Common Upper Extremity Nerve Entrapment Syndromes

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Learning Objective

- Awareness of pain syndromes that are commonly overlooked.
- Describe some common upper extremity nerve injury symptoms and physical exam findings.
- Identify the locations of some of the most common upper extremity nerve entrapments.
- Basic understanding of how EMG, MRI and diagnostic MSKUS can be used to identify these syndromes.
Basic Nerve Anatomy

- Anatomy
  - Endoneurium
    - Surrounds axons of peripheral nerves
  - Fascicles
    - Groups of axons
  - Perineurium
    - Surrounds individual fascicles
  - Epineurium
    - Intraneural
    - Outer circumferential
Basic Nerve Anatomy

- **Anatomy**
  - **Endoneurium**: Surrounds axons of peripheral nerves
  - **Fascicles**: Groups of axons
  - **Perineurium**: Surrounds individual fascicles
  - **Epineurium**: Intraneural, Outer circumferential

![Diagram of nerve anatomy](image)
Types of Nerve Injury

**Neuropraxia**
- Injury - Mild
- Recovery

**Axonotmesis**
- Injury - Severe
- Regeneration (1 mm/day)
- Recovery

**Neurotmesis**
- Injury
- Degeneration
- Neuroma Formation
Pathophysiology of Entrapment

Etiologies
- Isolated contusion
- Repetitive compression
- Stretch
- Surgical injury

Patterns of injury
- Demyelination → neurapraxia
- Axonal Loss → axonotmesis
- Transsection → neurotmesis
Entrapment Neuropathy

Compression of nerve

- Fibrous bands
- Scar tissue, ORIF
- Masses
- Narrow anatomical space
- Bony callus
- Cast, braces
- External compression
- Inflammation
Pathophysiology

- Prolonged compression causes ischemia due to compression of vasa nervorum.
- Mechanical deformation of the myelin sheath.
- Impairment of axonal transport.
- Proliferation of intra-neural connective tissue.
Physical Exam

- Physical exam findings are typically vague and non-localizing in early disease making a diagnosis challenging.
- If muscle weakness or atrophy is present in late stage disease the diagnosis is more readily made.
- Most injuries will have subtle features of a more classical nerve entrapment syndrome.
- Most physicians have little experience recognizing, diagnosing or treating many of the sensory cutaneous branch entrapments.
- “Classical” presentations are rarely present.
PE Symptoms

- “History” of poorly localized deep aching pain.
- Paresthesias, numbness, or dysesthesias
- PE findings of decreased sensation of sensory nerve distribution.
- Weakness of motor nerves distal to injury site.
- Tinel’s over entrapment.
- Pain with compression maneuvers.
Pain & Sensory Exam Findings

- Although PE findings can be classical they can likewise be vague.
- Know your nerve innervation patterns.
- Must have a sophisticated exam.
Electrodiagnostic Evaluation of Nerve Injury

Electrodiagnostic evaluation has two parts (Physiologic & EMG). Physiologic test of nerve function identifies type of injury (demyelinating, axonal or both)

Sensory & Motor Conduction

- **Distal Latency** is the time it take from a distal stimulation to the recording electrode. Prolonged = slowing or distal latency = demyelinating injury.

- **Amplitude** is the amount of signal that reaches the sensor. Decreased amplitude = conduction block from demyelination or axonal injury.

- **Conduction velocity** measures the speed at which the nerve conducts electricity or simply decreased conduction velocity = demyelinating injury.
Evaluation of Nerve Injury

- **Needle ElectroMyoGraphy (EMG)**
  - *Spontaneous activity* due to axon activity (3 weeks)
  - *Recruitment Pattern* or recruitment of motor units for increased muscular contraction. Decreased = conduction block form demyelination injury.
  - Amplitude is the size of the motor unit or simply the number of muscle cells per motor unit. The amplitude is increased with chronic axonal injury. *I.e.* healthy nerves are taking over for the injured nerves.
  - Duration is the length of the motor unit. This = the density of muscle cells in a motor unit. Increased in chronic axonal injury.
  - Phases is the times the motor unit crosses the baseline. Increased with chronic disease
  - Interference pattern is the ability to fill the screen with motor units with maximal contraction
Exceptions to EMG/NCT

