



PG Residency Brachial Plexus

Smart Notes. Better Scores.



EXAM PEARL

Accurate structural grading and classification directly dictate treatment protocols and prognosis in plexus trauma.

BRACHIAL PLEXUS INJURIES

PG Orthopedics Rapid Revision



• Plexus Architecture



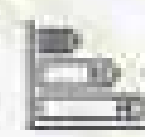
• Terminal Branches



• Injury Mechanisms



• Nerve Microanatomy



• Seddon & Sunderland Classifications



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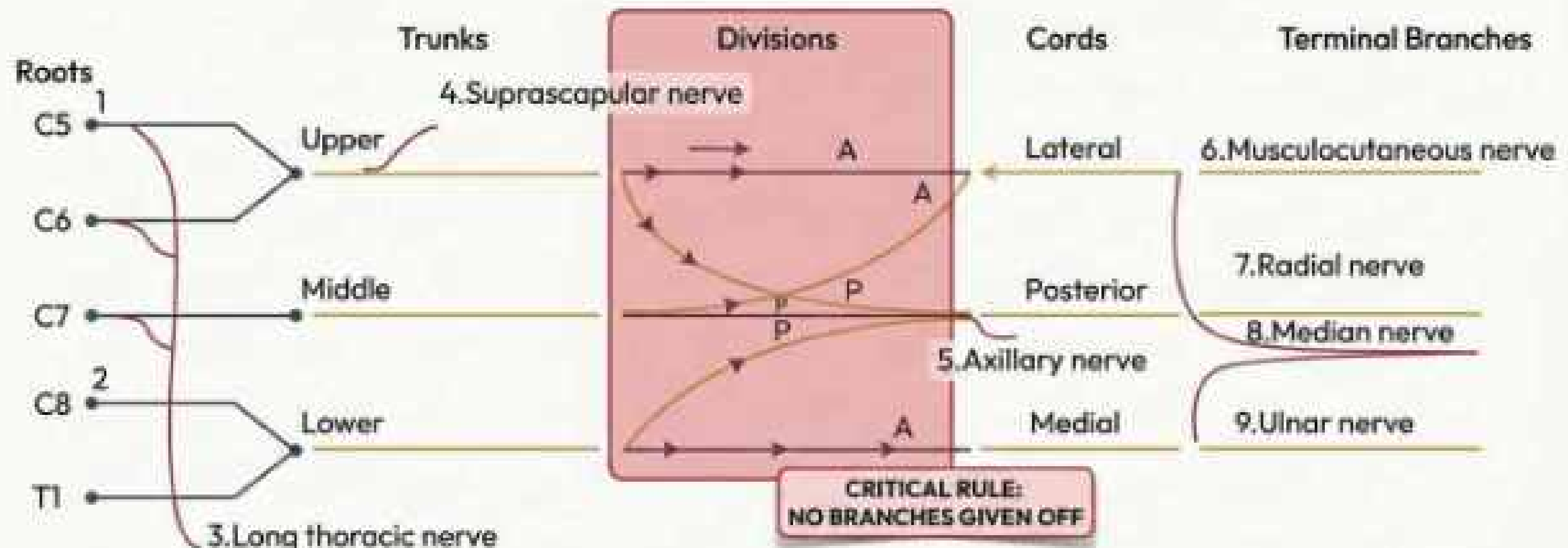


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Brachial Plexus



Ventral Rami Origins
- C5, C6, C7, C8, T1

Trunk Formation
- Upper: C5 + C6
- Middle: C7
- Lower: C8 + T1

The Sequence
Roots → Trunks → Divisions →
Cords → Branches

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The defining anatomical rule of the brachial plexus: Divisions give off absolutely no branches.



