Traumatic Peripheral Nerve Injuries

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Importance

Cause significant lifelong disability in most patients

Epidemiology

- Affect 360000 people/year in USA
- 73.5% in Upper extremities
- Ulnar nerve is the most commonly affected

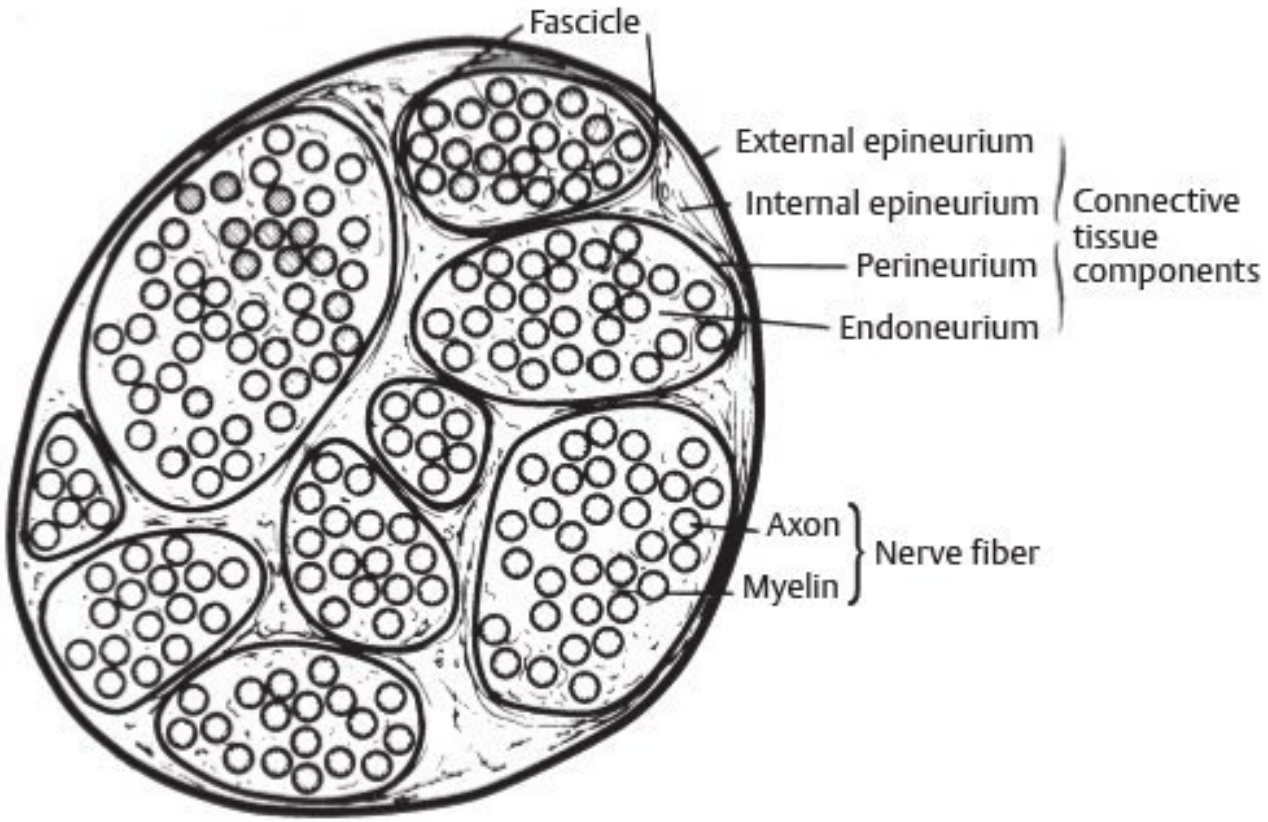
Etiology

- Automobile and motorcycle accidents (Most common cause)
- Gunshot wounds
- Stabbings
- Birth trauma
- Less commonly (radiation, thermal, electric, and vibration injuries)

