



Neurology II-5

Motor Disorders 2

Clinical Localization of the Lesion

The findings on examination should indicate whether the motor deficit is due to an upper or lower motor neuron disturbance, impaired neuromuscular transmission, or a primary muscle disorder. With an upper or lower motor neuron disturbance, the clinical findings may also help to localize the lesion to a single level of the nervous system, thereby reducing the number of diagnostic possibilities.



Upper Motor Neuron Lesions

Signs

1. Weakness or paralysis
2. Spasticity
3. Increased tendon reflexes
4. Extensor plantar (Babinski) response
5. Loss of superficial abdominal reflexes
6. Little, if any, muscle atrophy

Localization of Underlying Lesion

Parasagittal

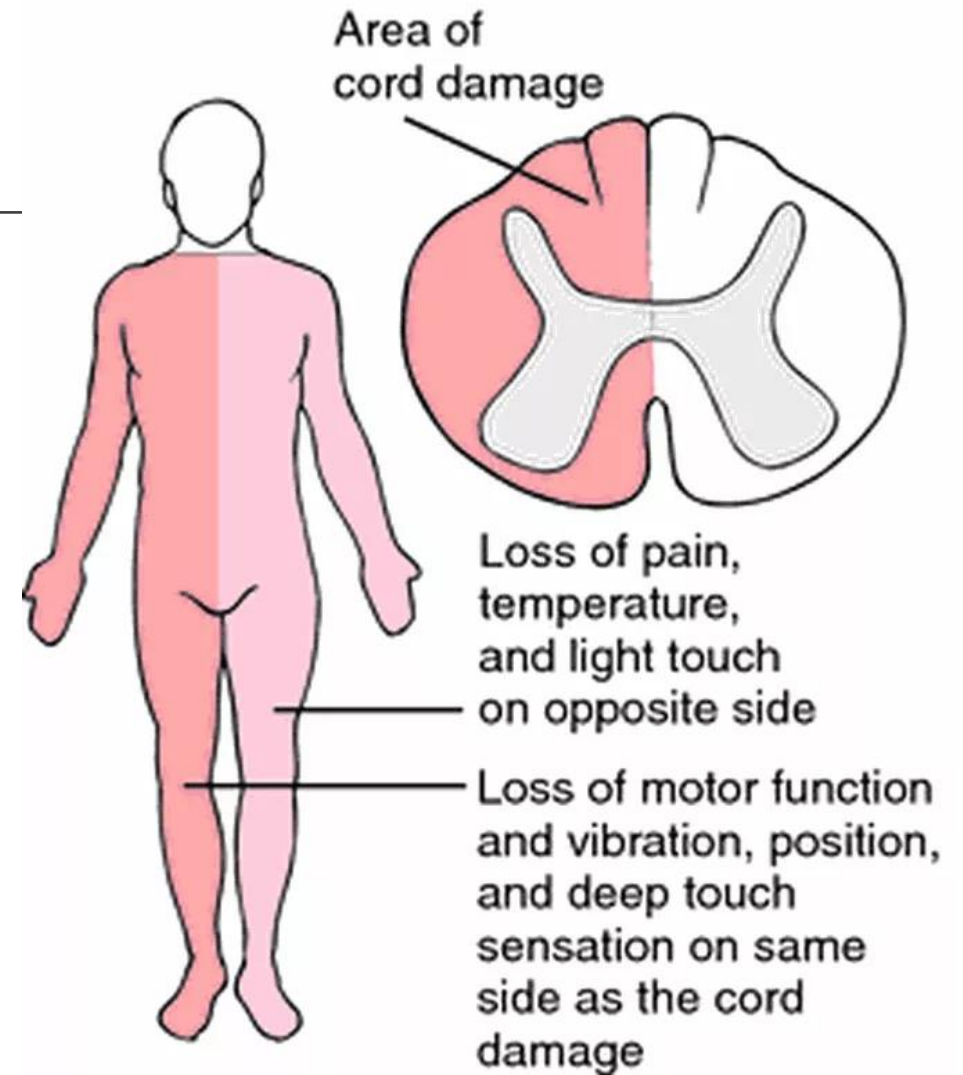
cerebral cortex

internal capsule

Brainstem

spinal cord (Brown-Séquard syndrome)

