

Brachial Plexus & Median Nerve

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Brachial Plexus

- The **Brachial plexus** is a **network of nerves** that **supplies the shoulder, arm, forearm, and hand**. It carries **motor (movement) and sensory (feeling) signals** between the spinal cord and the upper limb.
- Origin: Formed from the **ventral rami of spinal nerves**:
- **C5**
- **C6**
- **C7**
- **C8**
- **T1**
- It is the **nerve network** that **controls the entire upper limb**.

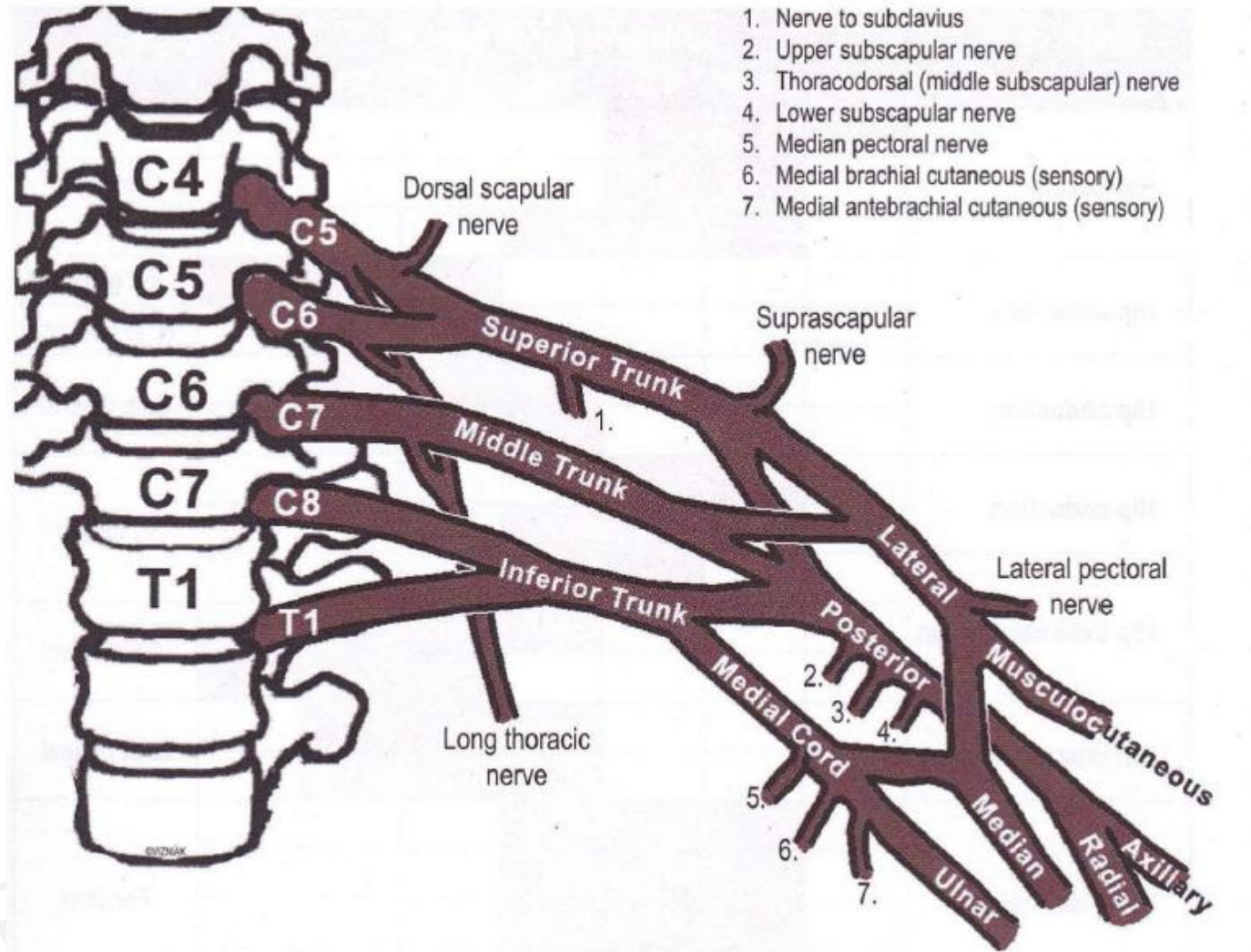


Brachial Plexus

Parts of the Brachial Plexus

- The brachial plexus has **5 main parts** (**Roots** → **Trunks** → **Divisions** → **Cords** → **Branches**).
- **Roots**
- C5
- C6
- C7
- C8
- T1

These roots come directly from the **spinal cord**.



Trunks:

- Roots join to form three trunks:
- Upper trunk → C5 + C6
- Middle trunk → C7
- Lower trunk → C8 + T1

Divisions:

Each trunk divides into:

- Anterior division
- Posterior division

So there are **6 divisions in total**.



Cords:

Divisions form three cords named according to their position around **the axillary artery:**

1. Lateral cord :formed by Ant. Division of upper & middle trunks
2. Medial cord: formed by Ant division of lower trunk
3. Posterior cord: formed by posterior division of all three trunks

Terminal Branches:

1. Musculocutaneous
2. Axillary
3. Radial
4. Median
5. Ulna

These nerves control **movement and sensation of the arm and hand.**



Function: Brachial Plexus

The brachial plexus provides:

Motor function:

- Shoulder movement
- Arm movement
- Wrist movement
- Finger movement

Sensory function:

- Feeling from:
 - Shoulder
 - Arm
 - Forearm
 - Hand



Brachial Plexus

Clinical Importance:

- Injury to the brachial plexus can cause:
- Weakness or paralysis of the arm
