

Peripheral nerve disease:

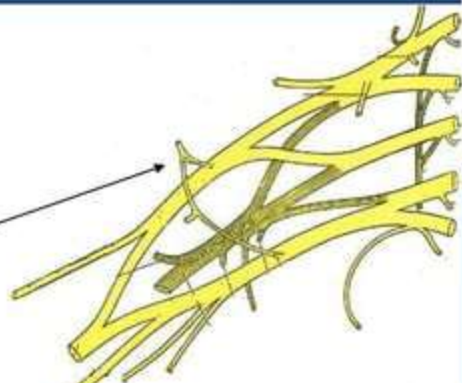
Praveen Dayalu, MD

What is the Peripheral Nervous System?

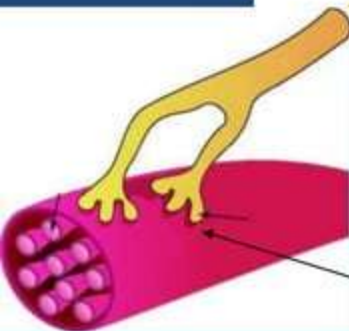
- CNS is confined to brain and spinal cord
- PNS includes (in anatomical order)
 - Anterior horn cell (located within spinal cord)
 - Spinal nerve roots (radicles)
 - Plexi (brachial and lumbosacral)
 - Named peripheral nerves (e.g. median, peroneal)
 - Tiny nerve endings (sensory fibers and tiny branches of lower motor axons at the neuromuscular junction)
 - Neuromuscular junction and muscle

The PNS (Emphasizing Motor Structures)

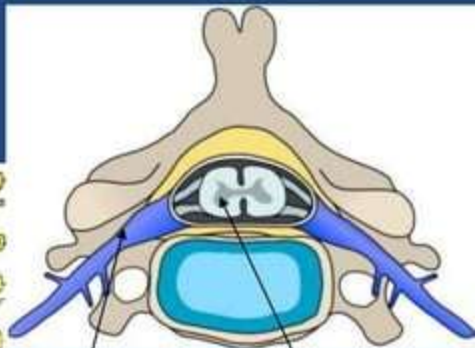
Brachial plexus



Ulnar nerve



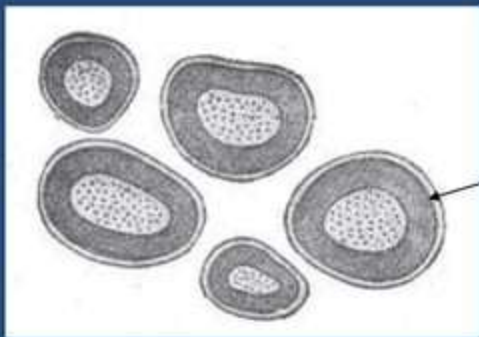
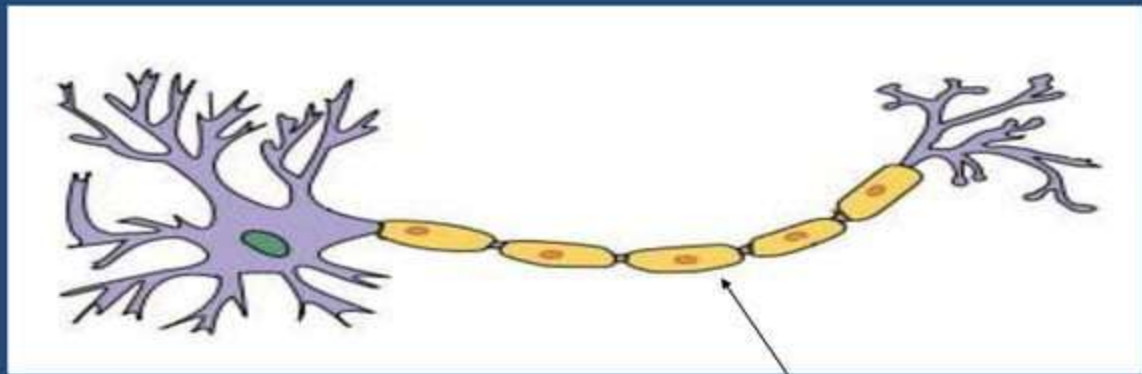
Neuromuscular junction and muscle