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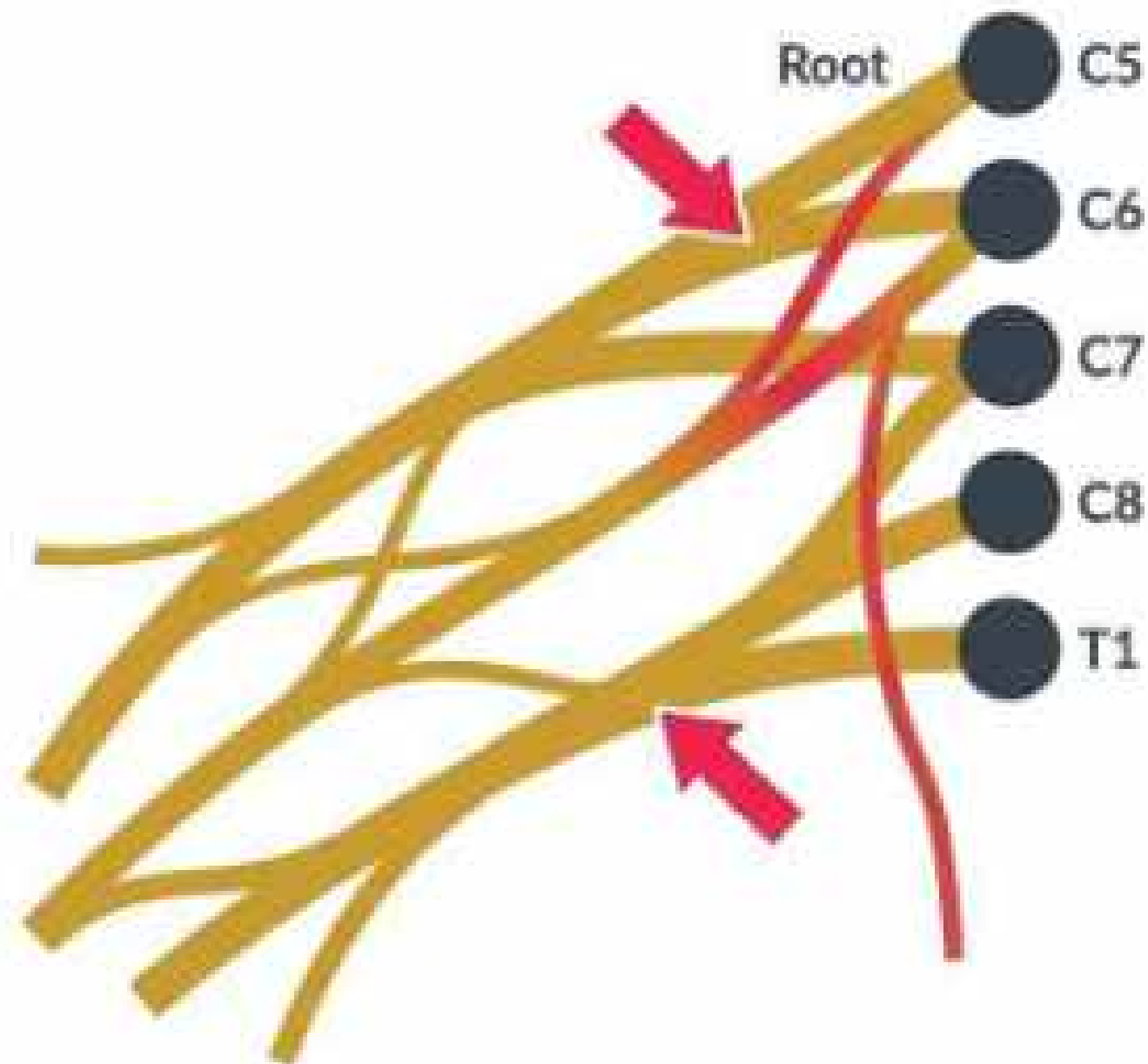


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Biological Wiring Diagram



Root Injuries

- Upper Root (C5–C6): Erb's palsy
- Lower Root (C8–T1): Klumpke's palsy

Long Thoracic Nerve

- Roots: C5, C6, C7
- Motor: Serratus anterior

Dorsal Scapular & C5

- Dorsal Scapular: Rhomboid major & minor
- C5 Contribution: Phrenic nerve & neck muscles