- **Must have demyelination of the nerve or significant axonal damage.**
- **At least 3-6 weeks after injury. EMG -**
- **First Degree or neurapraxia injury not well identified. EMG -**
- **Second Degree injury or axonotmesis not well identified. EMG -**
- **Third Degree = injury to the axon & endoneurium. EMG + helpful.**
- **Fourth Degree = injury to axon, endoneurium, perineurium. EMG +**
- **Fifth Degree = injury to axon, endoneurium, perineurium & epineurium. EMG +**
Ultrasound Evaluation of Nerve Entrapments
US Evaluation of Nerve Entrapments

- Longitudinal view can show a constricting tissue that creates a loss of normal linear architecture proximal swelling and distal tapering to normal nerve diameter.
- Normal nerves gradually decrease in size as you scan distally.
Ultrasound Appearance of Abnormal Nerves

- Caliber change secondary to entrapment. Nerve becomes enlarged proximal to site of compression (2-4 cm)
- Nerve returns to normal caliber or size after entrapment area.
- Loss of normal internal echo-texture. Loss of honey comb appearance secondary to swelling and edema.
- Decreased mobility of the nerve at site of entrapment.
- Sonographic palpation of the nerve to reproduce symptoms.
Evaluation Includes The Muscles

- Comprehensive exam includes muscular exam for atrophy or signal change.
- Fatty infiltration or high intensity signal when compared to surrounding muscle indicates nerve injury or tendinous injury (RTC).

Tuesday, June 17, 14
Exceptions to MSKUS

- Can’t see nerves underneath bone.
- Can be limited by the size of patient, power and processing speed of the ultrasound machine.
- Skilled and experienced MSK ultrasound sonographer.
In late stage disease MRI is very accurate as muscle atrophy or edema is present. 93%

MRI sequences images every 3-4 mm so they can miss an entrapment area.

Good sensitivity but poor specificity if negative study (20-30% sensitivity and specificity) for smaller nerves.

Many peripheral nerves are “small” and can be missed unless grossly enlarged.

Good at ruling in but poor at ruling out.

Can’t use with spinal stimulator or pacemaker.
MRI Accuracy

- Hyper-intense signal of the nerve suggest edema nerve damage.
- 60% of asymptomatic individuals have hyper-intense signal of the ulna nerve.
- Superior view for deep structures.
- Patient size?
Ultrasound can enhance the accuracy and safety of the clinical neurophysiology examination while providing additional structural and functional information. For these reasons, ultrasound is an ideal complementary tool that can enhance the electrodiagnostic evaluation, and as this develops, with an expanding base of literature, we foresee that high-resolution diagnostic ultrasound may become an integral component in the evaluation of neuromuscular disease.
Treatment Requires An Accurate Diagnosis

- Nerve entrapment syndromes can linger for years until the correct diagnosis is made.
- Beware of chronic pain syndromes that have numbness or radicular pain.
- The clinician must not rush to a malingering diagnosis unless they have a good understanding of peripheral nerve anatomy.
Upper Extremity Nerve Entrapment Syndromes

Axillary neurovascular structures
Upper Extremity Nerve Entrapments

- Common cause of pain.
- You may be looking at it, but don’t recognize it! May occur to the sensory or cutaneous nerve only.
- May or may not include muscular weakness.
- Muscle atrophy is a late finding.
- Muscle edema and fatty infiltration on MRI.
- EMG are typically unreliable in most upper extremity cutaneous nerve entrapment syndromes.
Spinal Accessory Nerve Injury (SAN)

- Innervation of the trapezius muscle.
- The shoulder may droop and muscle atrophy may be present (late)
- May cause weakness to sternocleidomastoid.
- Causes pain, weakness, and scapular winging.
- Winging is seen with abduction not with forward flexion.
- Winging of the inferior tip of the scapula.
SAN - Superficial Cervical Plexus

- Greater Auricular
- Supraclavicular
- Lesser Occipital
- Transverse Cervical
- Spinal accessory
SAN Injury

- Stretch or traction injury.
- Sling immobilization, backpack strap, knot in sling.
- Wrestling, fighting.
- Neck cracking.
- Whiplash injury-seatbelt injury.
- Dislocation of the AC joint,
- Lymph node surgery to the neck.
- Plastic surgery to the neck or face.
PE Finding in SAN

SAN has important sensory and motor contribution to the trapezius muscle and injury to the SAN contributes to shoulder dysfunction and pain.