Anterior horn cells (LMN)

C8 spinal nerve root

Many peripheral axons are myelinated



Myelin (Schwann cells)

Symptoms of PNS Disease

- Single focal lesions: weakness/numbness/ pain in one limb, often defined to one part of the limb
- Multiple or diffuse lesions: weakness/ numbness/pain in more than one limb, usually bilateral and distal

Signs of PNS Disease

- Lower motor neuron signs (atrophy, fasciculations)
- Hyporeflexia or areflexia
- Patch of sensory loss, or stocking-glove sensory loss

- Not UMN signs (spasticity, hyperreflexia, upgoing toe) or “brain” signs (impaired consciousness, cognition, or language)

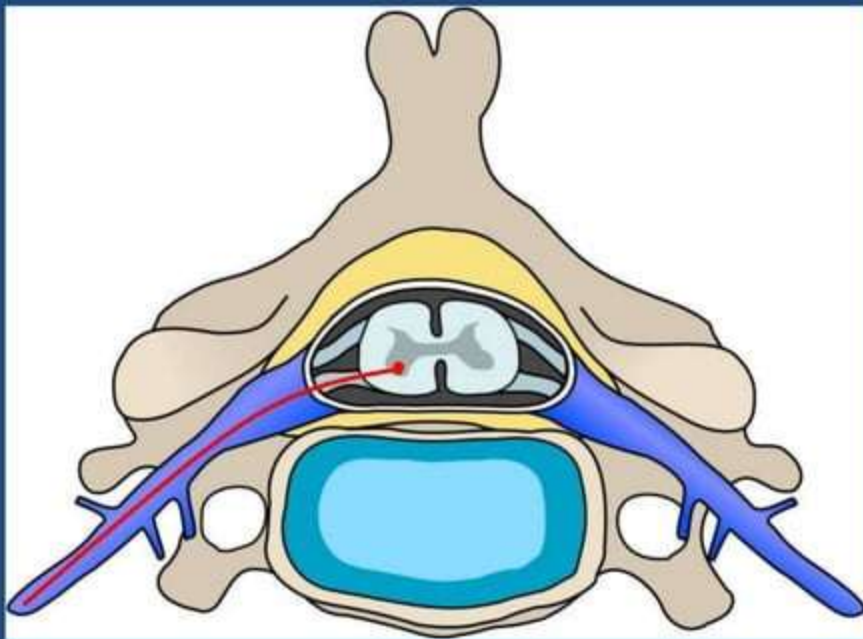
Reflexes... repeated

- Hyperreflexia and spasticity occur with upper motor neuron lesions (CNS)
- Hyporeflexia, fasciculations, atrophy with lower motor neuron lesions (PNS)

Workup

- Serologies, especially for treatable causes
- EMG helps localize and characterize lesions of PNS
- Imaging for some focal lesions, or to exclude CNS mimics (such as cord lesion or stroke)
- CSF analysis in demyelinating neuropathies, or polyradiculopathy
- Nerve biopsy

Anterior Horn Cell

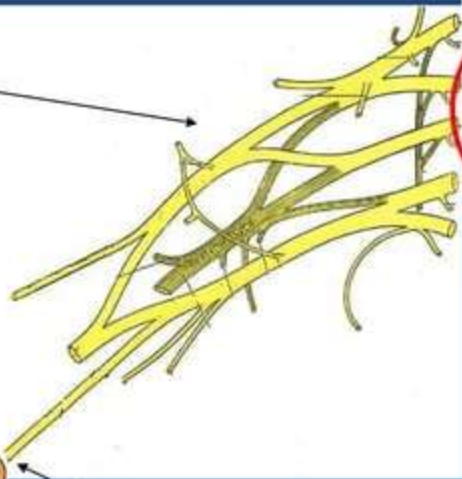


Amyotrophic lateral sclerosis

- Anterior horn cells (lower motor neurons) and upper motor neurons degenerate
- Mix of UMN and LMN signs/symptoms
- Weakness, spasticity, multifocal muscle atrophy
- No sensory loss from ALS!
- Loss of speech, swallow, respiration → Death in 2-5 years