Superior Trunk

- Branches: Suprascapular nerve, Nerve to subclavius

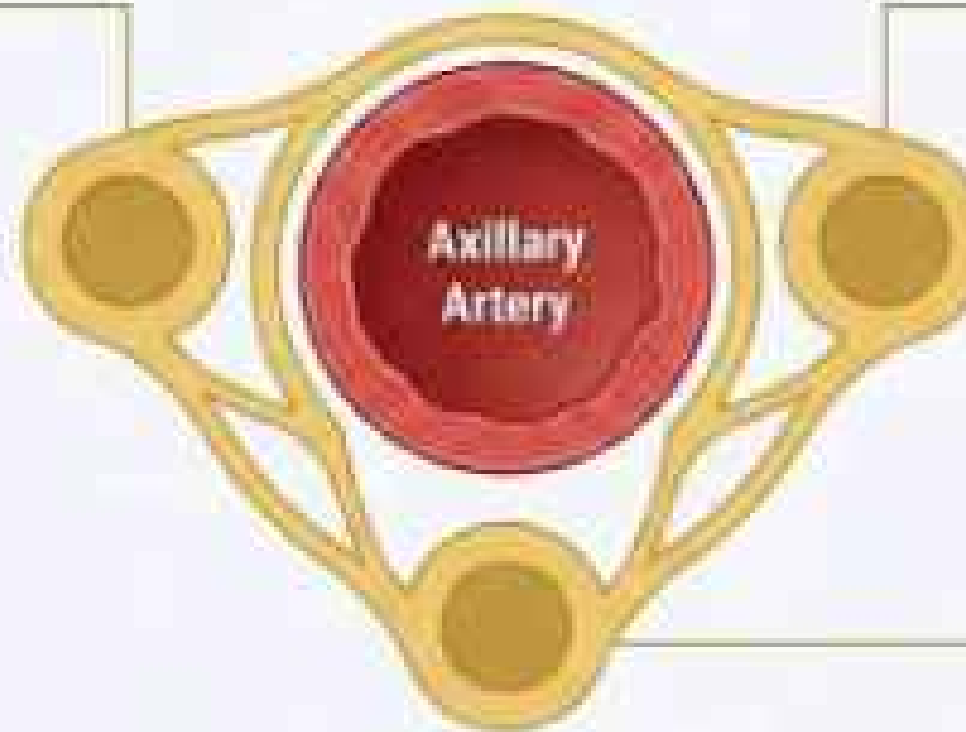
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A lone C5 root injury can compromise respiratory function due to its critical contribution to the phrenic nerve.

Cords: Strict Nomenclature based on relation to the Axillary Artery

- Anterior division of Upper trunk
- Anterior division of Middle trunk

Lateral Cord



- Anterior division of Lower trunk

Medial Cord

- Posterior division of Upper trunk
- Posterior division of Middle trunk
- Posterior division of Lower trunk

Posterior Cord

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The **Posterior Cord** is the only cord formed by divisions from all three trunks (Upper, Middle, Lower).



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Lateral Cord Branches	Medial Cord Branches
- Lateral Pectoral Nerve: Pectoralis major - Musculocutaneous Nerve: Biceps, Brachialis, Coracobrachialis - Lateral Cutaneous Nerve of Forearm: Sensory to lateral forearm	- Medial Pectoral Nerve: Pectoralis minor, part of Pectoralis major - Medial Cutaneous Nerves: Sensory to medial arm and forearm - Ulnar Nerve: Motor to most intrinsic hand muscles; sensory to medial 1½ fingers
Median Nerve - Formed by Lateral root (Lateral cord) + Medial root (Medial cord) ULNAR MOTOR EXCEPTIONS - Thenar muscles - Lateral two lumbricals	

EXAM PEARL

Always check the Exceptions for **Ulnar nerve** hand supply: Thenar muscles and lateral two lumbricals are spared.



