesion

Clinical notes

Clinician's option: to improve exam efficiency Slocum's test may be done in conjunction with the anterior drawer test (helps to speed up physical exam as patient is already in the correct position)

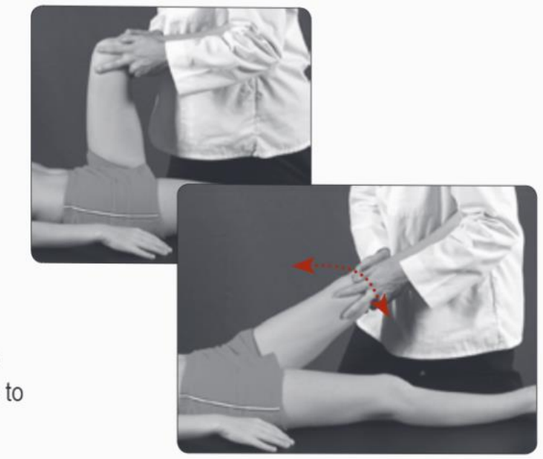
Slocum's ALRI Test: *side lying* with unaffected side down (~30° from supine) & lower leg is flexed 30° to increase stability, examiner proceeds to stabilize the involved ankle in the medial rotation and applies a valgus force at the knee -

(+) "Clunk" or joint subluxation → Anteriolateral rotational instability



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Steinmann's Test ★★★★★



Procedure

Patient supine with hip flexed 90° & knee flexed 90°, examiner palpates around the knee joint line & proceeds to flex & extend the knee while palpating the joint

Interpretation

(+) Pain with movement & crepitus → Meniscal lesion (R: 0.05 SN: 29 SP: 100)[31, 89], osteochondritis dissecans, ligament sprain

Clinical notes

This maneuver is essentially passive knee ROM with the examiner palpating the joint (a useful technique to employ with all passive ROM procedures)

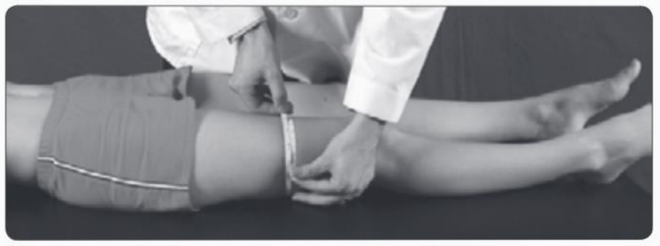
Thigh Circumference Test ★★★★

Procedure

Patient supine with legs straight, examiner measures the circumference of the thigh at 10 cm superior to the patella, & compares results bilaterally

Interpretation

(+) Asymmetry > 3 cm → Quadriceps muscle atrophy, which may be secondary to disuse syndromes or knee joint pathology (osteoarthritis or ligamentous damage at the knee that causes pain) or nerve lesions



Clinical notes

Mild asymmetry from side to side is a common finding (dominant vs. non-dominant side)

Torsion Test ★★★★

Procedure

Patient seated with knee bent 90°, examiner places hand against patient's lateral foot & instructs patient to attempt to externally rotate, procedure is repeated with the examiner placing hand against medial foot & asking the patient to internally rotate



Interpretation

(+) Knee pain → Meniscal tear, moderate/severe sprain, or fracture

(+) Inability to develop tension → Fracture

Clinical notes

If a fracture is suspected it is important that the patient perform as little movement as possible with the suspect extremity, in performing this test the examiner is not looking for motion, but rather the presence of force generated against their hand

The torsion test may be applied to other regions of the body where a fracture is suspected

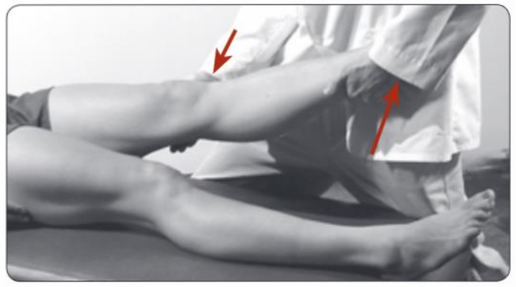


S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Varus/Valgus Stress Test ★★★★★

Valgus Test Procedure (Abduction Stress Test)

Patient supine with legs straight, examiner stabilizes medial ankle & applies a lateral to medial (valgus) force at the knee, procedure is then repeated with the knee slightly flexed (~25°)



Interpretation

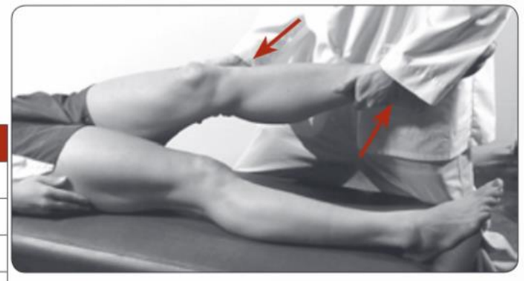
(+) Pain → Medial collateral ligament sprain
(+) Increased motion/gapping → Medial collateral ligament rupture

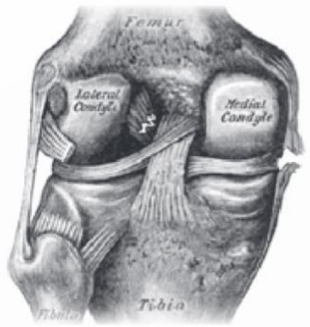
Clinical notes

The term valgus refers to the distal bone moving laterally

Medial collateral ligament injury classification

Grade	Description
I	0-5 mm of joint opening, no instability
II	5-10 mm of joint opening, mild instability
III	10-15 mm, moderate instability
IV	> 15 mm of joint opening, severe instability





Varus Test Procedure (Adduction Stress Test)

Patient supine with legs straight, examiner stabilizes lateral ankle & applies a medial to lateral (varus) force at the knee, procedure is then repeated with the knee slightly flexed (~25°)



Interpretation

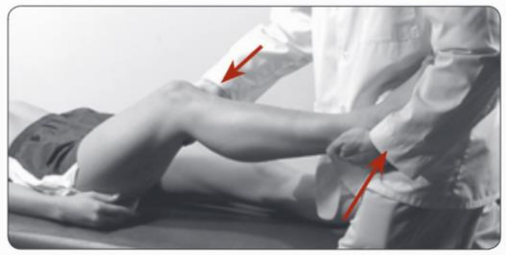
(+) Pain → Lateral collateral ligament strain
(+) Increased motion/gapping → Lateral collateral ligament rupture

Clinical notes

The term varus refers to the distal bone moving medially

Lateral collateral ligament injury classification

Grade	Description
I	0-5 mm of joint opening, no instability
II	5-10 mm of joint opening, mild instability
III	10-15 mm, moderate instability
IV	> 15 mm of joint opening, severe instability



Varus stress test may also be performed with the patients leg externally rotated 80-90° and the examiner may then allpy a downward force on the knee to challenge the ligaments (useful when assessing larger patients or smaller practitioner)

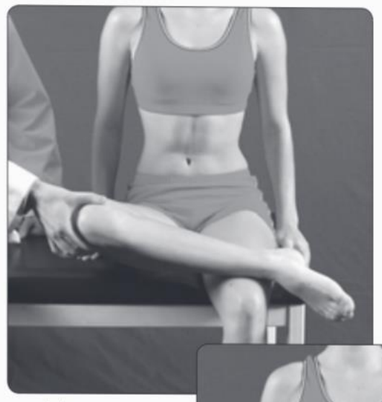
(R: 0.16 SN: 86-100 SP: 100)[1, 5, 46, 47, 48, 76, 95]

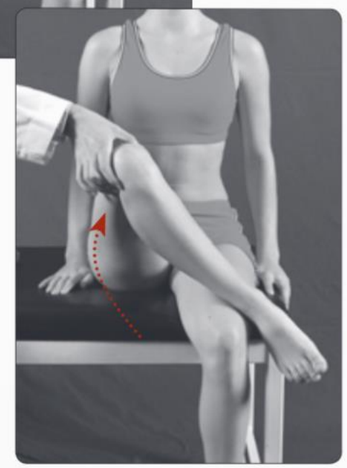
S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Vizniak LCL Maneuver ★★★★

Procedure

Patient seated or supine with one relaxed leg crossed over the other (hip flexed 90°, knee flexed ~110° & heel resting on opposite knee), examiner palpates the lateral knee at the joint line (both anterior & posterior to the lateral collateral ligament), patient is then instructed to lift their flexed knee about 10 cm & then return it to the resting position; examiner notes the amount of joint gapping that occurs with this motion





Interpretation

(+) Excess of joint gapping → Lateral collateral ligament tear
(+) Lateral knee joint pain → Lateral collateral ligament sprain
(+) Medial joint line pain → Medial meniscus lesion

Clinical notes

With the knee flexed, the intrinsic ligaments of the knee are relaxed & the examiner is better able to assess knee joint play & more specifically integrity of the lateral collateral ligament as it will be extremely obvious to palpate with this maneuver

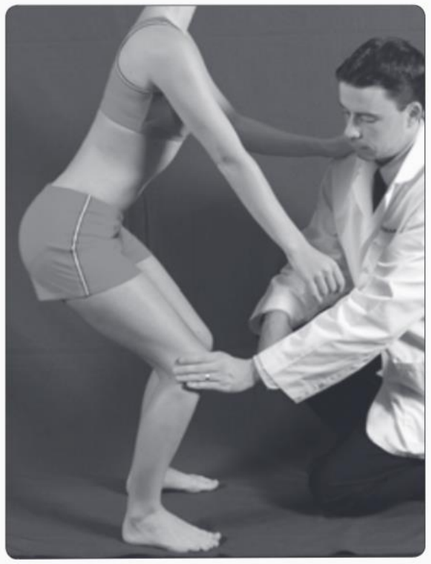
Clinician's option: examiner may passively elevate the knee to help further relax surrounding muscles

Waldron Test ★★★★

Procedure

Patient standing, examiner palpates the patella & instructs the patient to perform several slow knee bends (repeated squat & rise)





Interpretation

(+) Pain and/or crepitus → Chondromalacia patella, degenerative joint disease, osteochondritis of the patella, patellar fracture

Clinical notes

This test provides a more active weight bearing functional assessment of patellar tracking on the femur

(SN: 18 SP: 83 +LR: 1.05 -LR: 0.99)[81]

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Wilson's Test ★★★★

Procedure

Patient seated with knees flexed 90° hanging over the edge of the examination table, examiner instructs patient to internally rotate the tibia & extend leg, examiner then asks the patient to repeat the motion with the tibia externally rotated; during both motions the examiner is palpating the popliteal fossa looking for signs of crepitus or nonuniform motion



Interpretation

(+) Pain, apprehension or joint "locking" → Meniscal lesion, osteochondritis dissecans

Clinical notes

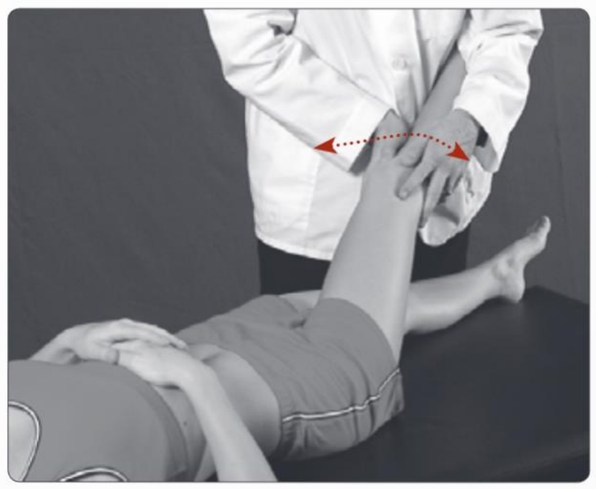
Common locations for osteochondritis dissecans at the knee (in order of frequency); 75% lateral side of the medial femoral condyles, 10% tip of the medial femoral condyles, 10% lateral femoral condyles, 5% patella

Osteochondritis dissecans may also occur at other joints (trochlea of the talus, capitulum of the humerus)

Wobble Test ★★★★

Procedure

Patient supine with leg straight, examiner supports the knee with both hands & "wobbles" it from side to side, while moving the knee through ranges of flexion & extension



Interpretation

(+) Pain → Medial or lateral ligament strain, meniscal lesion

(+) Increased motion/gapping → Medial or lateral collateral ligament rupture

Clinical notes

This test is useful as a general screen to help localize & assess knee joint ligament stability

Test is essentially valgus & varus stress testing

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Ottawa Knee Rule[107-109]

A knee X-ray series is only required for knee injury patients with *any* of these findings:

- Age ≥ 55
- Isolated tenderness of the patella (no bone tenderness of the knee other than the patella)
- Tenderness at the head of the fibula
- Inability to flex to 90°
- Inability to bear weight both immediately and in the emergency department (4 steps; unable to transfer weight twice onto each lower limb regardless of limping)

Clinical notes

- Exclusion criteria for the Ottawa rules are: age less than 18; isolated superficial skin injuries; injuries more than 7 days old; recent injuries being reevaluated; and patients with altered levels of consciousness, paraplegia, or multiple injuries. (SN: 85-100 SP: 49-50 +LR: 1.8 -LR: 0.1-0.3)[51, 91]

Pittsburgh Knee Rule[96]

A knee X-ray series is required for knee injury secondary to blunt trauma or a fall with either:

- Patient younger than 12 or older than 50 years of age
- Injury that causes an inability to walk four weight-bearing steps

Clinical notes

- Pittsburgh rules are not applicable in knee injuries sustained more than 6 days before presentation, patients with only superficial lacerations and abrasions, those with a history of previous surgeries or fractures on the affected knee, and those being reassessed for the same injury

(SN: 99-100 SP: 60-79 +LR: 2.5 -LR: 0.02)[96, 97]

Knee Film Evaluation

B = Bone: evaluate film for fractures & dislocations, describe variations in cortices, medullary & subchondral bone, density, shape, size, trabecular patterns & relationship of osseous arrangements.

A = Alignment: analyze joint alignment & posture, result of various measurements; misalignments

C = Cartilage: inspect the joint spaces, articular spaces for any abnormalities; pay attention to symmetry, continuity, widening or loss of joint space & calcification of cartilage

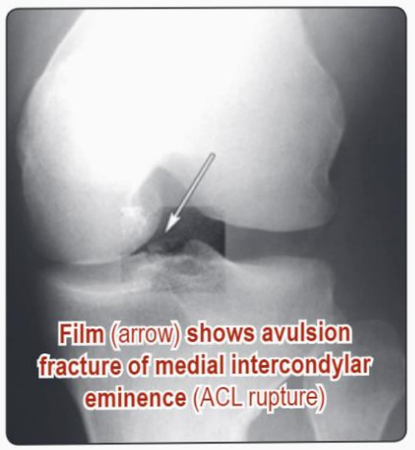
S = Soft Tissue: evaluate soft tissues; look for unusual calcifications, including in blood vessels, masses, displaced fascial lines & unusual gas distribution; note the presence of fat-pad signs ('sail sign') and soft tissue edema

Knee anatomical variants & anomalies

- Bipartite or multipartite patella - unfused apophysis of patella
- Os fabella - sesamoid bone in lateral head of gastrocnemius
- Pellegrini-Stieda disease - post traumatic ossification of medial collateral ligament

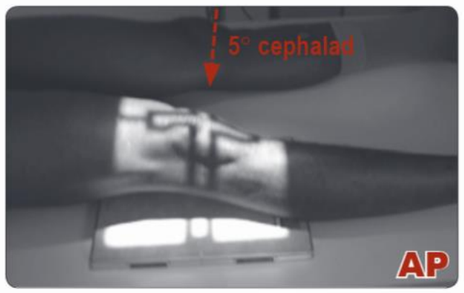


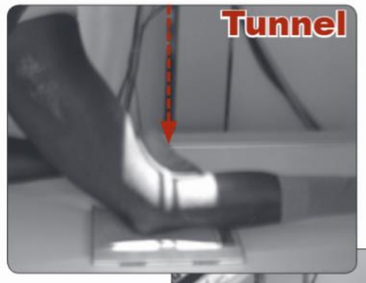
MRI of ACL rupture (arrow)

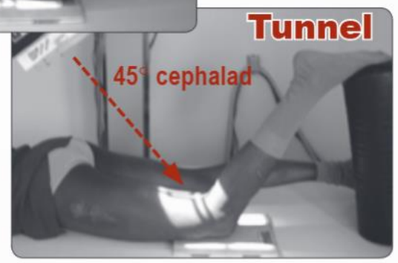


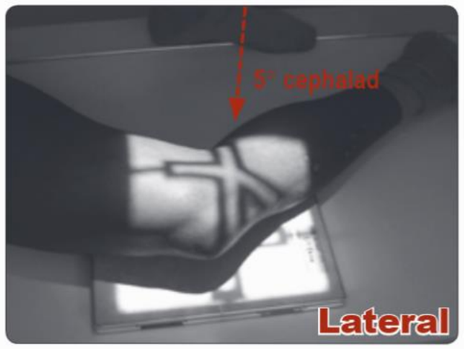
View Cassette, SID kV Range		Central Ray Tube ang., Grid Collimation, F. spot	Measure Marker	Breathing Clinical notes
Knee	**AP** 8x10, 40″ 60±5 kV	Inferior pole of patella 5° cephalad, yes (knee > 10 cm) Area of interest, small	Path of central ray Anatomically	5° cephalad tilt allows view down tibial plateau
	Lateral 8x10, 40″ 60±5 kV	Middle of joint line 5°, yes (knee >10 cm) Area of interest, small	Path of central ray Anatomically	Patient lying with side being examined down, flex knee 45°
	Tunnel / Intercondylar 8x10, 40″ 60±5 kV	Middle of joint line 45° caudal if patient prone 0° if patient is kneeling Area of interest, small	Path of central ray Anatomically	Position patient in most comfortable position (prone or kneeling) Correct for tube tilt
	Sunrise / Tangential 8x10, 40″ 60±5 kV	Middle of joint line 10° cephalad, yes (knee > 10 cm) Area of interest, small	Path of central ray Anatomically	Central ray through patellofemoral joint space

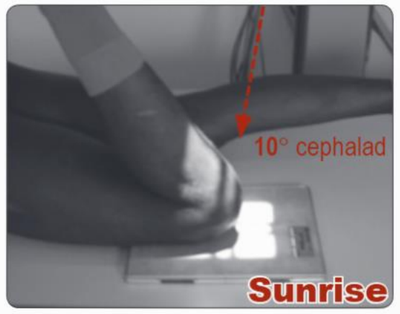
If knee measures less than 10 cm in diameter choose no grid (non-bucky)
8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended,
F. spot = Focal Spot, Cr. = central ray, SID = Source Image Distance (inches), MP = metacarpophalangeal joint









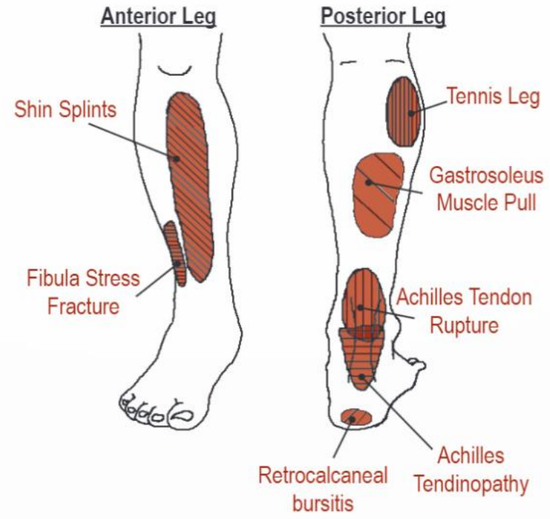


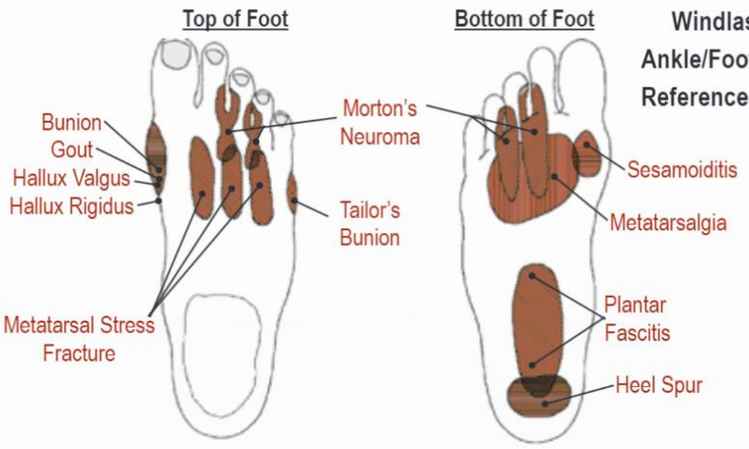
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Selected Leg, Ankle & Foot Pain Referral Patterns





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Follow HIP-MNRS - Clinicians performing physical exams must realize that no one sign is of absolute significance in isolation, each individual finding should be evaluated only in the context of other findings & the patient as a whole; this is particularly important with diagnostic procedures that may result in "soft" signs, which are difficult to reproduce & may have a large subjective bias in their interpretation.

When recording special test results it is not enough to write "test-X positive." Record any findings associated with the test (reproduction of symptoms, pain, numbness & tingling, decreased flexibility, etc) - more information results in a more accurate assessment & understanding.

Special history questions
- Specific mechanism of injury & forces involved? - did you hear a "popping" sound?
- Any swelling?
- What type & age of shoes? Running surface?
- Wear pattern on shoes? Possible fracture?