Radiculopathy

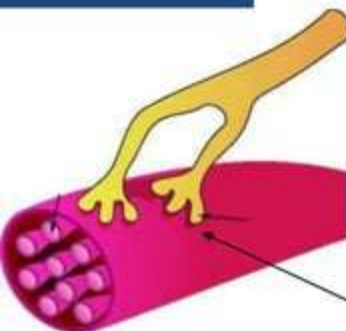
Brachial plexus



C8 spinal nerve root



Ulnar nerve

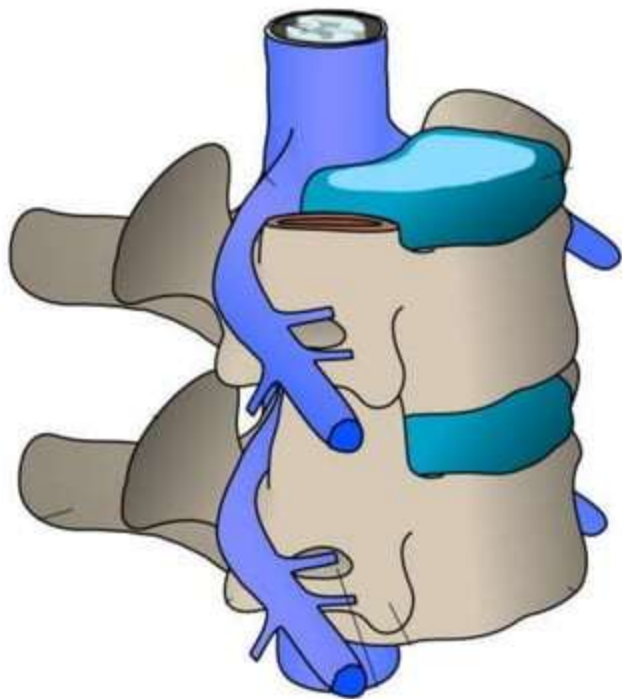


Neuromuscular junction and muscle



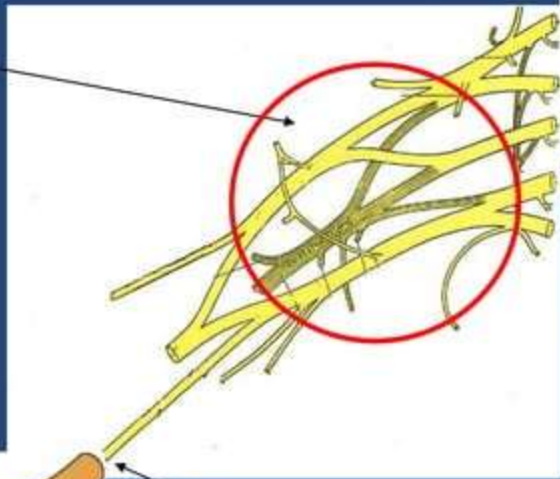
Spinal Nerve Root Disorders

- Most common: monoradiculopathy (cervical or lumbosacral)
- Radiating pain, +/- weakness, +/- sensory loss. Reduced reflex for that root level
- Commonest causes: disk herniation, minor trauma, degenerative change
- Usually self-limited
- Image if severe, worsening, or concern for cancer, infection



