



Ulnar Neuropathy

Roger Kasendorf, D.O.

Lyn Weiss, M.D.



Background

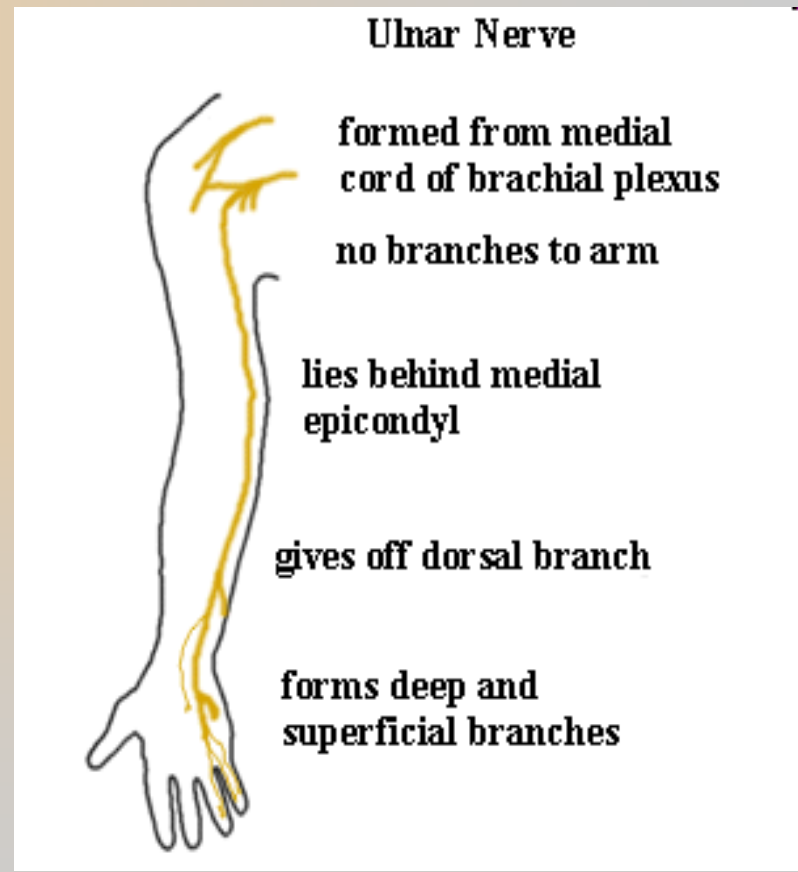
- ★ 2nd most common entrapment neuropathy of upper extremity
 - #1- Carpal Tunnel Syndrome
- ★ Compression most common at elbow (cubital tunnel), then at wrist (Guyon's canal).





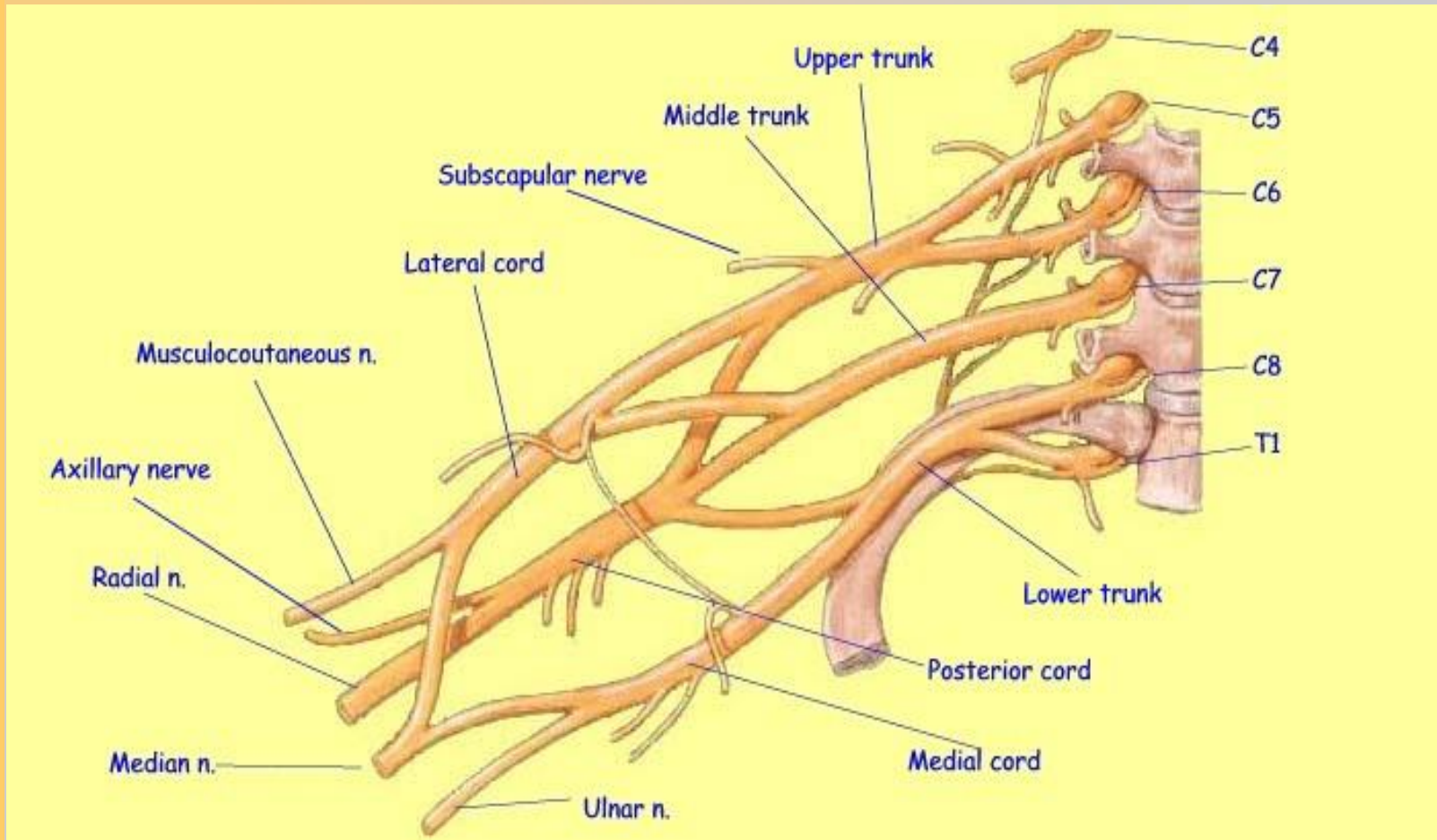
Ulnar Nerve Anatomy

- ★ Root- C8 and T1
- ★ Trunk- Lower
- ★ Cord- Medial
(terminal branch)





