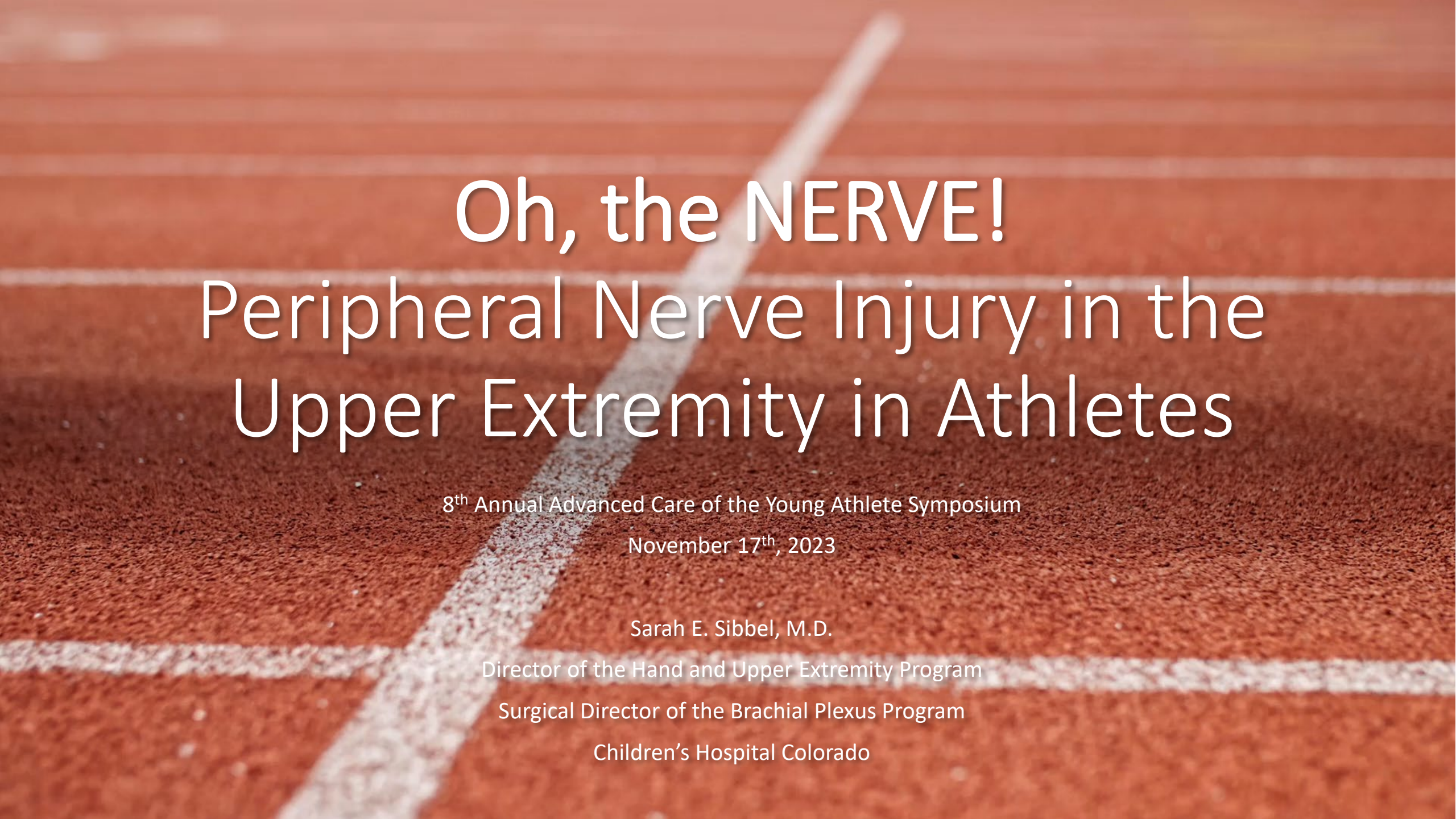

Oh, the NERVE!
Peripheral Nerve Injury in the Upper Extremity in Athletes

8th Annual Advanced Care of the Young Athlete Symposium

November 17th, 2023

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Objectives

1

The learner will be able to describe the different types of peripheral nerve injury that can occur from sports