Inspection
- Asymmetry, bruising, bumps, color, swelling
- Posture (pes planus, cavus)

Fracture screen (older than 55?)
1. 4 step test, torsion test
2. Bony tenderness on palpation
3. Percussion, tuning fork (128 Hz)

Palpation (may be done after ROM assessment)

Tibial tub./fibular head	Subtalar joint
Tibial crest	Midtarsal joint
Lateral malleolus	Tarsometatarsal joints
Medial malleolus	MP joints
Navicular	PIP joints
Cuboid	DIP joints
Cuneiforms	Gastrocnemius/soleus
Talus (head, neck, trochlea)	Lateral leg muscles
Calcaneus	Anterior leg muscles
Sustentaculum tali	Achilles tendon
Metatarsals	Fibularis tendons
Phalanges	TDH muscles
Sinus tarsi	Tarsal tunnel
Ant. talofibular lig.	Tibialis anterior
Calcaneofibular lig.	Calcaneal bursa
Post. talofibular lig.	Plantar fascia
Spring ligament	Plantar muscles
Deltoid ligament	Saphenous vein

TDH = Tom Dick & Harry - Tibialis posterior, Flexor Digitorum Longus & Flexor hallicus longus

Functional assessment (ADLs)
- Squat & rise, heel walk, toe walk

AROM

Talocrural
- Plantar flexion ..... 40°
- Dorsiflexion ..... 20°

Subtalar
- Inversion ..... 20°
- Eversion ..... 10°

PROM & Joint Play (if lacking AROM in any motion)

Myotomes (resisted isometric movements)
- Hip flexion (L1-L3, femoral n.)
- Knee extension (L3-L4; femoral n.)
- Knee flexion (L4-S2, sciatic n.)
- Ankle dorsiflexion (**L4**, L5 - deep peroneal),
- Ankle inversion (L5, **S1** - sup. peroneal)
- Ankle eversion (**S1** - sup. peroneal)
- Big toe extension, (L4, **L5**, S1; deep peron.)
- Big toe flexion (L5-S1, tibial nerve)

Neurovascular screen

Sensory: Light touch, sharp/dull or pinwheel Vibration (DIP, 3rd digit)

UMNL: Babinski (L1 & above)
- ***DTR's:*** patella (L4), hamstring (L5), Achilles (S1)
- ***Pulses:*** femoral, tibial, dorsal pedal
- Nail bed blanching
- Buerger's claudication test

Orthopedic tests (as indicated)

Screening
- Heel walk, toe walk

Instability/Ligament stress
- Anterior drawer/plantar flexed
- Posterior drawer/neutral ankle
- Inversion talar tilt (neutral)
- Inversion talar tilt (plantar flex)
- Eversion talar tilt
- Subtalar glide test
- Rotational stress

Vascular
- Claudication test
- Buerger's claudication test
- Tourniquet test
- Homan's test

Stress fracture
- Calcaneal squeeze test
- Morton's squeeze test

Achilles tendonitis/rupture
- Achilles tap test
- Achilles squeeze test
- Hoffa's/Simmond's test

Nerve compression
- Tinel's test

Lumbar, SI, hip & knee screen

Diagnostic imaging (if indicated)

Condition	Clinical notes
Achilles tendinitis	*Hx:* painful tendon, worse with running, jumping & stairs, better with rest *SSx:* tender to palpation, (+) Achilles squeeze test, Thompson test *DDx:* Achilles strain
Plantar fascitis	*Hx:* pain in morning worse with first few steps *SSx:* tender to palpation, (+) calcaneal squeeze *DDx:* calcaneal stress fracture
Stress fractures	*Hx:* insidious onset of pain, better with rest, overuse injury (repetitive stress) *SSx:* tender to palpation (common locations: tibia, calcaneus, metatarsals) **Tibial Stress Fracture** - most common stress fracture of body; usually involves dominant or long leg; repetitive trauma (long distance running/walking/ marching, military recruits, ballet dancers); usually proximal posterior diaphysis region which is usually stable; less common in mid-shaft where the "dreaded black line" may be observed indicating more significant injury **Metatarsals Stress Fracture** (March fracture) - common usually involve 2nd & 3rd (1st and 5th rare); secondary to repetitive stress (more often long leg, distance running, sprinting, pronation syndrome); tenderness with metatarsal/Morton's squeeze test but no numbness or tingling unless there is nerve involvement **Calcaneus Stress Fracture** – common stable fracture; secondary to repetitive trauma (distance running, military recruits, dancers, gymnasts, & jumpers); heel pain that may mimic plantar fascitis or retrocalcaneal bursitis/achilles tendonitis; tenderness with calcaneal side squeeze & calcaneal percussion; may be painful with heal strike during gait – patient will often have altered gait (soft heel strike)
Compartment syndrome	*Hx:* symptoms exercise induced, better with rest, muscle weakness, foot drop gait *SSx:* local swelling & tightness, (+) calf circumference test, muscle weakness *DDx:* tibial stress fracture, tibialis anterior strain
Ankle sprain	*Hx:* significant trauma, mild-moderate pain *SSx:* local swelling (+) talar tilt tests, anterior/posterior drawer, rotational stress test *DDx:* avulsion fracture
Tarsal tunnel syndrome	*Hx:* medial or plantar foot pain of paresthesia *SSx:* tenderness around tarsal tunnel, (+) Tinel's test *DDx:* lumbar radiculopathy
Morton's neuroma	*Hx:* burning pain between metatarsals *SSx:* local tenderness, (+) Morton's neuroma test (metatarsal squeeze) *DDx:* lumbar radiculopathy, metatarsal stress fracture

↑ = increase, ↓ = decrease, Hx = history, SSx = signs & symptoms, DDx = differential diagnosis, (+) = positive

Ankle/Leg Regional Exam

☑ Check normal, circle & describe abnormal

CC & significant history: _____

Patient: _____ date: _____
Insurance: _____ (primary)
Date of birth: _____ M/F

Fracture screen (tuning fork, percussion, torsion test, 5-step test): □ **WNL** □ **Refer for X-ray:** _____

Observation: □ WNL

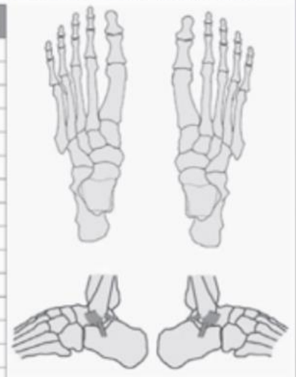
Development: □ good, □ fair, □ poor
□ Posture: _____
□ Skin (bruising, scars): _____
□ Swelling: _____
□ Asymmetry: _____

Observation □ WNL	L	R
Toe in / out		
Arch low / high		
Patella position (med, lat, ↑, ↓)		
Q-angle		
Genu varum / valgum		
Femur rotated int. / ext.		
Iliac crest height		
Lumbar hyper / hypolordosis		
Knee hyperextended		
Leg length		
Gait analysis		

Palpation: □ WNL, □ pain (circle), □ spasm (s), □ edema (e), □ fibrotic (f), □ MFTP (x), □ ache (a), □ tingling (t)

Palpation	L	R
Tibial tub./fibular haed		
Tibial crest		
Lateral malleolus		
Medial malleolus		
Navicular		
Cuboid		
Cuneiforms		
Talus (head, neck, trochlea)		
Calcaneus		
Sustentaculum tali		
Metatarsals		
Phalanges		
Sinus tarsi		
Ant. talofibular lig.		
Calcaneofibular lig.		
Post. talofibular lig.		
Spring ligament		
Deltoid ligament		

	L	R
Subtalar joint		
Midtarsal joint		
Tarsometatarsal joints		
MP joints		
PIP joints		
DIP joints		
Gastroc/soleus		
Lateral leg muscles		
Anterior leg muscles		
Achilles tendon		
Fibularis tendons		
TDH muscles		
Tarsal tunnel		
Tib. anterior/posterior		
Calcaneal bursa		
Plantar fascia		
Plantar muscles		
Saphenous vein		



ROM & Joint Play: □ WNL

□ Pain at end ROM: _____
□ Abnormal motion: _____

ROM	Active L	Active R	Passive L	Passive R
Plantarflexion (40°)				
Dorsiflexion (20°)				
Inversion (20°)				
Eversion (10°)				

Joint Play	L	R	Comments
Inferior tib-fib			
Ankle joint			
Subtalar joint			
Midtarsal joint			
Navicular-cuneif.			
Cuneiform-meta			
Intermetatarsal			
Hallux-metatarsal			
Metatarsophalang.			
PIP			
DIP			

Vascular Screen: □ WNL

Pulses (0-4)	L	R
Popliteal pulse		
Tibial pulse		
Dorsal pedial		
Blanch test		

Neurologic: □ WNL

Sensation, □ WNL	L	R
Light touch		
Sharp/dull		

Reflexes (0-5), □ WNL	L	R
Patellar (L4)		
Hamstring (L5)		
Patellar (S1)		
Babinski		

Motor (0-5), □ WNL	L	R
Plantarflexion (L4-S2)(tibial)		
Dorsiflexion (L4-S1)(deep fibular)		
Inversion (L4-L5)(deep fibular)		
Eversion (L4-S1)(superficial fib.)		
Toe flexion (L5-S2)(tibial)		
Toe extension (L4-S1)(deep fib.)		
Toe abd./add. (S1-S2)(tibial)		
other:		

Orthopedic: □ WNL

	L	R
Anterior drawer plantarflexed		
Anterior drawer neutral		
Inversion talar tilt plantarflexed		
Inversion talar tilt neutral		
Eversion talar tilt		
Rotational stress (Kleiger)		
Hoffa's sign		
Thompson/Simmond's test		
Achilles squeeze		
Calcaneal squeeze x 3		
Homan's sign/calf squeeze		
Buerger's claudication test		
Morton's foot squeeze		
Tinel's test at ankle		

Additional procedures: □ WNL

□ Hip exam: _____
□ Knee exam: _____
□ Lumbosacral: _____

DDx: _____

Signature: **Date:**

This form is a comprehensive checklist of examination procedures. Each item should be utilized as a diagnostic option based on the patient's presenting symptoms and the clinical discretion of the examiner. Every procedure does not have to be performed on every patient. Some procedures may be contraindicated in certain situations. Patient information contained within this form is considered strictly confidential. Reproduction is permitted for personal use, not for resale or redistribution. www.prohealthsys.com ©2005 by Professional Health Systems Inc. All rights reserved. "Dedicated to Clinical Excellence."

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Joint type: synovial
Hinge (talocrural, metatarsophalangeal & interphalangeal)
Gliding (subtalar, midtarsal joints)

AROM
Talocrural (talotibial)
Plantar flexion ..... 40°
Dorsiflexion ..... 20°
Subtalar
Inversion ..... 30°
Eversion ..... 15°
Metatarsophalangeal
Flexion ..... 75°
Extension ..... 35°
Interphalangeal
Flexion ..... ~60°
Extension ..... ~20°

Normal joint end feels
Talocrural: firm ligamentous
Subtalar: firm ligamentous
TMT: elastic firm
MTP extension: elastic / ligamentous
MTP flexion: firm / ligamentous
MTP big toe: firm / bony
PIP flexion: firm / bony
PIP extension: firm / ligamentous
DIP flexion: firm / ligamentous / elastic
DIP extension: firm / ligamentous / elastic

Main muscle actions
Plantar flexion: soleus, gastrocnemius, tibialis posterior, flexor digitorum longus, flexor hallicus longus
Dorsiflexion: tibialis anterior, extensor digitorum longus
Inversion: tibialis anterior, tibialis posterior
Eversion: fibularis longus, brevis & tertius

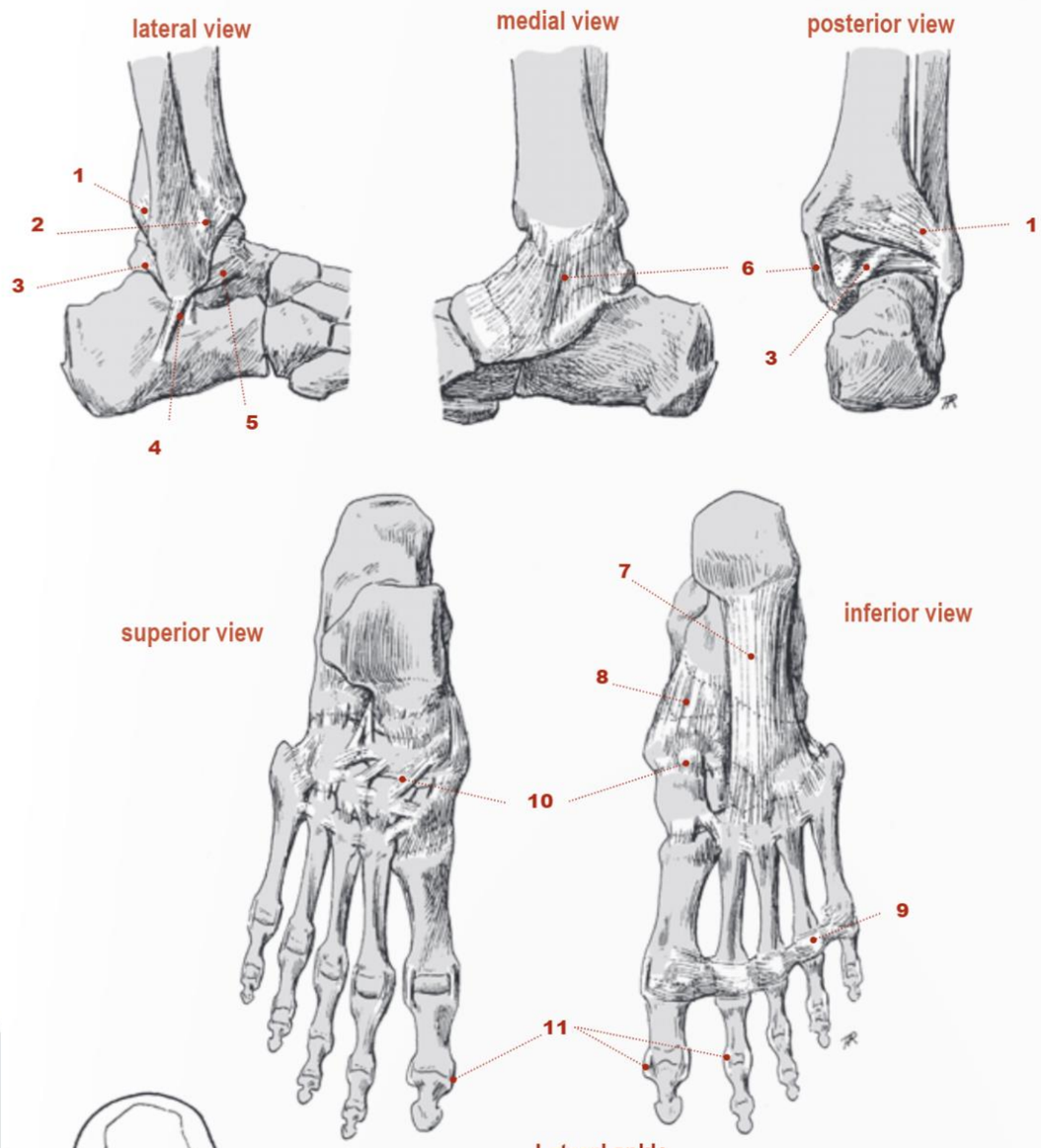
1st toe flexion: flexor hallicus longus & brevis
Toe 2-5 flexion: flexor digitorum longus & brevis, lumbricals
1st toe extension: extensor hallicus l. & brevis
Toe extension: extensor digitorum longus & brevis
Abduction: dorsal interossei
Adduction: palmar interossei

Joint	Resting Position	Tight Packed	Capsular Pattern
Talocrural	~10° plantar flexion	Full dorsiflexion	Plantar flex. > dorsi.
Subtalar	Mid ROM	Full supination	Varus, valgus
Midtarsal	Mid ROM	Supination	Dorsiflexion > plantarflex
1st toe	Mid ROM		
TMT		Supination	None
2-5 toes	Mid flexion & extension.		
1st MTP	5° extension	Full extension	Flexion > extension
2-5 MTP	2° flexion	Full extension	Variable
IP	2° flexion	Full extension	Flexion > extension

MTP = metatarsal phalangeal, TMT = tarsometatarsal, MTP = metatarsophalangeal, IP = interphalangeal



Leg, Ankle & Foot





Plantar fascia

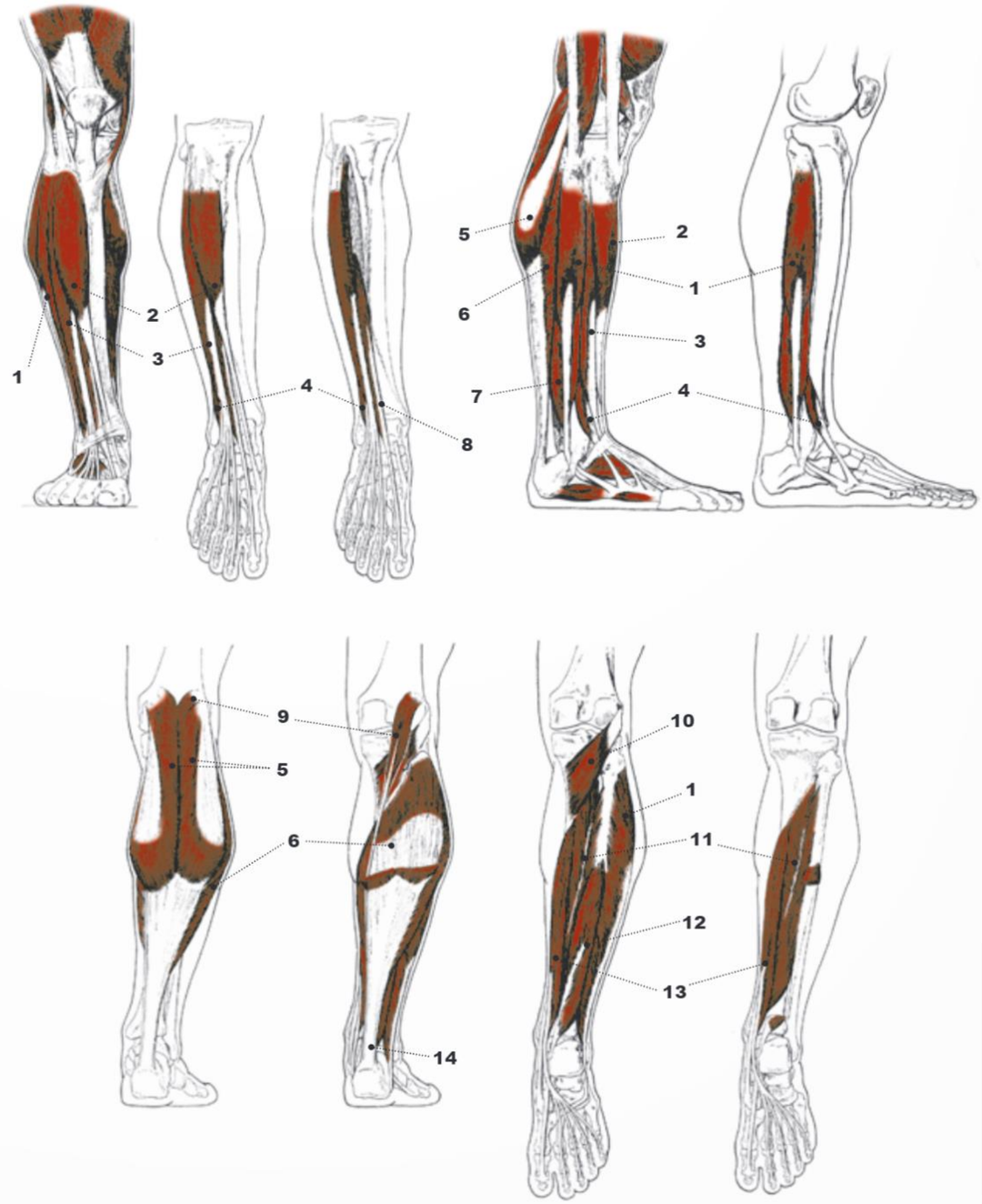
Clinical Note
During an inversion ankle sprain any or all of the 5 lateral ligaments may be damaged

Lateral ankle
1. Posterior tibiofibular ligament
2. Anterior tibiofibular ligament
3. Posterior talofibular ligament
4. Calcaneofibular ligament
5. Anterior talofibular ligament

Medial ankle
6. Deltoid (medial collateral) ligament

Sole of foot
7. Long plantar ligament
8. Spring (plantar calcaneonavicular) ligament
9. Transverse metatarsal ligament

10. Intertarsal ligaments
11. Interphalangeal collateral ligaments



1. Fibularis (peroneus) longus
2. Tibialis anterior
3. Extensor digitorum longus
4. Fibularis (peroneus) tertius
5. Gastrocnemius
6. Soleus
7. Fibularis (peroneus) brevis
8. Extensor hallucis longus
9. Plantaris
10. Popliteus
11. Tibialis posterior
12. Flexor hallucis longus
13. Flexor digitorum longus
14. Achilles tendon

Hammer toe: deformity of *proximal* interphalangeal joint of the 2nd, 3rd, or 4th toe causing it to be permanently bent (resembling a hammer)

Mallet toe: deformity of *distal* interphalangeal joint of the 2nd, 3rd, or 4th toe causing it to be permanently bent (resembling a mallet)

Claw toe: deformity resulting in dorsiflexion of proximal phalanx at the metatarsophalangeal joint, combined with flexion of both proximal & distal interphalangeal joints (may affect toes 2-5)

Morton's toe: a shortened 1st metatarsal in relation to the 2nd metatarsal (can lead to over pronation syndrome - see chapter)

Morton's neuroma: enlarged nerve that usually occurs in the 3rd or 4th metatarsal interspace

Freibergs disease: avascular necrosis of the metatarsal head that leads to bone collapse & osteoarthritis of the metatarsophalangeal joint

Bunion: enlargement on medial side of foot near base of the big toe (hallux). The enlargement is made up of a bursa (fluid filled sac) under the skin. The term bunion is commonly used to describe the bony deformity called hallux valgus

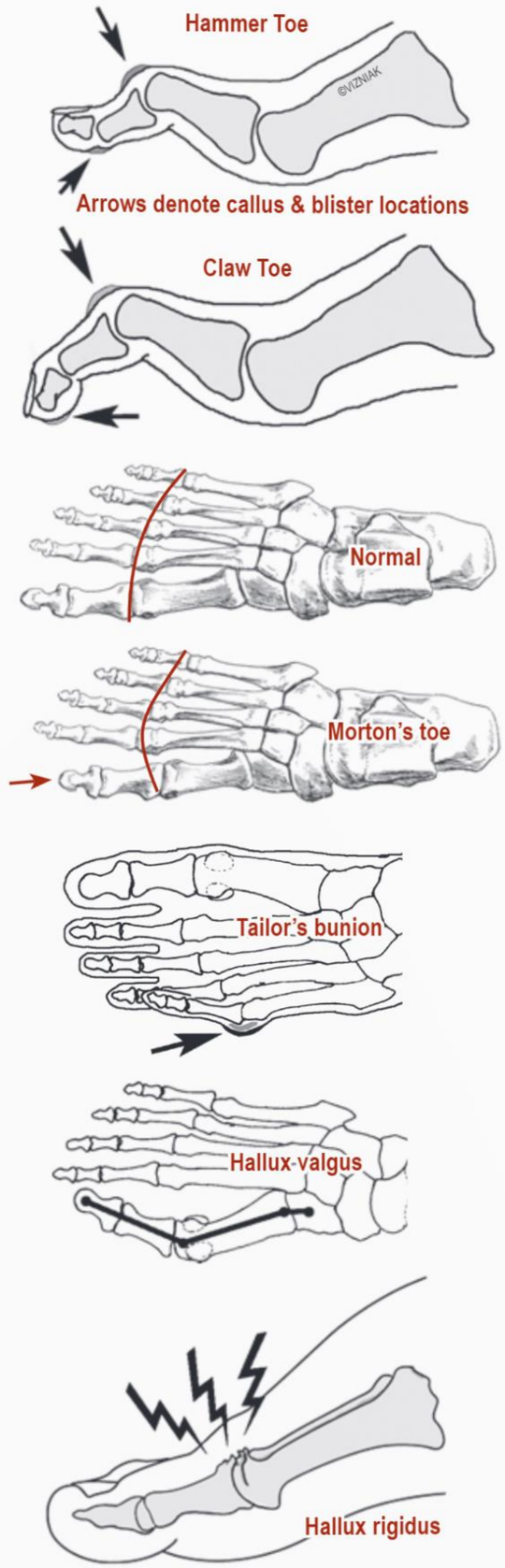
Tailor's bunion (Bunionette): enlargement on lateral side of foot near base of the 5th toe

- Treatment involves shoe modification, padding placed over bunion & PRICE to reduce pain & inflammation

Hallux valgus: enlargement of bone or tissue around the joint at the base of the big toe (metatarsophalangeal joint)

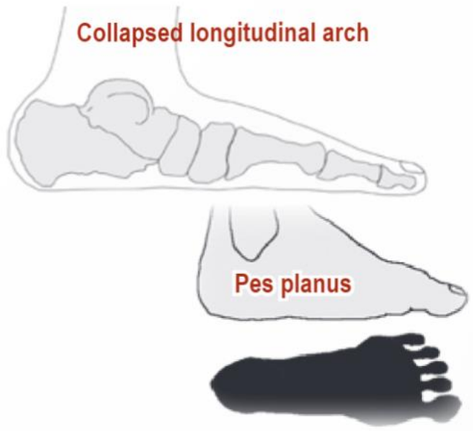
Hallux rigidus: degenerative arthritis that affects the MTP joint at the base of the big toe resulting in pain & stiffness that may affect walking, running & squatting (prevents dorsiflexion of the big toe during toe-off of gait cycle)

Corns & Callouses: areas of thick, hard skin. They usually develop due to rubbing or irritation over a boney prominence. The hard, thick skin is called a corn if it is on your toe and it is called a callous if it is somewhere else on your foot.



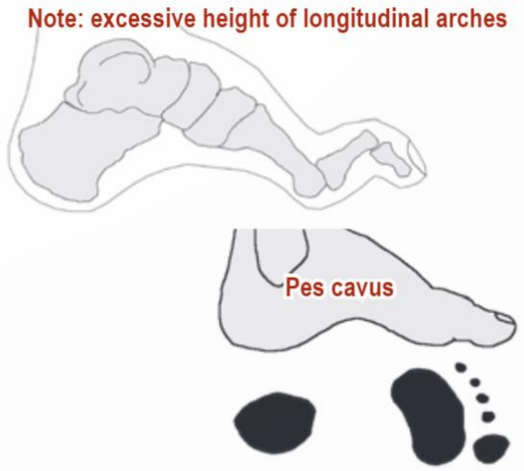
Pes Planus (flat feet): collapse of foot arches, with the entire sole of the foot coming into complete or near-complete contact with the ground, that results in less efficient foot performance

- It is normal for babies & young children to have flat feet
- Flat feet in adults can develop from injury, arthritis, poor biomechanics or pregnancy (increased weight + elastin causing relaxation of ligaments)
- Flexible flat foot = flat arch when standing, but arch is present when non-weight bearing
- Rigid flat foot = sole of the foot is rigidly flat even when a person is not standing
- *Treatment:* walking barefoot on uneven surfaces (sandy beach), short foot exercises, orthotic arch support



Pes Cavus (cavoid foot): abnormally high medial longitudinal arch

- High arches may predispose to lateral ankle instability, knee & low back pain
- Treatment can range from orthotic supports, special shoes to surgical interventions



Tarsal coalition: abnormal bridge of tissue that connects two bones that should be entirely separate; usually occurs between calcaneus & navicular or calcaneus & talus

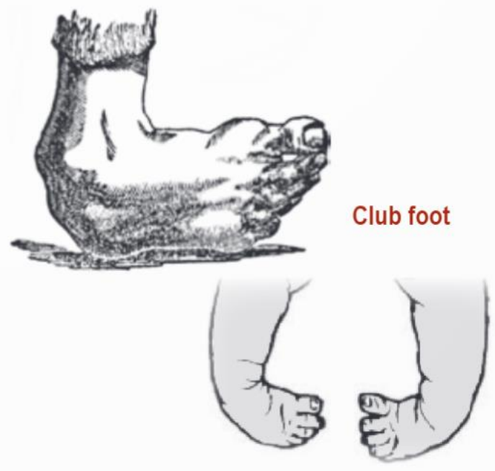
- Can result in pain secondary to altered foot biomechanics; treatments include bracing, orthotics or surgical intervention

Athletes foot (tinea pedis): fungal infection that causes redness, itchiness, tiny bumps filled with fluid or peeling skin. It is most commonly located between the toes or on the bottom of the feet

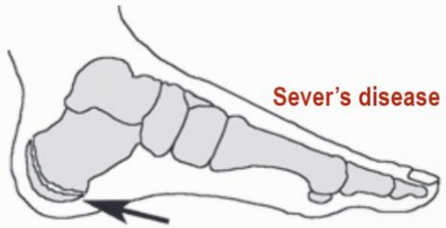
Club foot (congenital talipes equinovarus): congenital defect that affects joints of the foot occur in 3 regions:

1. Subtalar joint inversion
2. Talonavicular joint adduction
3. Ankle joint plantar flexion (toe walking)

- Treatment is usually started right after birth with manipulation, taping & bracing (Ponseti program); surgical options are also available



Sever's disease (calcaneal apophysitis): usually self-limiting, common cause of heel pain in the growing (age 10-15 yrs) athlete, due to overuse & repetitive microtrauma to the growth plates of the calcaneus



Compare bilaterally, start with unaffected side for PROM & Muscle Testing
Prior to assessing ROM the examiner should make an introduction statement:
"Try and move as far as possible, if any of the actions or movements are painful or uncomfortable please let me know, do not do any action you feel will cause you further injury."