Branches of Ulnar Nerve





Ulnar Nerve Anatomy

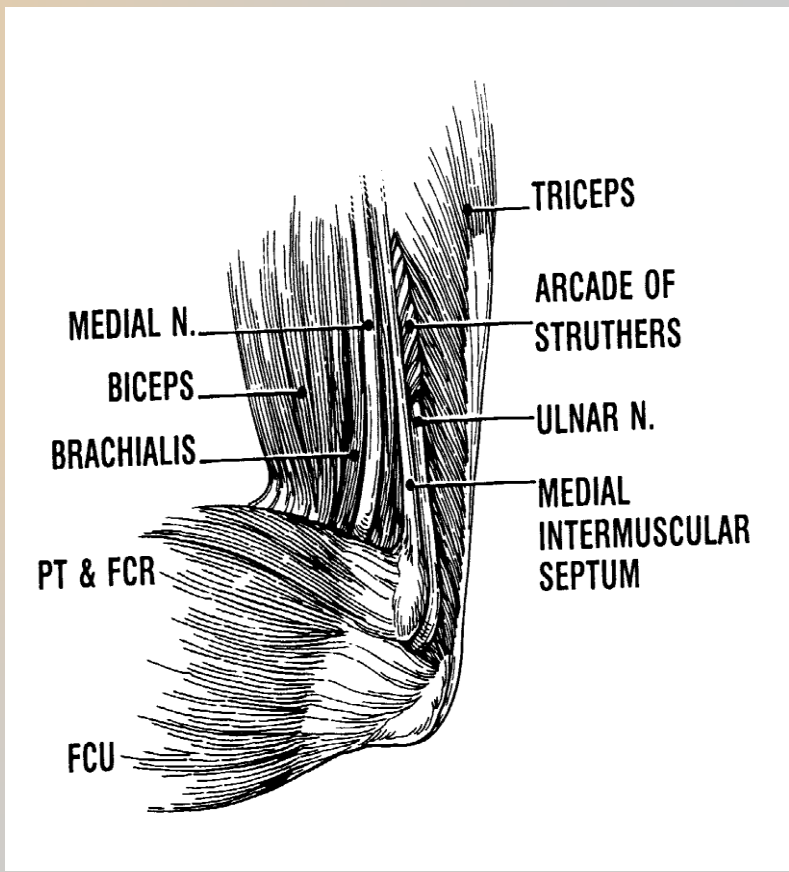
- ★ Enters the arm with the axillary artery and passes posterior and medially to the brachial artery.





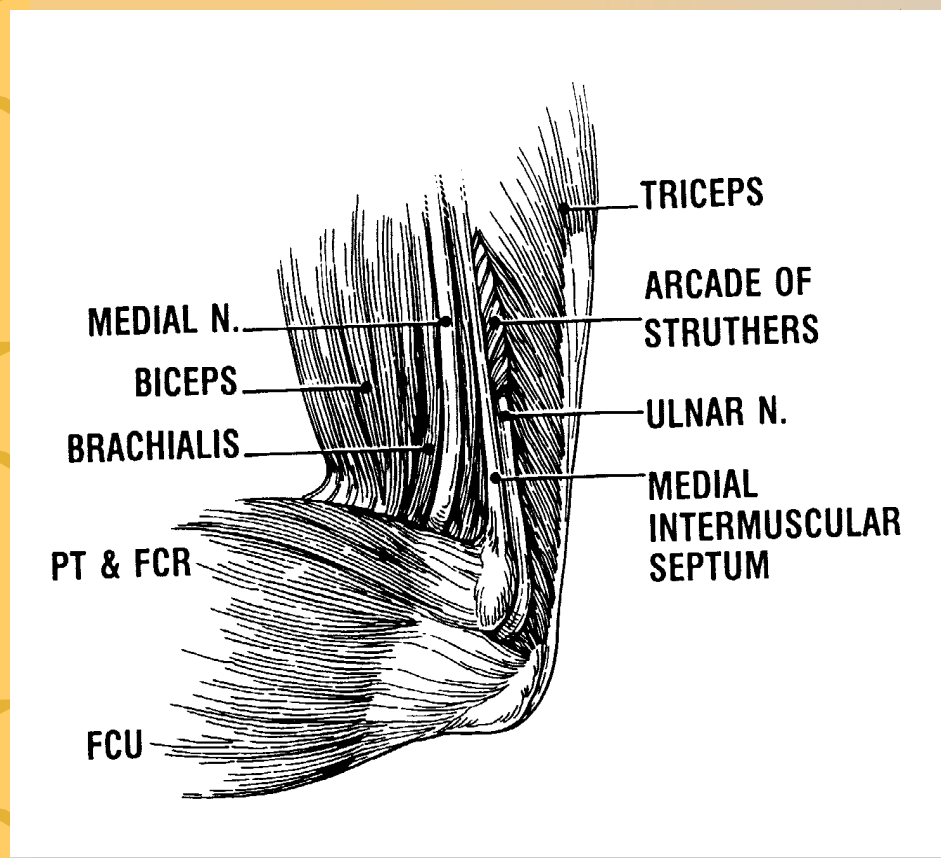
Ulnar Nerve Anatomy

- ★ At the level of insertion of the coracobrachialis muscle in the middle third of the arm, the ulnar nerve pierces the medial intermuscular septum to enter the posterior compartment of the arm.
- ★ **This is the first site of potential compression.





Ulnar Nerve Anatomy



Arcade of Struthers:

- Found in 70% of pts
- 8 cm prox. to medial epicondyle, extending from medial intermuscular septum to medial head of the triceps

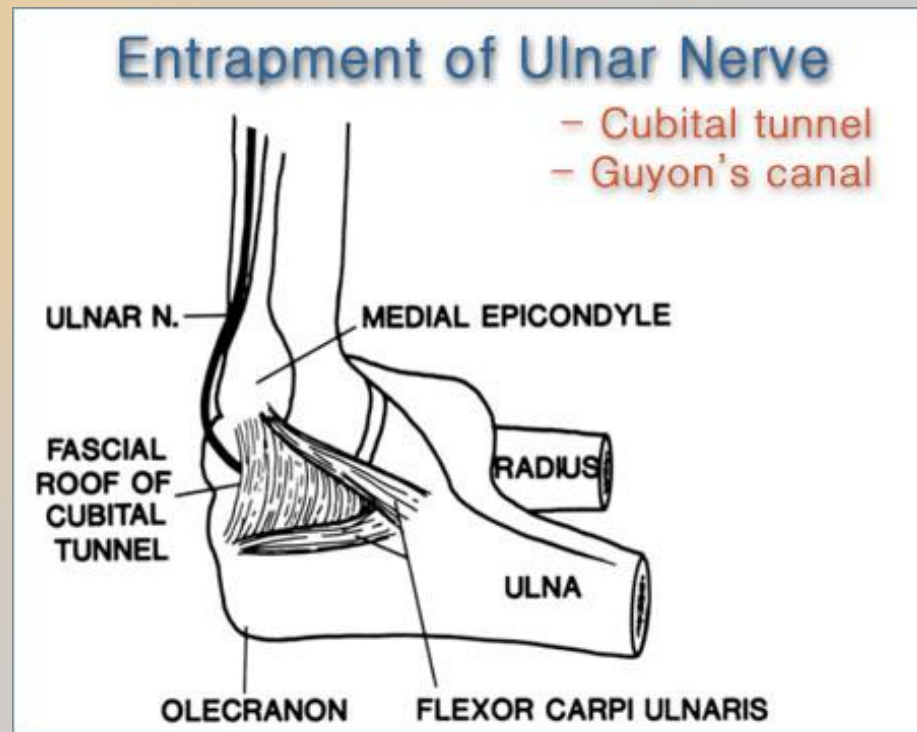
** Next site of potential compression



Ulnar Nerve Anatomy

★ CUBITAL TUNNEL:

- Roof: deep forearm investing fascia of FCU & the arcuate ligament of Osborne, a.k.a. cubital tunnel retinaculum.
 - BECOME TAUT WITH ELBOW FLEXION!!!
- Floor: Elbow capsule and the posterior transverse portions of the MCL
- Walls: Medial Epicondyle and Olecranon
- **Major compression site.