Plexopathy

Brachial plexus



C8 spinal nerve root

Ulnar nerve

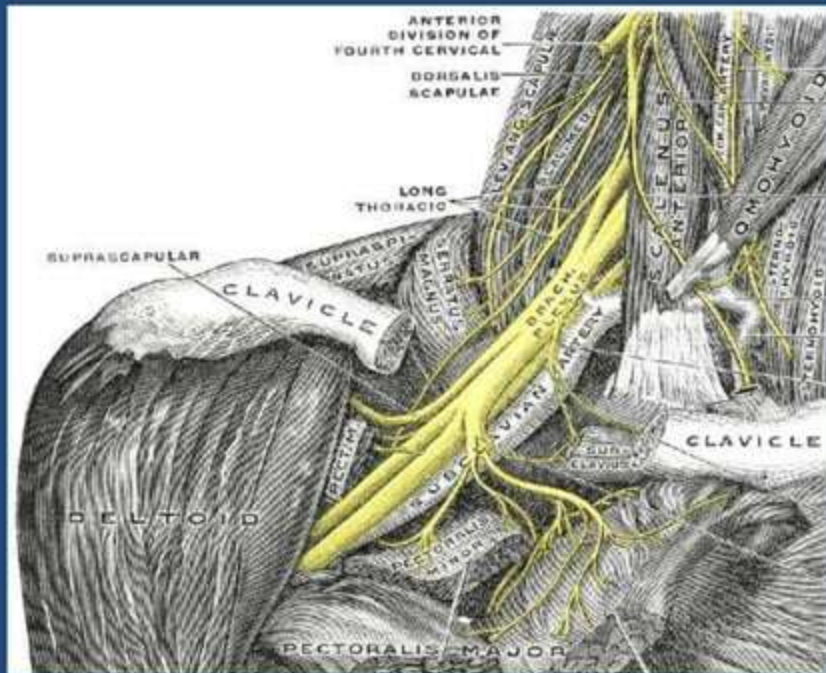


Neuromuscular junction and muscle

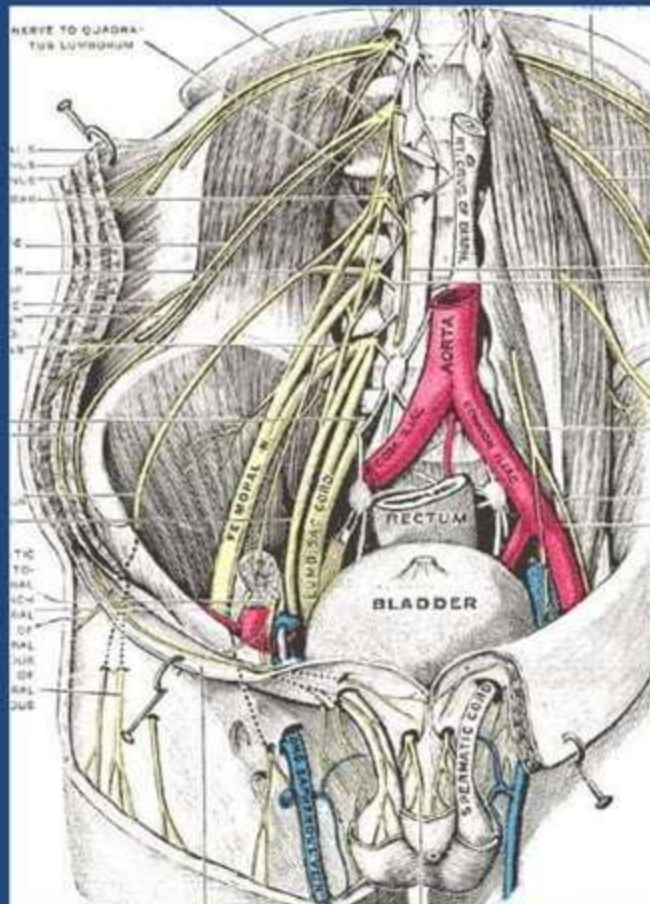
Plexopathy

- PNS syndrome in one limb not explained by a single spinal root, or by a single “named” peripheral nerve
- Causes: trauma or stretch, compression by tumor or hematoma, radiation, diabetic
- EMG confirms plexopathy
- Image if compressive lesion suspected