Leg, Ankle & Foot

AROM

Plantar Flexion (20º-40º)
Muscles Activated: soleus, gastrocnemius, tibialis posterior, flexor digitorum longus, flexor hallicus longus, plantaris
Tissue Stretched: tibialis anterior, extensor digitorum longus, anterior ankle joint capsule & ligaments
Tissue Compressed: posterior ankle structures



Dorsiflexion (0º-20º)
Muscles Activated: tibialis anterior, extensor digitorum longus
Tissue Stretched: soleus, gastrocnemius, tibialis posterior, flexor digitorum longus, flexor hallicus longus, Achilles tendon
Tissue Compressed: anterior ankle structure (joint capsule)



Inversion (adduction) (20º-35º)
Muscles Activated: tibialis anterior, tibialis posterior
Tissue Stretched: fibularis longus, brevis & tertius, lateral ankle ligaments (anterior talofibular, calcaneofibular & posterior talofibular)
Tissue Compressed: medial ankle structures

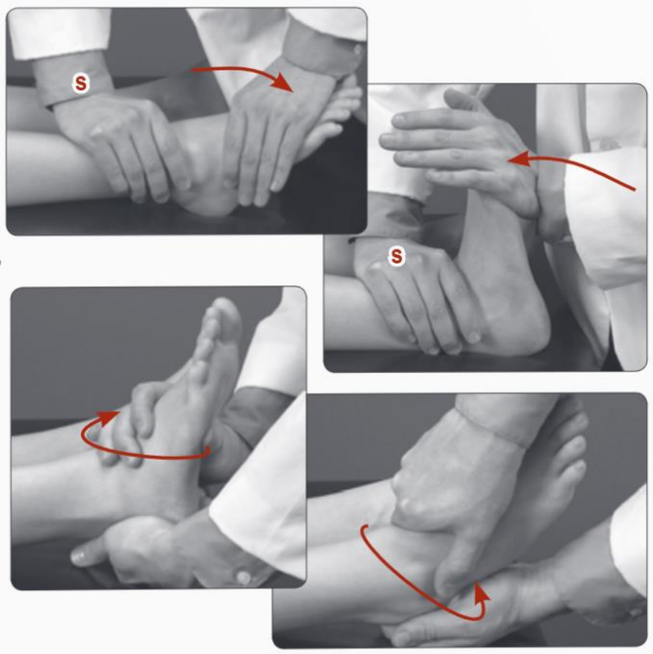
Eversion (abduction) (5º-15º)
Muscles Activated: fibularis longus, brevis & tertius
Tissue Stretched: tibialis anterior, tibialis posterior, medial collateral (deltoid) ligament of ankle
Tissue Compressed: lateral ankle structures



PROM

Plantar Flexion (> 20º-40º)
Tissue Stretched: tibialis anterior, extensor digitorum longus, anterior ankle joint capsule & ligaments

Dorsiflexion (> 0º-20º)
Tissue Stretched: soleus, gastrocnemius, tibialis posterior, flexor digitorum longus, flexor hallicus longus, Achilles tendon



Eversion (abduction) (> 5º-15º)
Tissue Stretched: tibialis anterior, tibialis posterior, medial collateral (deltoid) ligament of ankle

Inversion (adduction) (> 20º-35º)
Tissue Stretched: fibularis longus, brevis & tertius, lateral ankle ligaments (anterior talofibular, calcaneofibular & posterior talofibular)

Goniometry

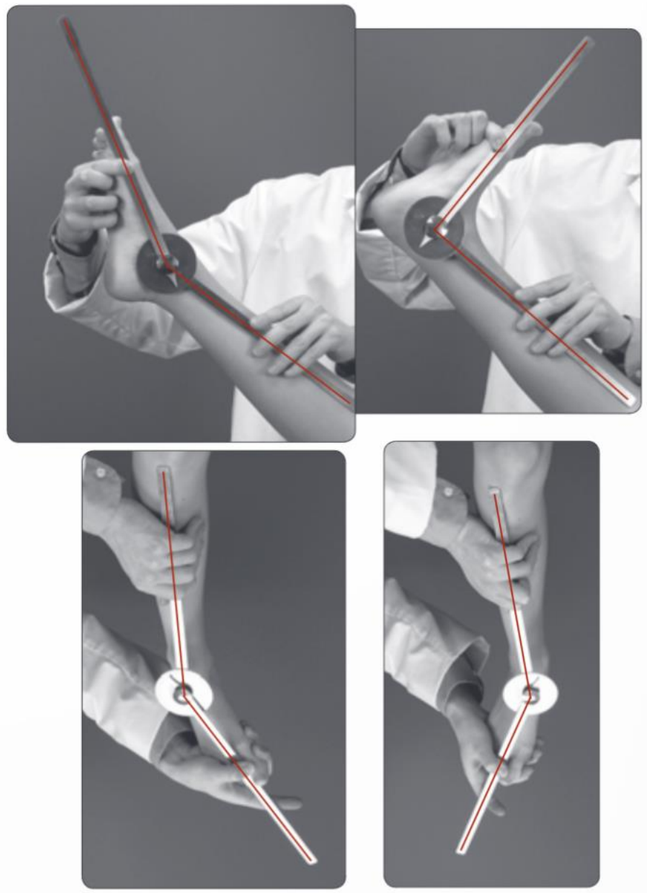
Procedure
- Patient seated with legs off the table, ankle in neutral position (~90°)

Plantar Flexion (normal: 20°-40°)
- Fulcrum aligned with the medial malleolus
- Stationary arm in line tibia; moving arm is parallel to the 1st metatarsal
- Ask patient to plantar flex ankle

Dorsiflexion (normal 0°-20°)
- Fulcrum aligned with the medial malleolus
- Stationary arm in line tibia; moving arm is parallel to the first metatarsal
- Ask patient to dorsiflex ankle

Inversion (20°-35°)
- Fulcrum aligned between malleoli
- Stationary arm in midline tibia; moving arm is parallel to the 2nd metatarsal
- Ask patient to invert ankle

Eversion (5°-15°)
- Fulcrum aligned between malleoli
- Stationary arm in midline tibia; moving arm is parallel to the 2nd metatarsal
- Ask patient to evert ankle



Muscle Testing

Plantar Flexion
Muscles Activated: soleus, gastrocnemius, tibialis posterior, flexor digitorum longus, flexor hallicus longus, plantaris

Dorsiflexion
Muscles Activated: tibialis anterior, extensor digitorum longus, extensor hallucis longus

Eversion (abduction)
Muscles Activated: fibularis longus, brevis & tertius

Inversion (adduction)
Muscles Activated: tibialis anterior, tibialis posterior



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Achilles Squeeze Test ★★★★

Procedure
Patient prone with legs straight, examiner squeezes the Achilles tendons bilaterally 2 cm above the insertion point on the calcaneus

Interpretation
(+) Pain → Achilles tendinitis, peritendinitis compression

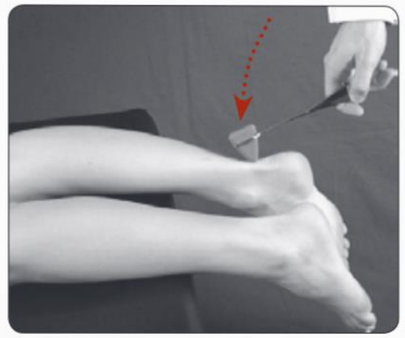
Clinical notes
Compression of inflamed or damaged tissue results in pain & discomfort



Achilles Tap Test ★★★★

Procedure
Patient supine, seated or prone, examiner taps patient's Achilles tendon with fingers or reflex hammer & observes patient for plantar flexion at the ankle

Interpretation
(+) Pain or lack of plantar flexion at the ankle → Achilles tendinitis, Achilles tendon rupture



Ankle Drawer Tests ★★★★★

Procedure
Patient supine or seated,

Anterior drawer: examiner places one hand on anterior tibia & the other hand on posterior calcaneus then proceeds to pull the foot anteriorly, first with the ankle in a neutral position (90°), then with the ankle plantar flexed

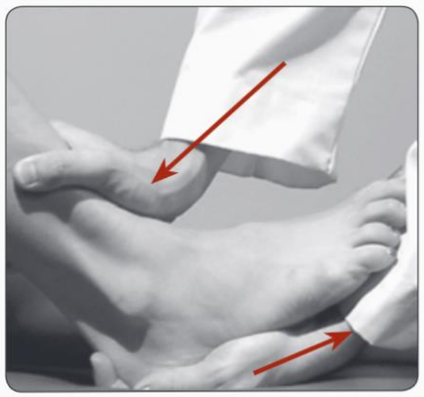
Posterior drawer: procedure above is then repeated with the examiner stabilizing the posterior tibia, gripping over the plantar surface of the heel & pushing the foot posteriorly

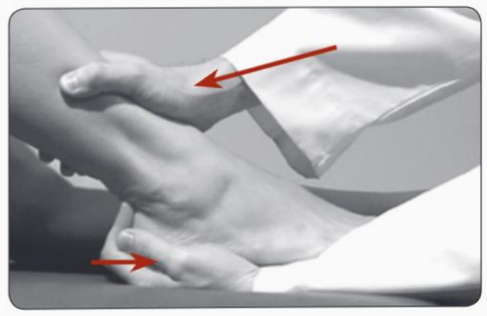
Interpretation
(+) Anterior motion of the foot → Anterior talofibular ligament instability (SN: 78-95 SP: 74-84 +LR: 3.1 -LR: 0.29)[5, 19]

(+) Posterior motion of the foot → Posterior ankle ligament instability

Clinical notes
Remember to compare results bilaterally; in normal individuals this test should produce little to no motion at the ankle joint

Clinician's option: examiner may stabilize the foot on the examination table and pull/push distal tibia anterior & posterior



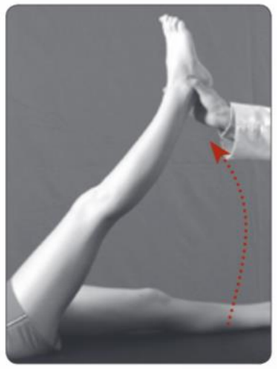


S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Buerger's Test ★★★

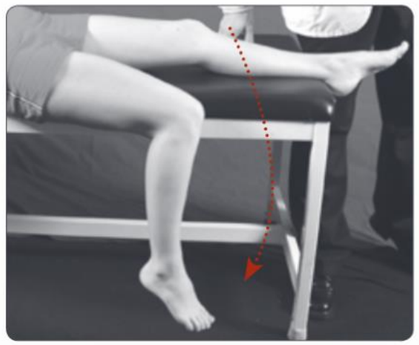
Procedure

Patient supine with legs straight, examiner lifts patient's straight leg to angle of 45° & holds position for 3 minutes, examiner then proceeds to lower the leg (below the level of the examination table) & instructs the patient to sit up; examiner then observes for refilling of the dorsal veins of the foot



Interpretation

(+) > 1-2 minutes are required for cyanosis (redness) & refilling of the dorsal veins of the foot to occur → Lower extremity vascular compromise, peripheral vascular disease, atherosclerosis, chronic compartment syndrome



Clinical notes

Although not a typical presentation, it is possible for sciatic-like pain to be produced from lower extremity vascular disorders; Buerger's test aids in the differential diagnosis between vascular & neurogenic pain generators

Calcaneal Squeeze Test ★★★★

Procedure

Patient prone with knee flexed at 90°, examiner squeezes calcaneus in three locations;

1. Sides of the calcaneus
2. Calcaneal tuberosity (posterior calcaneus)
3. Medial calcaneal tubercle

And observes patient for signs of discomfort or pain







Interpretation

(+) Pain with squeeze →

1. Sides of the calcaneus → Calcaneal fracture
2. Calcaneal tuberosity → Retrocalcaneal bursitis, fracture
3. Medial calcaneal tubercle → Plantar fascitis

Clinical notes

This relatively simple, quick test is an excellent way to reveal a huge amount of information in a short amount of time

If a fracture is suspected, diagnostic imaging should be an immediate follow-up procedure

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Calf Circumference Test ★★★★★

Procedure

Patient supine with legs slightly flexed; examiner measures the circumference of the leg at the level of the maximum bulk of the gastrosoleus muscle complex, measurements are compared bilaterally



Interpretation

(+) Unequal measurements → Muscle atrophy (secondary to internal derangement of the ankle, nerve lesion), increased circumference may indicate the presence of an acute compartment syndrome

(+) Difference > 15 mm men, > 12 mm women → Deep vein thrombosis (SN: 90 SP: 92 +LR: 11 -LR: 0.1)[15, 28]

Clinical notes

In elite athletes it is possible to have muscular differences from side to side (dominant versus non-dominant), but this is not common for general population (congenital variation may also occur)

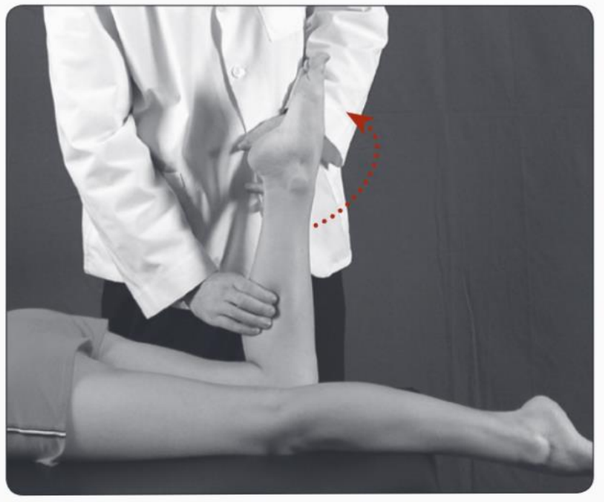
In addition, with ankle injuries that cause moderate to severe pain, patients may suffer atrophy from disuse syndromes (the joint is painful to move, so patients don't move the joint & the muscles that control that joint atrophy)

Calf Squeeze / Thompson Test ★★★★★

Synonym: Doherty Squeeze, Simmond's Test, Moses Test

Procedure

Patient prone with knee flexed 90° or with knee straight, examiner squeezes the calf over the widest point of the gastrosoleus complex & observes for the presence of plantar flexion with calf squeeze



Interpretation

(+) No plantar flexion with calf squeeze → Complete rupture of the Achilles tendon (SN: 96 SP: 93 +LR: 13.7 -LR: 0.04)[5]

(+) Local pain → Gastrocnemius or soleus muscle strain or MFTPs

(+) Short duration "deep" calf pain → Thrombophlebitis (SP: 40)[31]

Clinical notes

Patient history & observation should lead the examiner to the diagnosis of Achilles tendon rupture before this test is used

Typically the patient history involves a middle-aged male ("weekend warrior") playing sport (tennis, racquetball), they hear a "pop," instantly feel pain & drop to the ground

Patients with thrombophlebitis often give a history of a gradual onset of localized tenderness; there may be a prior history of local trauma, previous similar episodes, varicose veins, prolonged travel, or enforced stasis (standing in one position)



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Fibular Translation Test ★★★★★

Procedure

Patient side-lying; examiner stabilizes medial malleolus & applies anterior & posterior force over the lateral malleolus



Interpretation

(+) Pain or displacement of fibula → Complete tear of ankle syndesmosis ligaments (SN: 82 SP: 88 +LR: 6.8 -LR: 0.2)[13]

Clinical notes

Beumer et al.[13] did studies on cadavers & only found increased movement with complete ligament removal

Flatfoot Test ★★★★★

Procedure

Patient standing with weight distributed evenly, examiner places a straight edge (pen or ruler) at the inferior apex of medial malleolus & medial surface of the base of the 1st metatarsal, examiner then locates the navicular tuberosity & compares its location to the straight edge



Interpretation

(+) Navicular tuberosity below straight edge → pes planus, flatfoot, fallen medial longitudinal arch

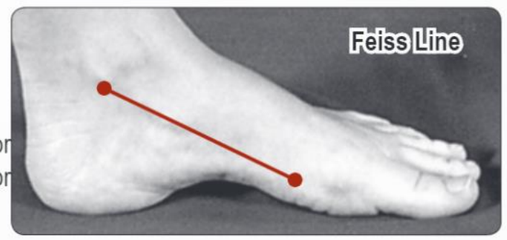
Clinical notes

Clinician's option: examiner may also check the arch height by placing a finger under the arch



Feiss Line: patient standing with weight distributed evenly, mark inferior apex of medial malleolus & medial surface of the base of the 1st metatarsal and draws a line connecting the two points, examiner than locates the navicular tuberosity & marks it

(+) Navicular tuberosity below line → pes planus, flatfoot, fallen medial longitudinal arch



Grades of flatfoot

Grade 1: Navicular tuberosity falls 1/3 of distance to floor
Grade 2: Navicular tuberosity falls 2/3 of distance to floor
Grade 3: Navicular tuberosity touching the floor

Navicular drop test: mark navicular tuberosity & measure distance to floor with the patient weight bearing mostly on *contralateral* limb, repeat measurement with the patient assume equal weight on both feet; difference between measurements is the navicular drop - (+) difference of >10 mm is considered significant excessive foot pronation

(INTRA-EXAMINER R: 0.33-0.9 INTER-EXAMINER R: 0.31-0.74)[13]



S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Forced Dorsiflexion Test ★★★★★

Procedure

Patient seated or supine; examiner stabilizes distal tibia & places thumb on anterolateral of talus (near lateral gutter), examiner then applies a strong dorsiflexion force to the ankle



Interpretation

(+) Pain over anterolateral of foot → Anterior ankle impingement (R: 0.36 SN: 95 SP: 88 +LR: 7.9 -LR: 0.06)[10, 23]

Clinical notes

This test is essentially PROM with over pressure & may be furthered by asking the patient to actively dorsiflex the ankle after pressure is applied



Ankle impingement prediction test - passive dorsiflexion with over pressure - (SN: 94 SP: 75 +LR: 3.8 -LR: 0.08)[21] considered positive for anterior ankle impingement when five of the six symptoms below are noted

1. Pain with activities
2. Anteriorlateral ankle swelling
3. Anteriorlateral ankle tenderness
4. Pain with squat & rise test
5. Pain with forced dorsiflexion
6. Absence of ankle instability

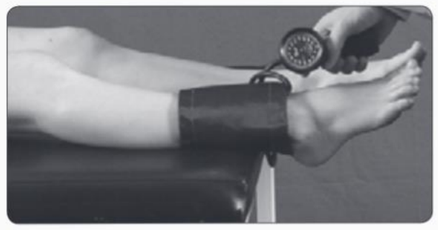
Foot Tourniquet Test ★★★

Procedure

Patient seated, prone or supine, examiner compresses the ankle for up to 3 minutes with a blood cuff (blood pressure cuff should be inflated to 20 mmHg above the patients resting diastolic pressure)

Interpretation

(+) Paresthesia (numbness, tingling, shooting electrical pain) or muscle weakness that occurs in less than 3 minutes of compression → Arterial insufficiency of the lower extremity



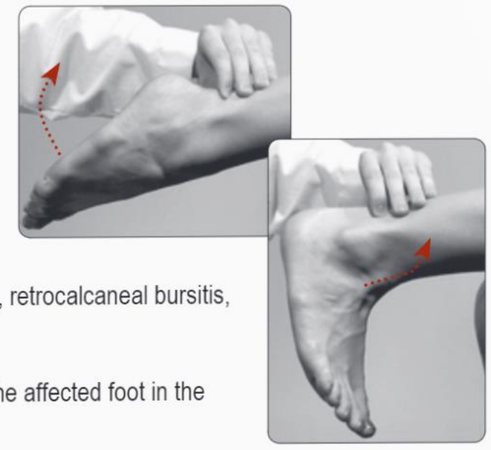
Clinical notes

This test decreases arterial inflow & stops venous outflow from the foot

Hoffa's Test ★★★★

Procedure

Patient prone with ankles hanging over edge of exam table, examiner palpates the Achilles tendon & instructs patient to actively plantar flex & dorsiflex the ankle; if heel pain or decreased tension of the Achilles tendon is noted then examiner may proceed to passively plantar flex & dorsiflex the ankle



Interpretation

(+) Pain or guarded motion → Fracture of the calcaneous, retrocalcaneal bursitis, moderate Achilles tendon strain, Achilles tendon rupture

Clinical notes

Patients may also demonstrate increased dorsiflexion of the affected foot in the relaxed position

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Homan's Test ★★★

Procedure
Patient supine with leg straight, examiner raises the patient's straight leg to 10° & forcefully dorsiflexes the foot & squeezes the calf with the other hand or blood pressure cuff

Interpretation
(+) Short duration "deep" calf pain → Thrombophlebitis (SN: 35-48 SP: 41 +LR: 1.3 -LR: 0.8)[15, 20]

(+) Persistent "achy" calf pain → Gastrosoleus strain



Clinical notes
Thrombophlebitis: also known as "intravascular coagulation" refers to inflammation & thrombosis of a vein as a result of local trauma, intravenous infusion, hypercoaguable state or damage to the endothelial lining of the veins all of which may ultimately result in venous blood stasis

Ottawa Ankle Rules ★★★★★

X-rays are only required if there is bony pain in the malleolar or midfoot area, and any one of the following:
- Bone tenderness along the distal 6 cm of the posterior edge of the tibia or tip of the medial malleolus
- Bone tenderness along the distal 6 cm of the posterior edge of the fibula or tip of the lateral malleolus
- Bone tenderness at the base of the fifth metatarsal (for foot injuries).
- Bone tenderness at the navicular bone (for foot injuries).
- An inability to bear weight both immediately and in the emergency department for four steps.