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Posterior Cord Branches

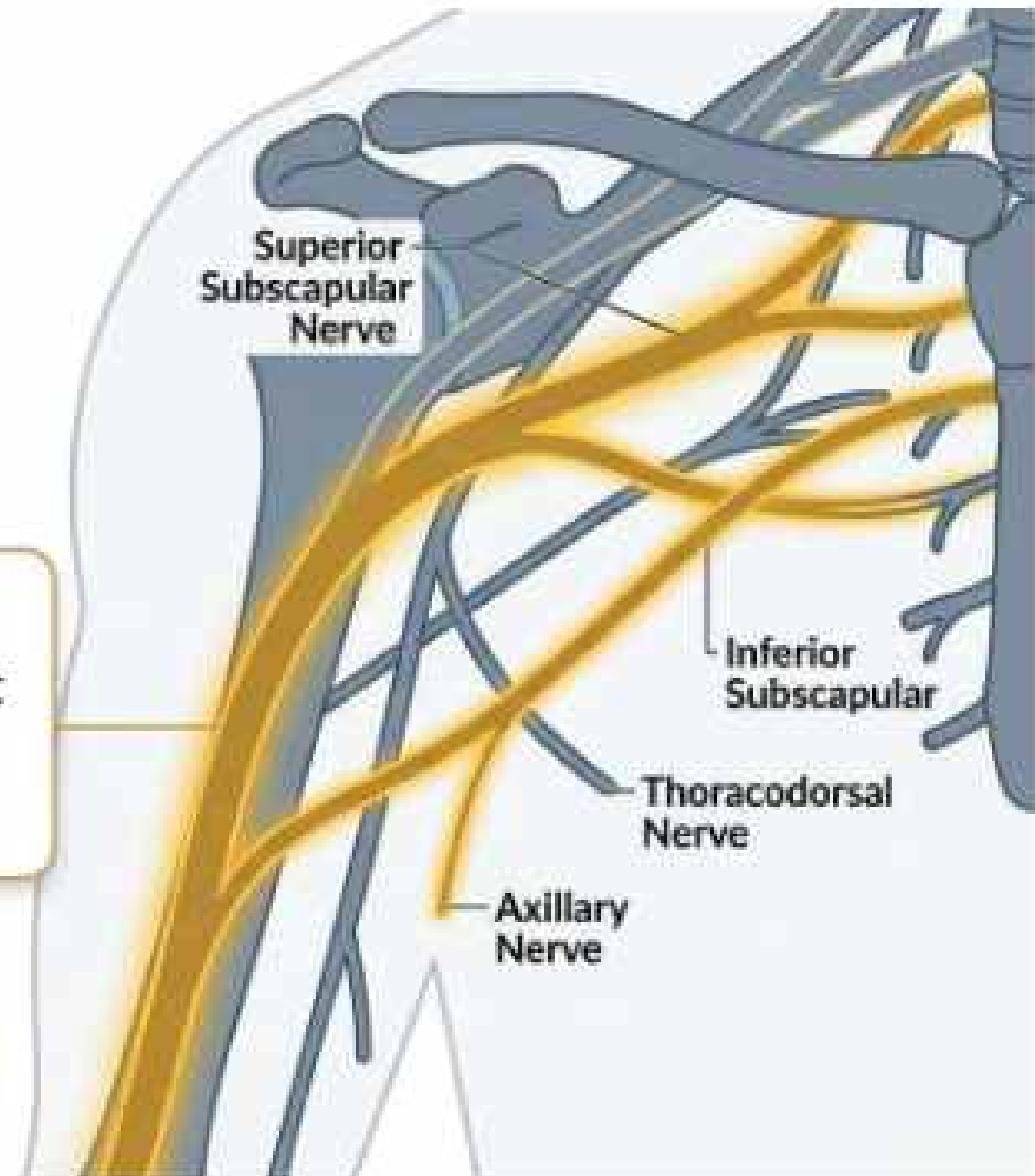
- Superior Subscapular Nerve: Subscapularis
- Inferior Subscapular Nerve: Subscapularis, Teres major
- Thoracodorsal Nerve: Latissimus dorsi
- Axillary Nerve: Deltoid, Teres minor