- Limited or loss of sustained abduction of the shoulder.
- Loss of motion similar to frozen shoulder.
- Ipsilateral shoulder droop
- Internal rotation of the shoulder.
- Atrophy of the trapezius.
- Scapular winging with abduction.
- Failed shoulder rehab program and minimal MRI findings.
SAN Imaging

- EMG of the SAN does not correlate well with the clinical symptoms and level of shoulder dysfunction.
- EMG is best used for evaluation in the setting of weakness or atrophy.
- MRI is sensitive if atrophy or significant weakness is present.
- MSKUS helps with localization of the nerve and diagnostic nerve block to confirm pain generation.
- MSKUS can be used for evaluation and treatment.
Spinal Accessory Nerve Treatment

- NSAID’s, compounding pharmacy, iontophoresis and neurontin.
- PT or massage therapy of stretching of the SCM.
- Nerve block.
- Neurohydrolysis = hydrodissection
- Surgical decompression.
Spinal Accessory Nerve Injection.

- Injection to resolve trap and neck pain.
- Think seatbelt injury.
Long Thoracic Nerve Entrapment

- Innervates the serratus anterior muscle
- Seen with labor workers lifting and carrying (Think wheelbarrow) secondary to bulk of the serratus anterior and pectoralis (traction injury)
- Causes winging with forward flexion.
- Winging of the inferior border of the scapula.
Long Thoracic Nerve Injury

- *Originates from C5 - C7.*

- *Descends posterior to the clavicle and anterior to the first - second ribs.*

- *The function of the serratus anterior is to stabilize the scapula during the early degrees of shoulder abduction. Winging with forward flexion.*

- *Can be injured in cervical whiplash, anterior chest wall trauma and neuralgic amyotrophy (Parsonage-Turner Syndrome).*
Treatment Long Thoracic Nerve

- NSAID’s, oral steroids, neurontin.
- Physical therapy, stretching.
- Chiropractic first rib manipulation.
- US guided decompression neurohydrolysis.
- Surgical decompression.

Tuesday, June 17, 14
Axillary Nerve Entrapment

- Acute shoulder dislocation.
- Direct blow to anterior-lateral deltoid.
- Overhead workers.
- May occur with severe motor findings without sensory findings.
- Hertel sign or loss of ability to hold arm in extension.
Axillary Nerve Injury

- Injury associated with the hyper-laxity of the shoulder.
- Direct trauma to the lateral shoulder with a fall.
- Weakness and fatigue with overhead activity with lifting.
- Subtle numbness to lateral shoulder & weakness to deltoid.
Quadrilateral Space Syndrome

- Involves compression of the axillary nerve and posterior circumflex artery.
- Typical presentation is vague & nonspecific.
- Pain is usually dull, burning or deep ache.
- Worse with overhead activity.
- Deltoid and teres minor weakness.
- Dead arm, posterior lateral pain in a non dermatomal pattern.
- Point tenderness QS, pain with abduction and external rotation.
Quadrilateral Space Syndrome Evaluation

- MRI is useful if tumor or space-occupying lesion. Arteriogram may be helpful.
- EMG’s typically negative as this is an intermittent compression with overhead work.
- Rehab with stretching, biomechanics.
- NSAID’s, rest, restriction of overhead.
- US is helpful for overhead evaluation as Doppler US can be used to evaluate for Neurovascular compromise/compression.
Axillary Nerve Treatment

- Neurohydrolysis to stretch out surrounding tissue.
- Nerve block to confirm pain.
- Surgery for recalcitrant cases failing to improve after six months.
- PT/OT.
- Stretching program.
- Limit overhead work.
Suprascapular Nerve Entrapment

- Innervation of infraspinatus and supraspinatus.
- Paralabral cyst is most common cause.
- Large rotator cuff tears. Osteoarthritis.
- Shoulder pain beyond the findings.
Suprascapular Nerve Entrapment