Brachial Plexus behind clavicle, in upper thorax

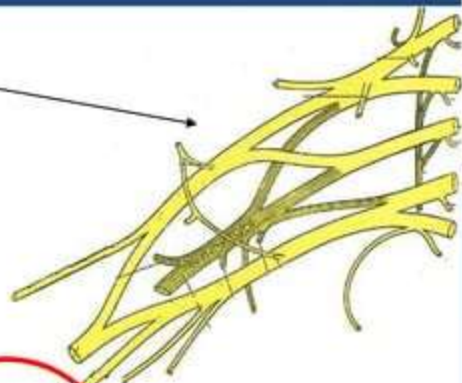


Lumbosacral Plexus: Pelvic, Retroperitoneal



Mononeuropathy

Brachial plexus



C8 spinal nerve root

Ulnar nerve



Neuromuscular junction and muscle



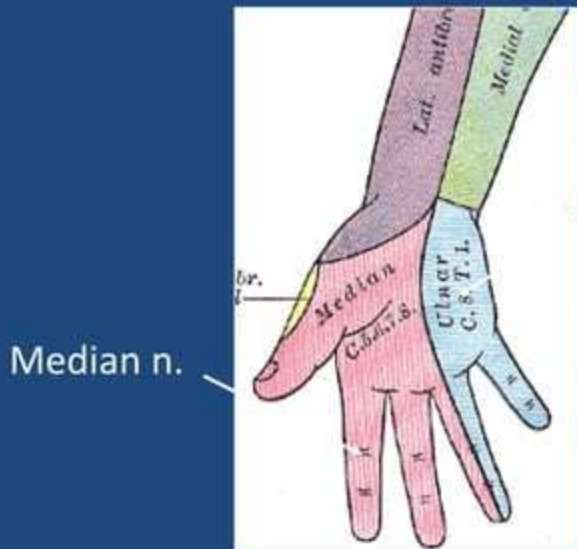
Mononeuropathy

- Weakness, numbness, pain, paresthesias confined to the distribution of
 - UE: median nerve, radial n., ulnar n.
 - LE: femoral n., sciatic n., peroneal n.
- Most common causes: entrapment, trauma, prolonged limb immobility (e.g., surgery)

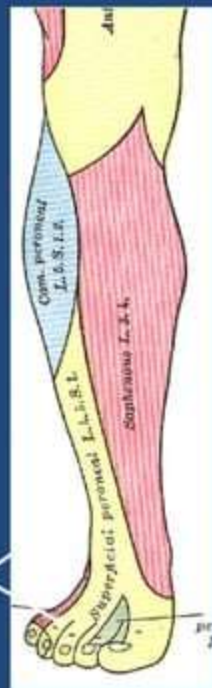
Important Mononeuropathies

- Median mononeuropathy at the wrist (carpal tunnel syndrome)
- Ulnar mononeuropathy at the elbow (cubital tunnel syndrome)
- Radial mononeuropathy (“Saturday night palsy”) → wrist and finger drop
- Peroneal mononeuropathy (e.g., from leg crossing) → one cause of footdrop

Named peripheral nerves have well-defined sensory territories (and muscle targets)

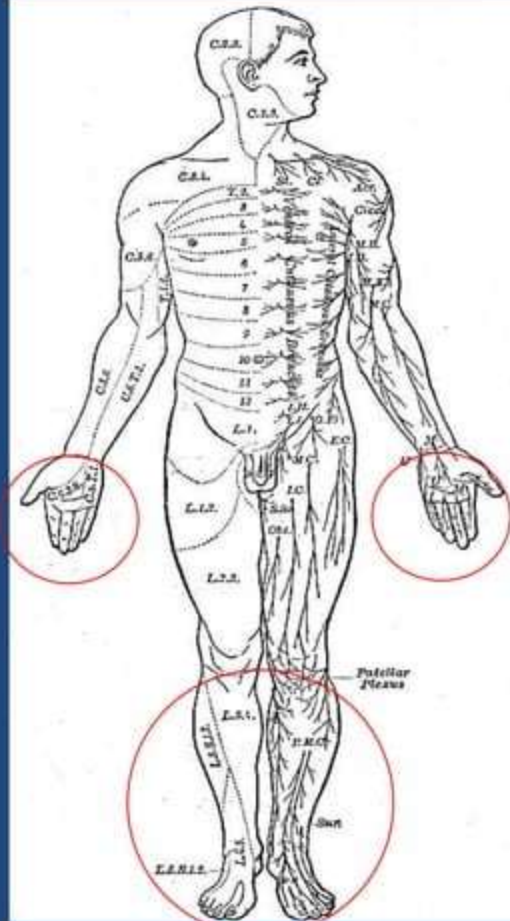


Ulnar n.



Peroneal n.

Peripheral Polyneuropathy



“Peripheral Neuropathy”

- Distal symmetric polyneuropathy
- Affects *longest* sensory/ motor/ autonomic nerves
- Nerves are “dying back”
- Length dependent (“stocking glove”)
- Symmetric loss of pin/ temp / vibration/ proprioception; distal reflex loss
- Usually chronic. Many possible causes!