2

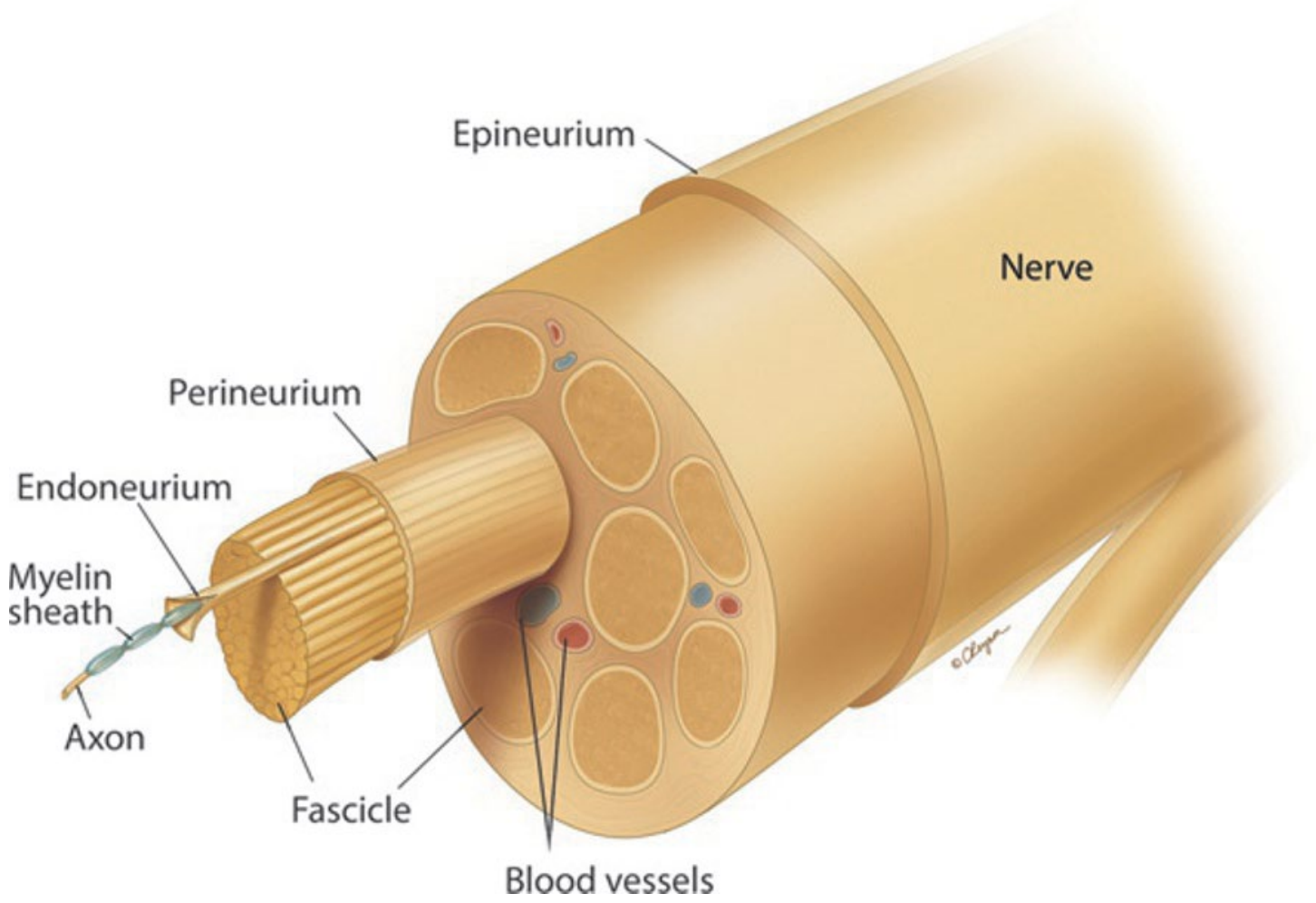
The learner will be able to identify the diagnostic studies used to evaluate peripheral nerve injuries

3

The learner will understand the timeline and importance of prompt recognition and referral for peripheral nerve injuries

Nerve Anatomy

- Epineurium →outer layer
  - Nourishes and protects fascicles
- Perineurium → surrounds fascicles
  - Biggest contributor to tensile strength of nerve
- Endoneurium → protects and nourishes axons



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Nerve Injury Classification

Table 1
Injury Classification

Seddon[2]	Sunderland[1]	Pathophysiologic Features
Neurapraxia	Type 1	Local myelin damage usually secondary to compression
Axonotmesis	Type 2	Loss of continuity of axons; endoneurium, perineurium, and epineurium intact
	Type 3	Loss of continuity of axons and endoneurium; perineurium and epineurium intact
	Type 4	Loss of continuity of axons, endoneurium, and perineurium; epineurium intact
Neurotmesis	Type 5	Complete physiologic disruption of entire nerve trunk

Lee & Wolfe, JAAOS 2000

Nerve Injury

- Mechanisms
  - Compression
  - Stretch
  - Traction
  - Laceration
  - Crush

- Causes
  - Acute injury
  - Repetitive microtrauma
  - Volume overload

- Factors that influence prognosis
  - Degree of traumatic nerve injury
  - Distance from injury to muscle