Certain groups are excluded, in particular children (under the age of 18), pregnant women, and those with diminished ability to follow the test (for example due to head injury or intoxication)

These rules have been found to have a very low rate of false negatives this test is 100% sensitive and has reduced the number of ankle X-rays taken in ERs by about 35% over the past 3 years

Morton's Test ★★★★

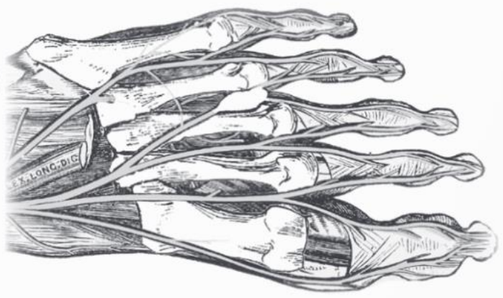
Procedure
Patient supine or seated, examiner squeezes foot around the metatarsal heads & observes the patient for signs of pain or discomfort

Interpretation
(+) Pain → Morton's neuroma, metatarsal joint arthritis, fracture of the metatarsal heads or stress fracture, metatarsalgia



Clinical notes
Morton's neuroma usually occurs between distal metatarsals (between #3-4 55%, between #2-3 45%)

Differential diagnosis
1. Metatarsalgia pain is less localized with pain under the metatarsal heads (paresthesia is not present)
2. Stress fracture pain localized to metatarsal shaft – not between metatarsals (palpate directly)
3. Deep peroneal neuropathy – signs & symptoms between first & second toe



S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Rotational Stress Test ★★★★★

Procedure
Patient supine or seated; examiner grasps the patient's distal tibia & fibula, then proceeds to rotate the foot internally & externally

Interpretation
(+) Pain, increased motion → Ligament laxity, instability, syndesmotic (high) ankle sprain (SN: 0.75 SP: 95)[10, 13]



Clinical notes
By rotating the foot, the head of the trochlea of the talus pushes against the inside edges of the malleoli; potentially causing pain or even diastasis of the distal tibia & fibula

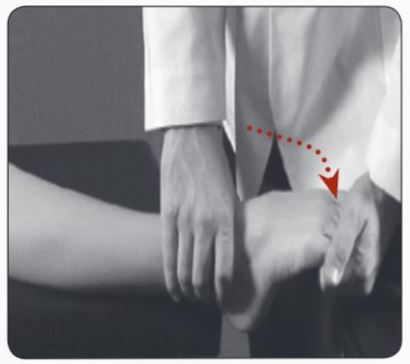


Grade 3 Sprain
- Severe bruising & swelling on *both sides* of ankle - rule out fracture!
- Difficult to visualize Achilles tendon (swelling), tenderness on both sides
- Complete tearing of multiple ligament & joint capsule may also involve a 'high' (syndesmotic) ankle sprain where tibiofibular ligaments
- Marked instability, unable to bear weight, almost complete loss of ROM

Strunsky's Sign ★★★

Procedure
Patient supine or seated; examiner grasps the patient's toes & rapidly flexes them & observes the patient for signs of pain or discomfort

Interpretation
(+) Forefoot pain with toe flexion → Metatarsalgia, forefoot inflammation

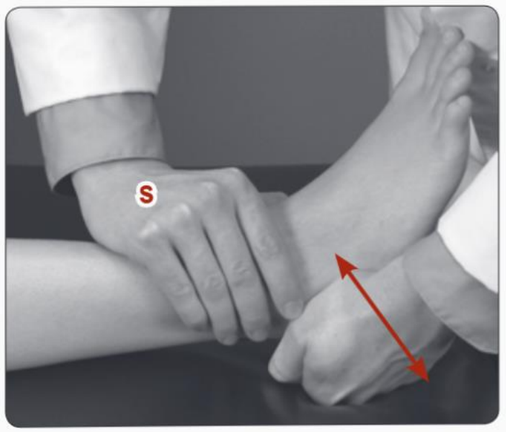


Clinical notes
Differential diagnosis of forefoot pain: metatarsal stress fracture, interdigital (Morton's) neuroma, bunion/bunionette, hammer toe/claw toe/mallet toe, gout or another arthropathy

Subtalar Glide Test ★★★★

Procedure
Patient supine; examiner stabilizes talus & applies a medial , then lateral forces to the calcaneus

Interpretation
(+) Pain or displacement calcaneus → subtalar sprain or instability (SN: 78 SP: 75 +LR: 3.1 -LR: 0.3)[19]

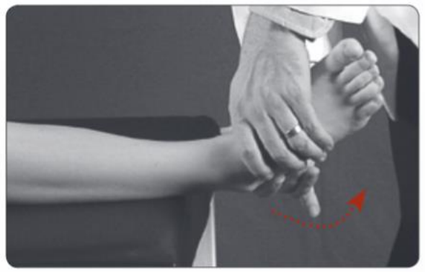


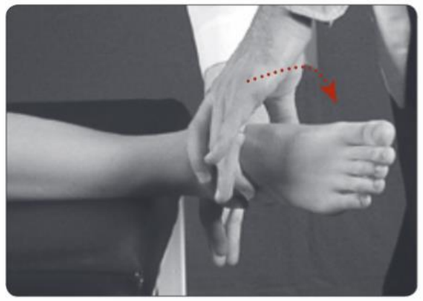
Clinical notes
Normal subtalar movement should be minimal

S = stabilization (indifferent hand), ● = contact, → = examiner force, ····→ = patient motion

Talar Tilt ★★★★★

Synonym: Inversion & Eversion Talar Tilt, Stability Test





Procedure

Patient seated or supine, examiner stabilizes ankle joint over tibia & fibula then proceeds to invert the ankle noting the amount of joint play & motion, examiner then everts the ankle again noticing the amount of joint motion & joint play; results are compare bilaterally

Interpretation

(+) Increased motion or pain with ankle inversion → Lateral ankle ligament sprain, ligament rupture (anterior talofibular, calcaneofibular ligament, posterior talofibular ligament) (SN: 67 SP: 75 +LR: 2.7 -LR: 0.4)[19]

(+) Increased motion or pain with ankle eversion → Medial ankle ligament sprain, ligament rupture (deltoid ligament)

Clinical notes

Patients who have a history of chronic ankle sprains will show increased motion at the ankle that is most commonly injured (ligament laxity)

Tinel's Foot Test ★★★★

Synonym: distal tingling on percussion (DTP) sign





Procedure

Patient may be prone, supine or seated; examiner percusses over the medial ankle behind the medial malleolus (posterior tibial nerve/ medial plantar nerve), & over the dorsum of the ankle near the neck of the talus (deep peroneal nerve)

Interpretation

(+) Distal tingling, paresthesia, or electrical sensation → Nerve compression syndrome, Tarsal tunnel syndrome (posterior tibial nerve) (SP: 58)[24]

Clinical notes

Examiner may use a reflex hammer to perform tapping

Windlass Test ★★★★



Procedure

2 part test, patient seated, examiner stabilizes ankle in neutral & extends the big toe while allowing the IP joint to flex, test is repeated with patient standing

Interpretation

(+) Pain or symptom reproduction → Plantar fasciitis

Clinical notes

Examiner may choose to extend all toes

The windlass effect is the primary mechanism that lifts the medial longitudinal arch during toe off of the gait cycle

S = stabilization (indifferent hand), ● = contact, → = examiner force, ⋯→ = patient motion

Leg, Ankle & Foot

View Cassette, SID kV Range	Central Ray Tube ang., Grid Collimation	Measure Marker	Clinical notes
Ankle			
AP ½-10x12, 40″ 55±5 kV	Between malleoli 0°, no Area of interest	Path of central ray Corner of film	Show AP & medial oblique views on same film for comparison
Oblique ½-10x12, 40″ 55±5 kV	Between malleoli 0°, no Area of interest	Path of central ray Corner of film	
Lateral 8x10, 40″ 55±5 kV	Medial malleolus 0°, no Area of interest	Path of central ray Corner of film	X-ray leg down Ankle at 90°
Calcaneus			
Lateral ½-10x12, 40″ 55±5 kV	Mid Calcaneus 0°, no Area of interest	Path of central ray Corner of film	Show lateral & axial on same film
Axial ½-10x12, 40″ 55±5 kV	3rd metatarsal base 40° cephalad, no Area of interest	Path of central ray Corner of film	Correct for tube tilt

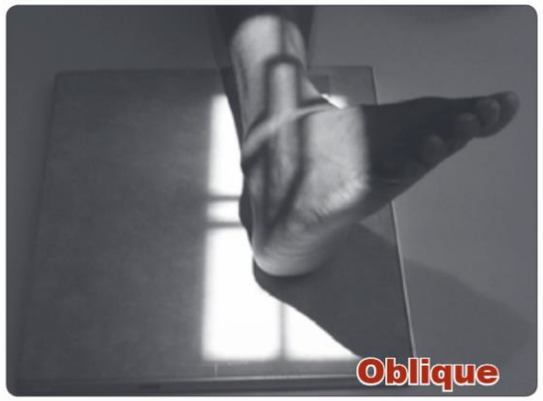
Leg, Ankle & Foot

View Cassette, SID kV Range	Central Ray Tube ang., Grid Collimation	Measure Marker	Clinical notes
Foot/Toe			
AP 8x10, 40″ 55±5 kV	MP joint 0°, no Area of interest	Path of central ray Corner of film	
Oblique 8x10, 40″ 55±5 kV	MP joint 0°, no Area of interest	Path of central ray Corner of film	Place all 3 views on the same film Ensure patient is comfortable
Lateral 8x10, 40″ 55±5 kV	MP joint 0°, no Area of interest	Path of central ray Corner of film	

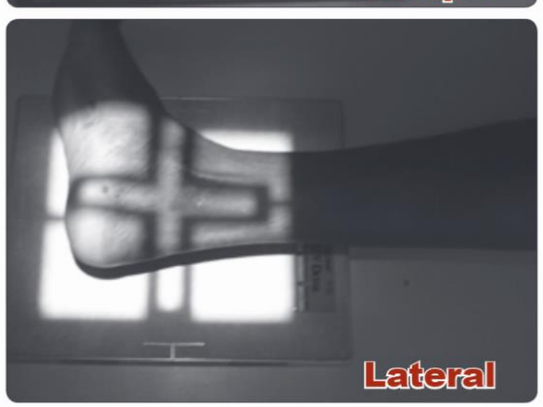
8x10 inches = 18x24 cm, 10x12 inches = 24x30 cm, 14x17 inches = 35x43 cm, 40" = 102 cm, 72" = 183 cm; susp. = suspended, F. spot = Focal Spot, Cr. = central ray, SID = Source Image Distance (inches), MP = metatarsophalangeal joint

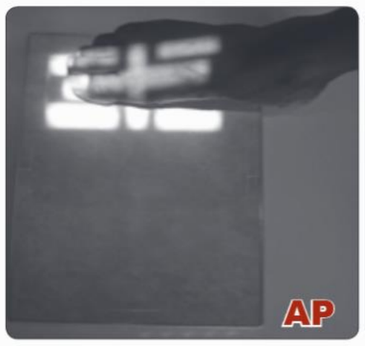


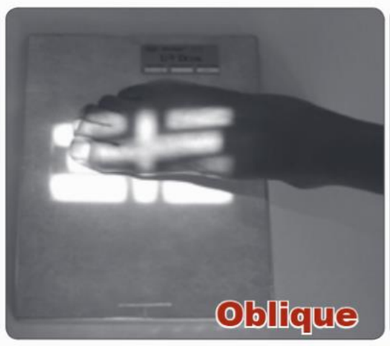


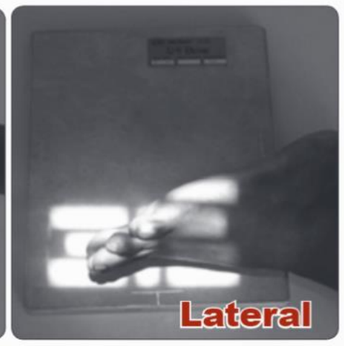












Ottawa Ankle Rules[54, 56]

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The rules have been found to have a very low rate of false negatives this test is 100% sensitive and has reduced the number of ankle X-rays taken in ERs by about 35% over the past 3 years

Ankle/Foot Film Evaluation

B = Bone: evaluate film for fractures & dislocations, describe variations in cortices, medullary & subchondral bone, density, shape, size, trabecular patterns & relationship of osseous arrangements.

A = Alignment: analyze alignment & posture, result of various measurements; misalignments

C = Cartilage: inspect the joint spaces, articular spaces for any abnormalities; pay attention to symmetry, continuity, widening or loss of joint space & calcification of cartilage

S = Soft Tissue: evaluate soft tissues; look for unusual calcifications, including in blood vessels, masses, displaced fascial lines & unusual gas distribution; note the presence of fat-pad signs ('sail sign') and soft tissue edema

Ankle anatomical variants & anomalies

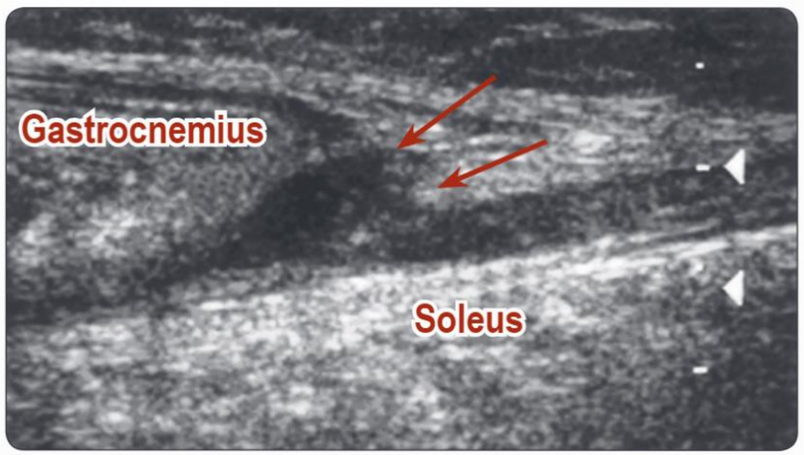
- Os perineum - accessory ossicle inferior to cuboid
- Os supranavicular - accessory ossicle above navicular
- Os trigonum - accessory ossicle posterior to talus or superior to posterior calcaneus







- **MRI** can be used as it is extremely specific for diagnosis, but given cost & availability it is usually not a practical choice;
- Sagittal MR of calf, arrow points to muscle tear & white below it is the gap from the muscle retraction and local inflammation



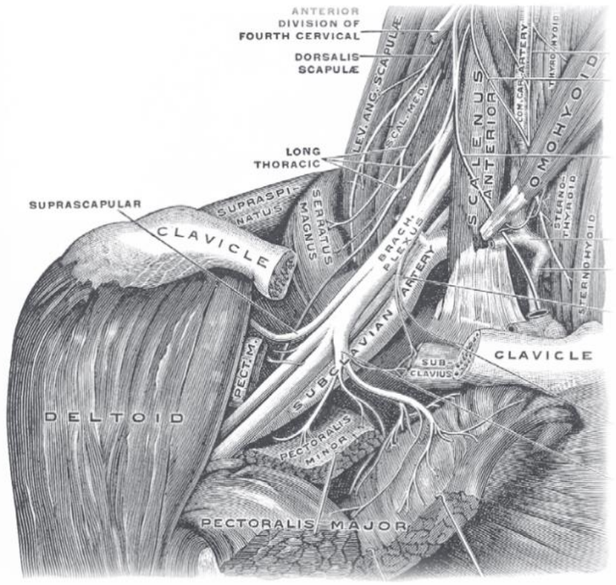
- Ultrasound of Gastrocnemius tear (grade 2)

Leg, Ankle & Foot

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Muscle Injury Grading

Grade	Description, ADLs & Healing

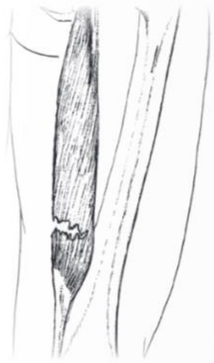
Grade I - Mild



Minimal 'stretch' of fibers (< 10% fibers damaged)

- Common findings: mild pain with activity, muscle guarding, mild myofascial trigger points & local mild compensatory joint motion restrictions
- No bruising or loss of function (minimal or no loss of ROM)
- Minimal pain with motion, mild pain with palpation over damaged site
- Slight weakness may be noted with strong muscle contraction (AROM/RROM)
- Delayed onset muscle soreness (DOMS) is classified as grade 1
- Usually self limiting unless there is repeat trauma to an area which can progress into grade II & III (chronic injury)
- Functional healing time: 2-7 days (structural healing time: 4-14 days)

Grade II - Moderate



Moderate to severe tearing of fibers (11%-99% fibers torn) - some sources suggest a 2+ or 2- scale to further distinguish severity within range

- Common findings: moderate to severe pain, guarding, loss of function, bruising & edema, decreased range of motion, moderate joint motion restriction
- Antalgic limp, muscle weakness
- Significant pain with AROM & PROM stretch of damaged tissue
- Moderate to severe pain with palpation tissue challenge
- Defect is likely palpable at higher end of range
- Significant loss of strength (3/5 or 4/5) with resisted muscle testing
- Consider referral for diagnostic imaging & surgical evaluation - large partial tears can progress to full tears with repeated trauma
- Functional healing time: 1-10 weeks (structural healing: 3-12+ wks)

Grade III - Severe



Complete tearing (100% fibers torn = full thickness tear)

- Common findings: severe pain at time of injury then minimal or no pain afterward, significant muscle guarding, severe bruising, loss of function
- Can usually visualize - ruptured muscle balls up under skin, palpable defect
- Complete loss of muscle strength an function (0/5 or 1/5)
- Usually requires surgical intervention (surgical gap closure)
- May be associated with avulsion fracture
- Return to full function is not expected, often with chronic sequelae
- If left untreated there is massive scar tissue formation, loss of function & increased risk of future injury developing into a chronic condition
- Functional healing time: 10 weeks - 6 months (muscle may heal in lengthened position there by changing function) - (structural healing time: 12+ months)

Key Principles for Muscle Healing

Acute phase (~1-5 day)

- PRICE, avoid aggravating activities & pain control - increase protein, Zn, Mg, Mn, Ca & water intake
- Avoid re-injury of damaged tissue & development of chronic condition - COMPLETE FULL REHAB.

Post-acute phase (~2 days - 6 wks)

- As tolerated begin pain-free ROM ASAP, switch to heat to improve local blood flow
- Soft tissue mobilization & manipulation to improve ROM & reduce contracture (regular stretching)

Remodelling phase (1 wk - 12+ months)

- Work toward functional recovery, proprioception improvement, proper warm-up before activity; address technique issues or biomechanical imbalances that may predispose to injury
- Strengthen exercises, work hardening or activity specific actions - stretch after exercise for flexibility

Ligament Injury Grading

Grading Ligament Damage

Ligament sprains occur when ligaments surrounding joint are forced beyond their normal ROM; because of a lower blood supply, ligaments usually take longer to heal than muscles

Grade	Description, ADLs & Healing
Grade I - Mild 	• Mild swelling & point tenderness over ligament, no bruising • Estimated > 10% fiber damage • Single ligament, mild stretch, no instability • (-) stress tests, mild pain at extreme end ROM (PROM w/ over pressure) • No or mild limp/loss of function, mild difficulty hopping on one leg • Functional recovery in 2-14 days (structural healing 6-30 days)
Grade II - Moderate 	• Bruising is common, mild to moderate swelling • Large spectrum of injury that can include partial tearing of many ligaments • Estimated 11-99% fiber damage (2+/- can be used to further grade severity) • Mild to moderate instability demonstrated on stress tests • Obvious limp, unable to hop or run • Functional recovery in 14 days - 2 months (structural healing 1-3 months)
Grade III - Severe 	• Severe bruising & swelling - fracture must be ruled out! • Difficult to visualize structures due to swelling & tenderness • Complete tearing of multiple ligament & joint capsule may also be involved • Marked instability (+) stress tests • Unable to bear weight, almost complete loss of ROM • Functional recovery time 1-3 months (structural healing 6 month+)

Given the huge range of a Grade 2 sprain, 2+ or 2- can be used to denote the upper or lower range

Ligament sprain healing occurs in 3 overlapping phases

Duration varies depending on injury severity & general health, activity, nutrition & age of the individual involved. Early return to full activity increases the likelihood of re-injury & the development of chronic pain, repetitive injury results in increased scar tissue/fibrosis formation & loss of function

Injury & Inflammation
Tearing, bleeding & hematoma

Proliferation
Scar formation
Fascial repair

Remodelling
Regeneration & fibrosis

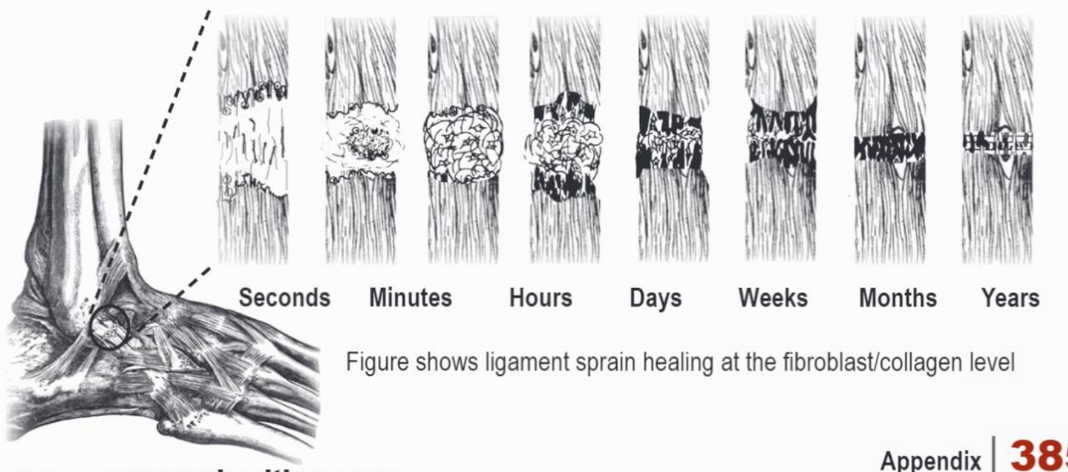


Figure shows ligament sprain healing at the fibroblast/collagen level

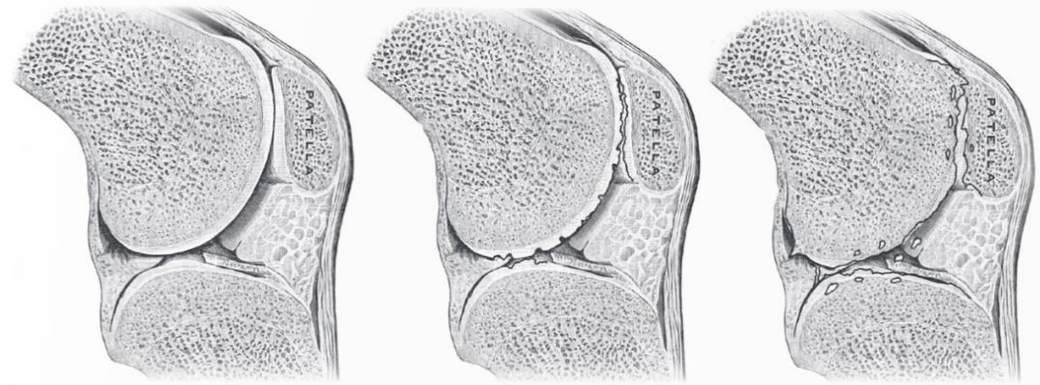
Cartilage Injury Grading

The leading cause of cartilage damage is osteoarthritis (degenerative joint disease); three processes:

1. A progressive loss of cartilage (either direct damage or slow wear & tear)
2. The body's attempt to repair cartilage (usually very slow scar tissue formation)
3. Finally, destruction of bone underneath the articular cartilage

Lifelong moderate use of normal joints does not appear to increase the risk. Factors such as high-impact, twisting injuries; abnormal joint anatomy & biomechanics; joint instability; inadequate muscle strength, balance or endurance, nutritional deficiency & medical or genetic factors can contribute to osteoarthritis

Progression of Osteoarthritis (OA) Joint Degeneration



Grade I - OA
Mild cartilage damage (tears); very mild subchondral reactive sclerosis (bone remodeling due to abnormal stress)

Grade II-III - Moderate OA
Irregular joint space due to loss of cartilage; cartilage fragmentation ('joint mice'); reactive sclerosis

Grade IV - Late OA
Osteophytes, periarticular fibrosis, cartilage calcification; subchondral cysts (geodes); sever cases may include ankylosis (fusion)

Cartilage Healing

- Articular cartilage is avascular which prevents it from mounting a vascular response to injury (no direct blood supply which imposes limits on healing potential (some traumatic defects in cartilage never heal)

Mechanisms of repair (type of cartilage healing is influenced by the depth of the injury)

- With ***subchondral injury***, capillary injury forms a fibrin clot, which is then replaced by granulation tissue & fibrocartilage; if defect is limited to cartilage, no blood vessels are disrupted & inflammatory response is less intense than if injury extends through cartilage into subchondral bone, as occurs in intra-articular fracture
- Injury ***isolated only to cartilage*** is dependent on chondrocytes to synthesize a new matrix
  - Since cartilage is largely avascular, healing is dependent on diffusion of nutrients from synovial fluid
  - Regeneration of cartilage is slow & highest potential for growth occurs in the perichondrium (periphery regions of articular cartilage)
  - Isolated injuries to cartilage (which do not extend to subchondral bone) heal slowly & incompletely

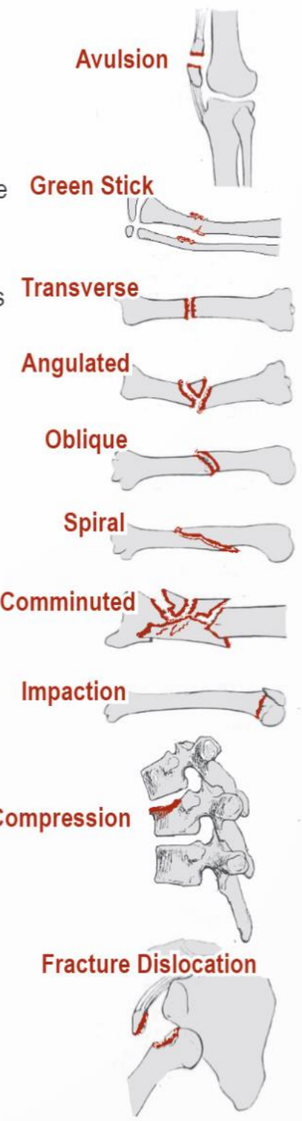
Regular motion & activity are crucial to ensure optimal joint health & healing