Peripheral polyneuropathy symptoms

- Initially, feet numb with paresthesia/ pain
- Symptoms ascend: → legs → fingertips
- Distal weakness (feet, or fingers/grip), atrophy,
- Severe sensory loss can cause “steppage gait”, “sensory ataxia”, imbalance, falls
- Feet prone to injuries, ulcers, deformation (e.g., “Charcot foot”)
- Autonomic: orthostasis, bladder and erectile dysfunction

Causes of peripheral polyneuropathy

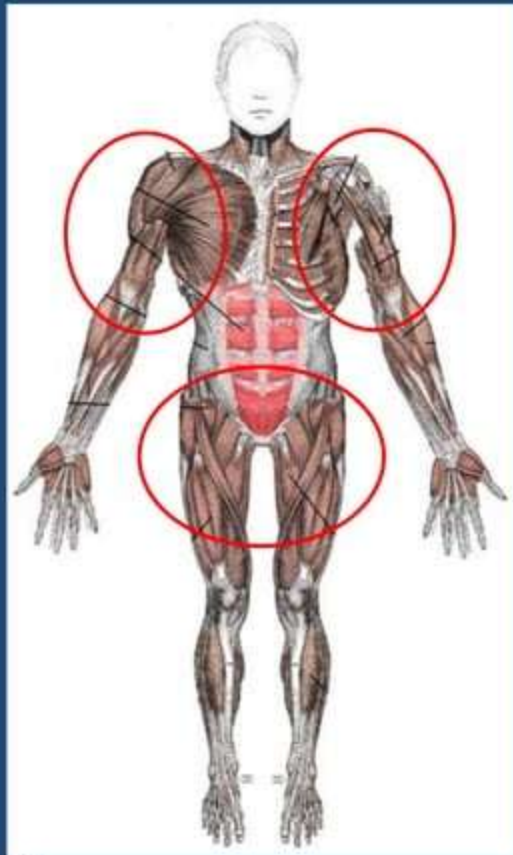
- Usually toxic or metabolic
- #1 cause: **diabetes** & impaired glucose tolerance
- B₁₂
- Hematologic (e.g., multiple myeloma) or other immunoglobulin disorders (check SPEP)
- Drugs: Li, chemotherapy
- Alcoholic neuropathy
- Liver or kidney disease
- HIV and neurosyphilis
- Inflammatory causes: connective tissue disease

Workup for peripheral neuropathy?

- For typical distal symmetric sensory > motor neuropathy: glucose / a1c, B12, SPEP with ifix
- Need EMG and more if rapid or severe, prominent weakness, asymmetry, young patient

AIDP = Acute Inflammatory Demyelinating Polyneuropathy

- Develops over ~2 weeks
- Follows viral infection or vaccination
- Weakness/ numbness/ paresthesia start in legs and ascend; reflexes lost early
- Intubate if severe weakness
- Autonomic instability, arrhythmia
- Rx: plasma exchange & IVIG
- Most have good long-term recovery



Myopathy = muscle disease

- “Can’t raise arms up”
- “Tough to comb my hair”
- “Hard to get out of a chair”
- “Can’t climb stairs”

Clues to a Myopathy

- Usually cause symmetric proximal limb weakness (upper/lower)
- Other possible sx: muscle pain, tenderness, atrophy; fatigue; change in urine color
- Extensive list of causes: TSH, CK, and med review are a good place to start

Time for review questions?

Over 3 days, a 42 y.o. RN rapidly weakens in all four limbs. She says “I think I have Guillain-Barré!”

Which is the most urgent first step?

- A. EMG
- B. Spinal cord imaging
- C. Lumbar puncture
- D. Brain imaging

A 61 y/o woman wakes up with a weak right arm. Zero strength in finger extensors, wrist extensors, and trace elbow extension. Flexion muscles are 5/5.

Which is the most likely diagnosis?

- A. Left frontal stroke affecting motor cortex
- B. Carpal tunnel syndrome
- C. Right radial mononeuropathy
- D. Peripheral polyneuropathy

Decreased reflexes are seen in all of the following except:

- A. AIDP
- B. Peripheral polyneuropathy
- C. Carcinomatous polyradiculopathy
- D. Alcoholic neuropathy
- E. Steroid myopathy

Weakness and sensory loss in the left hand can be caused by all of the following except:

- A. Right hemisphere stroke
- B. Lung cancer invading brachial plexus
- C. Median mononeuropathy
- D. Amyotrophic lateral sclerosis
- E. Cervical herniated disk

Which is the commonest symptom of radiculopathy in the general public?

- A. Weakness
- B. Radiating pain down a limb
- C. A patch of distinct sensory loss
- D. Bladder incontinence