- Loss of sensation (anesthesia) in the upper limb
- Altered sensation(Paresthesia)

Conditions like:

- Erb's palsy
- Klumpke's palsy



Erb's palsy

Erb's palsy is a condition caused by injury to the **upper part of the Brachial plexus, usually involving the C5 and C6 nerve roots**. It leads to weakness or paralysis of the shoulder and upper arm muscles.

Causes:

- **Birth injury** during difficult delivery (excess traction on baby's neck).
- **Trauma/falls/Accident** that violently separates the neck & shoulder due to motor vehicle accident.(thrown and lands on the head and shoulder).
- **Sports injuries** (e.g., strong shoulder stretch).



Erb's palsy

Nerves Involved:

Mainly **C5 and C6** spinal nerves.

These nerves supply muscles responsible for:

- Shoulder abduction
- External rotation of shoulder
- Elbow flexion.

Muscles Affected:

- Deltoid muscle
- Biceps brachii
- Brachialis muscle
- Supraspinatus muscle
- Infraspinatus muscle

These muscles help with lifting the arm and bending the elbow.



Characteristic Deformity

“Waiter’s Tip Position”

Arm position includes:

- Arm adducted (close to the body)
- Shoulder internally rotated
- Elbow extended
- Forearm pronated
- Wrist flexed

This appearance is called the waiter’s tip posture/ deformity.



Erb's palsy

Symptoms:

- Weakness in the shoulder and upper arm
- Inability to lift the arm
- Difficulty bending the elbow
- Loss of sensation in the lateral arm
- Reduced muscle reflexes (especially biceps reflex)



Erb Palsy (Erb-Duchenne Palsy)

Healthy arm

Unhealthy arm

© Lineage



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Klumpke's Palsy

Klumpke's palsy is a paralysis caused by injury to the lower part of the Brachial plexus, mainly involving the **C8 and T1 nerve roots**. It mainly affects the hand and finger muscles.