During normal movements, the synovial fluid held within the cartilage is squeezed out mechanically (weeping lubrication) to maintain a layer of fluid on the cartilage surface & circulate nutrients - synovial fluid that bathes cartilage provides adequate nutrition diffusion through several millimeters of matrix

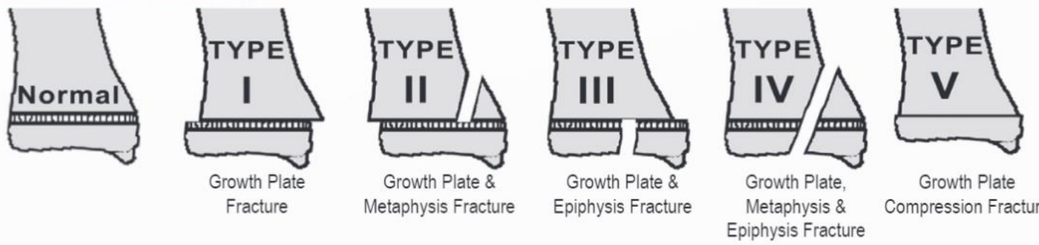
Numerous studies have shown prolonged joint immobilization results in cartilage thinning & degradation

Bone Injury

- **Fracture - cracking or breaking of a hard object or material (bone)**
- **Bone bruise:** can be described as a stage before the fracture (includes: sub-periosteal hematoma, inter-osseous bruising & sub-chondral lesion); fracture means that all bone trabeculae of that specific place are fractured, in a bone bruise only a few of the trabeculae are broken (visible on MRI)
- **Pathologic fracture** - bone breaks in an area weakened by another disease process (tumors, infection, osteoporosis & certain inherited bone disorders)
- **Stress (fatigue) fracture** - microfracture caused by repetitive stress, as may occur in sports, strenuous exercise, or heavy physical labor (bone does not heal sufficiently from each repetitive trauma event); if the forces on the bone continue with inadequate healing may progress to a full fracture
- **Closed fracture** - fracture does not penetrate skin
- **Open (compound) fracture** - fracture penetrates skin (a spike of bone sticks out or object penetrates skin)
- **Avulsion fracture** - separated bone fragment from a muscle, tendon or ligament attachment site
- **Comminuted fracture** - more than 2 bony fragments
- **Compression** (impaction) **fracture** - decreased bone size from trabecular compression (common in osteoporosis)
- **Greenstick fracture** - buckled trabeculae (not completely broken bone - occurs in children)
- **Oblique fracture** - fracture at 45° to long axis of bone
- **Occult fracture** - non-visualized fracture, often diagnosed through soft tissue swelling (fat pad signs) or advanced imaging (MRI/CT)
- **Spiral fracture** - fracture circumferential & longitudinal to long axis of bone
- **Torus fracture** - buckled trabeculae & cortical bulge
- **Transverse fracture** - fracture ~90° to long axis of bone
- **Salter-Harris fracture** - fractures involving growth plates (see below)



Salter-Harris Fracture Types



Fracture Complications

Immediate concerns	Short-term concerns	Long-term concerns
• Neurovascular damage • Compartment syndrome • Fat embolism • Thrombus formation • Gas gangrene (infection)	• Refracture • Synostosis • Delayed union • Osteomyelitis • Reflex sympathetic dystrophy • Myositis ossificans	• Osteonecrosis • Nonunion • Malunion • DJD • Osteoporosis

Nerve Injury & Healing

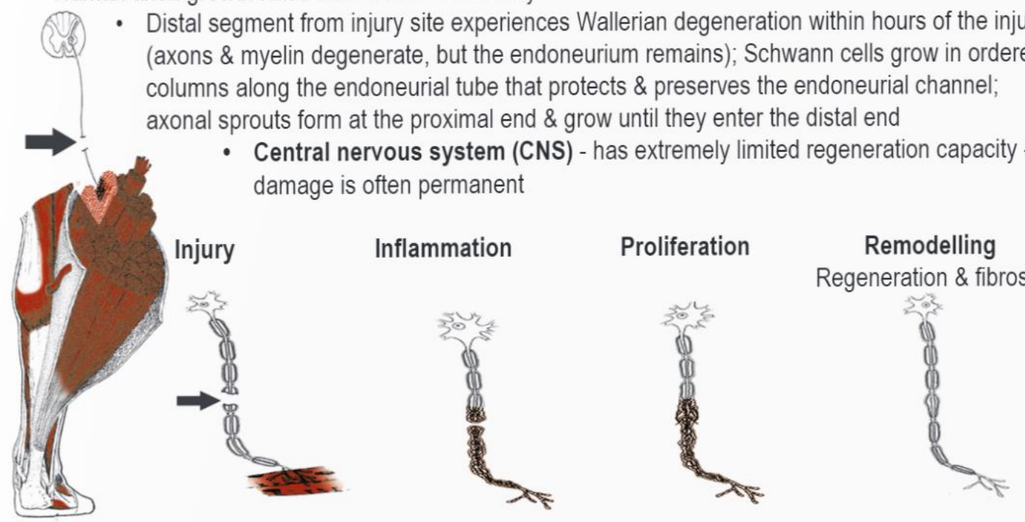
Classification of peripheral nerve injury assists in prognosis & development of treatment strategy

Grade	Clinical findings
I (Neuropraxia) 	• Nerve is intact but signaling ability is damaged (compression or stretch causes conduction block without nerve damage, "my arm fell asleep" or "pin & kneedles") • Numbness, tingling or motor weakness distal to the site of injury • The endoneurium, perineurium, & the epineurium are intact • No wallerian degeneration, no (+) Tinel's test • No denervation muscle changes are present, full recovery is expected in minutes to hours
II (Axonotmesis) 	• Axon is damaged but NOT surrounding connecting tissue • Wallerian degeneration occurs distal to the site of injury • Sensory & motor deficits distal to the site of lesion - (+) Tinel's test • No nerve conduction distal to the site of injury (3-4 days post injury) • Usually axon regenerates & recovery is possible without surgery (may take up to 3+ months to recover) • Denervation changes affected muscles (weakness & atrophy)
III (Neurotmesis) 	• Total severance or disruption of entire nerve fiber both axon & connective tissue are damaged (usually cutting or crush injury, severe stretch of nerve) • Wallerian degeneration occurs distal to the site of injury • Sensory-motor & autonomic issue are common • May require surgical approximation - un-repaired nerve is completely replaced by fibrous scar tissue; flaccid paralysis, anesthesia & atrophy of muscle follow (full loss of function)

Nerve Healing

Neurogeneration - regrowth or repair of nervous tissues & support cells

- **Peripheral nervous system (PNS)** - when a nerve axon is injured the proximal end swells & experiences some retrograde degeneration, but once the debris is cleared, it begins to sprout axons; the proximal axons are able to regrow as long as the cell body is intact & they have made contact with Schwann cells in endoneurial channel
  - Human axon growth rates can reach 2-5 mm/day
  - Distal segment from injury site experiences Wallerian degeneration within hours of the injury (axons & myelin degenerate, but the endoneurium remains); Schwann cells grow in ordered columns along the endoneurial tube that protects & preserves the endoneurial channel; axonal sprouts form at the proximal end & grow until they enter the distal end
- **Central nervous system (CNS)** - has extremely limited regeneration capacity - damage is often permanent



Imaging Decisions

- Cost effectiveness
- Potential benefits weighed against potential risks of each exam

Basic Concepts

- Determine diagnostic value of various imaging techniques
- Role of conventional plain film radiography
- Appropriate selection of advanced imaging procedures:
  - Computed tomography (CT)
  - Myelography, CT-myelography, Discography
  - Magnetic resonance imaging (MRI)
  - Radionuclide bone scan

Special Imaging Choices	♦♦♦ = excellent	♦♦ = good	♦ = fair	
Condition	**Radiograph**	**CT**	**MRI**	**Bone Scan**
Disc Herniation		♦♦	♦♦♦	
Infection		♦♦	♦♦♦	♦♦
Inflammatory. Arthropathy	♦♦	♦		
Instability	♦♦♦			
Neoplasm	♦	♦♦	♦♦♦	♦♦
Spondylolisthesis	♦♦♦	♦		♦ (acute)
Stenosis		♦♦♦	♦♦	
Trauma	♦♦	♦♦ bone	♦♦♦ soft tissue	

Diagnostic ultrasound - mainly used to detect soft tissue abnormalities, abdominal aortic aneurysm, genitourinary abnormalities or during pregnancy

Video fluoroscopy - limited use in LBP, may be used in flexion/extension functional studies, high radiation exposure - thus of little clinical use

General Concepts

- Few patients with low back pain require plain film radiographs, even fewer require special imaging
- Considerations in selecting appropriate imaging examination for individual patients:
  - Inherent risk of examination to patient
  - Likelihood that examination will be of benefit in establishing or refuting a diagnosis
  - Potential risk of liability if examination is requested or not requested
- Patient selection (those who require or do not require diagnostic testing)
  - Indicated by findings obtained by patient's history & physical examination
  - Is diagnostic study going to help confirm a diagnosis & if so how much?
  - Will study information change diagnostic thinking, significantly changing choice of treatment?
  - **Order diagnostic imaging only if there is high likelihood that information will lead to a change in treatment.**

High Risk Patients - patients with clinical indications (history & exam findings):

History: significant trauma, > 50 years old, neuromotor deficits, unexplained weight loss, ankylosing spondylitis, drug or alcohol abuse, history of cancer, corticosteroid use, fever > 100°F, no improvement in condition

Exam: cachexia, deformity & immobility, scars (surgical, accidental), lymphadenopathy, motor or sensory deficit, elevated ESR or ALP, (+) RH factor, (+) HLA-B27 antigen, serum gammopathy

Low Risk - patients that fail to exhibit any of high-risk signs of symptoms

- These patients seldom exhibit significant abnormalities on radiographs & therefore findings will not alter treatment

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Disc Herniation		♦♦	♦♦♦	
Infection		♦♦	♦♦♦	♦♦
Inflammatory. Arthropathy	♦♦	♦		
Instability	♦♦♦			
Neoplasm	♦	♦♦	♦♦♦	♦♦
Spondylolisthesis	♦♦♦	♦		♦ (acute)
Stenosis		♦♦♦	♦♦	
Trauma	♦♦	♦♦ bone	♦♦♦ soft tissue	

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Plain Film Radiography in Low Back Pain: When is it reasonable?

Pathologic Diagnosis

- To establish or confirm a clinical (pathologic) diagnosis
- High risk patients most probable of pathologic radiograph on initial visit
- Low risk patients (absence of neurologic deficit) radiographs are contradicted during first week of acute episode of low back pain & probably are unnecessary unless symptoms persist for a 7-week period (Quebec Task Force on Spinal Disorders)
- Frontal & lateral views are indicated at time of initial examination for high risk patients
- Special views are indicated in high risk patients only when frontal & lateral films are insufficient or equivocal
- Plain film radiographs are typically used as first imaging procedure in patients requiring imaging because: accessible, inexpensive, comfortable, convenient for patient & involves only minimal radiation exposure
- Sensitivity for plain film = 90% for many conditions
- For bone destruction (ie. malignancy, infection) 30-50% destruction must be present to view on plain film; 3-5% bone destruction necessary on radionuclide bone scans (more sensitive/less specific)
- Plain film is insensitive to many diagnoses: spinal stenosis, herniated nucleus pulposus, intraspinal neoplasms~ require more expensive imaging methods

Biomechanics & Posture

- The role of radiography in evaluating biomechanics & posture is controversial
- **Scoliosis:** full spine radiographic evaluation of patients with scoliosis is an effective diagnostic & analytic procedure with an effective risk/benefit ratio
- **Spinographic analysis:** with exception of disc space narrowing it is an unreliable predictor of present or prior history of low back complainants; with exception of scoliosis there is no clinical justification for taking radiographs exclusively for spinographic analysis
- **Functional radiography:** functional or "stress" radiography has been used extensively in orthopedic practices in an attempt to identify & explain biomechanical abnormalities that might contribute to low back pain
- Lateral bending or flexion/extension studies
- Generally excepted that greater than 3 mm of translational movement & greater than 10° angular motion (L1-L4) represents instability
- Greater than 4 mm & 20° (L5-S1) represent instability

Identification of Anomalies

- Lumbosacral anomalies (tropism, transitional vertebrae, spina bifida, & Schmorl's nodes) reveal no higher incidence of back pain than in patients without these abnormalities
- Leg length inequality studies may have an increased incidence of back pain
- Radiographic findings of vertebral anomalies & pelvic tilt may mislead clinician & patient & they frequently lead to inappropriate diagnosis

Contraindication Screening

- Use of radiographic screening to identify contraindications to care is unjustified
- Most conditions that contraindicate treatment are evident via history and/or physical examination (high risk patients) or other diagnostic methods

Monitoring Degenerative Processes

- Radiographs are almost always contraindicated because treatment will not be altered
- Exceptions are: progressive scoliosis, unstable degenerative spondylolisthesis or severe degenerative spinal stenosis (CT, MRI) or flexion-extension studies

Outside X-ray Suite

1. Greet patient
2. Explain exam to patient
3. 28 Day Rule
   a. Before examination of an area where uterus is within or close to irradiated area is conducted, ask the patient if there is any possibility of pregnancy
   b. If patient answers 'no,' then ask date last menstrual period
   c. If menstrual cycle is overdue, then examination may be postponed
4. 10 day rule - restrict high dose procedures to 1st ten days of the menstrual cycle
   - Signature of patient for consent
5. Signature of attending physician (if required)
6. Prepare patient in appropriate area
   - Remove metallic objects - jewelry, hairpins, brazier, manzier/bro (Seinfeld humor ☺), glasses, etc & have patient gown up
7. Escort patient to x-ray suite

Inside X-ray Suite

1. Introduce patient to radiographic technician
2. Measure all views & write down or measure as you go
3. Set panel for 1st view
4. Set x-ray tube - SID, tube angle, align vertical cross hairs to film
5. Insert cassette into holder or bucky
6. Bring patient into field
7. Patient protection - lead apron if necessary
8. Position approximately
9. Alignment - center to landmark/film to center or center to film
10. Position precisely (double check)
11. Collimate to area of interest
12. Place marker (double check)
13. Patient protection - place shielding
14. Give patient breathing instructions (as required)
15. Expose while watching patient for movement (tell patient to "hold very still")
16. Inform patient when they can relax

Next View

17. *Change cassette!*
18. Reposition patient, markers, shielding, etc.

After Exam

1. Ensure darkroom door is securely closed
2. Process films with identification & reload cassettes
3. Ensure film drawer is closed before opening door & turning on lights
4. Take film to radiologist for consultation (be prepared to relay impressions)
5. Interns: do not discuss findings with patient until consulting attending physician/radiologist
6. Escort patient back to treatment room & explain findings

Appendix/Index
Appendix/Index

Standard Radiographic Views

Anatomy	Minimal Dx Series	Additional Views
Cervical spine	AP, APOM, lateral	Flexion, extension, oblique, pillar
Thoracic spine	AP, lateral	Swimmer's
Lumbar spine	AP, lateral	PA, oblique, lateral spot, frontal spot, flexion, extension, traction, compression (20 kg vest)
Sacrum or coccyx	AP, lateral	PA
Upper Body		
Finger	PA, oblique, lateral	
Hand	PA, oblique, lateral	Reverse oblique, ball catcher's
Wrist	PA, oblique, lateral	Ulnar flexion, radial flexion
Forearm	AP, lateral	Oblique
Elbow	AP, lateral	Radial head, Jones, gun sight
Humerus	AP, lateral	Transthoracic
Shoulder/GH joint	Int. & ext. rotation	"Y" view, Grashey, transthoracic, axillary
AC joints	AP	Weight-bearing (20lbs held in each hand)
Clavicle	AP, angled view	
Scapula	AP, lateral	
Chest	PA, left lateral	Right lateral, apical lordotic, decubitus, oblique
Lower Body		
Toes	AP, oblique, lateral	
Calcaneus	Tangential, lateral	
Foot	AP, med. oblique, lat.	Lateral oblique, sesamoid views
Ankle	AP, lateral, oblique	
Leg (tib/fib)	AP, lateral	Oblique
Knee & Patella	AP, lateral	PA, intercondylar, sun-rise, oblique, tangential patellar, weight-bearing
Femur	AP, lateral	
Hip	AP, lateral (frog-leg)	
Pelvis	AP	Oblique ilium
SI joints	AP, spot view	Oblique
Abdomen	AP (supine)	AP standing

AP = anterior to posterior, PA = posterior to anterior, ext.= external, int. = internal, med = medial, lat. = lateral.

Selected Imaging Types

Radiograph

Indication
- Usually first choice modality
- Should be taken if clinical questions exist & treatment could be altered by findings

Procedure
- Plain film radiation exposure

Advantages
- Cost effective & highly available
- Minimal radiation dose

Disadvantages
- Not sensitive (30-50% bone destruction needed to see many conditions) & no axial images
- Quality dependant upon doctor or technician performing exam

X-ray Series	Effective Dose (mSv)
Chest (PA film)	0.02
Head	0.07
Cervical spine	0.3
Thoracic spine	1.4
Lumbar spine	1.8
Abdomen	0.53
Pelvis/hip	0.83
Limbs/joints	0.06
Screening mammogram	0.13



Computer Aided Tomography

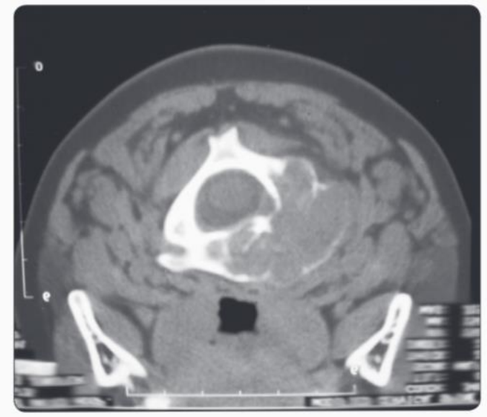
Indication
- Synonym: CT or CAT scan
- Axial views or better bony detail

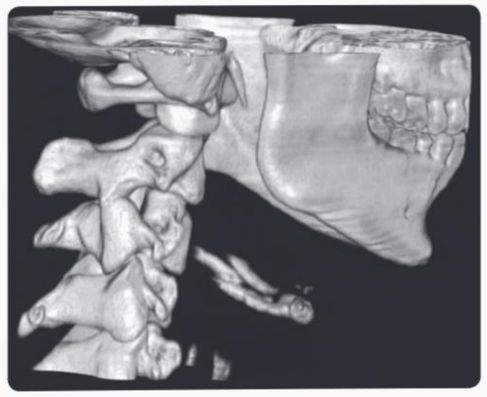
Procedure
- Radiographic axial sections are taken & manipulated by computer
- Injected contrast can be used to increase detail

Advantages
- Excellent bony detail, good soft tissue detail
- Image contract can be modified to show specific areas
- 3-D image reconstruction is possible (see image lower right)

Disadvantages
- **Relatively high radiation dose** (many clinicians forget that this is still radiation exposure via x-rays & is carcinogenic[1])
- More costly

CT	Effective Dose (mSv)
Head	2.0
Abdomen	10.0
Chest	20-40
Pulmonary angiography	20-40
PET - CT	25





Bone Scan



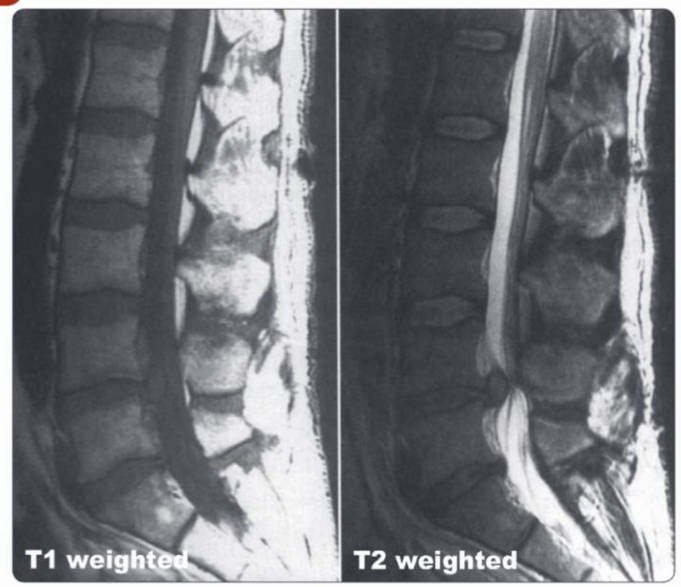
Indication
- Survey of entire body for areas of increased cell (osteoblastic) activity such as fracture or cancer

Procedure
- Radioactive nucleotide injected & body is scanned
- Scans may be timed to show phases of uptake difference

Advantages
- Very sensitive (only 3-5% bone destruction required to show "hot spots")
- Entire body can be evaluated for diffuse disease
- No ionizing radiation

Disadvantages
- Not specific (hot areas do not specify process)
- Invasive injection & radioactive risks

Magnetic Resonance



Indication
- Synonym: MR or MRI
- Detailed image of soft tissue & bone
- **Best imaging modality to show anatomy & tissue type**

Procedure
- Patient placed in a powerful magnetic field & images are created by manipulation of hydrogen atoms in the body

Advantages
- **Excellent structure detail**
- **No ionizing radiation**
- Any image plain can be used

Disadvantages
- **Expensive** & can be complicated to interpret
- Cannot be used on patient with metal artifacts (pacemakers, metal eye chips)
- Patients with life support equipment, prosthetic limbs (any metal at all) cannot go near MR unit
- Possible claustrophobia

Clinical notes

T1 Weighted	T2 Weighted
• CSF dark, bone marrow (fat) light	• CSF appears light (high signal intensity)
• Good spinal cord/CSF contrast	• H_2O shows light (CSF, soft tissue edema)
• Poor bone/disc/ligament contrast	• mnemonic: T**2** shows H_2O

Anosmia Test

Procedure
Seated patient is instructed to smell a variety of different aromatic substances; vanilla, coffee grounds, peppermint & lastly spirit of Ammonia directly irritates trigeminal nerve endings in the nasal cavity; damage to the olfactory nerve does not limit the patient's ability to "smell" ammonia

Interpretation
(+) Anosmia to ammonia → Symptom of magnification (malingering should be suspected)

Clinical notes
Conditions that may cause complete anosmia are rare but may include: severe nasal inflammation, tumors in the pituitary gland or frontal lobe, fractures of the anterior cranial fossa, meningitis, hydrocephalus, arteriosclerosis, cerebrovascular accidents, congenital defects

Axial Trunk-loading Test



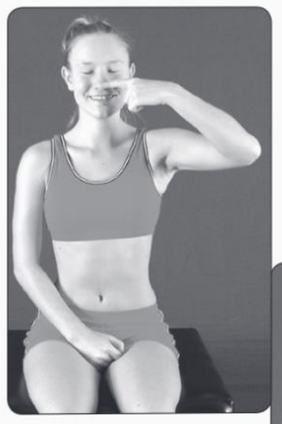
Procedure
Patient standing or seated, examiner applies gentle downward pressure on the patient's head with both hands (axial loading) & observes the patient for signs of pain or discomfort

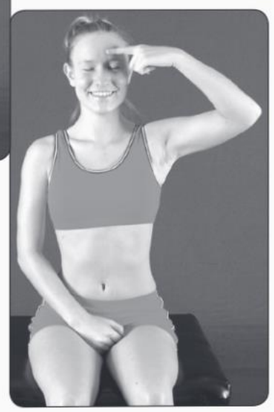
Interpretation
(+) Lumbar spine pain → Malingering lumbar spine

Clinical notes
If the patient presents in an antalgic posture, the examiner must be careful not to disturb that position during axial loading

Axial loading may cause neck pain, but should not cause low back pain

Basic Coordination Testing



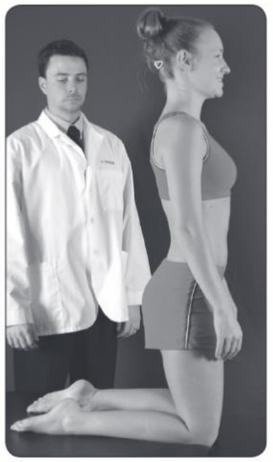


Procedure
Seated patient is instructed to touch the tip of the finger to the nose with eyes open; this maneuver is then repeated with the patient's eyes closed

Interpretation
(+) Lack of an intentional tremor or simple displacement of the finger to another region of the face → Symptom magnification (malingering should be suspected)

Clinical notes
In patients with true cerebellar lesions, an intentional tremor usually manifests & increases in amplitude as the finger approaches the nose, this will not be the case in a malingering patient

Burn's Bench Test







Procedure

Patient is instructed to kneel on examination table & flex forward in an attempt to touch fingertips to floor (reaching hands at least 15 cm below the surface of the table)

Interpretation

(+) Inability to perform test → Malingering (simulated) lumbar spine

Clinical notes

Clinician's option: examiner may choose to stabilize patient at the ankles while they bend forward

