Peripheral Nerve Entrapments

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Objectives

- Review terminology
- Review Anatomy
- Areas of entrapment
- Clinical presentations
Nerve Injuries

- Neurapraxia
- Axonotmesis
- Neurotmesis
Neurapraxia

- Local demyelination
- Reduction or complete block of conduction across a segment
- Axonal continuity conserved
- Reversible injury
- Spontaneous recovery is usually completed in 2-3 weeks
- Prognosis: good
Anatomy of the Nerve bundle

1. **Endoneurium**
   1. Loose connective tissue
   2. Thick longitudinal collagen
   3. Continuous with subarachnoid space
   4. Interstitial fluid similar to CSF
   5. Protects nutrition of nerve fibers

2. **Perineurium**
   1. Thick concentric layers of collagen
   2. Layers of fibroblasts connected by tight junctions to prevent
   3. Barrier to mechanical external forces
   4. Protects endoneurium

3. **Epineurium**
   1. Envelops and protects fasicle
   2. Allows for gliding of the fasicles in the epineurium, VERY IMPORTANT in the arms and legs for the nerves that bend at acute angles.
Effects of Compression on Nerves

- Demyelination
- Continuous pressure can reduce or dissolve the myelin sheath
- Wallerian degeneration can start in the axons
- Repair occurs as soon as compression stops
- Edema in the nerve can cause a chronic swelling due to lack of lymph drainage in the fasicle
Axonotmesis

- Axonal damage
- Preservation of neural connective tissue sheath
Axonotmesis

- Distal wallerian degeneration
- Proximal axonal regeneration
- 1 mm/day as axon follow the “tubule”
- Recovery time depends on length of nerve
Neurotmesis

- Disruption of axon as well as myelin and supportive connective tissue
- Lower incidence of recovery
- Usually external continuity is preserved but intraneural fibrosis occurs and blocks axonal regeneration
- Prognosis: poor
Role of EMG/NCS

- Can help differentiate pain inhibition from true muscle weakness
- Differentiate type of nerve lesion
- Localize the lesion
- Allow recognition of reinnervation, before detected clinically
- Can help distinguish two separate pathological processes
Value of EMG/NCS

- Normal vs Abnormal
- Distribution
  - Generalized, distal, proximal
  - Localized
    - Peripheral nerve, root, plexus
- Time of onset
- Severity
- Neuropathy vs myopathy
- Improving vs progressing
Route of the Median Nerve

- Travels slightly lateral to the brachial artery for the first ½ of the upper arm.
- Crosses over the brachial artery to travel medial to the brachial artery
- Enters the antecubital fossa and goes through 3 arches
  - Bicipital aponeurosis (2 fingers lateral and 2 proximal to medial epicondyle)
  - Pronator Teres
  - Sublimus arch
Median Nerve Entrapment

- Carpal Tunnel
- Ligament of Struthers
  - 1% of population
- Supracondylar fractures
  - Affects Anterior interosseous nerve
  - Can be delayed after fracture due to callus formation
- Pronator Teres syndrome
Pronator Teres Syndrome

• Most common median nerve entrapment in the elbow
• Elbow pain radiating proximally and distally
• Dull aching pain in forearm
• Resisted forearm flexion for 30 seconds may reproduce symptoms
• Occurs in people who have repetitive forceful forearm pronation
• Positive Tinnel’s sign in antecubital fossa
Pronator teres

Radial head (superficial)
Ulnar head (deep)
Right arm (distal viewpoint)

Brachial artery

Biceps tendon

Antecubital vein

Bicipital aponeurosis

Median nerve

Pronator teres muscle

Brachialis muscle
Ligament of Struthers is present in about 1% of the population.
Transverse carpal ligament

Palmar (volar) carpal ligament

Median nerve

Ulnar artery

Ulnar nerve

Pisiform

Lateral (radial)

Medial (ulnar)
Carpal Tunnel Syndrome (CTS)

- Clinical syndrome with
  - Numbness
  - Tingling
  - Burning
  - Pain
- Median nerve distribution
- Wasting of the Thenar eminence
- Preservation of sensation over the thenar eminence
CTS

• Most common peripheral neuropathy
• Distribution is variable and dysesthesias in areas outside the distribution of the median nerve can occur
• Worse at night or with repetitive hand activities
• Associated with localized compression of the median nerve at the wrist
• Confirmed with EDx studies
Treatment of CTS

- Night braces
- Myofascial release
- Manipulation of the carpal bones
GENTLY
Listening

• Evaluative- feeling the CRI
  ▫ The structure matches the weight of the hand
  ▫ Feel for the flexion and extension of the Primary respiratory mechanism

• Therapeutic phase
  ▫ Begins as soon as the motion is perceived
  ▫ The hand increases the “listening”
Contraindications

- Acute pain to the nerve
- Strong radiation of pain
- Skin reactions (as in herpes zoster)
- Unclear atrophy in a supply area of a nerve
- Paralysis in the supply area of the nerve
- Hyporeflexia
- Skin disease
- Palpable local and regional lymph nodes
Glide Test: GENTLY
Compress the nerve proximal to the area being tested. Test longitudinal glide with joint movement. Extending the wrist as in the picture.