Diagnostic work-up

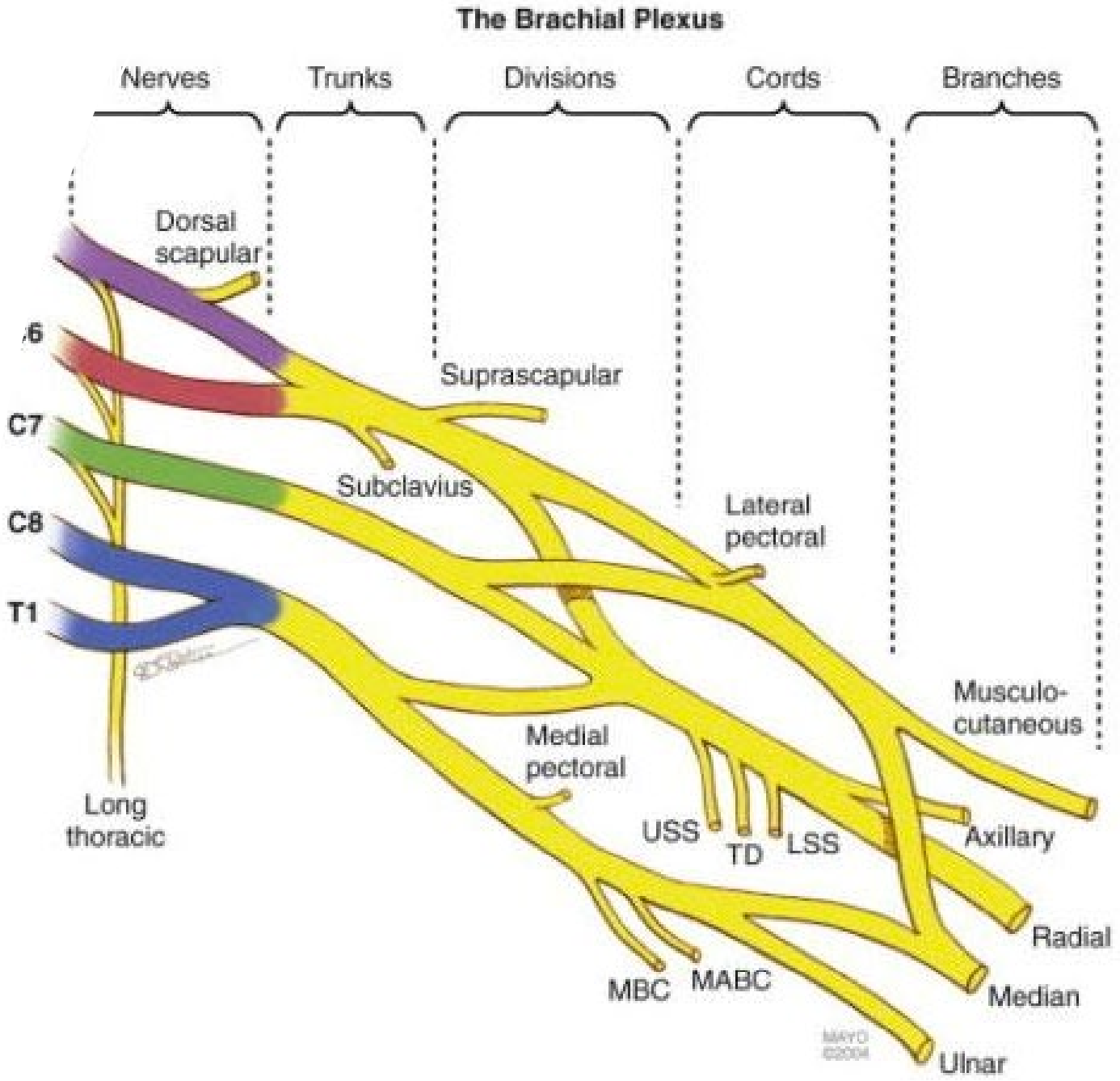
- X-ray
- CT Scan
- MRI
- Ultrasound
- EMG/NCS
- But most important: PHYSICAL EXAM!!!