Radial Nerve

- Motor: Supplies entire extensor compartment (Elbow, Wrist, and Finger extension)
- Sensation: Dorsum of hand

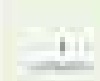
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The Radial nerve is solely responsible for all extension mechanisms of the upper limb (elbow, wrist, and digits).



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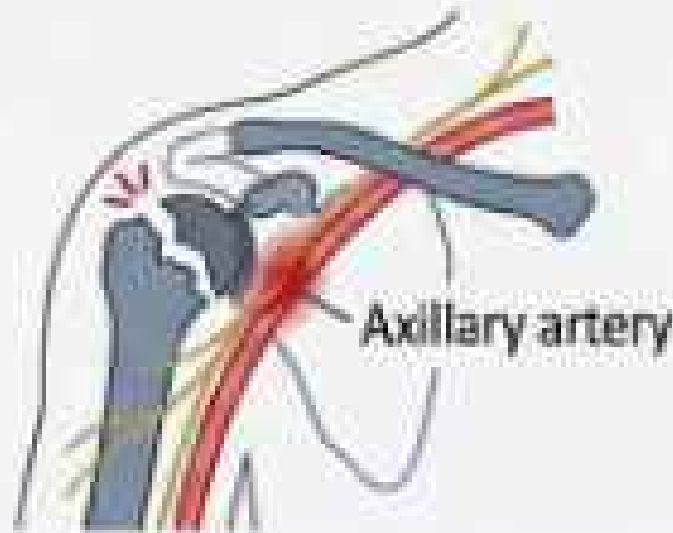


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Mechanisms of Plexus Injury: ~50% caused by Traction (MVAs)

Supraclavicular Injury	Infraclavicular Injury
Location: Above clavicle Mechanism: Neck and shoulder forced apart Associated Vascular Injury: Subclavian artery	Location: Below clavicle Mechanism: Fractures or dislocations around shoulder Associated Vascular Injury: Axillary artery
 Subclavian artery	 Axillary artery

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Identify the vascular injury to localize the plexus injury: Subclavian = Supraclavicular; Axillary = Infraclavicular.