- Appears to be the most commonly injured peripheral branch of the brachial plexus.
- Typical presentation is painless weakness of the external rotators.
- Vague shoulder pain to the lateral shoulder as presenting complaint.
- 30-45% had infraspinatus muscle impairment by neurophysiology.
Suprascapular Nerve Injury in Athletes

- Frequency of the disorder is increasing as it appears to be common in volleyball, baseball and other overhead or throwing sports.
- One study up to 45% of shoulder pain.
- Decrease throwing velocity and or hitting power.
- Pain with over head work.
- Backpacker’s shoulder & construction workers. Think straps across the shoulder or overhead work. Carpenters nail bag.
Diagnostic Testing

- MSKUS look for focal compression of nerve from space occupying lesion (paralabral cyst, lipoma or ganglion)
- EMG/NCS many false positive and false negative test.
- MRI best at showing paralabral cyst secondary to labral tear.
- MSKUS diagnostic injection very useful to the suprascapular notch or spinoglenoid notch.
SSN Entrapment Treatment

- NSAID’s, rest, activity modifications & biomechanics. 6-12 months.
- Rehab focus on RTC, deltoïd, scapular stabilization posterior capsule stretching.
- US guided neurohydrolysis
- Cortisone?
- Address structural lesion as treatment depends on etiology.
- Traumatic 65%, inflammatory 28%, cyst 26%.
Treatment for Shoulder OA & Pain

- Nerve blocks can be used to help with glenohumeral OA, adhesive capsulitis, full thickness rotator cuff tears not eligible for repair.
- PT for nerve glides, RTC strengthening program and massage therapy.
- Acupuncture.
- Surgical release of nerve.
Musculocutaneous Nerve Entrapment

- C5 – C6
- Lateral cord
- Biceps brachii, brachialis, coracobrachialis,
- Superficial sensory after elbow is lateral antebrachial cutaneous n. (LABCN)
Musculocutaneous Nerve

Muscular weakness to the Bicep & Brachialis

Radicular pain down the lateral flexor surface of the forearm.

Repetitive lifting
MCN = Lateral Antebrachial Cutaneous Venipuncture Injury
Musculocutaneous Nerve Imaging

- Study of MC nerve entrapment found with MSKUS
- All had abnormal EMG/NCS.
- MRI showed abnormal nerve 75%.
- Only seen on T2 images as hyperintense signal.
Lateral Antebrachial Cutaneous Nerve
LABCN Entrapment

- Lateral elbow pain 3-5 cm proximal to elbow crease
- Associate with repetitive activity.
- Forearm paresthesia.
- Lidocaine injection/block resolves pain.
- Partial surgical release of bicep tendon resolves pain.
- Painful Brachioradialis

Naim et al., *Journal of Hand Surgery*, 2004
23 pts with LABCN entrapment
All with lateral elbow pain 3-5 cm proximal to elbow crease
Often associated with repetitive activity
6 had forearm paresthesia’s
All had pain go away with lidocaine injection
All with + EMG/NCS

TREATMENT
- 7 resolved spontaneously
  - None with paresthesia’s
- 16 had partial resection of lateral biceps tendon
  - 14 with complete resolution
  - 2 with mild persistent pain

pronation
supination
LABCN Treatment of Nerve Entrapment
Medial Brachial Cutaneous Nerve

- Composed of fibers from C8 cervical root and T1.
- Arises from the medial branch of the brachial plexus.
- Provides cutaneous sensation the medial posterior upper arm.
- Injured with venipuncture.
- Medial arm pain that may mimic medial epicondylitis.
- Think failed golfer’s elbow.
Medial Elbow Pain That Won’t Go Away?

- MACN neuropathy include iatrogenic reasons such as steroid injection due to medial epicondylitis, routine venipuncture, cubital tunnel surgery, loose body removal, elbow arthroscopy, open fractures fixation, tumor excision. It is also caused more rarely by repeated minor trauma (golf, tennis & throwing sports) and soft tissue laceration.
Medial Brachial Cutaneous Nerve

- Followed from the mid upper arm down across the elbow.
- Mostly an ache that won’t go away. May have numbness.
Median Nerve Entrapments

- May occur at the shoulder, arm, elbow, forearm and hand.

- Diagnosis requires the tools of electrophysiological and ultrasound to make an accurate diagnosis.

- Early and accurate diagnosis facilitates optimal treatment.