Common UE Nerve Injuries in Sport

- Brachial Plexus Injury
  - Burners/Stingers
- Spinal Accessory Neuropathy
- Suprascapular Neuropathy
- Axillary Neuropathy
- Ulnar Neuropathy
- Median Neuropathy

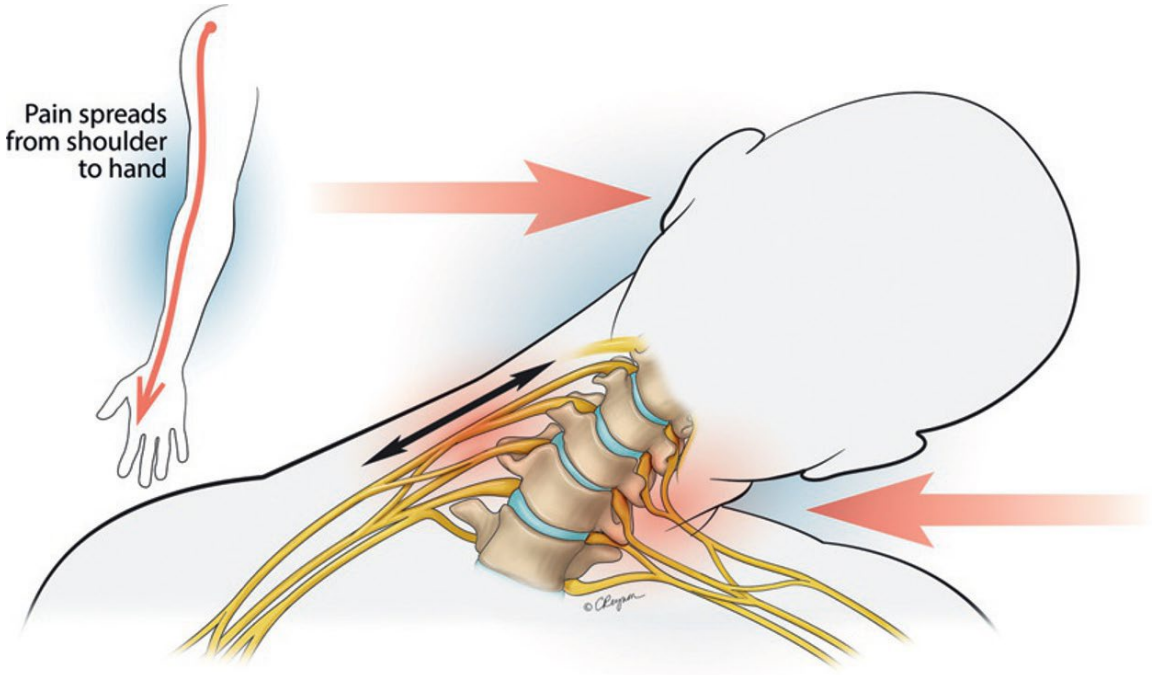
Brachial Plexus

- https://orthoinfo.aaos.org/en/diseases--conditions/brachial-plexus-injuries/



Burners and Stingers

- Injury to the nerve supply of the upper arm
  - Neck or shoulder
- Presents with inability to move the extremity after a high energy collision
  - Burning pain
  - “Shake off”
- Weakness in muscles innervated by the upper trunk
  - Deltoid, biceps, supraspinatus, infraspinatus
- Typically temporary and symptoms quickly dissipate
  - Neuropraxic injury
- Close observation for recovery
- Often underreported
- Bilateral symptoms should have work up for a central cause of injury



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Brachial Plexus Injury

A more severe stinger, if you will…

Medical evaluation if:

- More than 3 episodes in a 24 hour period
- Neurologic deficits that do not resolve after 24 hours