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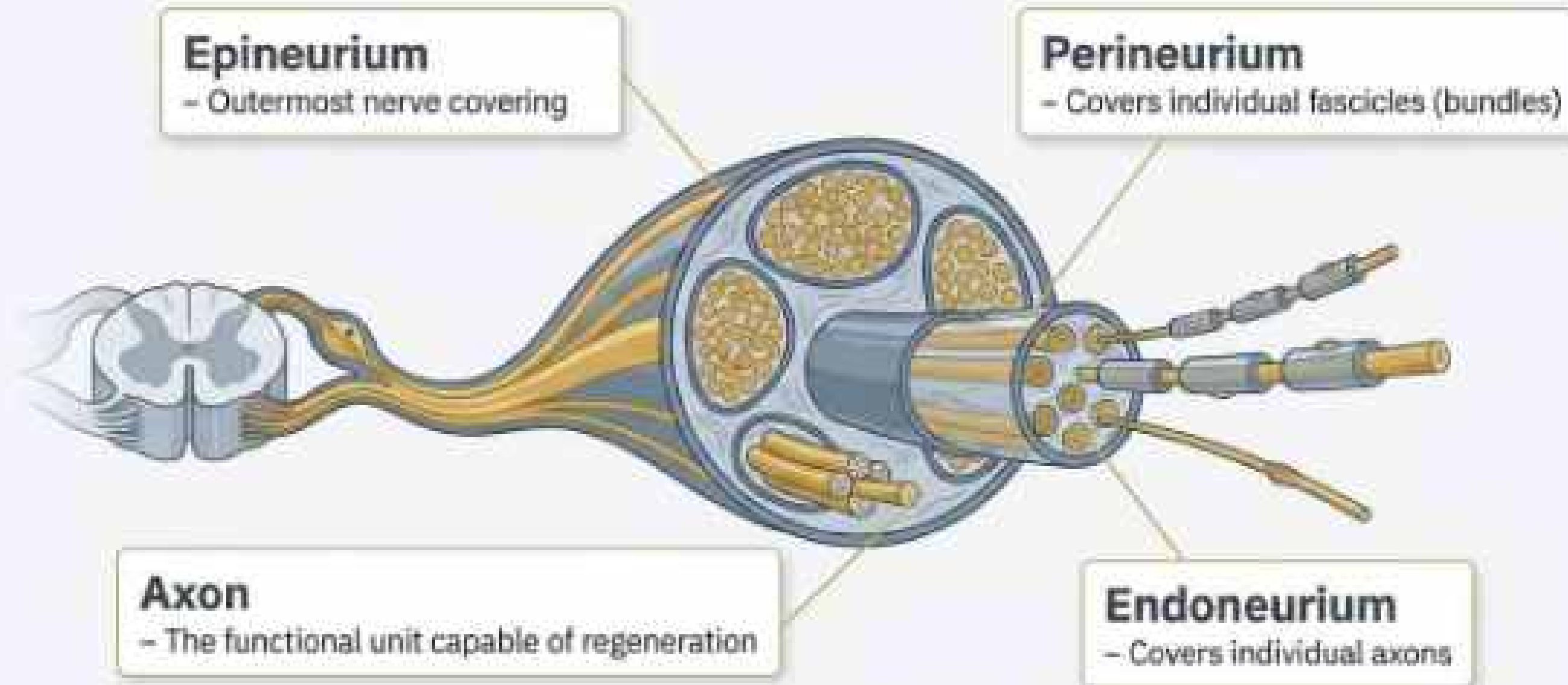


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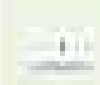
**EXAM PEARL**

Prognosis is inversely proportional to connective tissue sheath involvement; intact sheaths are critical for directed axonal regeneration. A lone axonal injury always has a better prognosis.



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Seddon's Classification of Nerve Injury



Neurapraxia

- Physiological conduction block (Myelin injury only)
- Axon perfectly intact
- Spontaneous recovery within days to weeks



Axonotmesis

- Axonal injury; Nerve sheath remains intact
- Features Wallerian degeneration distal to injury



Neurotmesis

- Complete nerve transection/disruption
- Loss of myelin, axon, endoneurium, and all coverings
- Most severe type of injury

EXAM PEARL

Axonotmesis always presents with Wallerian degeneration distal to the injury, but the intact sheath allows for guided regeneration.



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SUNDERLAND SUMMARY

- Type I: Equivalent to Neurapraxia (No Wallerian degeneration)
- Type II: Equivalent to Axonotmesis (Endoneurium intact)
- Type III: Axonal + Endoneurial injury
- Type IV: Perineurial injury + Fascicular disruption
- Type V: Complete transection (Neurotmesis) + Epineurial disruption
- Type VI: Mixed injury

Sunderland vs. Seddon Classification of Nerve Injuries

DEGREE OF INJURY (SUNDERLAND)	SEDDON EQUIVALENT	HISTOPATHOLOGIC CHANGES (MYELIN, AXON, ENDONEURIUM, PERINEURIUM)				TINEL SIGN (PRESENT, PROGRESSES DISTALLY)	
		MYELIN	AXON	ENDONEURIUM	PERINEURIUM	PRESENT	PROGRESSES
Type I	Neurapraxia	+	-	-	-	-	-
Type II	Axonotmesis	+	+	-	-	+	+
Type III		+	+	+	-	+	+
Type IV		+	+	+	+	+	-
Type V	Neurotmesis	+	+	+	+	+	-
Type VI		Mixed injury, components of I-V				(±)	(±)

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Sunderland Type IV is the critical threshold where spontaneous recovery becomes impossible due to perineurial disruption.