Ulnar Nerve Anatomy



- ★ Nerve then passes between humeral and ulnar heads of FCU.
 - **potential site of compression
- ★ 5 cm distal to medial epicondyle, ulnar nerve pierces the flexor pronator aponeurosis (fibrous common origin of flexor and pronator muscles)
 - **potential site of compression



Ulnar Nerve Anatomy

- ★ At the wrist, the ulnar nerve passes into Guyon's canal.
- ★ A palmar cutaneous branch is given off to supply hand musculature
- ★ Also a dorsal cutaneous branch is given off to supply sensation to ulnar dorsal aspect of hand.

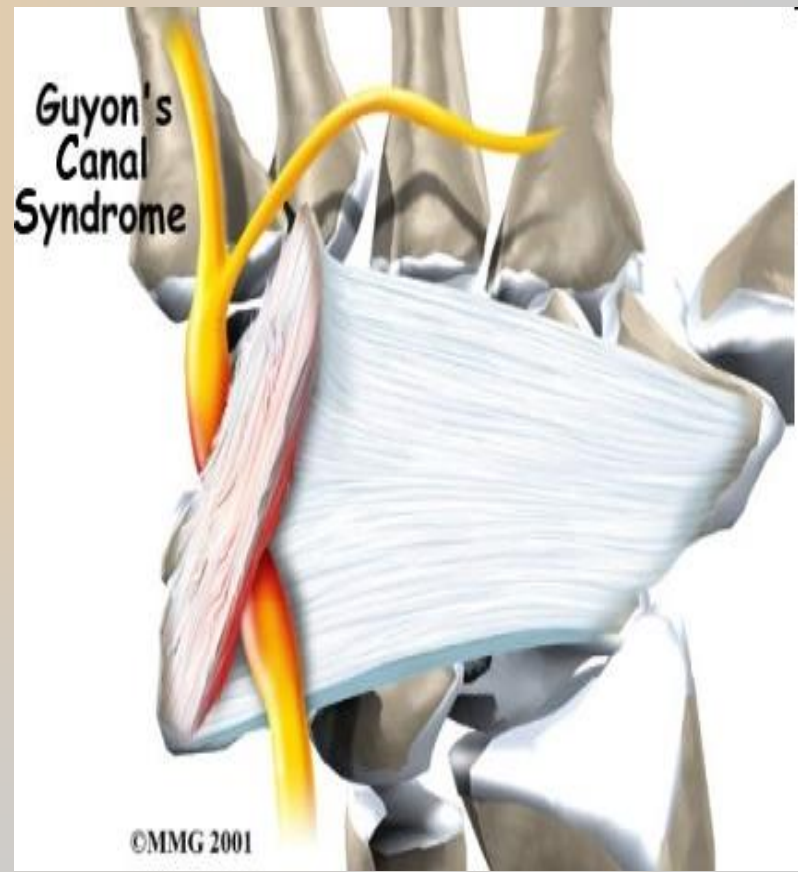
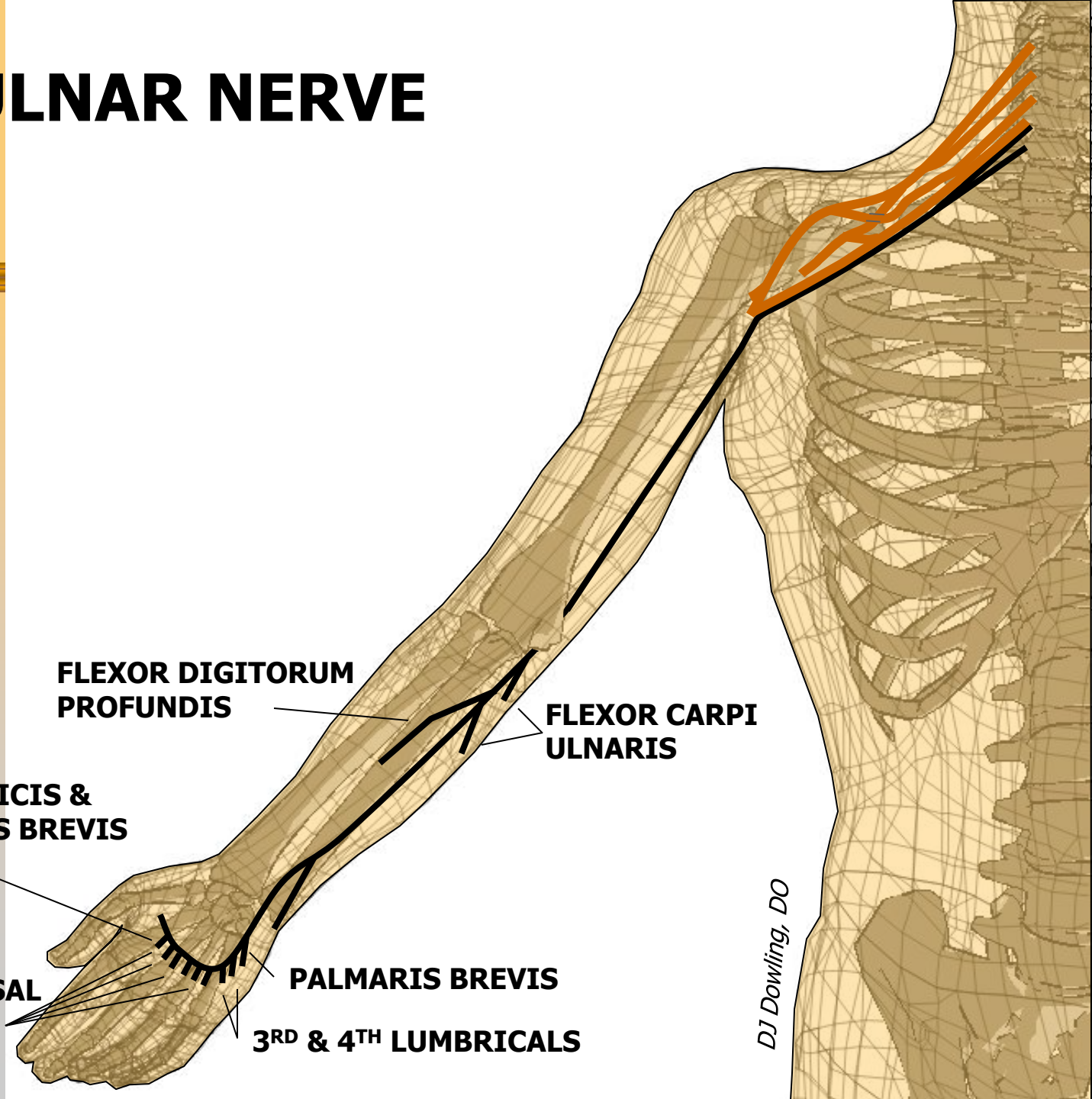