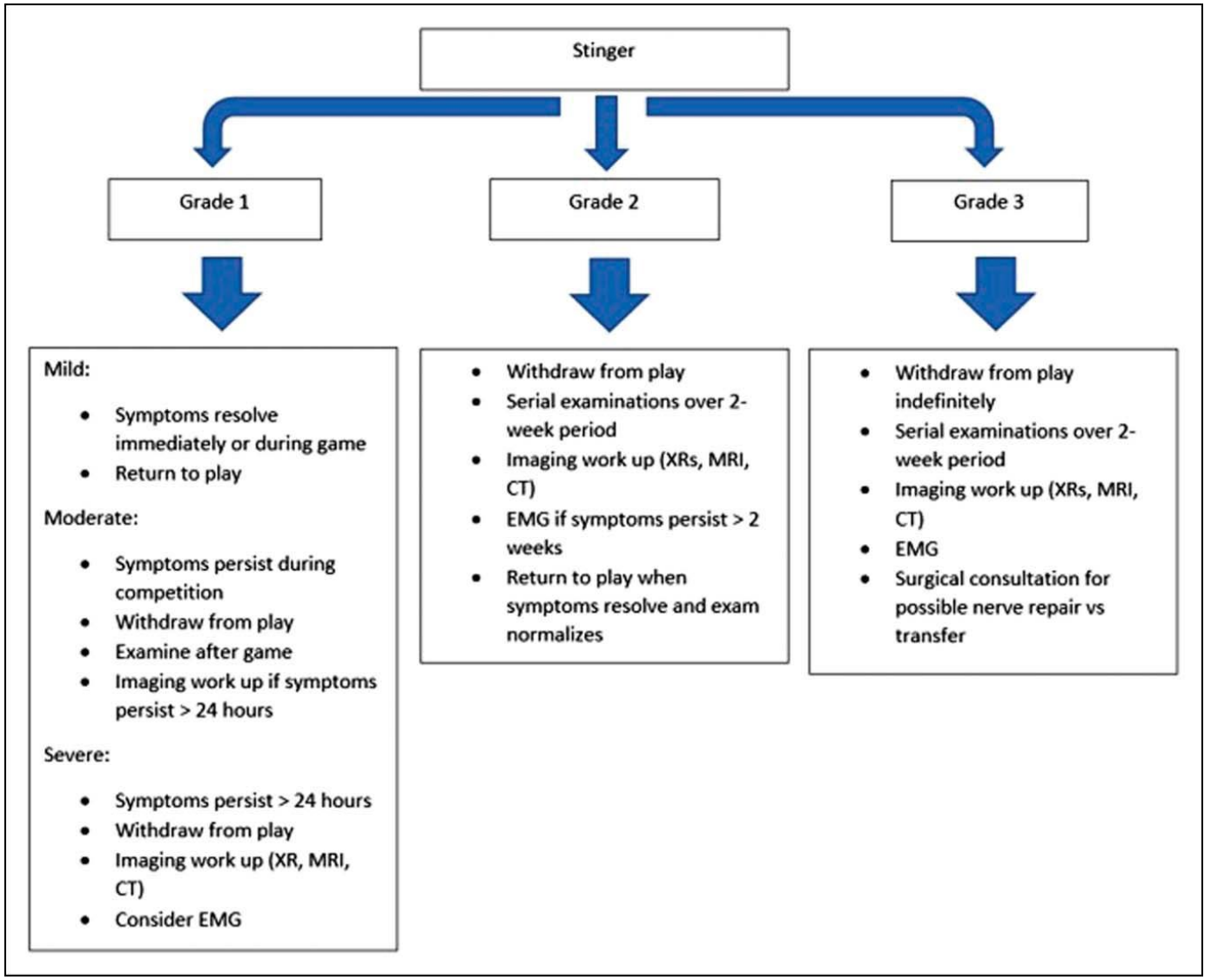
Imaging:

- Cervical spine radiographs
- CT or MRI

EMG/NCS

- Most sensitive once Wallerian degeneration of the distal axon has occurred
- 4-6 weeks from time of injury
- Can help determine location of injury and severity
- Find a trusted specialist, if you can

Brachial Plexus Injury Algorithm



Traumatic Brachial Plexopathy in Athletes. J Am Acad Orthop Surg 2019;27: 677-684

When to involve the nerve surgeon?

- Grade 2 or 3 injury patterns
- Any brachial plexus injury that does not resolve spontaneously after ~2 weeks
- Any patient with Horner's syndrome
- Worsening neurologic exam
- Flail arm

Why?

Timing of nerve directed surgery is VERY IMPORTANT

A delay in the care may result is loss of the ideal "window" to potentially intervene surgically (ideally 6-12 months)

Prompt evaluation allows the surgeon to follow serial clinical exams

- Allows us to see improvements with time
- Allows us the time to obtain further diagnostic work-up