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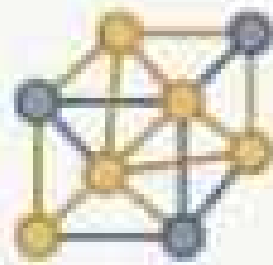


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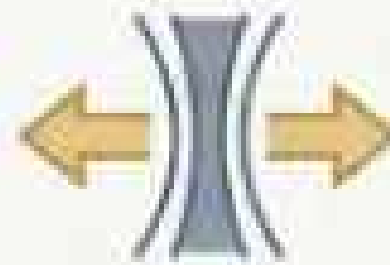
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Rapid Revision Summary Dashboard



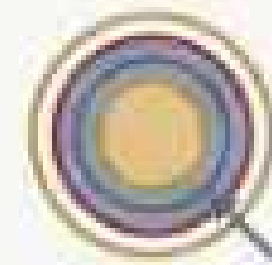
Anatomy

- Sequence: Roots → Trunks → Divisions → Cords → Branches
- Divisions give off NO terminal branches
- Cords are named relative to the Axillary Artery



Trauma

- Traction (MVAs) is the predominant mechanism (~50%)
- Supraclavicular injuries associate with the Subclavian artery
- Infraclavicular injuries associate with the Axillary artery



Pathology

- Nerve injury severity depends entirely on the depth of connective sheath disruption
- Layers: Epineurium → Perineurium → Endoneurium

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Complete root avulsion from the spinal origin represents the most severe, irreparable form of primary brachial plexus injury.



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Must-Remember Classifications & Values

Roots & Clinical Correlates

- Erb's Palsy Roots	C5, C6
- Klumpke's Palsy Roots	C8, T1
- Long Thoracic Nerve Roots	C5, C6, C7
- Ulnar Nerve Sensory Supply	Medial 1½ fingers

Recovery Rules & Timelines

- Sunderland Auto-Recovery Potential	Types I, II, and III only	⚠
- Neurapraxia Recovery Timeline	Days to weeks	
- Sunderland Type IV & V	Surgical repair required	⚠

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Sunderland Type III is the highest grade capable of spontaneous recovery because the axon remains capable of regeneration despite endoneurial injury.

Common Exam Traps



TRAP: Assuming all parts of the plexus give off branches.



TRUTH: Divisions give off NO branches.



TRAP: Assuming all intrinsic hand muscles are Ulnar-innervated.



TRUTH: Thenar muscles and Lateral 2 lumbricals are Median-innervated.



TRAP: Equating Sunderland Type III with guaranteed failure of recovery.



TRUTH: Spontaneous auto-recovery is still possible in Type III.



TRAP: Assuming Tinel sign is present in Neurapraxia.



TRUTH: Tinel sign is positive in Axonotmesis (Sunderland II & III), tracking distal progression.

EXAM PEARL The presence of a progressing Tinel sign fundamentally rules out Neurapraxia (Type I) and complete Neurotmesis (Type V/VI).