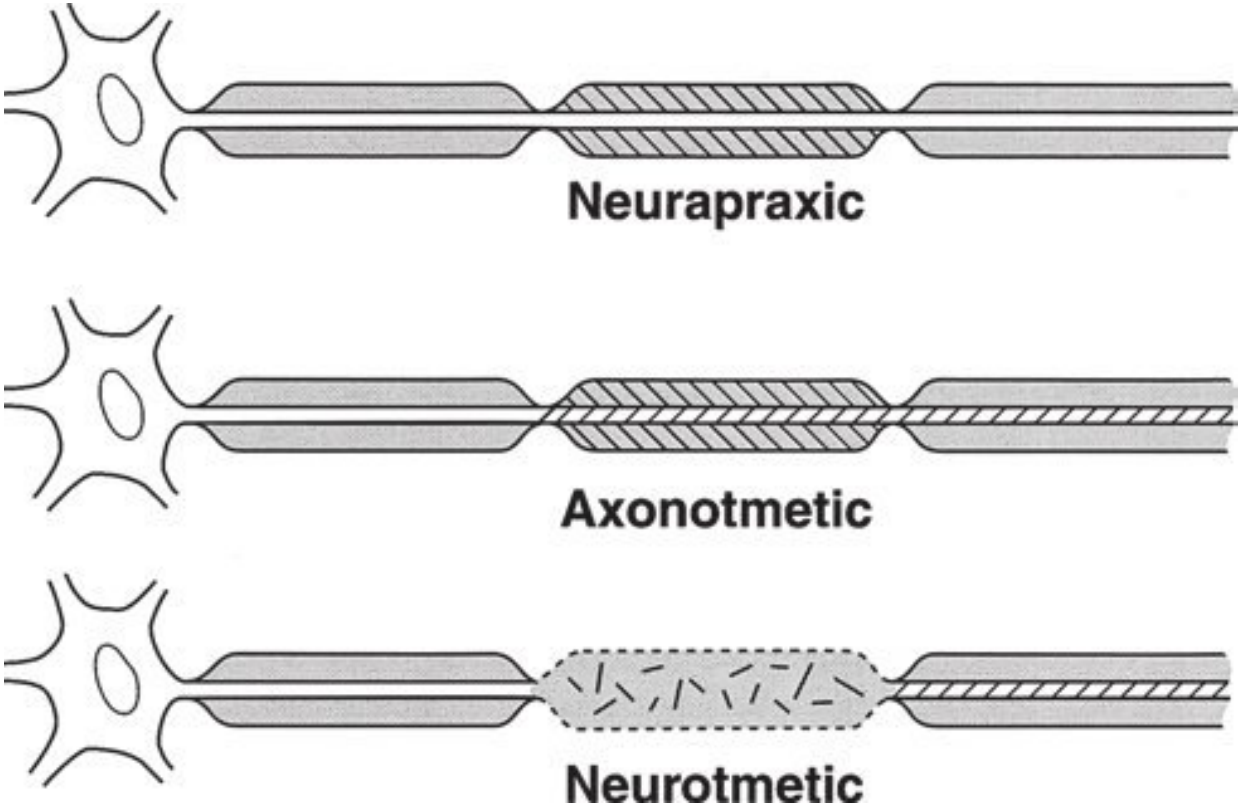
Mechanisms of injury

- Penetrating
- Crush
- Mechanical compression
- Stretch/ traction
- Ischemic

Normal peripheral nerve Cross section



Seddon's three grades



Seddon and Sunderland classification

Seddon Classification	Sunderland Classification	Neuropathology
Neurapraxia	I	Segmental demyelination
Axonotmesis	II	Axon severed, endoneurium intact
	III	Axon and endoneurium injured, perineurium and fascicular arrangement preserved
	IV	Axon, endoneurium, and perineurium injured, epineurium intact
Neurotmesis	V	Loss of continuity of entire nerve

Potential for recovery

Seddon Classification	Sunderland Classification	Potential for recovery
Neurapraxia	I	Spontaneous over days to weeks
Axonotmesis	II	Reasonable recovery
	III	Variable reinnervation (return of 60 to 80% of normal function)
	IV	(Neuroma formation) No reinnervation without surgical repair
Neurotmesis	V	No reinnervation without surgical repair