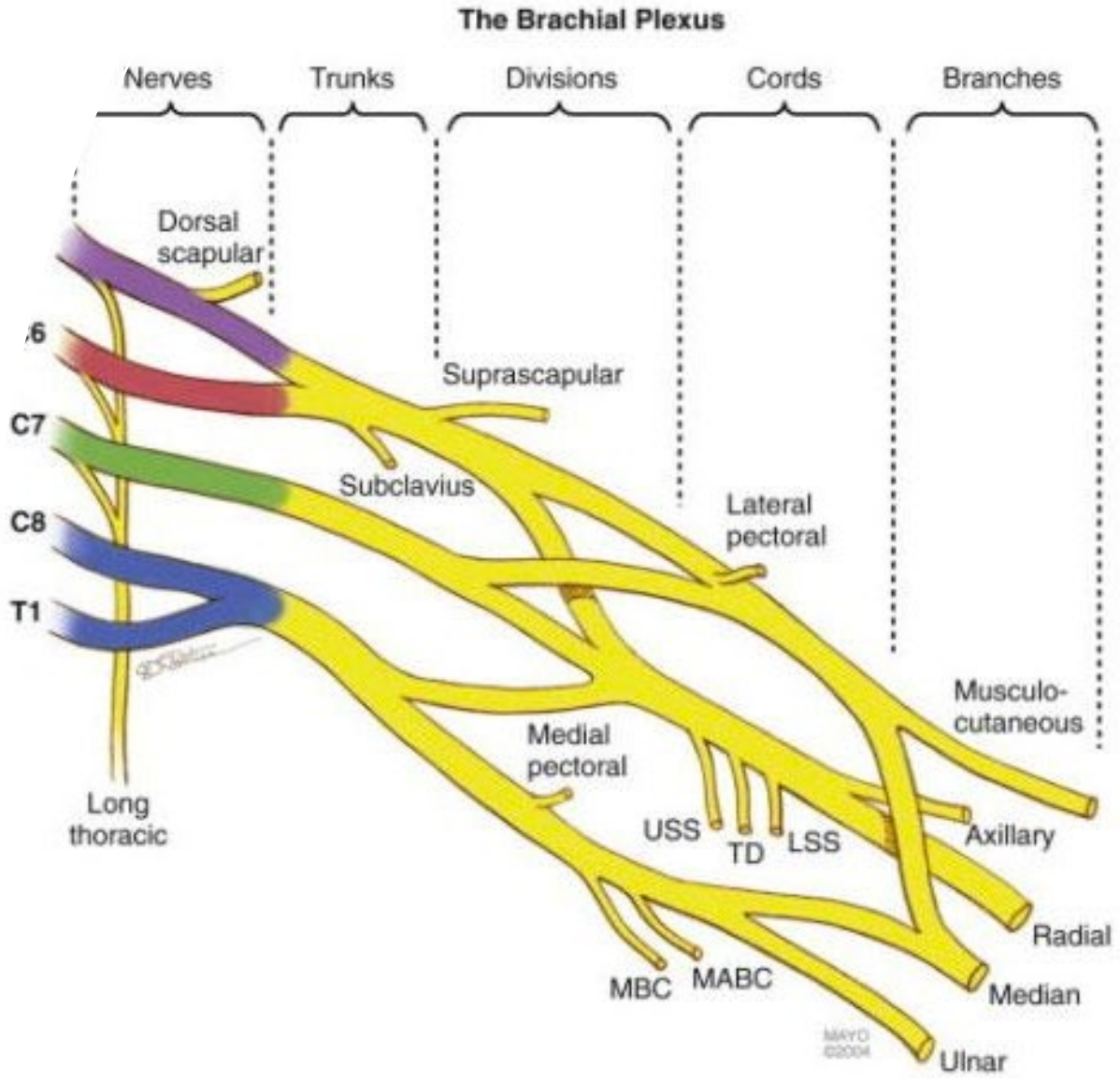
Allows us to thoroughly discuss nerve injury with a family

Cultivates the patient-surgeon relationship

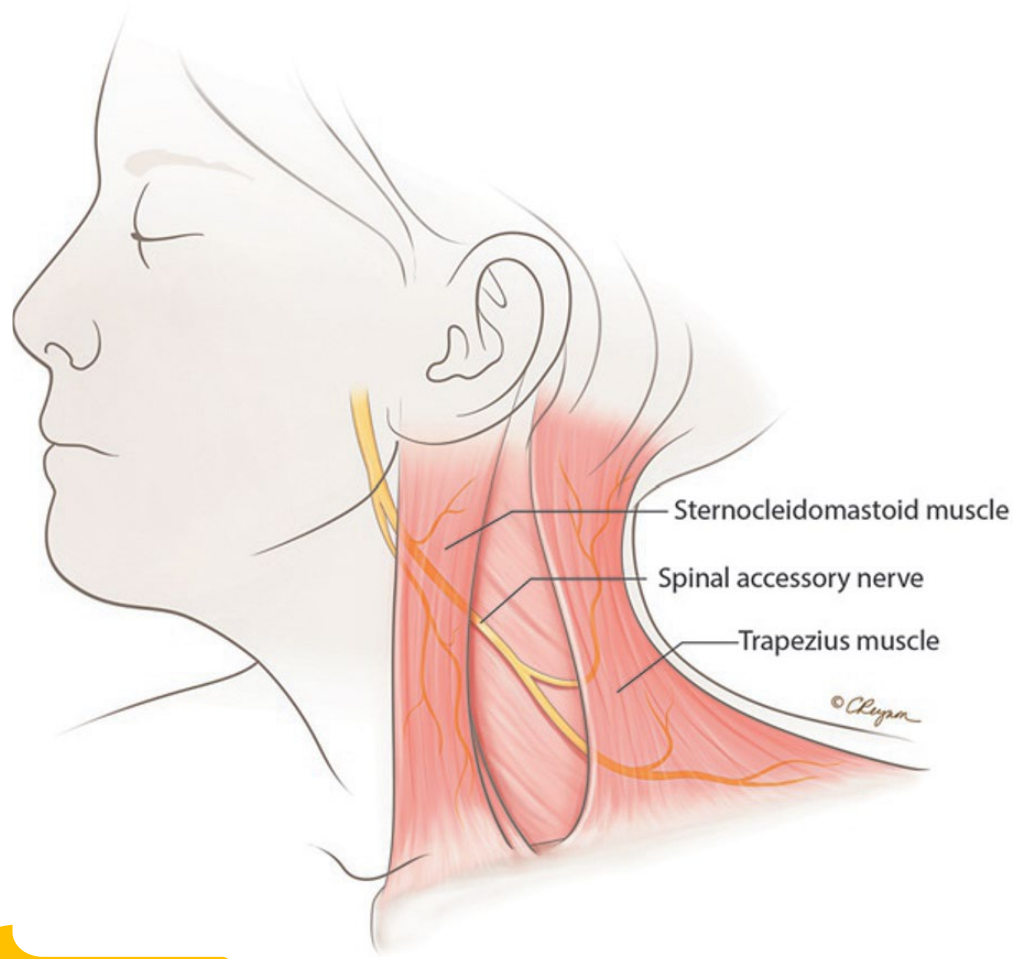
What do I do about it?