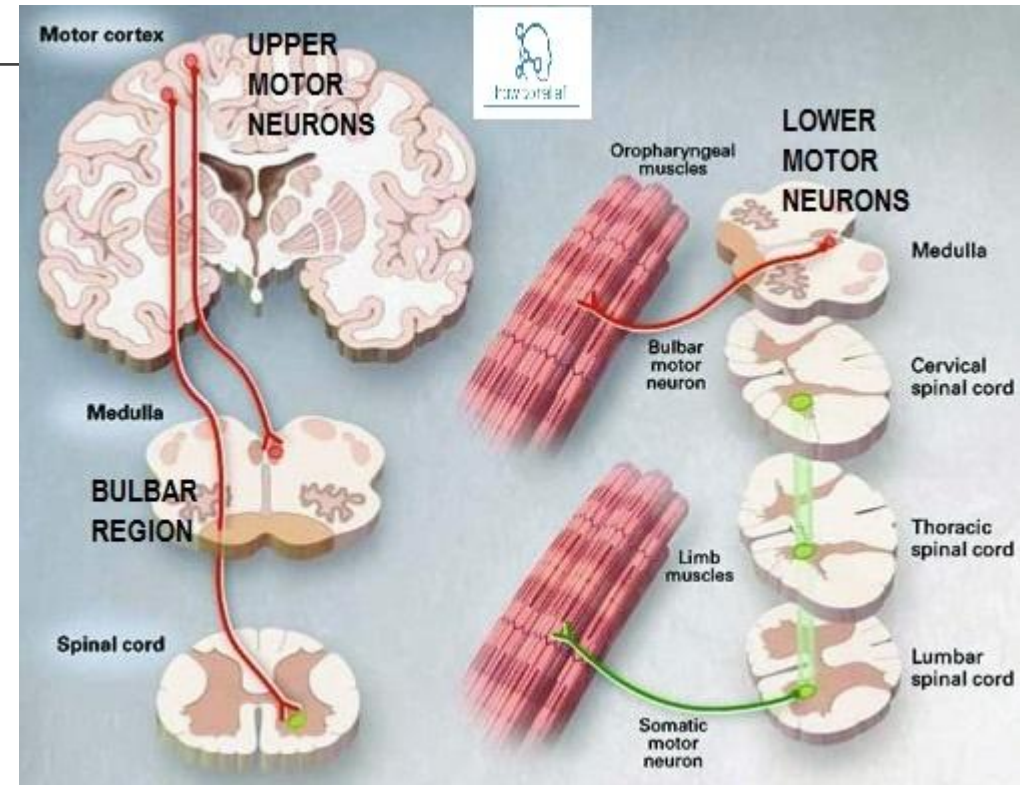
anterior horn cells



Lower Motor Neuron Lesions

Signs

1. Weakness or paralysis
2. Wasting and fasciculations of involved muscles
3. Hypotonia (flaccidity)
4. Loss of tendon reflexes when neurons subserving them are affected
5. Normal abdominal and plantar reflexes



Localization of the Underlying Lesion

In distinguishing weakness from a segmental **spinal cord**, **anterior horn cell**, **radicular (nerve root)**, **plexus**, or **peripheral nerve** lesion, the distribution of the motor deficit is important.

Table 9-5. Innervation of Selected Muscles of the Upper Limbs.

Muscle	Main Root	Peripheral Nerve	Main Action
Supraspinatus	C5	Suprascapular	Abduction of arm
Infraspinatus	C5	Suprascapular	External rotation of arm at shoulder
Deltoid	C5	Axillary	Abduction of arm
Biceps	C5, C6	Musculocutaneous	Elbow flexion
Brachioradialis	C5, C6	Radial	Elbow flexion
Extensor carpi radialis longus	C6, C7	Radial	Wrist extension
Flexor carpi radialis	C6, C7	Median	Wrist flexion
Extensor carpi ulnaris	C7	Radial	Wrist extension
Extensor digitorum	C7	Radial	Finger extension
Triceps	C8	Radial	Extension of elbow
Flexor carpi ulnaris	C8	Ulnar	Wrist flexion
Abductor pollicis brevis	T1	Median	Abduction of thumb
Opponens pollicis	T1	Median	Opposition of thumb
First dorsal interosseous	T1	Ulnar	Abduction of index finger
Abductor digiti minimi	T1	Ulnar	Abduction of little finger