FIGURE 10-5

ULNAR NERVE



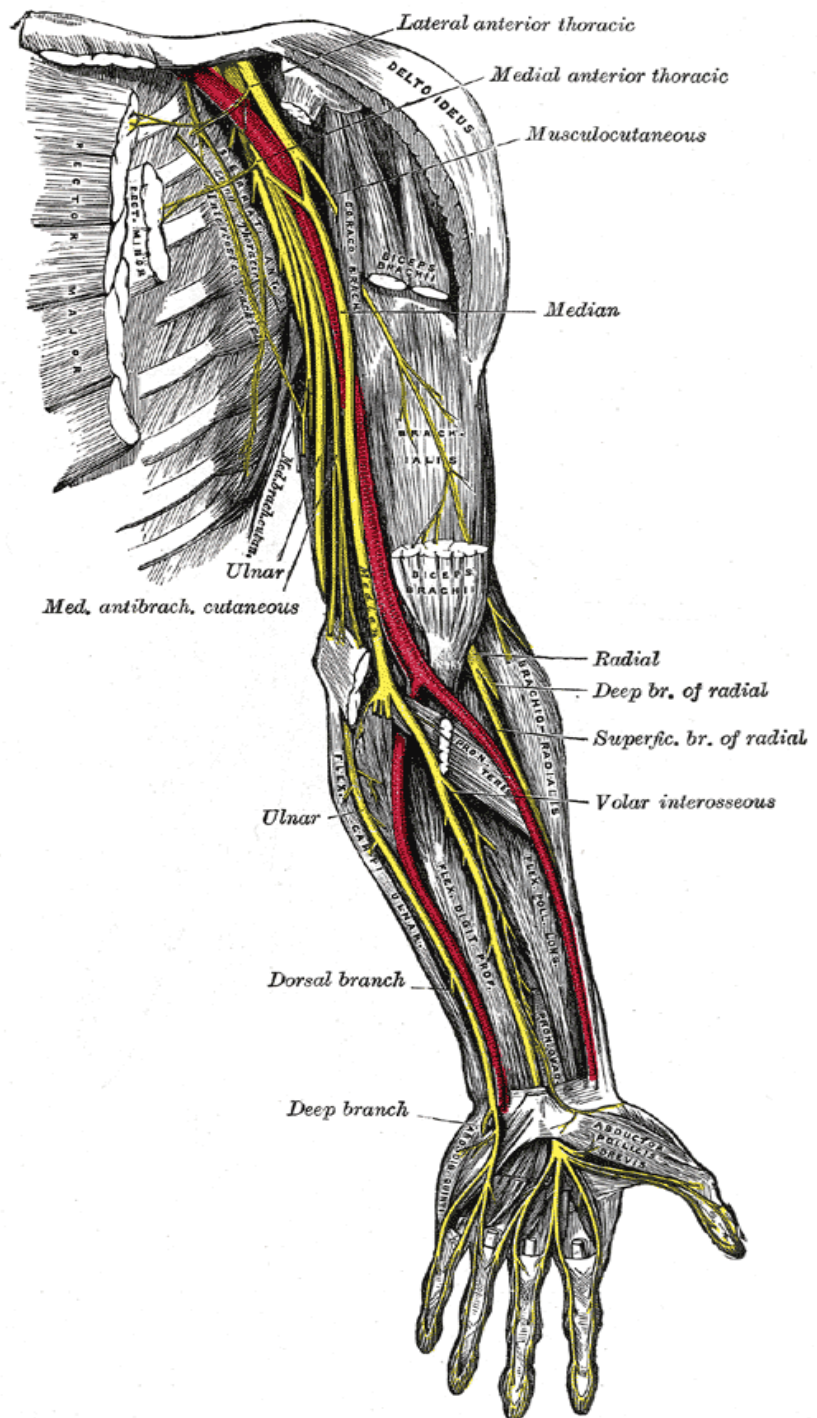
DJ Dowling, DO



Ulnar Nerve Branches

- ★ ARM: No motor branches, sensory only
- ★ FOREARM:
 - Flexor Carpi Ulnaris (FCU)
 - Flexor Digitorum Profundus (FDP, IV & V only)
- ★ Just prior to entering wrist, the dorsal ulnar cutaneous nerve branches out and misses Guyon's canal.







Ulnar Nerve Branches



Deep branch (hypothenar muscles)

- Abductor digiti minimi
- Flexor digiti minimi
- Opponens digiti
- Interossei
- Lumbricals III, and IV
- Adductor pollicis



★ The superficial branch supplies the palmar surface of ulnar 1 + 1/2 fingers.

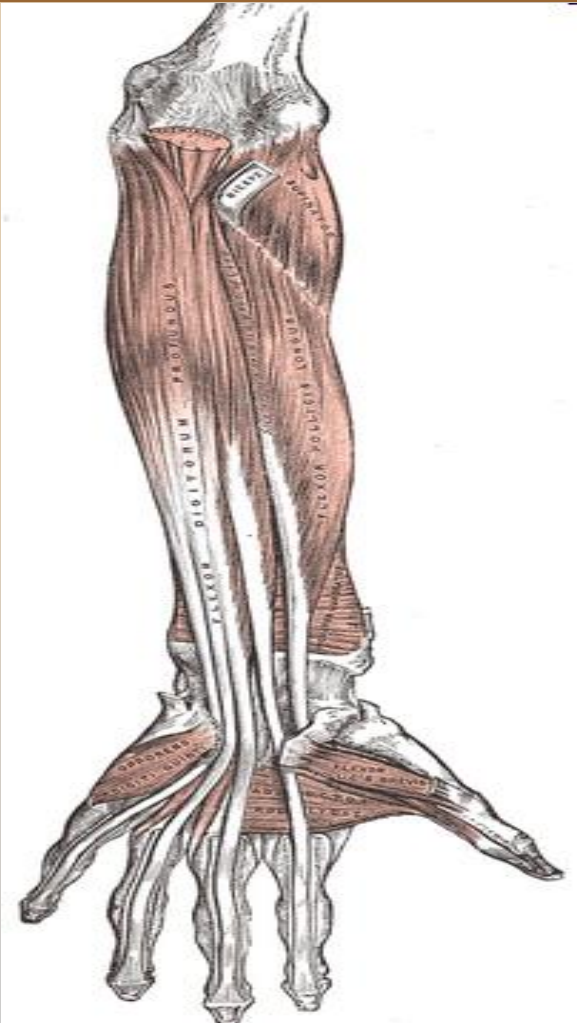




Ulnar Nerve Branches

★ Flexor Digitorum Profundus has dual innervation.