Wallerian degeneration

- Occurs in the distal portion of the axon
- Macrophage infiltration and phagocytosis of axonal and myelin debris
- Begins within hours of injury and is complete by 6 to 8 weeks

Regeneration

- Depends on:
  - Degree of internal disorganization
  - Distance to the muscle

- Mechanisms:
  - Remyelination
  - Collateral sprouting distally from preserved axons
  - Regeneration from the site of injury (Main)

Regeneration

- Barriers:
  - Size of the gab between stumps
  - Connective tissue Scar at regeneration site
- Rate:
  - 1 mm/day or 1 inch/month
  - Recovery of function may be delayed beyond this
- Neuron's ability to regenerate:
  - Persists for at least 12 months after injury.

Clinical Assessment

- Timing
- Mechanism
- Nerves affected
- Extent
- Severity
- Open or closed
- Passive joint range of motion
- Serial examinations!

Electrodiagnostic studies

- Valuable source of in formation
- Obtained 3 to 4 weeks after the injury
- EMG: Identifies denervated muscles, & also early regeneration.
- NCS: Axonotmesis vs Neurotmesis
- SNAP: Identifies a nerve root avulsion injury

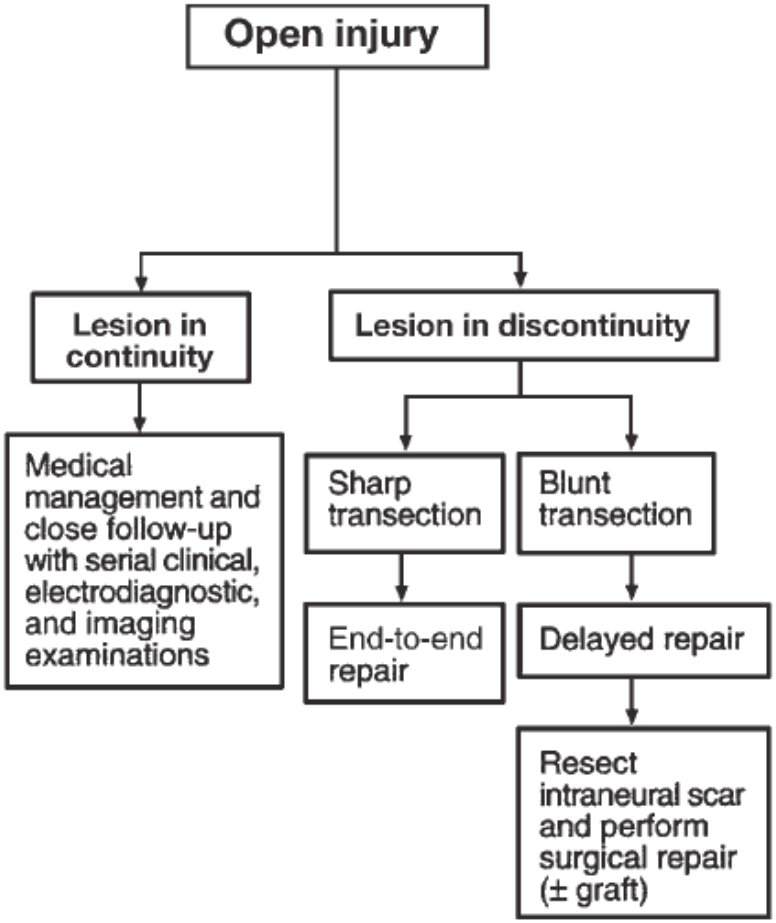
- Do not to overinterpret!