- BP exploration to evaluate neuroma and graft (if needed)

- **Nerve transfers:**
  - SAN to SSN
  - Triceps nerve branch to Axillary nerve
  - Oberlin transfers:
    - Ulnar nerve fascicle to biceps branch (musculocutaneous)
    - Median nerve fascicle to brachialis branch (musculocutaneous)



Spinal Accessory Nerve



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- Pure motor nerve to trapezius and SCM
- Injury typically occurs from a direct blow to the neck
- May also occur from a traction injury
- SCM is typically spared as innervation is proximal
- Trapezius is always involved
- Loss of trapezius function results in scapular winging
- Bonus point: What type of scapular winging resuls from trapezius paralysis?
  - Lateral

Suprascapular Nerve

Seen in repetitive overhead loading activities

Baseball

Swimmers

Volleyball

Tennis

Presentation:

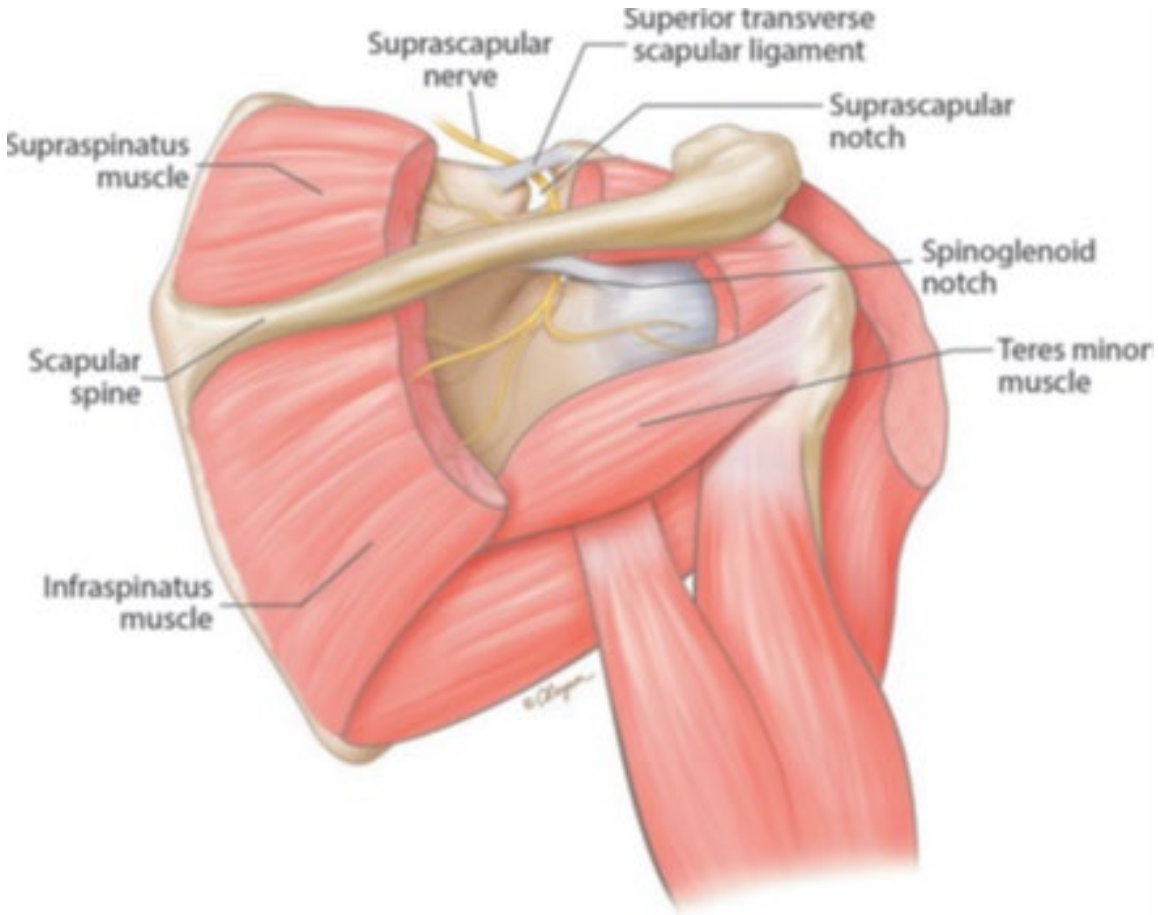
Shoulder pain with weakness of shoulder abduction and ER