Patients with the following conditions should be able to perform this test; sciatica (nerve root tension), mild-moderate lumbar sprain/strain, spondylolisthesis

Cuignet's Test

Procedure

Seated patient is instructed to read a Snellen eye chart with one eye at a time, & the patient will claim that the blind eye cannot read the chart; examiner instructs the patient to place a refractive lens (that obscures vision) over the "good" eye & instructs the patient to again that read the eye chart

Interpretation

(+) Ability to read eye chart → Simulated unilateral blindness (malingering should be suspected)

Clinical notes

Conditions that cause unilateral blindness are rare but may include; optic nerve atrophy, glaucoma, trauma, tumors of the pituitary gland, frontal or occipital lobe

Facial Sensory Testing



Procedure

Patient seated, examiner applies a vibrating tuning fork to the affected (numb) side of the face (near midline) & asks the patient if they note any vibratory sensation; examiner then moves the vibrating tuning fork to the "normal" side of the face & repeats the question

Interpretation

(+) No vibratory sensation noted on the numb side of the face → Simulated face anesthesia (malingering should be suspected)

Clinical notes

Because the tuning fork is placed near midline bone conduction of vibration will pass from the "numb" to the "normal" side of the face, therefore it is a near impossibility for patient NOT to have some sensation of vibration through bone conduction

Malingering Ortho
prohealth

Flexed Hip Test



Procedure

Patient supine, the examiner passively flexes patient's hip to 90° with knee flexed 90° & palpates for movement of the lumbar spine while observing the patient for signs of pain or discomfort

Interpretation

(+) Pain in the low back or leg before lumbar spine motion is felt → Malingering (simulated) lumbar spine

Clinical notes

If a patient claims shooting, electrical type pain down the back of the leg, the examiner should also be very suspect as sciatic nerve traction will be minimal at best

Flip Sign





Procedure

Patient supine, examiner performs a straight leg raise; if motion is decreased due to muscle pain examiner then instructs patient to sit up while the patient's legs are kept flat on the examination table

Interpretation

(+) Patient can sit up without pain → Malingering (simulated) lumbar spine condition should be suspected

Clinical notes

The angle of tension created by a supine straight leg raise should be duplicated when the patient sits up; in the presence of true pathology, the same reproduction of symptoms should be reproduced with the patient sitting & with a supine straight leg raise

Gault Test

Procedure

Patient seated, examiner instructs patient to cover "good" ear & look straight ahead, examiner then proceeds to stand out of the patient's line of sight on the side of the "bad" ear & either clap hands or pop a bag, during this action the examiner observes the patient for the presence of an auditory-palpebral reflex (reflex of blinking of the eye due to being startled by a loud sound)

Interpretation

(+) Blinking and/or startle response → Patient has heard something, simulated hearing loss (malingering should be suspected)

Clinical notes

Potential causes of unilateral hearing loss:

1. Infection (meningitis, mumps, Streptococcus, typhoid)
2. Tumor (temporal lobe, cranial nerve eight, cochlea, cerebellar-pontine angle)
3. Trauma (repeated exposure to loud noises, skull fractures)
4. Medication side effects (aminoglycoside, kanamycin, quinine, mercury)

Hoover's Test

Procedure

Patient supine, examiner instructs patient to perform a straight leg raise while examiner places one hand under the patient's nonactive leg heel

Interpretation

(+) No pressure felt against examination table with examiner's hand under nonactive leg during active straight leg raise → Malingering should be suspected



Clinical notes

If a patient is a truly trying to perform straight leg raise then pressure will be felt under the heel of the nonactive leg

Janet's Test

Procedure

Patient seated, examiner instructs patient to close eyes & proceeds to test cutaneous sensation with light touch & pin prick tests, & ask the patient to say "yes" if they feel the sensation

Interpretation

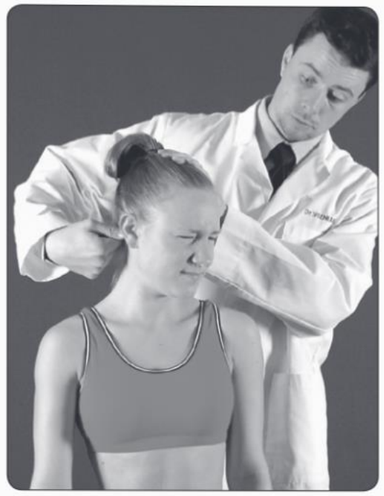
(+) Patient answers "yes" when the examiner test over region of "alleged" anesthesia → Simulated anesthesia (malingering should be suspected)

Clinical notes

If the patient has true anesthesia, when the examiner test the affected cutaneous region the patient will be unable to feel the sensation & thus no response will be given; the examiner should also be sure to examine sensation bilaterally

Malingering Ortho
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Libman's Sign



Procedure

Patient seated or supine, examiner gradually applies pressure to the mastoid process, increasing the amount of pressure until the patient shows signs of pain or discomfort

Interpretation

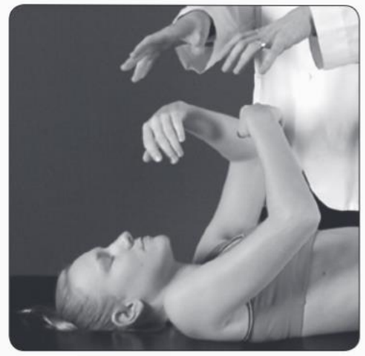
(+) Pain with minimal pressure → Low pain threshold, possible magnification of symptoms (malingering)

Clinical notes

This test is useful as a general measure of a patient's pain tolerance, which varies greatly from patient to patient

If patient has a history of headaches, occipital pain or mastoiditis this test may reveal a falsely low pain tolerance

Limb Drop Test





Procedure

Patient supine, the examiner raises patient's chest above body & proceeds to drop them, examiner then proceeds to lift patient's arms directly over the patient's head & proceeds to drop them again

Interpretation

(+) Arm swerve to avoid striking the face → Simulated unconsciousness (malingering should be suspected)

Clinical notes

If a patient is truly unconscious, their arms should fall onto their face; the conscious patient will swerve to keep the hands from striking the face

Lombard's Test

Procedure

Patient seated, examiner instructs patient to read text aloud or engages the patient in a conversation, as the reading progresses or the conversation continues background noise in the examination room is increased; the examiner observes & notes that patient's voice amplitude

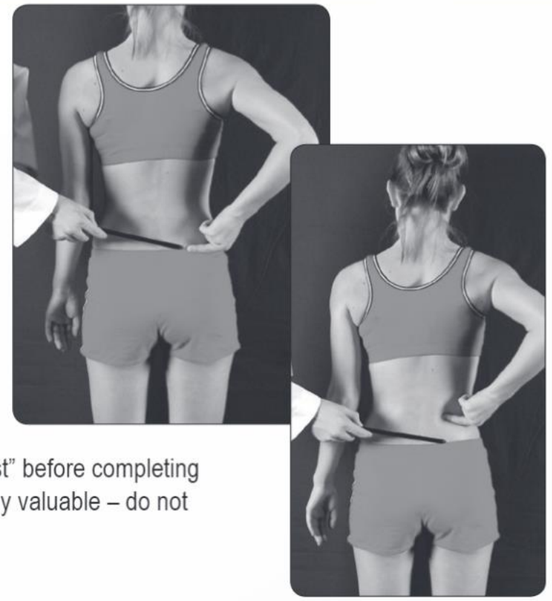
Interpretation

(+) Increase in voice volume has background noise increases → Simulated hearing loss (malingering should be suspected)

Clinical notes

In a patient with normal hearing function, as background noise increases so does their voice increase in volume in order to continue communication or reading aloud (natural human response to increased background noise)

Magnuson's Test



Procedure

Patient seated or standing, examiner instructs patient to point at the location of low back pain, examiner then marks the point & distracts the patient by performing another test & again asks the patient to point to the location of pain

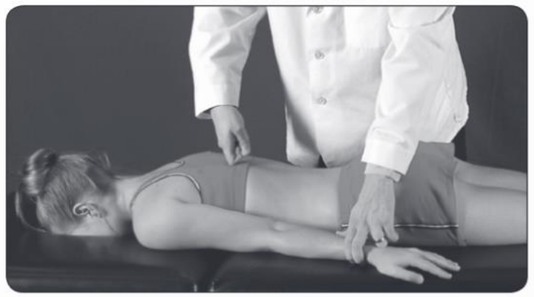
Interpretation

(+) Change in pain location > 2 cm or vague response → Malingering (simulated) lumbar spine condition should be suspected

Clinical notes

Some authors suggest performing an "irrelevant test" before completing this maneuver, your time as a clinician is extremely valuable – do not waste it on "irrelevant test"

Mannkopf's Sign



Procedure

Patient prone or seated, examiner palpates patients radial pulse while the patient is in a position that is most comfortable, examiner & then moves patient into a position that causes pain or discomfort & measures radial pulse rate change

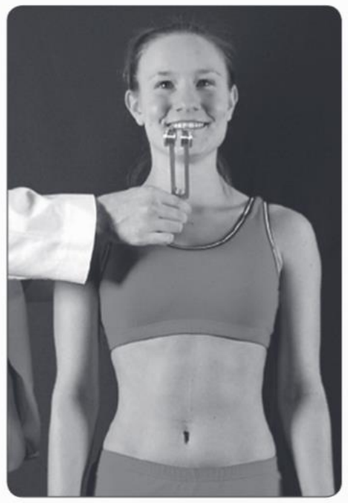
Interpretation

(+) No change in pulse → Malingering (simulated) pain should be suspected

Clinical notes

Normally, in the presence of true pain the patient's pulse rate should increase by approximately 10% (6-10 beats per minute)

Mid-line Tuning Fork Test



Procedure

Patient seated, examiner applies a vibrating tuning fork to the affected (numb) side of the sternum (near midline) & asks the patient if they note any vibratory sensation; examiner then moves the vibrating tuning fork to the "normal" side of the sternum & repeats the question

Interpretation

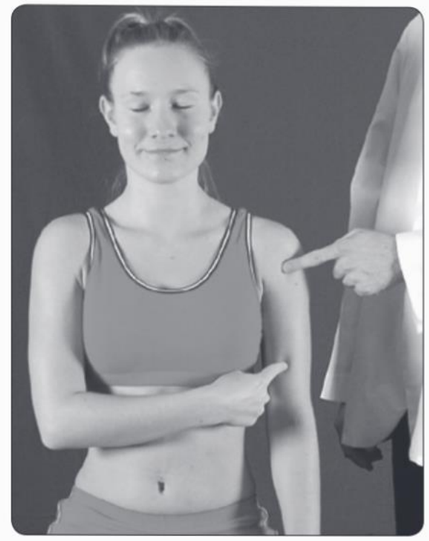
(+) No vibratory sensation noted on the numb side of the sternum → Simulated body anesthesia (malingering should be suspected)

Clinical notes

Because the tuning fork is placed near midline bone conduction of vibration will pass from the "numb" to the "normal" side of the sternum, therefore it is a near impossibility for patient not to have some sensation of vibration through bone conduction

Malingering Ortho
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Pain Suggestibility Test



Procedure

Patient seated, supine or standing, patient points to area of pain & examiner marks the location, examiner then proceeds to distract the patient by performing an examination on another body region, patient is then instructed to close eyes & point to location of pain again

Interpretation

(+) Change in pain location > 2 cm or vague response → Malingering (simulated) condition should be suspected

Clinical notes

In the presence of true musculoskeletal symptoms, pain location is almost always easy to localize; this is not always the case when dealing with visceral complaints

Related Joint Motion Test

Procedure

Painful region is moved either actively, by the patient, or passively, by the examiner; examiner then instructs patient to perform & isometric contraction (while the examiner resists the motion) with the antagonistic muscle group of the painful region, examiner then continues with the rest of the physical examination but eventually returns to the original area of pain & directly isometrically tests that area

Interpretation

(+) Pain during initial examination that is not reproduced when area is re-examined → Exaggerated pain, malingering should be suspected

Clinical notes

For example, if the patient has biceps femoris muscle belly pain, the patient actively flexes the knee, then the examiner would proceed to isometrically tests the quadriceps muscle group, continue the physical exam & then come back & re-test the hamstring muscle group looking for the reproduction of the initial symptoms (see specific muscle test in chapters)

Tripod Test

Procedure

Patient seated with knees flexed 90° hanging over the edge of the examination table, examiner instructs the patient to alternately extend & flexed the knees (flutter motion) & observes the patient for signs of pain, discomfort or leaning backwards



Interpretation

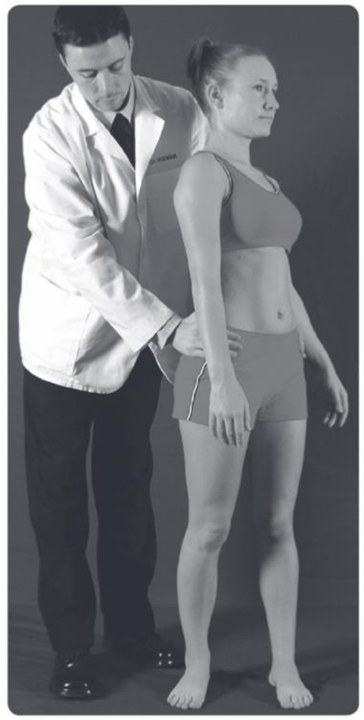
(-) Inability to perform maneuver or leaning back on hands (tripod sign) → Lumbar disc herniation, nerve root tension, radiculopathy, sciatica

(+) Able to perform maneuver without leaning backwards → Simulated radicular syndrome (malingering should be suspected)

Clinical notes

In the presence of true nerve root tension when the patient tries to straighten their legs, there is increased tension placed upon the sciatic nerve that may result in an inability to fully straighten the leg or cause the patient to leaning backwards on examination table in an attempt to help reduce the nerve root tension

Trunk Rotation Test



Procedure

Standing patient is instructed to rotate to one side while examiner ensures that the pelvis rotates in the same direction as the trunk (the examiner is attempting to ensure that no rotation occurs in the lumbar spine)

Interpretation

(+) Low back pain → Malingering may be suspected

Clinical notes

In this maneuver the lumbar spine is not moving, but rather the entire trunk is rotated from the hips & thighs; due to the lack of spinal motion the examiner may rule out the spine as a pain generator

Waddell Tests

Procedure

1. Standing patient rotates trunk spine & pelvis simultaneously (no spinal stress)
2. Axial loading: patient standing examiner applies minimal digital compression to the head
3. SLR improves when the patient is mentally distracted

Interpretation

(+) Widespread "non-anatomic" pain → Symptom magnification (malingering should be suspected)

Clinical notes

Waddell Tests are a combination of many individual maneuvers

Wrist Muscle Weakness Test

Procedure

Patient seated with elbow flexed 90°, examiner instructs patient to squeeze dynamometer while examiner palpates the patient's wrist flexors & extensors

Interpretation

(-) Antagonistic contraction of both forearm flexors & extensors → Normal muscle function
(+) Synergistic (unilateral) contraction of the forearm extensors → Simulated forearm/wrist muscle weakness (malingering should be suspected)

Clinical notes

This test is used as a confirmatory procedure in patients who do not display grip strength loss, but do claim persistent forearm or wrist weakness
The examiner should also be aware that in the presence all specific peripheral nerve lesions only the flexors (median nerve) may be affected, or only extensors (radial nerve) may be affected, which may result in decreased grip strength with unilateral synergistic muscle contraction

Collection Technique

Women:

- Wash hands with soap and water
- Spread labia with 1 hand and hold apart for collection
- Use three povidone-iodine swabs to clean area
  1. Wipe down one side, front to back
  2. Wipe down other side, front to back, with second swab
  3. Wipe down center, front to back, with last swab
- Dry area with sterile gauze
- Void into toilet for a few seconds and then collect
- Avoid stopping urine flow while positioning cup
- Stopping flow increases risk of contamination
- Collect in sterile container Cap and avoid touching inside of container

Men:

- Wash hands with soap and water
- Retract foreskin if needed
- Use povidone-iodine swabs to clean tip of penis
- Clean glans penis
- Clean urethral opening
- Dry area with sterile gauze
- Void into toilet for a few seconds and then collect
- Collect in sterile container
- Avoid stopping urine flow while positioning cup
- Stopping flow increases risk of contamination
- Cap and avoid touching inside of container

Visual Examination

Color (normal: colorless to amber)

- Yellow/green/brown: Bilirubinuria
- Red: Hemoglobin, myoglobin, foods/dyes (e.g. beets)
- Brown/black: Homogentisic Acid
- Blue/green: Indicans (bad protein digestion) Pseudomonas infection, chlorophyll

Appearance (normal: clear to slightly hazy)

- Hazy to cloudy: amorphous sediment, epithelial cells, WBCs (pyuria), RBCs, microorganisms, crystals, sperm
- Milky: WBC, WBC clumps, fat

Chemical Examination (reagent strip, dipstick)

pH (normal: usually 4-8 slightly acidic)

- Acid urine: normal western diet, ketosis, systemic acidosis, acidification therapy
- Alkaline urine: vegetarian diet, postprandial specimen, stale specimen, UTI, alkalinization therapy

Specific Gravity (normal: 1.005-1.035)

- 'True' kidney function test, easily altered by fluid consumption -not very sensitive
- Dilute: ↑ fluid intake, random specimen, renal disease
- Concentrated: ↓ fluid intake, 1st morning specimen, ↑ levels of solutes: ↑ glucose, ↑ ketones, ↑ protein

Glucose (normal: none detected)

Glucosuria with hyperglycemia

- Following a heavy meal
- Diabetes mellitus; "Hyper"-endocrinopathies (thyroid, Cushing's)
- Pancreatic disease; drug associated

Glucosuria without hyperglycemia

- Renal tubular disease
- Late (normal) pregnancy

Ketones (normal: none detected)

Ketones are the byproducts of fatty acid metabolism & impaired glucose metabolism

Ketones (ketone bodies)
acetoacetic acid, acetone, β-hydroxybutyric acid

Ketonuria observed in:

Inadequate carbohydrate diet
Successful *weight loss diet, malnutrition*
Defect in carbohydrate metabolism
Diabetes mellitus
Defects in carbohydrate absorption
Malabsorption
Febrile illness (fever)

Protein (normal: none detected)

Types of protein in urine: albumin, globulins, Hb, fibrinogen, nucleoproteins, Bence Jones proteins

Categories

Pre-renal proteinuria
- Fever, hypertension, Bence Jones Renal proteinuria
- Kidney disease
  Post-renal proteinuria
- Vaginal secretions, infection in renal pelvis

Minimal (<0.5 g/24 hrs.)

- Vigorous exercise
- Orthostatic (postural) proteinuria
- Pregnancy
- Hypertension; kidney dysfunction
- Lower UTI

Protein (continued)

Moderate (0.5-3.0 g/24 hrs.)

- Chronic glomerulonephritis; pyelonephritis
- Diabetic neuropathy
- Multiple myeloma; pre-eclampsia

Marked (>3.0 g/24 hrs.)

- Acute & chronic glomerulonephritis
- Diabetic neuropathy
- Nephritic syndrome; nephrosis; lupus nephrosis; amyloidosis
- Young males masturbating < 2-3 hours before urinalysis (semen contamination)

Urobilinogen (normal: 0.1-1 EI unit/mL)

Catabolic product of conjugated bilirubin via bacterial actions in the intestines, up to 20% of urobilinogen formed in intestines is reabsorbed into enterohepatic system & some finds its way into the urine

↑ ***Urinary urobilinogen:***

- Hemolytic disease
- Hepatic disease

↓ ***Urinary urobilinogen:***

- Biliary obstruction

Bilirubin (normal: none detected)

Only conjugated bilirubin can be excreted by the kidney, therefore bilirubinuria is only observed when there is conjugated hyperbilirubinemia

Intrahepatic obstructive disorders - hepatitis

Extrahepatic obstructive disorders, biliary tract obstruction

Leukocyte Esterase (normal: none)

Cytoplasmic enzyme of neutrophils; reagent strip turns positive in the presence of significant numbers of WBCs, either lysed or intact - sensitive indicator of UTI

Potential False Positives:

- Vaginal contamination, heavy mucus discharge, Trichomonas infestation, ↑ ascorbic acid (vitamin C)

Pyuria (↑ WBC in urine)

- Inflammation within the urinary tract, UTI

Nitrite (normal: none detected)

Dietary urinary nitrate is reduced to nitrite by many urinary tract pathogens - requires adequate time for incubation

Specific indicator of UTI, not very sensitive

Ascorbic Acid - presence of adequate amounts of ascorbic acid in the urine may effect the dipstick's biochemistry such that there may be reduced positives or false negatives for the following:

- Blood, Glucose, Nitrite, Bilirubin

Hemoglobin (normal: none detected)

Presence of hematuria always warrants investigation into the site of bleeding

Hematuria (without casts or proteinuria)

- Normal individuals - menstrual contamination; following severe exercise
- Trauma to any part of the urinary tract, lower UTI (especially cystitis), hypertension, bleeding disorders, kidney pathologies (stones, tumors)

Hematuria (with casts & proteinuria)

- Acute glomerulonephritis
- Chronic glomerulonephritis
- Rheumatoid diseases

Epithelial cells (normal: occasional/lpf)

Renal Epithelial cells; ***Transitional Epithelial cells; Squamous cells***

Micro organisms

Bacteria (normal: occasional/hpf)

Yeast (normal: none detected)

Protozoa - *Trichomonas vaginalis*

Crystals

Calcium Oxalate Crystals

Uric Acid Crystals (monosodium urate)

Cholesterol Crystals

Leucine, Tyrosine, Cysteine Crystals

Casts

Hyaline Casts *(protein casts)*

RBC/Hemoglobin Casts (glomerulonephritis)

WBC Casts *(pyelonephritis)*

Epithelial Casts *(tubular damage)*

Waxy Casts *(renal failure)*

Broad Casts *(chronic renal failure)*

Laboratory Safety

1. Exercise "Universal Precautions"
2. Use latex gloves when performing venipuncture or handling ANY body fluid
3. Wear lab coats, goggles, glasses, etc.
4. Use proper SHARPS & BIOHAZARD containers
5. Know your blood borne pathogens plan

Venipuncture

- 21 Gauge needle most common; larger number = smaller hole (bore)
- If tourniquet is on for >1 min, it must be left off for 3 min before next attempt
- Tubes with ***no additives*** are filled ***first*** - Red top (do not invert)
- Tubes ***with additives*** are filled ***second*** - Purple top
- Caution: keep the needle well anchored while engaging/disengaging tubes

1. Patient sits or lies supine with elbows anchored/supported; clinician STANDS (never reach across table); organize equipment within easy reach
2. Cleanse puncture site; wipe dry or allow to air dry while gloving up
3. Apply tourniquet; patient clenches fist; palpate veins
4. Uncap needle; hold needle *bevel up*; anchor vein; puncture vein
5. Engage evacuated tube; release tourniquet; patient unclenches fist
6. Disengage tube once filled & insert next tube or if finished, withdraw needle
7. Have patient apply mild pressure with gauze for 5 min over puncture site
8. Dispose of needle in SHARPS & BIOHAZARD container as soon as possible
9. ***Label tubes ASAP***, apply bandage

RED TOP TUBE: Contains no anticoagulant or preservative; used for serum samples in which contact with serum separator gel may affect results

SERUM SEPARATOR TUBE (SST): Contains a gel which when centrifuged forms a barrier to separate the blood cells (clot) & the serum; used to collect serum for most routine medical surveillance testing

LAVENDER TOP TUBE: Contains EDTA as anticoagulant; used for various hematology procedures (CBC, hematocrit), cholinesterase & blood solvent determinations

ROYAL BLUE TOP TUBE: Contains EDTA & used for whole blood analysis of trace metals

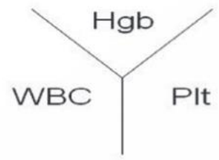
GRAY TOP TUBE: Contains sodium fluoride as preservative & potassium oxalate as anticoagulant; used for both whole blood & plasma analyses: glucose, acetone & alcohols

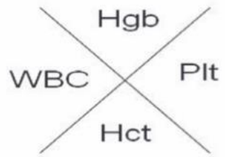
Finger Stick - have patient wash hands in warm water

1. Arrange equipment on a paper towel: lancet, alcohol wipes, gauze, capillary tubes, sealing clay, bandage
2. Choose appropriate finger (3rd or 4th most common); clean with alcohol & dry
3. Expose lancet & puncture; wipe away first drop of blood with gauze
4. Rhythmically & GENTLY squeeze fingertip from proximal to distal end; fill capillary tube being careful to avoid air gaps
5. After tube(s) are filled, apply gauze to finger tip & have patient hold with gentle pressure
6. Seal tube with clay