Diagnostic imaging studies

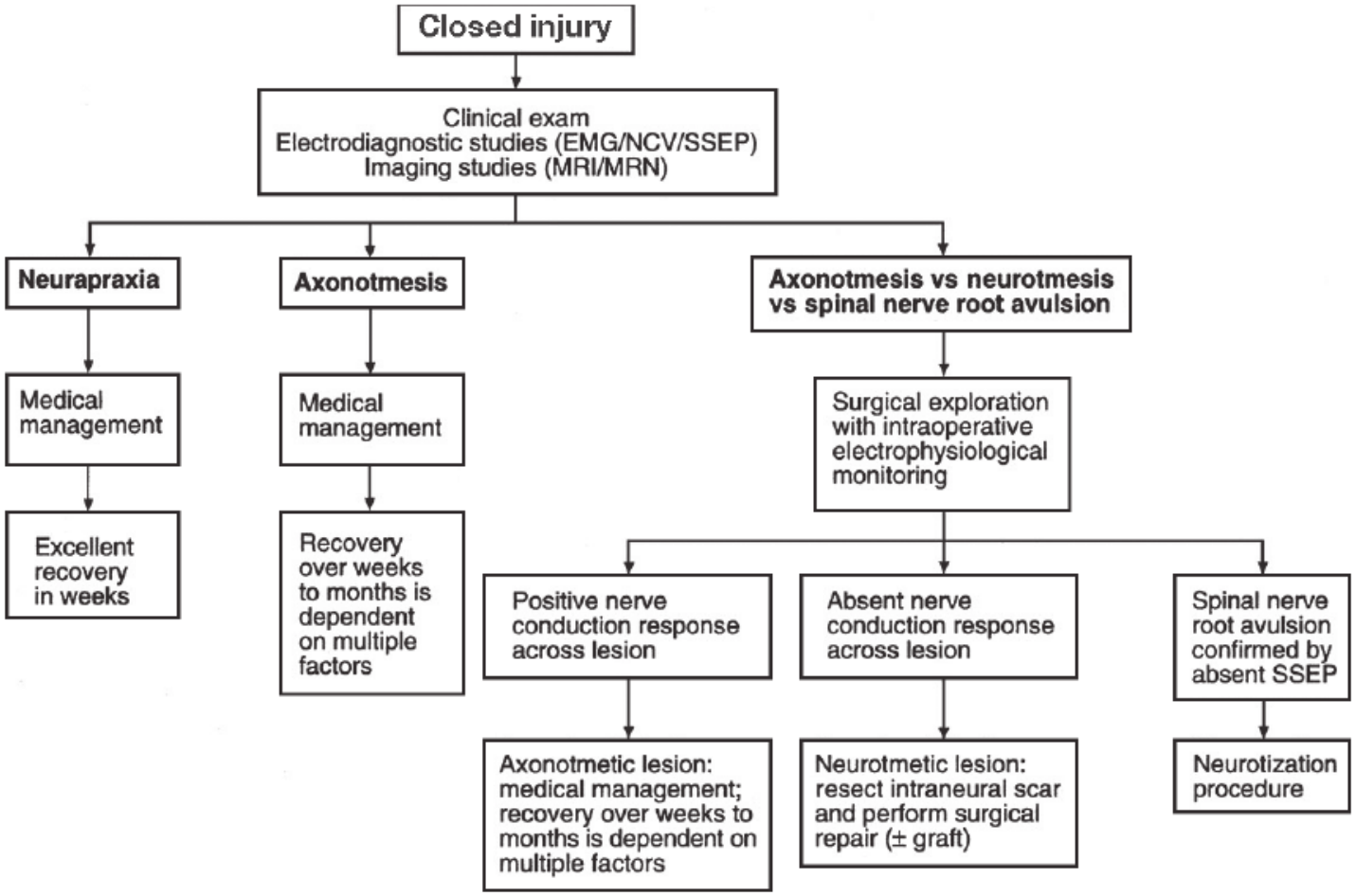
- CT myelogram: to detect root avulsions with 85% sensitivity & 95% specificity

- MRI/MRN: detects root avulsions & the precise location of injury

Management of Open Injury



Management of Closed Injury



Nerve Repair Techniques

- Neurolysis: external/internal
- Direct nerve suture (if there is no tension)
- Nerve grafting:
  - Autologous sural nerve graft
  - Cadaveric options/ veins/ manufactured conduits
  - (length, number, local scar, healthy prox. stump are all factors which affect outcome)
- Nerve transfers
- Palliative procedures: muscle/tendon

Thanks



Any Questions?