Causes:

- **Traction** injury of the arm upward (sudden pulling of the arm).
- **Birth injury** when the baby's arm is pulled during delivery.(Poor positioning at birth like breech/ forcep delivery)
- **Falls or accidents** where a person grabs something to stop the fall.
- **Tumors or compression** affecting lower brachial plexus.

Klumpke's Palsy-2

Nerves Involved

- C8 and T1 spinal nerves
- These nerves supply intrinsic muscles of the hand.

Important nerves affected:

- Ulnar nerve
- Median nerve (partly)

Muscles Affected

Mainly intrinsic hand muscles, such as:

- Interossei muscles of hand
- Lumbrical muscles of hand
- Thenar and hypothenar muscles
- These muscles control fine finger movements and grip strength.



Klumpke's Palsy-3

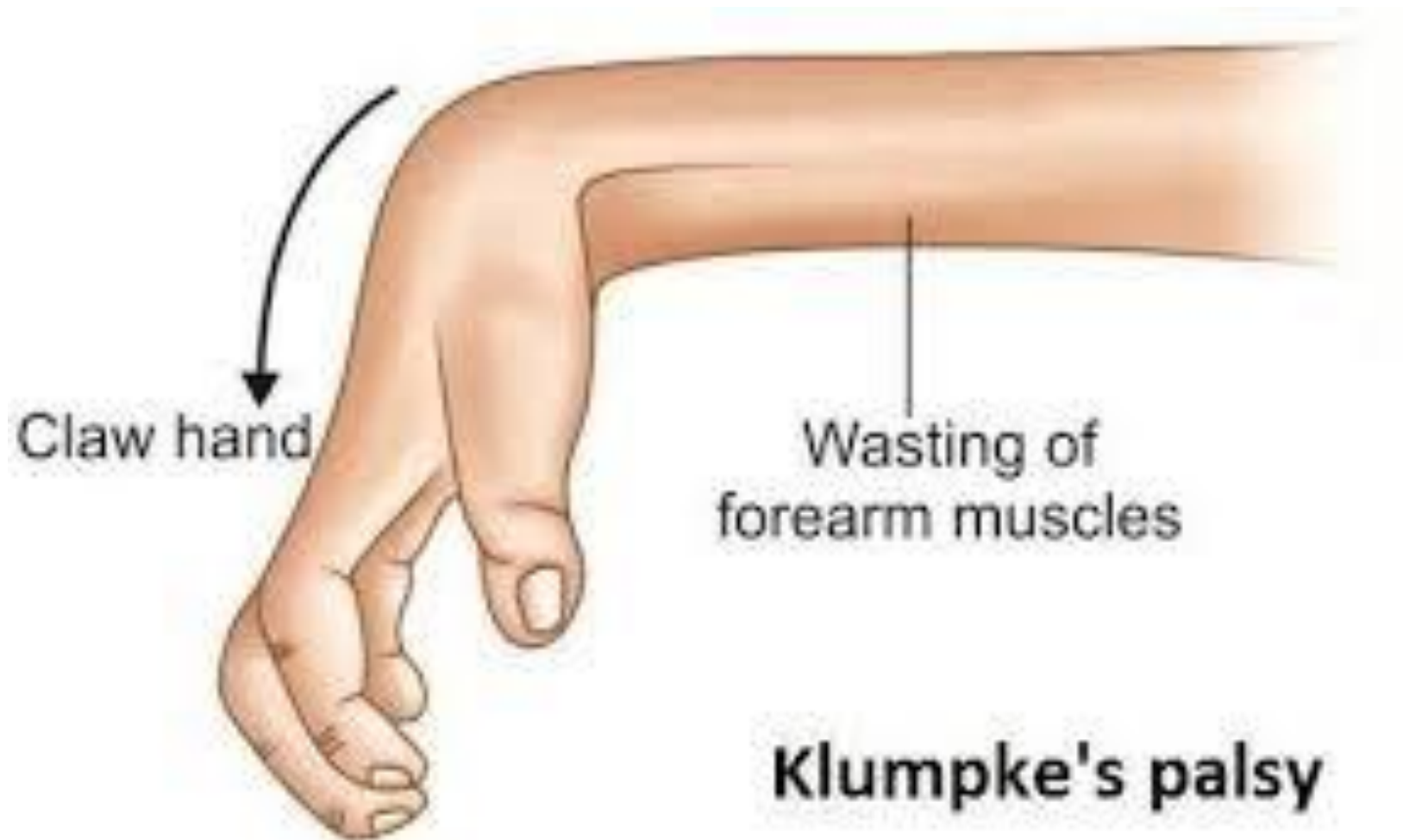
Characteristic Deformity:

- Claw Hand
- Features include:
- Hyperextension at metacarpophalangeal joints (MCP)
- Flexion at interphalangeal joints
- Fingers appear claw-like
- This occurs because intrinsic hand muscles are paralyzed.

Symptoms

- Weakness of hand and finger movements
- Loss of grip strength
- Difficulty with precise hand movements
- Sensory loss on medial side of forearm and hand
- Possible muscle wasting of the hand





- **Simple summary:**
- **Erb's palsy → C5–C6 → shoulder/arm problem → waiter's tip posture**
- **Klumpke's palsy → C8–T1 → hand muscles → claw hand.**

Feature	Erb's palsy	Klumpke's palsy
Part of Brachial plexus affected	Upper brachial plexus	Lower brachial plexus
Nerve roots involved	C5 – C6	C8 – T1
Main cause	Excessive separation of head and shoulder	Sudden upward traction of the arm
Muscles affected	Shoulder and upper arm muscles (deltoid, biceps, brachialis)	Intrinsic muscles of the hand
Characteristic deformity	Waiter's tip position	Claw hand
Arm position	Arm adducted, internally rotated, elbow extended	Fingers clawed with MCP hyperextension
Movement loss	Loss of shoulder abduction and elbow flexion	Loss of finger movements and grip
Sensory loss	Lateral side of arm	Medial forearm and hand
Associated condition	Usually none	May be associated with Horner's syndrome
Area mainly affected	Shoulder and upper arm	Hand and fingers

Median Nerve

- The **median nerve mainly innervates the flexor muscles of the forearm and hand.**
- It is especially important for **precise hand movements**, particularly of the **thumb and index finger.**

Precise hand movements:

Precise hand movements means very accurate, small, and controlled movements of the hand and fingers, especially used for fine tasks.

Example:

Writing with a pen

Buttoning a shirt

Picking up small objects (coin, pin)

Using a needle and thread

Typing on a keyboard

- The nerve originates from the **brachial plexus:**
- Medial cord → C8–T1
- Lateral cord → C5–C7



Origin of Median Nerve

- Median nerve arises from the **brachial plexus**

Formed by:

- Medial cord (C8–T1)
- Lateral cord (C5–C7)
- Responsible for fine motor control of the hand
- Especially important for thumb and index finger movements

Course of the Median Nerve:

- Travels with the **axillary-brachial artery**.
- Descends along the **radial side of the arm** from axilla to cubital fossa.
- Passes **between the two heads of pronator teres**.
- Continues deep beneath **superficial finger flexor muscles**.



Path in the Forearm and Wrist

- Lies between:
- Flexor pollicis longus
- Flexor digitorum profundus
- Near the wrist:
- Located between flexor carpi radialis and palmaris longus tendons
- Gives off palmar cutaneous branch before entering the carpal tunnel.
- Enters the carpal tunnel with finger flexor tendon



Muscles Innervated by Median Nerve (Forearm)

Median nerve supplies:

- Pronator teres
- Flexor carpi radialis
- Flexor digitorum superficialis
- Flexor digitorum profundus (radial half)
- Palmaris longus
- Flexor pollicis longus
- Pronator quadratus



Muscles Innervated in the Hand

Thenar muscles supplied by the median nerve:

- Abductor pollicis brevis
- Opponens pollicis
- Flexor pollicis brevis
- First and second lumbricals



Causes of Median Nerve Lesions

Common causes include:

1. Fractures

1. Elbow
2. Wrist
3. Carpal bones

2. Dislocations

1. Elbow
2. Wrist
3. Lunate and scaphoid bones

3. Compression

1. Carpal tunnel syndrome
2. Pronator teres syndrome

4. Trauma

1. Traction injury
2. Contusion (soft tissue injury caused by direct blunt force-that damages small blood vessels without breaking the skin)
3. Laceration (open wound-from blunt or sharp trauma) of wrist or hand



Sites of Injury

Median nerve is most vulnerable where it is **superficial**:

- **Elbow region**
- **Wrist region**

These areas are more prone to **trauma and compression**.



Symptom

A complete lesion produces characteristic deformities.

Ape Hand: A condition in which the thumb lies in the same plane as the fingers due to loss of opposition, giving a flattened appearance of the hand.

Cause

Damage or compression of the **median nerve**

- Common in:
 - **Carpal tunnel syndrome**
 - Wrist injuries
 - Forearm trauma
- **Muscles Affected**
- Mainly **thenar muscles**:
- Abductor pollicis brevis
- Opponens pollicis
- Flexor pollicis brevis
- These muscles are responsible for **thumb movement and opposition**.



Characteristic Features

Thumb is:

- **Adducted**
- **Laterally rotated**
- **Lies in the same plane as fingers**
- **Loss of thumb opposition**
- **Thenar eminence appears flattened (atrophy)**

Functional Problems

Difficulty:

- Holding a pen
- Buttoning clothes
- Picking small objects
- **Loss of precise hand movements**



Ape Hand Deformity



Other Symptoms

Oath Hand (Hand of Benediction)

Oath hand is a characteristic sign seen in **Median nerve injury**, especially when the patient tries to make a fist.

Cause:

- Injury to the **median nerve**, usually at or above the **elbow**
- Common causes:
 - Supracondylar fracture of humerus
 - Elbow trauma
 - Deep lacerations
- **Muscles Affected**
- Flexor digitorum superficialis
- Flexor digitorum profundus (lateral half)
- Flexor pollicis longus
- These muscles are responsible for **finger flexion**.



Oath Hand (Hand of Benediction)

Characteristic Sign

When asked to make a fist:

- **Index finger → remains straight**
- **Middle finger → remains straight**
- **Ring & little fingers → flex normally**
- **Hand looks like taking an oath or blessing position**

Functional Problems:

- Inability to:
 - Grip objects properly
 - Make a full fist
- Weak **precision grip**



Clinical Points to Remember :

- Oath hand appears only when the patient tries to make a fist
- Oath hand ,At rest, the hand may look **normal**
- Oath hand → seen during movement (making a fist)
- **Ape hand → seen at rest (thumb position)**



Autonomic(involuntary) functions of the body and Trophic Changes

Trophic changes are **changes in the nutrition, growth, and health of tissues** (skin, muscles, nails) that occur due to **loss of proper nerve supply**.

- Because the median nerve contains **autonomic fibers**, lesions can cause:
- Edema of hand and fingers
- Nail ridges
- Thin glossy skin
- Loss of normal skin lines

Muscle atrophy may occur in:

- Forearm flexors
- Thenar muscles
- There is also risk of **causalgia (severe nerve pain)**.

Sensory Dysfunction

Loss or alteration of sensation occurs in:

- Thumb
- Index finger
- Middle finger
- Half of ring finger
- Distal two-thirds of palm

Additional features:

- Sensory changes extend to distal phalanges on the extensor surface.
- **Anesthesia at distal interphalangeal joints of index and middle fingers.**

OF THE HAND



RADIAL NERVE



ULNAR NERVE



MEDIAN NERVE



Thank You