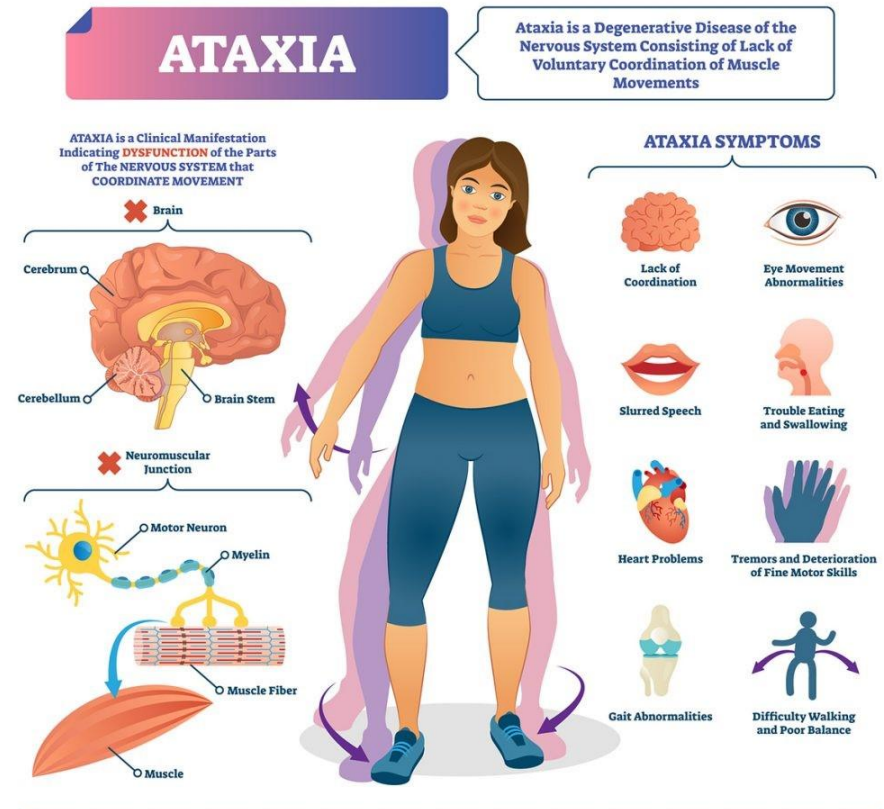
Table 9-6. Innervation of Selected Muscles of the Lower Limbs.

Muscle	Main Root	Peripheral Nerve	Main Action
Iliopsoas	L2, L3	Femoral	Hip flexion
Quadriceps femoris	L3, L4	Femoral	Knee extension
Adductors	L2, L3, L4	Obturator	Adduction of thigh
Gluteus maximus	L5, S1, S2	Inferior gluteal	Hip extension
Gluteus medius and minimus, tensor fasciae latae	L4, L5, S1	Superior gluteal	Hip abduction
Hamstrings	L5, S1	Sciatic	Knee flexion
Tibialis anterior	L4, L5	Fibular (Peroneal)	Dorsiflexion of ankle
Extensor digitorum longus	L5, S1	Fibular (Peroneal)	Dorsiflexion of toes
Extensor digitorum brevis	S1	Fibular (Peroneal)	Dorsiflexion of toes
Peronei	L5, S1	Fibular (Peroneal)	Eversion of foot
Tibialis posterior	L4	Tibial	Inversion of foot
Gastrocnemius	S1, S2	Tibial	Plantar flexion of ankle
Soleus	S1, S2	Tibial	Plantar flexion of ankle

Cerebellar Lesions

Signs

1. Hypotonia.
2. Depressed or pendular tendon reflexes.
3. Ataxia
4. Gait disorder
5. Imbalance of station
6. Disturbances of eye movement—Jerk nystagmus
7. Disarthria



Neuromuscular Transmission Disorders

Signs

1. Normal or reduced muscle tone.
2. Normal or depressed tendon and superficial reflexes.
3. No sensory changes.
4. **Weakness**, frequently involves the cranial muscles

Myopathic Disorders

Signs

1. **Weakness**, usually most marked **proximally** rather than distally.
2. **No muscle wasting or depression of tendon reflexes**, at least until an advanced stage of the disorder.
3. **Normal abdominal and plantar reflexes.**
4. **No sensory loss or sphincter disturbances.**

Investigative Studies

Investigative studies of patients with weakness from focal cerebral deficits are considered before, Investigative Studies. The investigations discussed here may be helpful in evaluating patients with weakness from other causes;

Table 9-7. Investigation of Patients With Weakness of Noncerebral Origin.