(Digits 2 & 3 are innervated by median nerve)





Differential Diagnosis

- ★ Root Lesion
- ★ Lower trunk of brachial plexus
- ★ Ulnar neuropathy of upper arm.
- ★ Ulnar neuropathy at the elbow.
- ★ Ulnar neuropathy at the wrist.





Signs & Symptoms of ulnar nerve injury if above or at elbow...



★ Paralysis of medial half of the flexor digitorum profundus with loss of flexion of the distal phalanges of medial two digits.



★ Flexion of the wrist joint will produce abduction due to the paralysis of the flexor carpi ulnaris.



★ The hypothenar eminence will be paralyzed and atrophied.



Signs & Symptoms continued...

- ★ Localized paresthesias and hypoesthesias to dorsal & palmar aspects of digits 4 & 5.





Which will be spared if injury at Guyon's canal???





And the winner is ...

-
- ★ The Doral Ulnar Cutaneous branch comes off BEFORE the canal!!!





Signs & Symptoms continued...



- ★ Symptoms worse with elbow flexion
- ★ Radiation of pain possible along course of innervation.
- ★ Nocturnal symptoms, especially with elbow flexion, may be quite disturbing.
- ★ Patients with chronic ulnar neuropathy may complain of loss of grip and pinch strength and loss of fine dexterity.



Signs & Symptoms

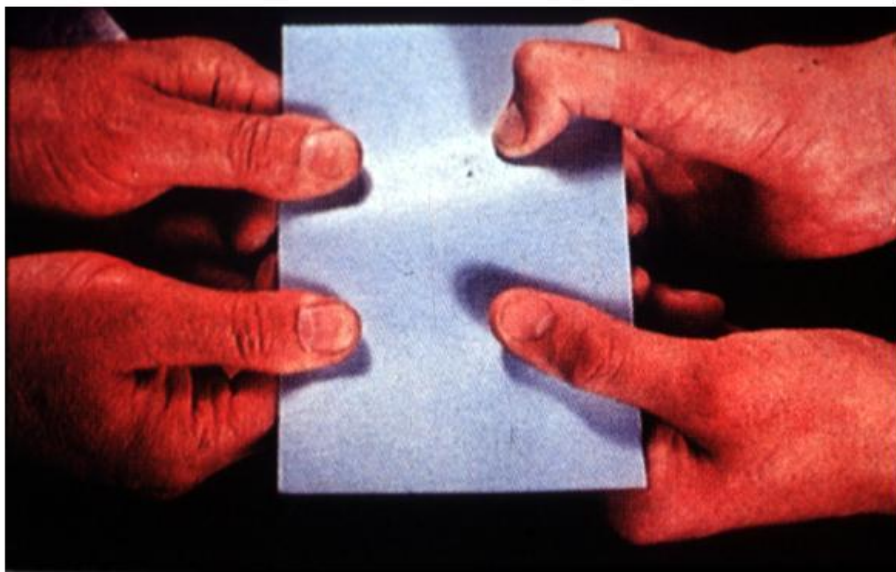


- ★ Atrophy of the FDI
 - Froment's sign

- ★ Inability to adduct thumb due to paralysis of adductor pollicis muscle.
 - “O” sign



Froment's sign



- ★ Positive on the right side. A positive sign indicates that there is paralysis of the adductor pollicis.
- ★ The thumb on the right side is being flexed at the interphalangeal joint by the flexor pollicis longus to compensate for the adductor paralysis and to allow for the cloth to be held and not pulled away from the thumb.



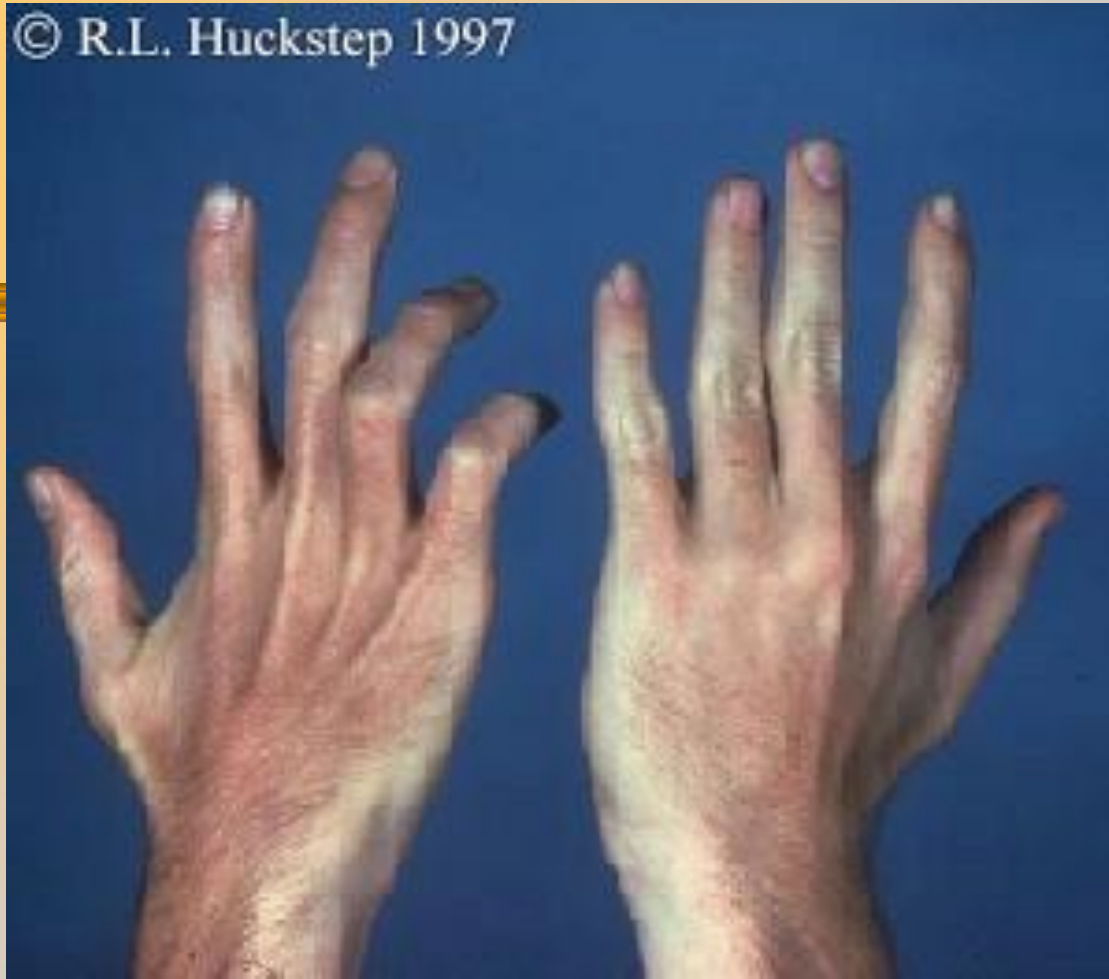
Signs & Symptoms



- ★ The fourth and fifth MCP joints are hyperextended due to the loss of the lumbricals and interossei, while the interphalangeal joints of the same digits are flexed
 - “Claw Hand”



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The typical appearance of an ulnar nerve palsy with partial clawing of the 4th and 5th fingers.