- Treatment depends on an accurate diagnosis.
**Median Nerve Entrapment**

- *Multiple entrapment sites besides the carpal tunnel.*
- *Sensory precedes motor.*
- *EMG 85-90% in later stages.*
- *MRI for difficult cases, Poor sensitivity if early disease.*
- *MSKUS 99% sensitivity and specificity.*
Entrapment Sites of the Median Nerve

- Carpal Tunnel Syndrome
- Palmar Cutaneous Nerve
- Pronator Teres Syndrome
- Anterior Interosseous Syndrome
- Proximal forearm at the fibrous arch of the heads of the flexor digitorum superficialis
- Distal elbow by the ligament of Struthers
- Proximal elbow by a thickened biceps aponeurosis
Pronator Syndrome Median Nerve

- Aching pain in the proximal volar forearm.
- Paresthesias in the thumb, index & middle finger.
- Pain increases with pronations and supination.
- No nocturnal pain.
- Numbness over the thenar eminence, but not with CTS.
Pronator Syndromes PE

- **Sites of compression include:**
  - **Ligament of Struthers**- flexion of elbow against resistance 120-135 degrees
  - **Pronator teres** - Pain with resisted pronation with wrist flexed.
  - **Lacertus fibrosis**- pain with resisted elbow flexion.
  - **Fibrous arch FDS**- pain with resisted middle finger flexion.
Imaging Pronator Teres Syndrome

- Entrapment of the Median or the Anterior Interosseous nerve.
- Think the atypical carpal tunnel syndrome patient.
- If didn’t get better with carpal tunnel surgery think pronator teres syndrome.
Anterior Interosseous Nerve Entrapment
AIN Syndromes

- Anterior Interosseous Syndrome is a pure motor branch.
- Compressed at the Pronator Teres or by repetitive elbow flexion or repetitive pronation/supination.
- Pure motor weakness.
- OK sign as they can’t pinch thumb and finger together.
- Weakness of flexor pollicus longus & flexor digitorium profundis.
- Shoulder pain and then weakness of AI = Parsonage Turner Syndrome = acute brachial neuritis.
- The accessory head of flexor pollicis longus (Gantzer muscle).
- The deep head of the pronator teres muscle.
- A fibrous arch in the flexor digitorum superficialis of the middle finger.
- Fractures of the radius.
- Aberrant origin of the flexor carpi brevis radialis muscle.
- Aberrant origin of the palmaris profundus muscle
- Inflammatory neuropathy analogous to Parsonage-Turner syndrome.
- Thrombosis of the ulnar collateral vessels
- Post-traumatic hematoma.
- Soft tissue masses (e.g., lipomas).
- Prolonged external compression from crush injuries or tourniquet.
Medial Palmer Cutaneous Branch Entrapment

- Branches off the median nerve before the proximal carpal tunnel.
- CTS does not include numbness to the hyper-thenar.
- Compressive neuropathy.
- Sensory only, no weakness!
Carpal Tunnel Syndrome

- Classical median nerve symptoms to the index, middle and radial 1/2 of the 4th finger. Night time pain.
MSK UltraSound Criteria for Carpal Tunnel Syndrome

- Greater 2mm bowing of the flexor retinaculum.
- 2mm increase in the cross sectional area measurement of the median nerve when measured from pronator quadratus and the nerve size within the carpal tunnel.
- Nerves decrease in size as they course distally.
- 99% sensitivity and 100% specificity.
- Presence of hyperemia within the nerve on doppler ultrasound has a 95% accuracy alone.
EMG Testing For CTS?

- Good sensitivity. A positive test is 85-90% that they have the disease. Demyelination and atrophy.

- OK Specificity. Most EMG testing is intermediate at identifying those with a negative test as some still have the disease. High false negative testing with early disease.

- EMG for CTS if done well has good sensitivity and specificity when neuropathy is present. Many other nerve entrapment syndromes about 50% specificity for early disease.

- Bifid median nerve or atypical location?