Test	Spinal Cord Disorders	Anterior Horn Cell Disorders	Peripheral Nerve or Plexus Disorders	Neuromuscular Junction Disorders	Myopathies
Serum creatine kinase (CK) and other muscle enzymes	Normal	Normal or mildly increased	Normal	Normal	Normal or increased
Electromyography	Reduced number of motor units under voluntary control; with lesions causing axonal degeneration, abnormal spontaneous activity (eg, fasciculations, fibrillations) may be present if sufficient time has elapsed after onset; with reinnervation, motor units may be large, long, and polyphasic			Often normal, but individual motor units may show abnormal variability in size	Small, short, abundant polyphasic motor unit potentials; abnormal spontaneous activity may be conspicuous in myositis
Nerve conduction velocity	Normal	Normal	Slowed, especially in demyelinating neuropathies. May be normal in axonal neuropathies	Normal	Normal
Muscle response to repetitive motor nerve stimulation	Normal	Normal, except in rapidly progressive disease	Normal	Abnormal decrement or increment depending on stimulus frequency and disease	Normal
Muscle biopsy	May be normal in acute stage but subsequently suggestive of denervation			Normal	Changes suggestive of myopathy
Spinal MRI or CT myelography	May be helpful	Helpful in excluding other disorders	Not helpful	Not helpful	Not helpful

Imaging

Plain X-Rays of the Spine

CT Scan or MRI

Electrodiagnostic Studies

Serum Enzymes

Muscle Biopsy

Spinal Cord Disorders (Myelopathy)

Spinal cord disorders can lead to motor, sensory, or sphincter disturbances, or to some combination of these deficits. Depending on whether it is unilateral or bilateral, a lesion above C5 may cause an ipsilateral hemiparesis or quadriparesis.

Spasticity is a common accompaniment of upper motor neuron lesions and may be especially troublesome below the level of a myelopathy.

Traumatic Myelopathy

Clinical Findings

Total Cord Transection

“spinal shock”, spastic paraplegia or quadriplegia, Flexor or extensor spasms of the legs

Less Severe Injury

bibrachial paresis

Imaging

Plain radiographs will reveal misalignments, fractures, and soft tissue swelling, but CT scanning is more sensitive for detecting spinal fractures, especially in the cervical region, and also allows evaluation of the spinal cord.

Treatment

Immobilization, Decompression, & Stabilization

General Measures

Corticosteroids

Treatment of Painful Spasms

Skin Care

Bladder & Bowel Disorders

Experimental Therapeutics

Demyelinating Myelopathies

Multiple Sclerosis

Epidemiology

Pathology

Pathophysiology

Clinical Findings

Investigative Studies

Diagnosis

Treatment

Prognosis

Symptoms and
Signs of Multiple
Sclerosis

	Percentage of Patients
Symptoms (at presentation)	
Paresthesia	37
Gait disorder	35
Lower extremity weakness or incoordination	17
Visual loss	15
Upper extremity weakness or incoordination	10
Diplopia	10
Signs	
Absent abdominal reflexes	81
Hyperreflexia	76
Lower extremity ataxia	57

Symptoms and
Signs of Multiple
Sclerosis

Extensor plantar responses	54
Impaired rapid alternating movements	49
Impaired vibratory sense	47
Optic neuropathy	38
Nystagmus	35
Impaired joint position sense	33
Intention tremor	32
Spasticity	31
Impaired pain or temperature sense	22
Dysarthria	19
Paraparesis	17
Internuclear ophthalmoplegia	11

A mid-sagittal T2-weighted MRI of the cervical spinal cord in a young woman with multiple sclerosis. An abnormal region of high signal intensity (arrow) is seen.



Axial T2-weighted MR brain image of a patient with multiple sclerosis showing multiple, primarily punctate, white matter plaques (arrows); note the typical location in the periventricular region (arrowheads).