Signs & Symptoms



- ★ Abducted posture of the little finger when extended fully in cases of intrinsic paralysis.
- ★ The palmar interosseous muscle usually counters the ulnar pull of the EDQ tendon during extension.
 - “Wartenberg's Sign”



Wartenberg sign





Physical Examination



- ★ Decreased sensation
- ★ Tinel's Sign at Elbow (be careful, 24% of normal population will have positive Tinel's)
- ★ Ulnar Clawing
- ★ Observe for possible Cubital Valgus deformity (from healed fracture)



Physical Examination

- ★ Exclude other causes of dysesthesias and weakness along the C8-T1 distribution, such as cervical disk disease or arthritis, thoracic outlet syndrome, or ulnar nerve impingement at the Guyon canal.





Physical examination

★ Check elbow ROM, examine the carrying angle, areas of tenderness or ulnar nerve subluxation.

★ **The elbow flexion test** is the most diagnostic test for cubital tunnel syndrome.

- The test involves the patient flexing the elbow past 90 degrees, supinating the forearm, and extending the wrist. Results are positive if discomfort is reproduced or paresthesia occurs within 60 seconds. The addition of shoulder abduction may enhance the diagnostic capacity of this test.



Physical Examination

★ Cubitus Valgus Deformity:

- May be due to:
 - Healed fx's
 - Trauma
 - Deformity





Pathophysiology

- ★ Valgus stress deformities (just mentioned)
- ★ Compression of the fascial band that connects the brachialis to the triceps brachii.
- ★ Increased physiologic muscle hypertrophy and a hypermobile ulnar nerve due to ligamentous laxity causes traction and friction on the nerve.





Pathophysiology

- ★ Ulnar Nerve most susceptible injury at the elbow because:
 - Decreased # of fascicles in elbow region (more sensitive to compression)
 - Decreased space in cubital tunnel with elbow flexion
 - Very Superficial
 - Hypermobility of ulnar nerve (possible subluxation over medial epicondyle)
 - Tardy ulnar palsy after fx or dislocation (limit elbow extension).





Pathophysiology

★ Chronic subluxation

- 16% of population
- Ulnar Nerve subluxes from posterior condylar groove and slips over medial epicondyle
- When nerve outside of groove, susceptible to compression





ALMOST THERE!!!





Cubital Tunnel Syndrome

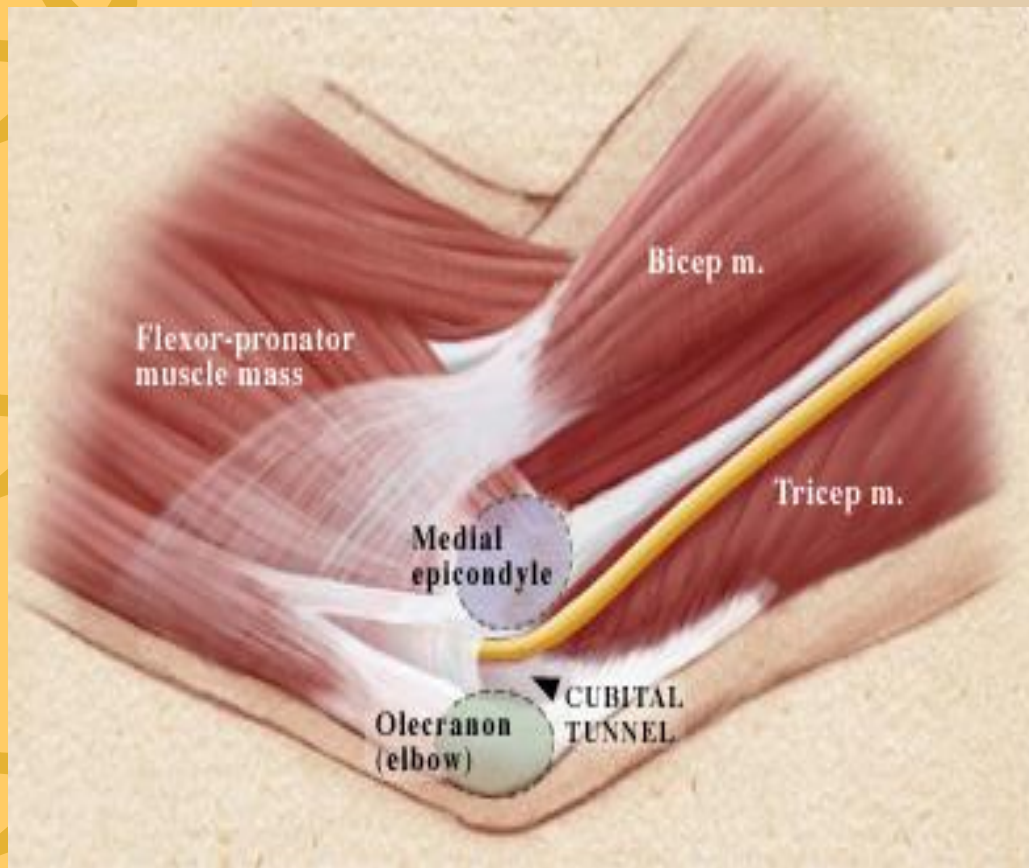
★ Compression of the Ulnar Nerve at or beneath :