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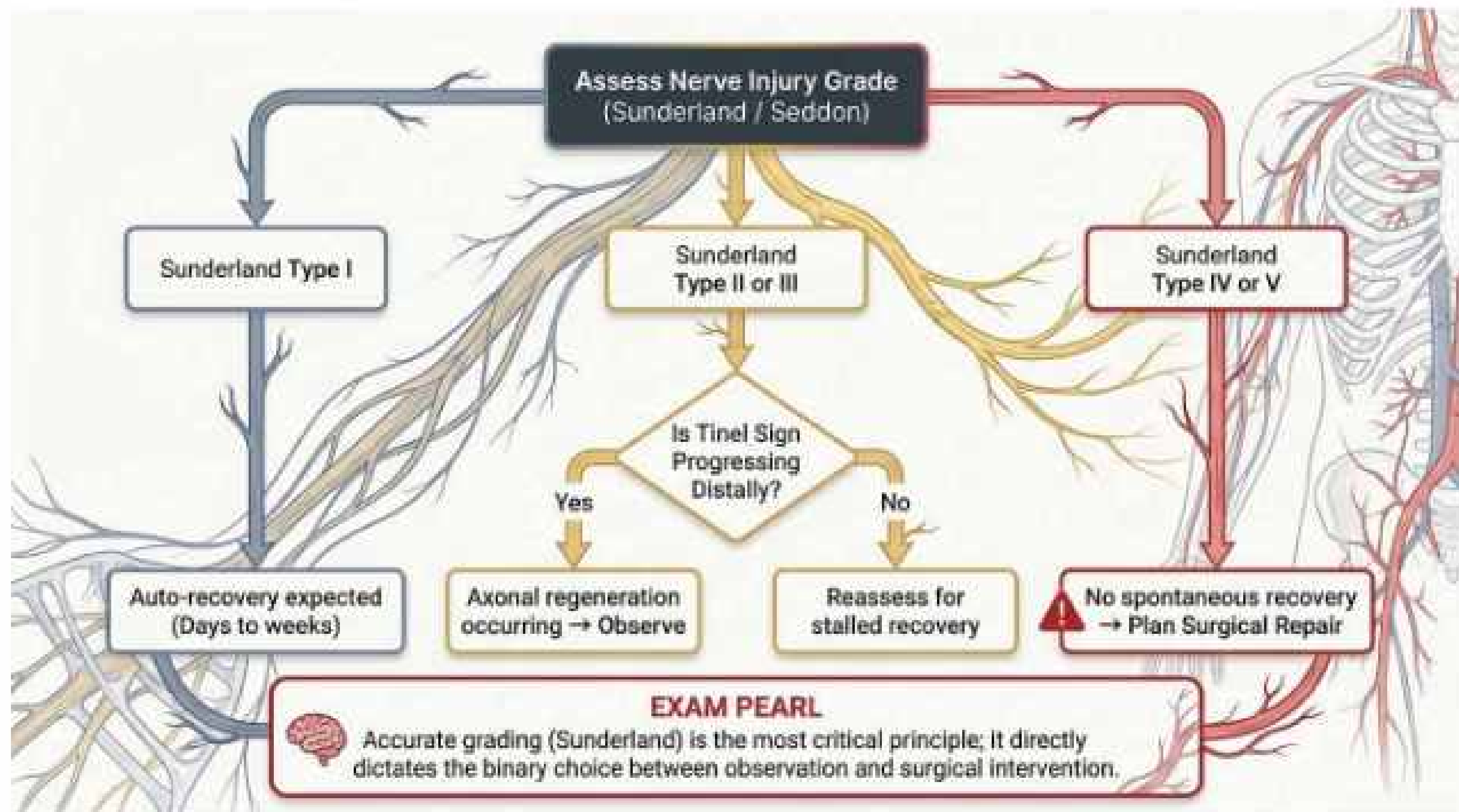
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Final Take-Home Messages

- Master the RTDCB sequence and cord relations to the axillary artery to localize lesions perfectly.
- Distinguish between supraclavicular (subclavian) and infraclavicular (axillary) injury patterns clinically.
- Understand peripheral nerve microanatomy to accurately apply Seddon's and Sunderland's classifications.
- Use the Tinel sign as your primary clinical monitor for axonal regeneration in Types II and III injuries.
- Lone axonal injuries (with intact sheaths) always carry a favorable prognosis compared to covering-sheath disruptions.

EXAM PEARL

The exact depth of histopathologic disruption (Myelin → Axon → Endoneurium → Perineurium → Epineurium) defines the patient's entire surgical prognosis.



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