Mimicks a RTC injury

Cause:

Nerve compression from a cyst in spinoglenoid or suprascapular notch

Traction



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Suprascapular Nerve

- EMG/NCS helps to identify the site of compression:
- Suprascapular notch compression = weakness in both supraspinatus and infraspinatus
  - Shoulder ER and abduction will be weak
  - More common
- Spinoglenoid notch compression = weakness in infraspinatus only
  - Shoulder ER is weak

Axillary Nerve

Presentation:	• Shoulder pain with abduction weakness
Causes:	• Traction injury • Direct blow to quadrilateral space • Shoulder dislocation can cause a traction injury • Iatrogenic
Work-Up:	• EMG/NCS to define the extent of injury
Treatment:	• Non-operative with therapy • Surgery is indicated in severe, complete cases • Nerve transfer: triceps branch to axillary nerve

Ulnar Nerve: Elbow

Most common in baseball players

Valgus stress across the medial elbow results in microtrauma to the mUCL

Joint laxity leads to nerve hypermobility, stretching, compression and subluxation of the nerve

Clinical findings:

Sensory loss and paresthesias in the ring and small fingers

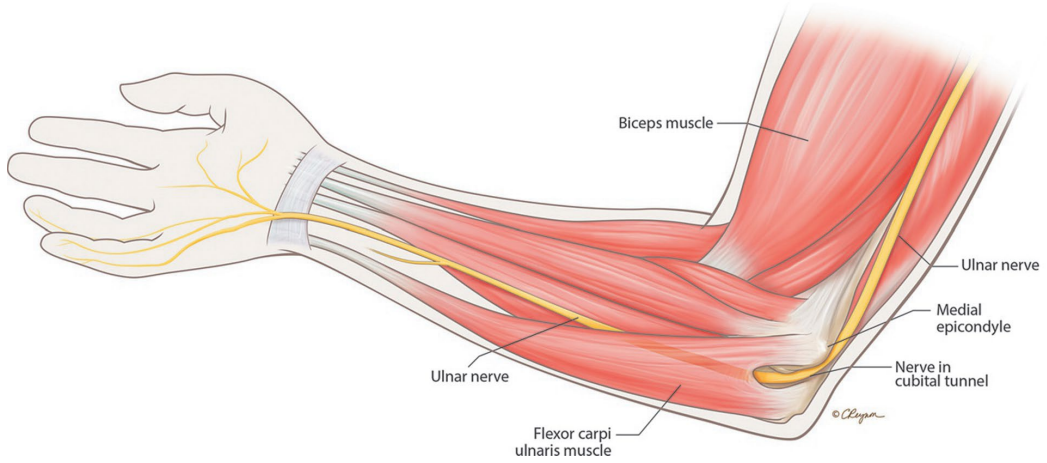
Vague pain over medial elbow and forearm

Hand weakness

Ulnar Nerve: Elbow

Patient should be evaluated for BOTH nerve and mUCL pathology:	Non-operative treatments:	Surgery
• Physical exam • X-ray • MRI • EMG/NCS	• Rest • ROM • PT/OT • Night splinting • Strengthening • Assessment of throwing mechanics	• Persistent symptoms • Nerve instability • Cubital tunnel release with or without transposition

Ulnar Nerve: Wrist



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- Guyon's canal
- Pressure placed on the wrist
  - Cyclists
  - Golfers
  - Baseball players
- Wheelchair athletes
- EMG/NCS used to distinguish location of compression (proximal vs. Distal)

Median Nerve

- Multiple sites of potential compression
- Most common is the carpal tunnel
- Symptoms:
  - Wrist pain
  - Weakness in thenar musculature and some intrinsics
  - Numbness/tingling in the volar thumb, index, long and radial ½ of ring finger
- Treatment:
  - Splinting to place wrist in neutral position
  - Stretching exercises
  - Corticosteroid injection
- If all fails... can consider CTR

Questions?

Thank you!!!