- Proximal edge of Flexor Carpi Ulnaris aponeurosis
- Arcuate ligament

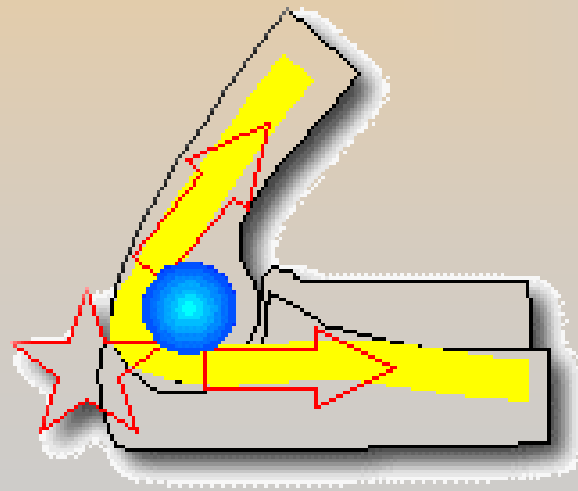
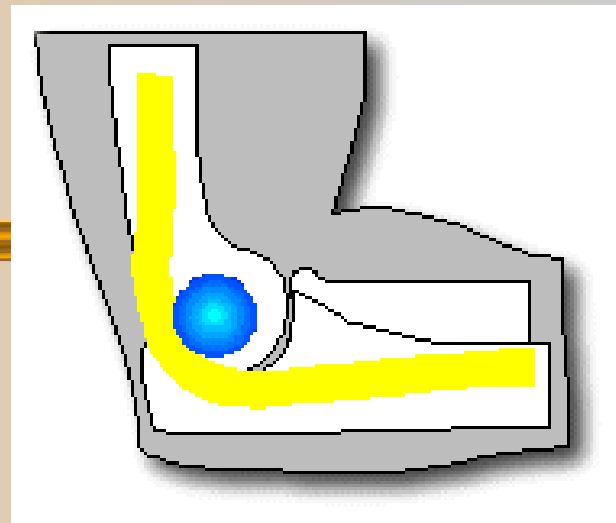
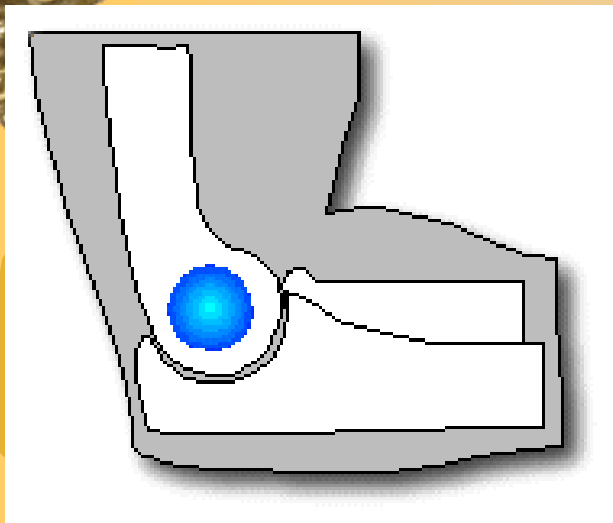




Cubital Tunnel Syndrome



- ★ The cubital tunnel loses height during elbow flexion.
 - Approx 55% volume reduction





Electrodiagnostic findings of Ulnar Neuropathy at the Elbow

★ Nerve Conduction Studies:

- SNAP: Abnormal dorsal ulnar cutaneous and ulnar nerve findings
 - Decreased amplitude
 - Slowing of nerve conduction velocities.
- CMAP: Abnormal
 - Decreased amplitude
 - Slowing of nerve conduction velocities
- Side to side difference of >50% area signif.





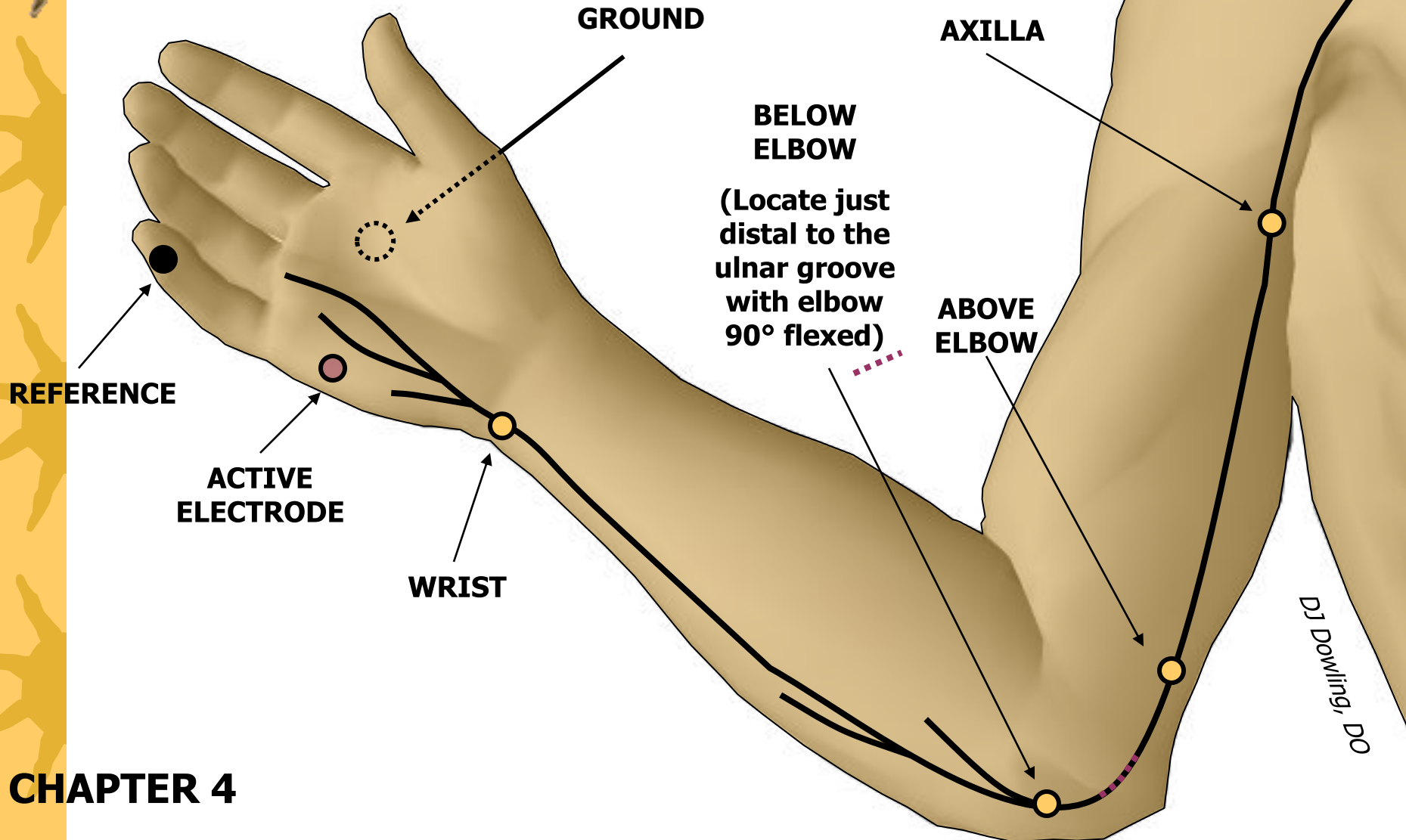
Electrodiagnostic findings of Ulnar Neuropathy at the Elbow

★ IMPORTANT:

- Make sure to keep patient's elbow at about 90 degrees when performing NCV's.
 - MAKE SURE TO MEASURE CORRECTLY!!!