Fig. 4.6 Glide test for tunnel sections.
Course of the Ulnar nerve

- Branch of the Medial cord
- Medial aspect of brachial artery
- Becomes enveloped in medial triceps head
- Emerges from triceps and enters posterior elbow
- Ulnar nerve becomes mobile just proximal to the postcondyler groove of the elbow
- Vulnerable in the post condylar groove
- Past the groove it enters the cubital tunnel formed by the 2 heads of the flexor carpi ulnaris
Elbow flexed
Ulnar Nerve entrapment (elbow)

- Post condylar groove, between the medial epicondyle of the humerus and olecranon the ulnar nerve is vulnerable
- Cubital tunnel is the aponeurosis that connects the two heads of the flexor carpi ulnaris
Ulnar Nerve: Guyons Canal

- Between Pisiform and Hook Hamate
- Ulnar nerve bifurcates in the canal
  - **Deep Ulnar branch**-
    - Adductor Pollicis
    - Flexor pollicis brevis
    - Dorsal interossei
    - Palmar interossei
    - 3\textsuperscript{rd} & 4\textsuperscript{th} lumbricals
  - **Superficial branch**
    - Medial side of 4\textsuperscript{th} digit
    - Distal end of 5\textsuperscript{th} digit
- Cyslists Palsy damage to Ulnar nerve in canal
Deep Motor innervates hypothenar eminence

Superficial sensory division innervates the volar surface of the 5th digit.
Course of the Radial Nerve
Leaves Axilla and enters spiral groove
From the spiral groove pierces the lateral intermuscular septum, into flexor compartment and is superficial, immobile and vulnerable.
Runs under Brachioradialis, extensor carpi radialis longus and extensor radialis brevis and form the radial tunnel
Saturday Night Palsy

- Sensory loss of the posterior arm and forearm
- Weak triceps
- Wrist drop
- Also called Honeymooners Palsy
Course of Radial nerve

- Passes under the supinator and divides
  - **Superficial sensory radial nerve**
    - Crosses Extensor Pollicis Longus
    - Innervates sensation over lateral dorsum of hand
  - **Posterior interosseous nerve**
    - Wrist and finger extensors
- Handcuff neuropathy
Course of the Sciatic nerve

• Exits the pelvis through the sciatic notch under the piriformis
• Runs down the posterior thigh under the hamstring muscles to the popliteal fossa where it divides into its 2 component nerves
  ▫ Tibial Nerve
  ▫ Fibular Nerve
Tibial nerve

- Runs down the middle of the leg
- Deep to gastroc and soleus
- Goes medial and posterior to the medial Malleolus
- Tarsal tunnel
  - Covered by Flexor retinaculum from medial malleolus to calcaneus
  - Posterior tibialis tendon, Flexor digitorum longus and Flexor hallucis longus
Popliteal fossa anatomy. Viewing the popliteal fossa from posterior, the following structures are visible:

- **Semitendinous**
- **Semimembranosus**
- **Proximal**
- **Common peroneal nerve**
- **Lateral**
- **Medial sural cutaneous branch**
- **Medial**
- **Tibial nerve**
- **Plantaris**
- **Popliteus**
- **Popliteal artery and vein**
- **Soleus**
- **Short head of the biceps femoris**
- **Plantaris**
- **Tibial nerve**
- **Popliteus**
- **Popliteal artery and vein**
- **Soleus**
Fibular Nerve
- Trapped along head of fibula
- Causes foot drop
Fibular Nerve

- Deep fibular nerve
  - Innervates:
    - Tibialis anterior
    - Extensor digitorum longus
    - Extensor hallucis longus
- Superficial fibular nerve
  - Innervates:
    - Fibularis longus
    - Fibularis brevis
Meralgia Paresthetica

- Low riding jeans
- Tight Jeans
- Pannus
Fascial Collars

- Adhesions can inhibit gliding
- Impingement can prevent a longitudinal stretch
Lateral Glide test

- Avoid painful stimulation
- Generate a sinusoidal wave
- Note the elasticity of the surrounding tissue
Stretching of a nerve

- Find a sensitive area
- Compress GENTLY
- Stretch distally
Stretching a nerve

- Fixate proximally
- Pull distally below the fixation point
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