Synonyms: full blood count (FBC), full blood exam (FBE), blood panel, hemogram

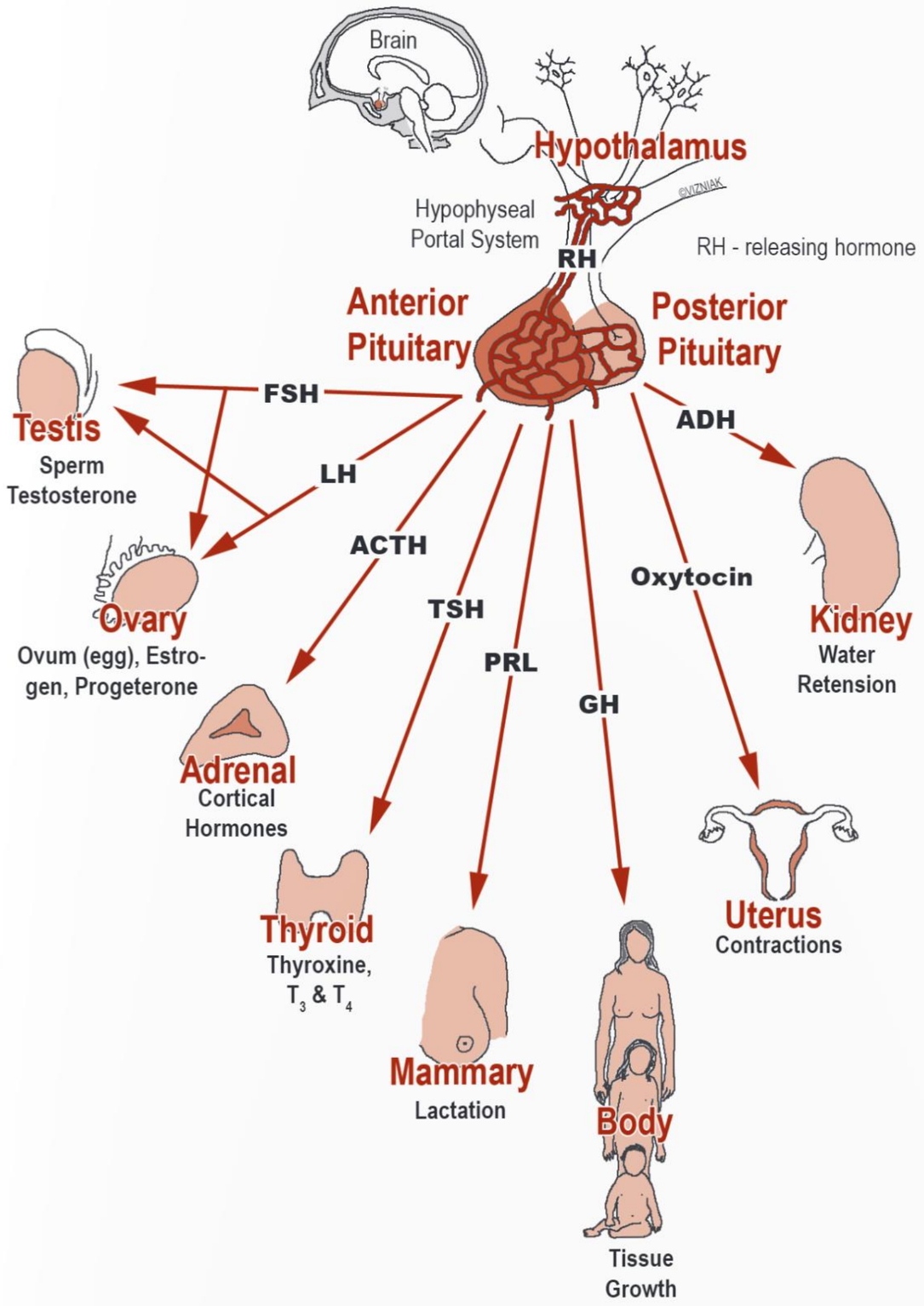
Diagrams on right is often used as short-hand for recording information in chart notes





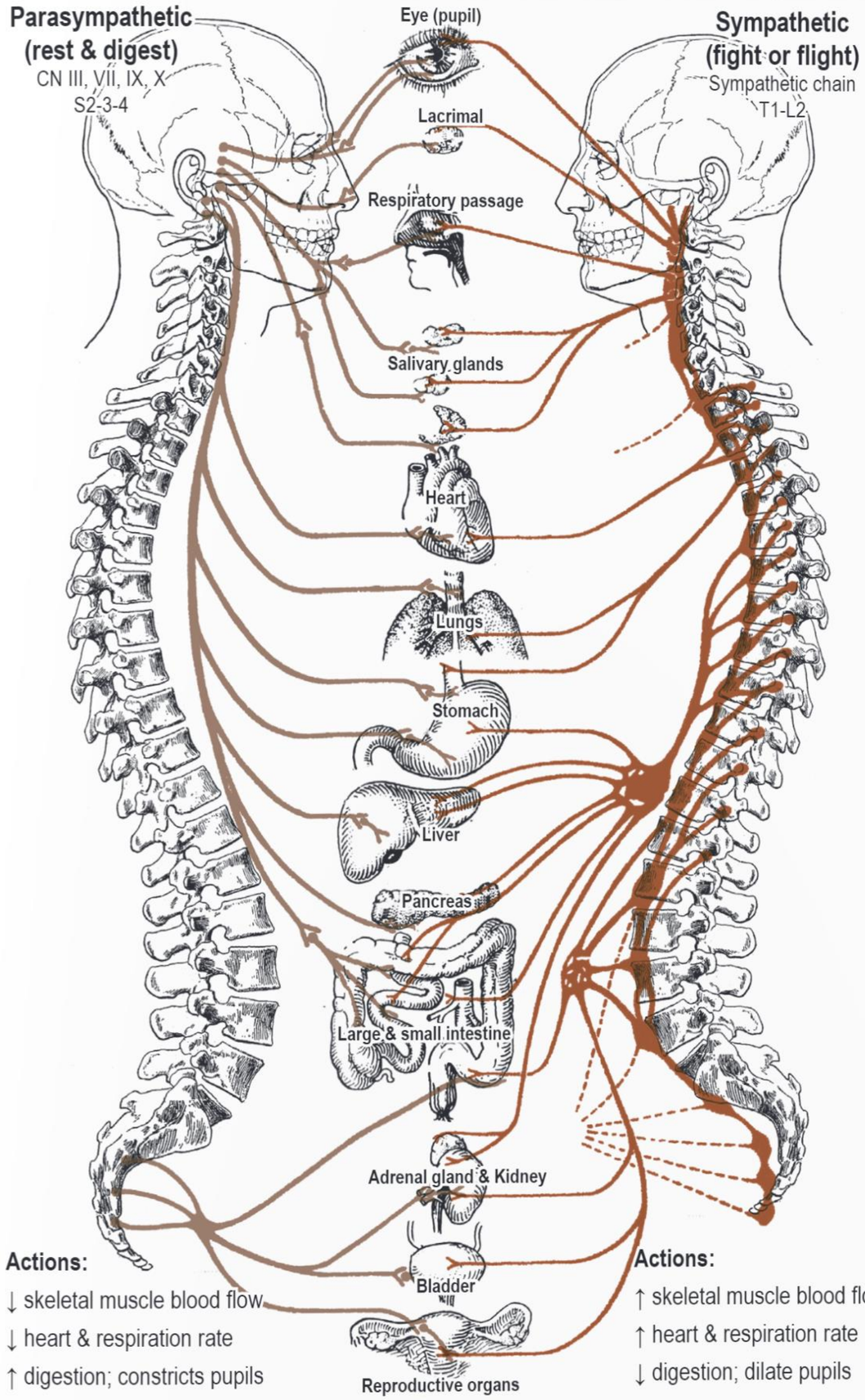
Determine if Anemic	**RBC count** ♂: *4.7 - 6.1 million/mcL* ♀: *4.2 - 5.4 million/mcL*	Absolute # of circulating RBCs per unit volume of blood • Indirect measure of the amount of circulating hemoglobin (i.e. oxygen carrying capacity of the blood) ↑ → polycythemia vera; ↓ → anemia
	Hemoglobin Concentration	Direct measure of weight of hemoglobin/unit volume of blood • Most sensitive measurement for existence of anemia • Used medically to judge need for transfusion ↑ → dehydration, polycythemia vera; ↓ → anemia, pregnancy
	HCT (Hematocrit) ♂: *40.7% - 50.3%* ♀: *36.1% - 44.3%*	PCV (Packed Cell Volume), ratio of the volume of the RBCs (after centrifugation) to that of whole blood ↑ → polycythemia vera, Addison's disease, acute pancreatitis ↓ → anemia, cystic fibrosis, CHF, pregnancy
Categorize type of anemia	**MCV** (Mean Corpuscular Volume) ♂: *13.8 - 17.2 gm/dL* ♀: *12.1 - 15.1 gm/dL*	Calculated measure of the size of the average circulating RBC **MCV = HCT/RBC x 10 (**Normocytic: 80 - 100 μm^3) • **Microcytic**: < 80μm^3 (fL); → iron deficiency anemia, leukocytosis • **Macrocytic**: >100 μm^3; → chronic alcoholism, methanol poisoning
	MCH (Mean Corpuscular Hb) *Normal: 27-32 pg/cell*	Calculated weight of hemoglobin in the average circulating RBC **MCH = HGB/RBC x 10 (**normochromic: 27-32 pg) • **Hypochromic**: <27 pg, **Hyperchromic**: >32 pg
	MCHC (Mean Corpuscular Hb Concentration) *Normal:* 32-36 g/dL	Average concentration of Hb in a given volume of packed cells **MCHC = HGB/HCT x 100 (**Normochromic: 320-360 g/L) • **Hypochromic**: <330 g/L → hemolytic anemia • **Hyperchromic**: >370 g/L → polycythemia vera, malignancy, leukemia, rheumatoid arthritis
RBC morphology		Microscope determinations from Wright's stained peripheral blood smear; **Microcytosis**: small MCV, **Macrocytosis**: large MCV • **Poikilocytosis**: different shapes
WBC count (Leukocyte count) *Norm: 4,500 - 10,000 cells/mcL*		Absolute quantification of total circulating WBC/unit volume blood • **Leukocytosis**: ↑ total WBC count → infection, inflammation, leukemia, bacterial infection • **Leukopenia**: ↓ total WBC count → aplastic anemia, pernicious anemia, severe infections, viral infections
WBC differential count -cytosis/-philia = ↑, -penia = ↓		**Neutrophilia** → Hodgkin's disease, infection **Lymphocytosis** → pertussis, mono, mumps, measles, tuberculosis **Monocytosis** → chronic infection, leukemia, protozoan infection **Eosinophilia** → allergies, parasitic infections, scarlet fever **Basophilia** → polycythemia vera, leukemia, chicken or small pox
Platelet count *Norm: 150 - 400 x 10^9/L*		Absolute quantification of circulating thrombocytes/volume **Thrombocytopenia** → B12 deficiency, leukemia, medication side-effect (heparin, quinidine, sulfonamide antibiotics, interferons)

→ may indicate/suggests/seen in, ↑ = increased, ↓ = decreased, Hb = hemoglobin, actual normal values for given test may vary slightly depending on laboratory



	Source & Name	Function
Anterior Pituitary	Follicle-stimulating hormone (FSH)	Sperm & egg development
	Luteinizing hormone (LH)	Estrogen, progesterone & testosterone secretion
	Adrenocorticotropin (ACTH)	Release of corticoids from adrenal gland
	Thyroid stimulating hormone (TSH)	↑ T3 & T4 secretion
	Prolactin (PL)	Lactation
	Growth hormone (GH)	↑ protein synthesis, lipolysis, ↑ blood glucose
Post. pit.	Antidiuretic hormone (ADH) (vasopressin)	↑ water reabsorption in kidney
	Oxytocin (OXY)	↑ uterine contractions during labor
Adrenal	Aldosterone (mineralcorticoid)	↑ blood Na^+ & water (↑ BP), ↓ blood K^+
	Cortisol (glucocorticoid)	Stress - gluconeogensis, lipolysis, ↓ inflammation
	Androgens	Male secondary sexual characteristics
	Epinephrine & norepinephrine	Sympathetic response (fight or flight)
Testis	Testosterone	Male secondary sexual characteristics, regulate spermatogensis
Ovary	Estrogen & Progesterone	Female secondary sexual characteristics, regulate menstrual cycle & oogensis
	Relaxin	↑ ligament laxity prior to birth (pubic symphysis)
Thyroid	Thyroxine (T_4), Triiodothyronine (T_3)	↑ basal metabolic rate, ↑ protein synthesis, ↑ ATP generation, ↑ lipolysis, accelerate growth
	Calcitonin	↓ blood calcium (inhibits osteoclast activity)
Para-thyroid	Parathormone (PTH)	↑ blood Ca^{2+} levels (increases osteoclast activity & Ca^{2+} reabsorption in kidneys & GI tract)
Pancrease	Insulin (alpha cells)	↓ blood glucose (↑ cell uptake, glycogensis), ↑ lipogensis & protein synthesis
	Glucagon (beta cells)	↑ blood glucose (glycogenolysis, gluconeogensis)
Kidney	Erythropoietin (EPO)	↑ red blood cell formation
	Calcitriol* (vitamin D)	↑ absorption of Ca^{2+} & phosphorus
	Renin	Renin-angiotensin-aldosterone pathway = ↑ BP
Stom-ach	Gastrin	↑ gastric juice secretion, ↑ stomach motility
Duodenum	Cholecystokinin (CCK)	↑ pancreatic juice secretion, gall bladder contraction, causes satiety
	Secretin	↑ pancreatic juice & bile secretion, ↓ stomach emptying

*synthesis starts in skin with sun light, continues to liver & active form made in kidney

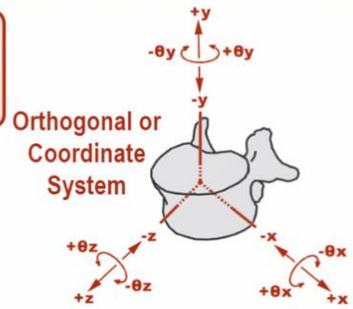


Actions:
- ↓ skeletal muscle blood flow
- ↓ heart & respiration rate
- ↑ digestion; constricts pupils

Actions:
- ↑ skeletal muscle blood flow
- ↑ heart & respiration rate
- ↓ digestion; dilate pupils

Appendix/Index
Appendix/Index

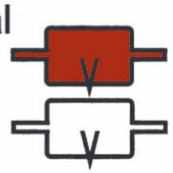
Joints may have a static *malposition* (bone out of place) or they can have a *restriction* of motion with normal static position but abnormal motion.



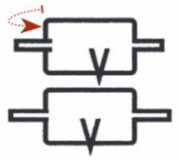
Orthogonal or Coordinate System

Neutral

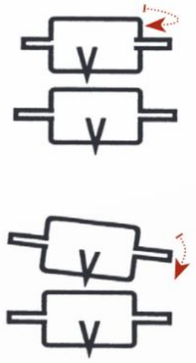
Listings given refer to the position of the superior vertebrae in relation to the vertebrae below



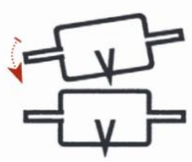
Medicare: Left Rot. Malposition
National: LP (Left post. Body)
Gonstead: PR (Post. Right SP)
Motion: Right Rot. Rest.
Orthogonal: +θy malposition
Osteopathic: L rotation lesion



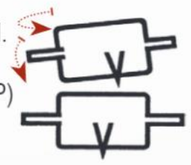
Medicare: Right Rot. Malposition
National: RP (Right post. Body)
Gonstead: PL (Post. Left SP)
Motion: Left Rot. Rest.
Orthogonal: -θy malposition
Osteopathic: R rotation lesion



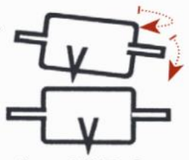
Medicare: Right Lat. Flex. Mal.
National: RI (Right inf. Body)
Gonstead: none
Motion: Left Lat. Flex. Rest.
Orthogonal: +θz malposition
Osteo.: R side-bending lesion



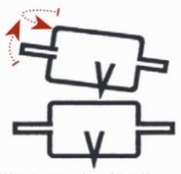
Medicare: Left Lat. Flex. Mal.
National: LI (Left inf. Body)
Gonstead: none
Motion: Right Lat. Flex. Rest.
Orthogonal: -θz malposition
Osteo: L side-bending lesion



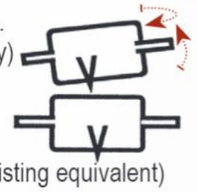
Medicare: L Rot. L Lat. Flex. Mal.
National: LPI (L post. inf. Body)
Gonstead: PRS (Post. R sup. SP)
Motion: R Rot. R Lat Flex. Rest.
Orthogonal: +θy, -θz mal.
Osteo: Csp: NNS_LR_L or NR_LS_L; Tsp/Lsp: NNR_LS_L



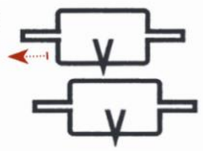
Medicare: R Rot. R Lat. Flex. Mal.
National: RPI (R post. inf. Body)
Gonstead: PLS (Post. L sup. SP)
Motion: L Rot. L Lat. Flex. Rest.
Orthogonal: -θy, +θz mal.
Osteo: Csp: NNS_RR_R or NR_RS_R; Tsp/Lsp: NNR_RS_R



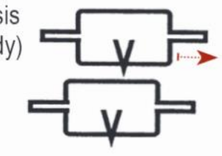
Medicare: L Rot. R Lat. Flex. Mal.
National: LPS (L post. sup. body)
Gonstead: PRI (Post. R inf. SP)
Motion: R Rot. L Lat. Flex. Rest.
Orthogonal: +θy, +θz mal.
Osteo: Tsp/Lsp: NS_RR_L (no Csp listing equivalent)



Medicare: R Rot. L Lat. Flex Mal.
National: RPS (R post. sup. body)
Gonstead: PLI (post. L inf. SP)
Motion: L Rot. R Lat. Flex. Rest.
Orthogonal: -θy, -θz mal.
Osteo: Tsp/Lsp: NS_LR_R (no Csp listing equivalent)



Medicare: Left Lateral Listhesis
National: LL (Left Lat. body)
Gonstead: none
Motion: Right lateral restriction
Orthogonal: +x malposition



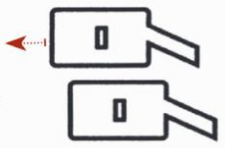
Medicare: Right Lateral Listhesis
National: RL (Right Lateral Body)
Gonstead: none
Motion: Left lateral restriction
Orthogonal: -x malposition



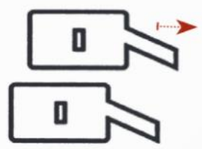
Medicare: Flexion Malposition
National: AI (Ant. Inf. Body)
Gonstead: none
Motion: Extension Restriction
Orthogonal: +θx malposition



Medicare: Extension Malposition
National: PI (post. inf. Body)
Gonstead: P (post. SP)
Motion: Flexion Restriction
Orthogonal: -θx malposition



Medicare: Anterolisthesis
National: A (anterior body)
Gonstead: none
Motion: Posterior Restriction
Orthogonal: +z malposition



Medicare: Retrolisthesis
National: P (posterior body)
Gonstead: P (posterior SP)
Motion: Anterior Restriction
Orthogonal: -Z malposition

Rot. = rotation, Mal. = Malposition, SP = spinous process, inf. = inferior, sup. = Superior, post. = posterior, Ant. = anterior, Lat. = lateral, L = Left, R = Right, Rest. = Restriction, Flex. = Flexion, Ext. = Extension, R_R = rotation right, R_L = rotation left, S_R = side-bending right, S_L = side-bending left, N = neutral (also be noted as F), NN = non-neutral (also be noted as E), L = left, R = right, Csp = cervical spine, Tsp = thoracic spine, Lsp = lumbar spine

Upper Extremity Practical Exam

The candidate has 10 minutes to complete this section of the exam. Give the candidate 1 condition from the list and ask them to perform a regional exam

Proctor: _____ Date: _____

Body region: ☐ **shoulder,** ☐ **elbow,** ☐ **wrist & hand**

History: ask candidate to give Hx, SSx & DDx associated with one condition of region (3)

Condition: _____
☐ **Hx:** _____
☐ **SSx:** _____
☐ **DDx:** _____

H Score: /3

Inspection: give 2 inspection parameters they may evaluate for this body region (1)

☐ _____ (½)
☐ _____ (½)

I Score: /1

Palpation: ask candidate to palpate 2 structures in the region (2)

☐ _____
☐ _____

P Score: /2

Motion: ask candidate to perform a single AROM, PROM or RROM assessment on region (4)
(Introductory statement - hands on assessment, verbalize bilateral comparison, ask for a single ROM tissue list)

☐ **AROM** (intro statement): _____
☐ **PROM** (with end play): _____
☐ **RROM** (correct instructions): _____
☐ **Tissue list:** _____
(give a list of tissue stretched/compressed,bone, ligament, muscle, nerve, blood vessel, viscera)

M Score: /4

Neurovascular: Ask candidate to perform 2 parameters for evaluated (2)

☐ **Neurologic:** sensation, DTRs, muscle test _____
☐ **Vascular:** pulse, capillary refill, temperature of region _____

N Score: /2

Referred Pain: provide 2 areas/conditions that may refer pain to the assessment area (1)

☐ _____ (½)
☐ _____ (½)

R Score: /1

Special Tests: ask candidate to perform 3 named orthopedic tests from list provided (12)

Test	Patient position	Contacts	Ability & confidence	Explanation	Total
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	

0 = inability to perform task; 0.5 partial ability to perform task; 1 acceptable ability to perform task

S Score: /12

Proctors option: any clinically relevant question you believe should be in the candidates knowledge base (1 bonus)

_____

Total: x 4 = %

Candidate:

Total: /100%

Comments

Conditions

Shoulder
- AC sprain
- Bicipital tendinopathy
- Brachial neuritis
- Calcific tendinopathy
- Frozen shoulder
- Glenohumeral instability
- Glenoid labral tear
- GH dislocation
- Supraspinatus imping.
- Subscap. tendinopathy
- Supraspinatis tendonitis
- Thoracic outlet syn.