- Specificity is very operator dependent ax small nerves are hard to find.
Median Nerve Recurrent Motor Branch

- Exits after carpal tunnel outlet.
- Mostly a motor branch to the adductor pollicus brevis, flexor pollicus brevis and opponens pollicis.
Median Nerve Entrapment Treatment

- NSAIDS
- Night Splints
- Ergonomics!!!!
- Iontophoresis
- CS injection
- Hydroneurolysis
- Surgery
CT Treatments

- **Beware of braces**, many have a hard aluminum stay that as the padding wears out compresses the nerve. Needs to have a soft gel pad and nylon stay.

- **Injections.**

- **Surgical release for failed conservative treatment.**
Ulnar Nerve Entrapment

- C8 - T1
- Medial cord
- FCU, FDP(4/5), ADM, ODM, FDM, Lumbricals 3 & 4, Interossei, Adductor pollicis, FPB(1/2)
- sensory to ulnar palm and small finger
Cubital Tunnel Neuropathy

- Common ulnar nerve entrapment site
- Causes:
  - constricting fascial bands
  - subluxation of the ulnar nerve over the medial epicondyle
  - cubitus valgus
  - bony spurs
  - Tumors
  - Ganglia
  - Direct compression
  - Trauma
Cubital Tunnel Syndrome

- Physical Exam:
  - Numbness/tingling in ulnar distribution
  - Weakness of ulnar innervated muscles
    - Passive benediction sign
  - +/- Tinels (check other side)
  - Froment sign

- Wartenberg sign
MSKUS Evaluation

- Mean x-sectional area of Ulnar nerve at elbow is 6-7mm² (Cartwright et al, 2007)
- Normally this is 0.5-1mm² larger than prox. forearm or distal UE (Chiou et al, 1998)
- X-sectional area > 10mm² always abnormal (Weisler et al, 2006)
  - Will vary with elbow position so be consistent/careful with measurements
- Always evaluate nerve fasicular architecture (Gruber et al, 2010)
- Worse outcomes following ulnar neuropathy at elbow have been associated with more pronounced ulnar nerve thickening
  - EMG evidence of demyelination associated with favorable outcomes (Beekman et al, 2004)
Entrapment Evaluation
Snapping Ulna Nerve Syndrome
Cubital Tunnel Treatment

- 50% improve spontaneously
- Avoidance of pressure on elbow
- Elbow extension brace
- PT/OT
- Cortisone injection has little or no evidence unless inflammatory component is present. Power doppler hyperemia.
- Hydroneurolysis
- Surgical decompression vs transposition
Dorsal Cutaneous Ulna Branch Entrapment

- Provides innervation to the dorsal surface of the 4th & 5th finger
- Entrapment from prolonged casting or bracing.
- Repetitive pronation/supination
- Can mimic 6th dorsal compartment tenosynovitis
Dorsal Cutaneous Ulna Nerve Treatment

- NSAID’s, stretching, rest.
- Protective padding.
- Biomechanics assessment
- Corticosteriod injection
- Hydroneurolysis
- Surgical decompression
Ulna Nerve Guyon’s Canal Entrapment

- C8-T1
- Medial cord
- FCU, FDP(4/5), ADM, ODM, FDM, Lumbricals 3 & 4, Interossei, Adductor pollicis, FPB(1/2)
- Sensory to ulnar palm and small finger
Guyon’s Canal

- Two nerve bundles (motor & Sensory).
- Constant pressure over the wrist with typing, hammering, splinting, cast or compression.
- Hyopthenar hammer syndrome.
- Pushing up from chair.
- Jackhammer work.
If the Ulna nerve is entrapped at the elbow, both dorsal cutaneous branch and the Guyon canal branches cause numbness.

Therefore numbness to both flexor and dorsal surface of the hand and fingers.

If the entrapment occurs at Guyons canal, the posterior cutaneous branch is spared.
Radial Nerve Entrapment

- Radial Nerve
  - Spinal nerves C5-T1
  - Posterior cord of brachial plexus
  - Superficial Branch Radial Nerve (SBRN)
  - Deep Branch of Radial Nerve (DBRN)
Radial Tunnel Syndrome

- Pure pain syndrome
- Radial tunnel is the potential space located anterior to proximal radius.
- Rarely EMG or MRI is helpful as this is typically a neuropraxia injury. Atrophy and weakness is a late finding.
- Pain presents along the dorsal-radial aspect of the proximal forearm. No weakness. Numbness occasionally.
- Hallmark findings is focal tenderness 3-5 cm distal to the lateral epicondyle over the supinator mass.
Radial Tunnel Syndrome