Elbow
- Toddler's elbow
- Elbow osteochondritis
- Lateral epicondylitis
- Medial epicondylitis
- Olecranon bursitis

Wrist
- Carpal tunnel syndrome
- de Quervain's
- Thumb (UCL)
- Wrist sprain
- Carpal instability
- Scaphoid fracture
- Lunate dislocation
- Triangular fibrocart. tear
- Ganglion cyst
- Dupuytren contracture

Special Tests

Shoulder
- Apley's Scratch test
- Biceps load test II
- Brachial stretch test
- Clunk or Crank
- Drop arm test (Codman's)
- Empty can
- Faegan's test
- GH apprehension test
- Hawkins-Kennedy
- Lift off test
- Lippmans or Yergason's
- Neer's or Speed's
- O'Brien's
- Roos' or Wright's

Elbow
- Cozen's or Mill's test
- Reverse Cozen's or Mill's
- Pronator teres test
- Tinel's at the elbow
- Valgus stress test
- Varus stress test

Wrist & Hand
- Allen test
- Finkelstein's test
- Froment's sign
- Load test for TFCC
- Phalen's test
- Reverse Phalen's test
- Tinel's sign

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Form a study group and practice going through the clinical exam procedure to improve performance

Lower Extremity Practical Exam

The candidate has 10 minutes to complete this section of the exam. Give the candidate 1 condition from the list and ask them to perform a regional exam

Proctor: _____ Date: _____

Body region: □ hip, □ knee, □ ankle foot

History: ask candidate to give Hx, SSx & DDx associated with one condition of region (3)

Condition: _____

□ Hx: _____

□ SSx: _____

□ DDx: _____

H Score: /3

Inspection: give 2 inspection parameters they may evaluate for this body region (1)

□ _____ (½)

□ _____ (½)

I Score: /1

Palpation: ask candidate to palpate 2 structures in the region (2)

□ _____

□ _____

P Score: /2

Motion: ask candidate to perform a single AROM, PROM or RROM assessment on region (4)

(Introductory statement - hands on assessment, verbalize bilateral comparison, ask for a single ROM tissue list)

□ **AROM** (intro statement): _____

□ **PROM** (with end play): _____

□ **RROM** (correct instructions): _____

□ **Tissue list:** _____

(give a list of tissue stretched/compressed,bone, ligament, muscle, nerve, blood vessel, viscera)

M Score: /4

Neurovascular: Ask candidate to perform 2 parameters for evaluated (2)

□ **Neurologic:** sensation, DTRs, muscle test _____

□ **Vascular:** pulse, capillary refill, temperature of region _____

N Score: /2

Referred Pain: provide 2 areas/conditions that may refer pain to the assessment area (1)

□ _____ (½)

□ _____ (½)

R Score: /1

Special Tests: ask candidate to perform 3 named orthopedic tests from list provided (12)

Test	Patient position	Contacts	Ability & confidence	Explanation	Total
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	

0 = inability to perform task; 0.5 partial ability to perform task; 1 acceptable ability to perform task

S Score: /12

Proctors option: any clinically relevant question you believe should be in the candidates knowledge base (1 bonus)

_____ Total: x 4 = %

Candidate:

Total: /100%

Comments

Conditions

Hip & thigh
- Femoral/Inguinal hernia
- Leg length inequality
- Groin strain
- Hamstring strain
- Hip DJD
- Acetabular labral tear
- Legg-Calve-Perth (AVN)
- Myositis ossificans
- Slipped femoral epiphysis
- Snapping hip
- Transient hip synovitis

Knee
- ACL or PCL Sprain
- MCL or LCL Sprain
- Meniscus tear
- Chondromalacia patellae
- ITB syndrome
- Osteochondritis dess.
- Osgood Schlatter's
- Patella dislocation
- Tibila stress fracture

Leg, Ankle & Foot
- Inversion ankle sprain
- Compartment syndrome
- Deep vein thrombosis
- Achilles tendonitis
- Morton's neuroma
- Metatarsal stress Fx
- Plantar fascitis
- Over pronation syndrome

Special Tests

Hip & SI
- Thomas Gaenslen test
- Trendelenburg test
- Allis/Skyline view
- Ober's test
- Patrick's test
- Noble's compression test
- Scouring test (Quadrant)
- Piriformis test
- Hibbs (prone gapping)
- Yeoman's test
- Nachla's/Ely's test
- SI joint play

Knee
- Valgus/Varus stress test
- Lachman's test
- Anterior/posterior drawer
- Apley's comp./dist. test
- Apley's distraction test
- Bounce home test
- Patellar apprehension
- Patellar grind test
- Clark's test
- McMurray's test

Ankle & Foot
- Anterior/Posterior drawer
- Tinel's (peroneal nerves)
- Thompson's Squeeze
- Rigid supple Pes planus
- Talar tilt test
- Metatarsal squeeze test
- Tibial Torsion test

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Spinal Practical Exam

The candidate has 10 minutes to complete this section of the exam. Give the candidate 1 condition from the list and ask them to perform a regional exam

Proctor: _____ Date: _____

Body region: □ TMJ, □ C-spine, □ T-spine/ribs, □ L-spine, □ Sacroiliac/pelvis

History: ask candidate to give Hx, SSx & DDx associated with one condition of region (3)

Condition: _____

□ Hx: _____

□ SSx: _____

□ DDx: _____

H Score: /3

Inspection: give 2 inspection parameters they may evaluate for this body region (1)

□ _____ (½)

□ _____ (½)

I Score: /1

Palpation: ask candidate to palpate 2 structures in the region (2)

□ _____

□ _____

P Score: /2

Motion: ask candidate to perform a single AROM, PROM or RROM assessment on region (4)

(Introductory statement - hands on assessment, verbalize bilateral comparison, ask for a single ROM tissue list)

□ **AROM** (intro statement): _____

□ **PROM** (with end play): _____

□ **RROM** (correct instructions): _____

□ **Tissue list:** _____

(give a list of tissue stretched/compressed,bone, ligament, muscle, nerve, blood vessel, viscera)

M Score: /4

Neurovascular: Ask candidate to perform 2 parameters for evaluated (2)

□ **Neurologic:** sensation, DTRs, muscle test _____

□ **Vascular:** pulse, capillary refill, temperature of region _____

N Score: /2

Referred Pain: provide 2 areas/conditions that may refer pain to the assessment area (1)

□ _____ (½)

□ _____ (½)

R Score: /1

Special Tests: ask candidate to perform 3 named orthopedic tests from list provided (12)

Test	Patient position	Contacts	Ability & confidence	Explanation	Total
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	
	0...0.5...1	0...0.5...1	0...0.5...1	0...0.5...1	

0 = inability to perform task; 0.5 partial ability to perform task; 1 acceptable ability to perform task

S Score: /12

Proctors option: any clinically relevant question you believe should be in the candidates knowledge base (1 bonus)

_____ Total: x 4 = %

Candidate:

Total: /100%

Comments

Conditions

Cervical & TMJ
- Cervical radiculopathy
- Burner/Stinger
- Cervical facet syndrome
- Sprain/strain (whiplash)
- Cervical DJD
- Cervicogenic headache
- Migraine headache
- Cluster headache
- Pathologic headache
- Stroke or TIA
- Benign positional vertigo
- TMJ syndrome

T-spine & Ribs
- Scoliosis
- Scheuermann's disease
- Compression fracture
- Postural syndrome
- Herpes Zoster (shingles)
- Vertebral subluxation
- Rib subluxation

Lumbar & Sacroiliac
- Pelvic instability
- Leg length inequality
- Piriformis syndrome
- Ankylosing spondylitis
- Lumbar disc herniation
- Lumbar facet syndrome
- Lumbar sprain/strain
- Lumbar spondylolithesis
- Lumbar DJD
- Abdominal aneurysm

Special Tests

C-Spine
- Vertebral Artery test (VBI)
- Transverse lig. stress test
- Alar ligament stress test
- Cervical distraction test
- Cervical compression test
- Kernig's (Dural Slump)
- Foraminal compression
- Soto-Hall test (Brudinski)
- Shoulder depression test
- Brachial stretch test

T-Spine
- Adam's sign
- Dural Slump
- Scapular approximation
- Adson's or Reverse
- Wright's
- Costoclavicular maneuver
- Wright's hyperabduction

L-Spine
- Kernig's (Dural Slump)
- SLR (Laseque)
- Braggard's test
- Bechterew's (seat SLR)
- Belt test (SI vs lumbar)
- Burns Bench test (maling)
- Kemp's (Quadrant)
- Lindner's test
- Hoover test (malingering)
- Milgram test (leg lift test)
- Minor's Sign
- Valsalva
- Murphy's punch (kidney)

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Practical Exam

The candidate has 15 minutes to complete this section of the exam.
0 = inability to perform task; 0.5 partial ability to perform task; 1 acceptable ability

Proctor: _____

Region: □ **C-spine,** □ **T-spine,** □ **L-spine & SI,** □ **shoulder,** □ **elbow,** □ **wrist & hand,** □ **hip,** □ **knee,** □ **ankle foot**

History: give findings associated with 1 condition .....(____/4)

Condition: circle on list

□ **Hx:** _____

□ **SSx:** _____

□ **DDx:** _____

□ **Tx:** _____

Palpation: list of structures below hand .....(____/5)

□ _____ **(muscle, bone, lig., nerve, vessle, joint)**

Motion: ROM/functional assessment on region .....(____/3)

□ **AROM** (intro statement): _____

□ **PROM** (with end play): _____

□ **RROM** (correct instructions): _____

Neurovascular: perform 1 muscle test for region .....(____/3)

□ Muscle test / DTR / sensation _____

Special tests: perform 3 orthopedic/functional tests ..(____/3)

test may be from **any** region of body evaluate position, contacts, ability & explanation

□ _____ **(1)**

□ _____ **(1)**

□ _____ **(1)**

Basic understanding: .....(____/2)

□ **List 5 factors that improve healing time? or slow healing time?**

□ **What are the 3 parts of a basic diagnosis?** (stage, severity, pathoanatomy and give an example)

Treatment: demonstrate a treatment protocol .....(____/5)

indications, contraindications,**application**, confidence, follow-up

□ **Stretching** _____

□ **Strengthen rehab.** _____

□ **Pin & Stretch** _____

□ **Contract/relax** _____

□ **IASTM** _____

□ **Mobes/Manip** _____

□ **Electrotherapy** _____

□ **Dry needle/acupuncture** _____

Total: /25

Candidate:

Conditions

Shoulder
- AC sprain
- Bicipital tendinopathy
- Brachial neuritis
- Calcific tendinopathy
- Frozen shoulder
- Glenohumeral instability
- Glenoid labral tear
- GH dislocation
- Supraspinatus imping.
- Reflex Symp. Dystrophy
- Subscap. tendinopathy
- Supraspinatis tendonitis
- Thoracic outlet syn.

Elbow
- Toddler's elbow
- Elbow osteochondritis
- Lateral epicondylitis
- Medial epicondylitis
- Olecranon bursitis

Wrist
- Carpal tunnel syndrome
- de Quervain's
- Thumb (UCL)
- Wrist sprain
- Carpal instability
- Scaphoid fracture
- Lunate dislocation
- Triangular fibrocart. tear
- Ganglion cyst
- Dupuytren contracture

Hip & thigh
- Femoral/Inguinal hernia
- Avascular necrosis hip
- Groin strain
- Hamstring strain
- Hip DJD
- Acetabular labral tear
- Legg-Calve-Perthes
- Myositis ossificans
- Slipped femoral epiphysis
- Snapping hip
- Transient hip synovitis

Knee
- ACL Sprain or PCL Sprain
- MCL Sprain or LCL Sprain
- Meniscus tear
- Chondromalacia patellae
- Iliotibial band syndrome
- Osteochondritis dissecans
- Osgood Schlatter's
- Patella dislocation
- Tibila stress fracture

Leg, Ankle & Foot
- Inversion ankle sprain
- Compartment syndrome
- Deep vein thrombosis
- Varicose veins
- Achilles tendonitis
- Morton's neuroma
- Metatarsal stress Fx
- Plantar fascitis
- Over pronation syndrome

Lumbar & Sacroiliac
- Pelvic instability
- Leg length inequality
- Piriformis syndrome
- Ankylosing spondylitis
- Lumbar disc herniation
- Lumbar facet syndrome
- Lumbar sprain/strain
- Lumbar spondylolithesis
- Lumbar DJD
- Abdominal aneurysm

Thoracic & Costal
- Scoliosis
- Scheuermann's disease
- Compression fracture
- Postural syndrome
- Herpes Zoster (shingles)
- Vertebral subluxation
- Rib subluxation

Cervical & TMJ
- Cervical radiculopathy
- Burner/Stinger
- Cervical facet syndrome
- Sprain/strain (whiplash)
- Cervical DJD
- Cervicogenic headache
- Migraine headache
- Cluster headache
- Pathologic headache
- Stroke or TIA
- Benign positional vertigo
- TMJ syndrome

C-Spine
- Vertebral Artery test (VBI)
- Transverse lig. stress test
- Alar ligament stress test
- Cervical distraction test
- Cervical compression test
- Door bell test
- Kernig's (Dural Slump)
- Foraminal compression
- Soto-Hall test (Brudinski)
- Shoulder depression test
- Brachial stretch test

T-Spine
- Adam's sign
- Dural Slump
- Scapular approximation
- Adson's
- Halstead's
- Wright's hyperabduction

L-Spine
- Kernig's (Dural Slump)
- Straight leg raise (Laseque)
- Braggard's test
- Bechterew's (seated SLR)
- Belt test (SI vs lumbar)
- Burns Bench test
- Kemp's (Quadrant)
- Lindner's test
- Hoover test (malingering)
- Milgram test (leg lift test)
- Minor's Sign
- Valsalva
- Murphy's punch (kidney)

Shoulder
- Apley's Scratch test
- Drop arm test (Codman's)
- GH apprehension test
- Hawkins-Kennedy
- O'Brien's
- Neer's or Speed's
- Lippmans test
- Roos' test
- Yergason's test
- Clunk or crank

Elbow
- Valgus stress test
- Varus stress test
- Tinel's at the elbow
- Cozen's test
- Mill's test
- Pronator teres test

Wrist & Hand
- Finkelstein's test
- Phalen's test
- Retinacular test
- Tinel's Sign
- Reverse Phalen's test
- Froments Sign
- Allen test
- Cap refill test
- Load test for TFCC

Hip & SI
- Thomas test
- Trendelenburg test
- Leg length discrepancy
- Allis/Skyline view
- Ober's test
- Ortolani click
- Patrick's test
- Noble's compression test
- Scouring test (Quadrant)
- Piriformis test
- Gaenslen
- Hibbs (prone gapping)
- Yeoman's test
- Nachla's/Ely's test
- SI joint play (AS & PI)

Knee
- Valgus/Varus stress test
- Lachman's test
- Anterior/posterior drawer
- Apley's comp./dist. test
- Apley's distraction test
- Bounce home test
- Patellar apprehension
- Patellar grind test
- Clark's test
- McMurray's test

Ankle & Foot
- Anterior/Posterior drawer
- Dorsiflexion test
- Homan's sign
- Tinel's (peroneal nerves)
- Thompson's Squeeze test
- Rigid supple Pes planus
- Talar tilt test
- Metatarsal squeeze test
- Tibial Torsion test

Signature:

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Form a study group and run sample practice exams for testing

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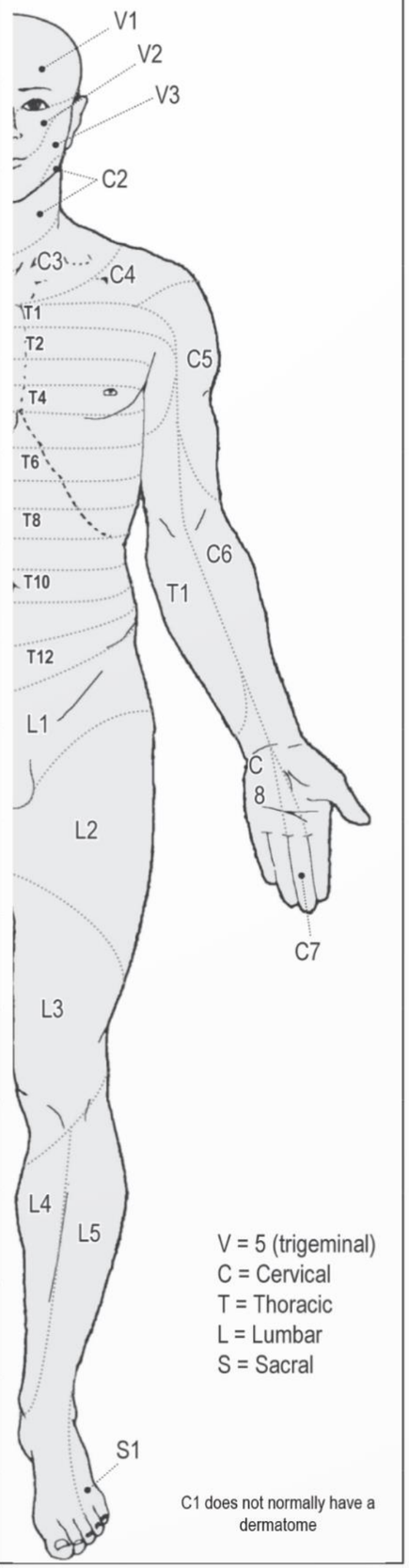
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(P)	pain
(R)	right
(L)	left
↑	increase
↓	decrease
→	causes / may indicate or suggest
(-)	negative
(+)	positive
AC	acromioclavicular joint
ADL	activity of daily living
AF	acetabulofemoral joint
AIS	adolescent idiopathic scoliosis
AP	anterior to posterior
AROM	active range of motion
AAROM	active assisted range of motion
AS	ankylosing spondylitis
ASIS	anterior superior iliac spine
AVN	avascular necrosis
BHK	bachelor of human kinetics
BP	blood pressure
cc	chief complaint, chief concern
CI	contra-indication
CMC	carpometacarpal joint
CPRs	clinical prediction rules
CSCS	certified strength & conditioning specialist
CT	computed tomography
CTS	carpal tunnel syndrome
DC	doctor of chiropractic
DDx	differential diagnosis
DIP	distal interphalangeal joint
DJD	degenerative joint disease
DN	dry needling
DO	doctor of osteopathy
DOI	date of injury
DOMS	delayed onset muscle soreness
DTR	deep tendon reflex (muscle stretch reflex)
Dx	diagnosis
ext	extension/external
FABQ	Fear-Avoidance Beliefs Questionnaire (FABQ)
FID	frequency, intensity, duration
flex	flexion
FMP	functional movement pattern
Fx	fracture
GH	glenohumeral
GMMT	general manual muscle testing
HA	headache
HIP-MNRS	history, inspection, palpation - motion, neurovascular screen, referred, special tests
HTN	hypertension
Hx	history
HVLA	high velocity low amplitude
IAM	instrument assited mobilization
IASTM	instrument assisted soft tissue mobilization
ICD	international classification of disease
IMS	intermuscular stimulation
IVD	intervertebral disc
IVF	intervertebral foramen
KIS	keep it simple
LBP	low back pain
LLI	leg length inequality
LMP	licensed massage practitioner
LMNL	lower motor neuron lesion
LOC	loss of consciousness
MCP	metacarpophalangeal joint
MD	medical doctor
MEAT	motion, exercise, analgesic, treatment
MFR	myofascial release
MFTP	myofascial trigger point
MMT	manual muscle testing
MRI	magnetic resonance imaging
MVA	motor vehicle accident
NCS	nerve conduction study
ND	naturopathic doctor
NMS	neuromusculoskeletal
NRS	numeric rating scale
NSAID	non-steroidal anti-inflammatory medication
OA	osteoarthrosis
OM	osseous manipulation
OT	occupational therapist
OTC	over the counter (medication)
PA	posterior to anterior
PAR-Q	**procedures, alternatives, risk - questions**
PhD	doctor of philosophy
PIR	post isometric relaxation
PFROM	pain free ROM
PRICE	protect, rest, ice, compress, elevate
PRN	patient return as needed
PROM	passive range of motion
pt	patient
PT	physical therapist
PTR	patient to return
Px	prognosis
RA	rheumatoid arthritis
RMT	registered massage therapist
ROF	review of findings
ROM	range of motion
SCFE	slipped capital femoral epiphysis
SLAP	superior labrum anterior posterior (tear)
SMART	specific, measurable, attainable, realistic, time
SOL	space occupying lesion
SP	spinous process
STM	soft tissue manipulation
TBI	traumatic brain injury
TENS	transcutaneous electrical nerve stimulation
TIA	transient ischemic attack
TFC	triangular fibrocartilage (ulnar meniscus)
TOS	thoracic outlet syndrome
tp	tender point
TP, TvP	transverse process
Tx	treatment
UA	urinalysis
UMNL	upper motor neuron lesion
US	ultrasound
VAS	visual analog scale (0-10 pain rating)
VBI	vertebral basilar insufficiency
VRS	verbal rating scale (0-10)
WNL	within normal limits

Neuro Rapid Review

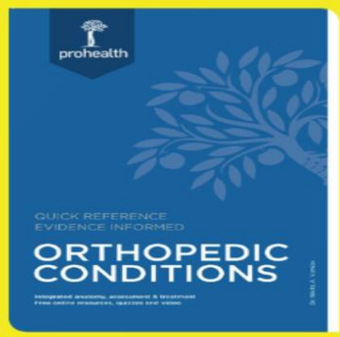
Level	Reflex	Myotome	Dermatome
V Trigeminal	Jaw jerk, Corneal	Mandibular movements	
C1	-	Capital flexion	
C2	-	Capital flexion	
C3	-	Cervical lateral flexion	
C4	Biceps	Shoulder elevation	
C5	Biceps	Shoulder abduction	
C6	Brachioradialis	Elbow flexion, wrist extension	
C7	Triceps	Elbow extension, wrist flexion	
C8	Triceps	Finger flexion, thumb extension	
T1	-	Finger adduction & abduction	
T7-12	Abdominal reflex	Trunk flexion & extension	
L1	Cremasteric	Hip flexion	
L2	Cremasteric	Hip flexion	
L3	Patellar	Knee extension	
L4	Patellar	Ankle dorsiflexion	
L5	Medial hamstring	Big toe extension	
S1	Achilles	Plantar flexion & eversion	





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- Soft Tissue Mobilization & IASTM
- Joint Mobilization & Manipulation
- Pin & Stretch, Electrotherapy
- Acupuncture & Dry Needling
- Rehab., Taping & Nutrition
- 1500+ Images & Clinic Forms



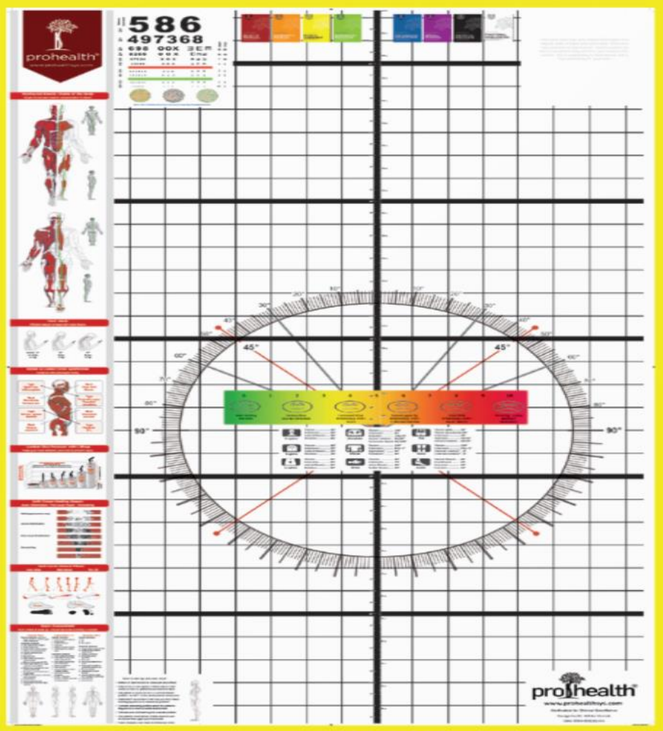
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- Top 300+ conditions seen in practice
- Advanced assessment & treatment
- Integrated multidisciplinary management
- Nutrition, Imaging & Rehab.
- Manual medicine techniques
- 1500+ Images



SPINAL MANUAL

- Advanced assessment & treatment
- Integrated multidisciplinary management
- General & specific regional exams
- Neurologic, orthopedic & special tests
- Nutrition, Imaging & Rehab.
- 2500+ medications, 1500+ images

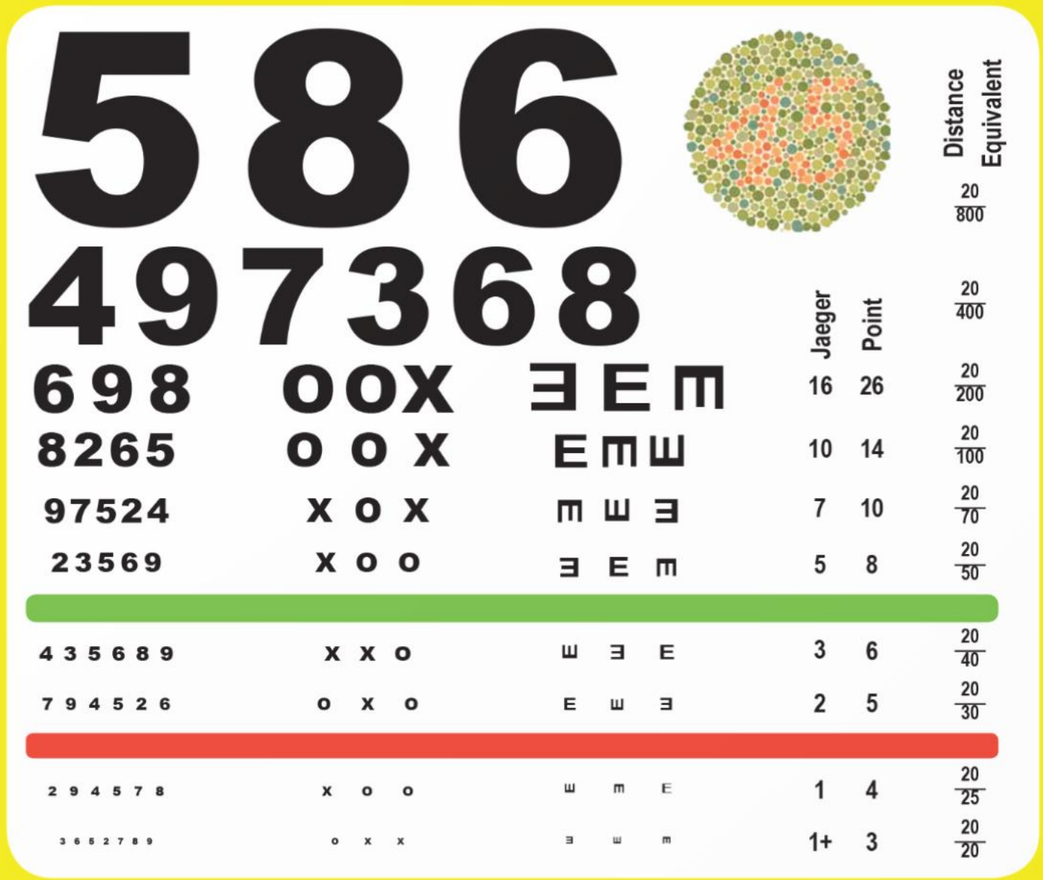


POSTURE CHART

- Posture grid
- Height (inches/cm)
- Eye chart
- Pain scale
- ROM of entire body
- Myofascial trains
- Cross syndromes
- Lumbar disc pressure
- Tissue healing stages
- Gait cycle



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