- 5 potential entrapment sites.
- Arcade of Froshe
- Fibrous bands anterior to radiocapitellar joint.
- Leash of Henry, recurrent radial vessels at the level of radial neck.
- Leading medial/proximal edge of Extensor carpi radialis brevis.
- Distal edge of supinator muscle
Treatment Radial Tunnel Syndrome

- Splinting, activity modification.
- Correction of biomechanics.
- NSAIDS.
- IONTOPHORESIS
- PHYSICAL THERAPY
  - Ultrasound guided hydronurolysis to relieve tight muscle/bands around nerve.
- Cortisone injection
- Surgical exploration/decompression.
Beware!

- Counter Force braces apply pressure directly over the radial tunnel and PIN.
- Only use braces that have a tension gauge.
- Most patients think if a little tightening is good then a lot is better!
- Dry needling over nerves?
- ASTYM?
Posterior Interosseous Nerve Entrapment

- Motor branch of the radial nerve.
- May present as painless weakness to third finger extension weakness.
- Usually a mixture of PIN and Radial tunnel.
- Painful lateral elbow refractory to conservative care?
Posterior Interosseous Syndrome

- Has a motor loss in later stages.
- PIN pierces the supinator at arcade of Froshe.
- Weakness to finger and wrist extension.
- Radial deviation is present as the extensor carpi radialis longus is usually not involved.
- Lack of thumb strength with extension.
- Resisted middle finger extension may cause pain.
Impingement Arcade of Froshe
PIN Treatment

- Rest, NSAIDS & Compounding topical.
- Correct Biomechanics (pronation/supination)!
- Physical Therapy?
- Cortisone injection?
- U/S guided hydreneurolysis.
- Surgical exploration/decompression
Refactory Lateral Elbow Pain?

- Posterior lateral brachial cutaneous branch of the radial nerve provides sensation to the lateral elbow.
- Pain complaint is posterior and cephalad of the common extensor tendon origin.
- They will point to the area!
Superficial Cutaneous Radial Nerve

- Common cause of chronic regional pain syndrome after casting or bracing.
- Accidentally injured with venipuncture of the wrist.
- Handcuff injury.
- Usually aggravated with first dorsal compartment tenosynovitis.
- EMG and MRI not useful.
- Vitamin C 500mg / day/
Superficial Cutaneous Radial Nerve

- **SC Radial nerve** glides over the 1st & 2nd dorsal compartments
Superficial Cutaneous Radial Nerve Treatment

- Conservative treatment initially.
- Thumb spica brace are manufactured to fit everyone so in other words they don’t fit anyone. Bending the aluminum stay in the brace for a custom fit helps.
- Vitamin C 500 mg daily for 50 days helps with CRPS prevention.
- Topical NSAID’s or for neuropathic pain can help.
- Corticosteroids Injection? Iontophoresis.
- U/S guided Hydroneurolysis
Neurohydrolysis or Hydrodissection

- **Real time.**
- **Diagnostic and therapeutic.**
- **Break up scar tissue.**
- **Resolves entrapment**
Future Imaging Techniques

- Ultrasound guided EMG/NCT
- 3D MSKUS imaging
- MRI/MSKUS fusion
- CT/MRI fusion
Final Thoughts

- Nerve entrapment syndromes are common but easily missed unless looked for.
- Provider must have a excellent understanding of cutaneous nerve anatomy.
- Can present as a atypical pain syndrome.
- Can present with weakness or muscle atrophy if involving the motor nerve.
- MSKUS and EMG/NCT can be complementary.
- MSKUS can be used for treatment.
- MRI rarely indicated unless confusing or difficult cases.
Questions?

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Pronator Teres Syndrome

- Pronator teres syndrome. Mimicking CTS. Repetitive pronation supination motion.
- Similar numbness to the fingers. May or may not have positive Phalen test. Positive Tinel’s at the wrist. Also positive mid forearm and distal elbow.
- Hallmark diagnosis PE finding is numbness of the hyperthenar as the palmar cutaneous branch leaves the median nerve prior to the wrist crease.
- Trapped between the superficial and deep heads of the Pronator teres.
- Increased pain with resisted pronation and supination.