ULNAR NERVE - MOTOR





Electrodiagnostic findings of Ulnar Neuropathy at the Elbow

★ EMG:

- Abnormal spontaneous activity in all the ulnar nerve innervated muscles. (Presuming proximal and distal segment CMAP's are abnormal)
 - Fibs and PSW's
- FCU may be spared

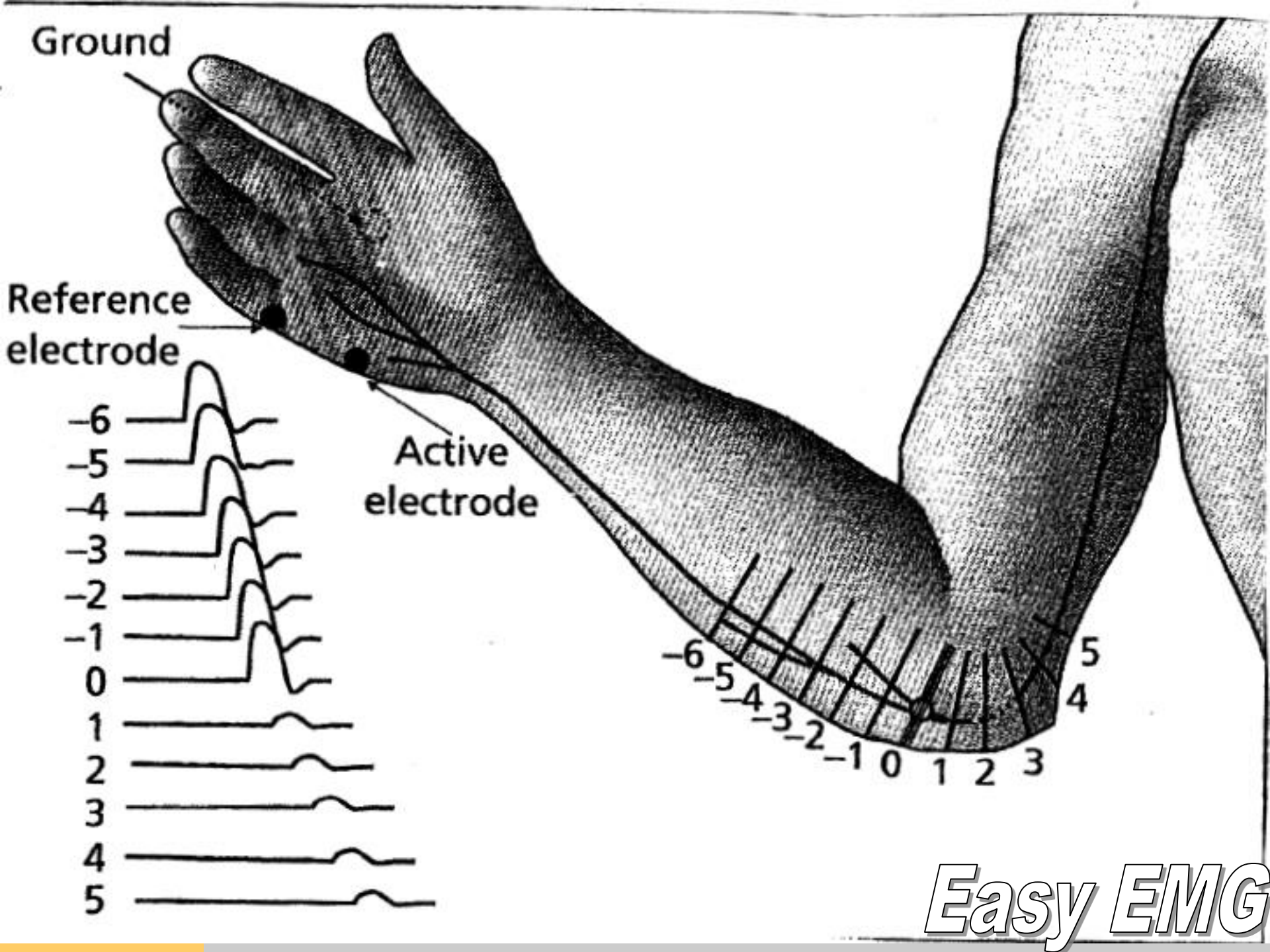




The “INCHING” technique

- ★ Used to localize the site of conduction block or focal slowing (usually surgical implications).
- ★ With elbow flexed at 90 degrees, ulnar nerve is stimulated at 1 cm intervals and the CMAPs are compared.

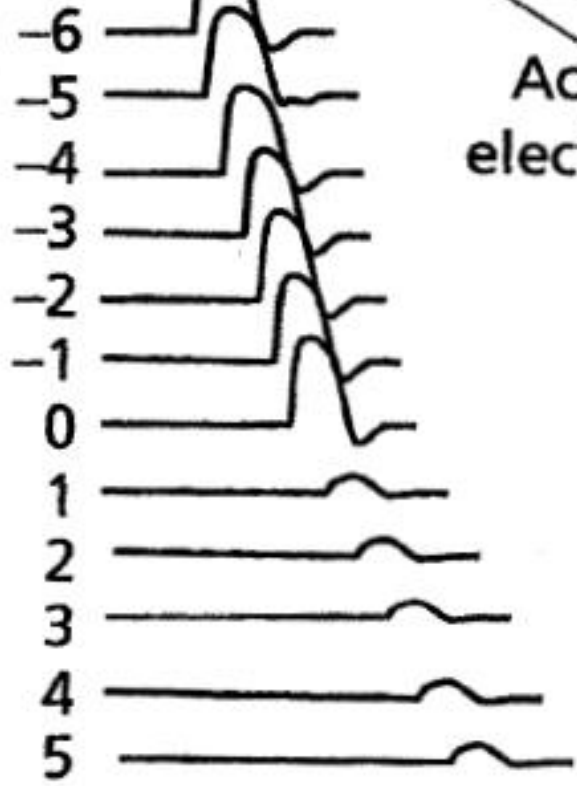




Ground

Reference electrode

Active electrode



Easy EMG



The “INCHING” technique

- ★ Increase in latency of $> \text{ms/cm}$ is indicative of focal slowing.
- ★ *A substantial drop in amplitude from one segment to a more proximal segment indicates a conduction block across that area. (more important than latency)





The “INCHING” technique

★ Usefulness

- Literature only supports use of inching technique when surgical decision making is necessary.





Treatment



- ★ Isometric and isotonic strengthening of the elbow flexors/extensors within 0-45 degrees ROM.
- ★ Decrease activities of repetition that may exacerbate the patient's symptoms.
- ★ NSAIDS
- ★ Protect elbow from direct pressure



Treatment- non-surgical

- ★ Elbow pads
- ★ Rigid Thermoplastic splint at 45 degrees flexion





Treatment-Surgical

- ★ Depends on the site of compression
 - Surgical release of Arcade of Struthers
 - Transposition of the ulnar nerve- ulnar nerve is transposed anterior to the medial epicondyle
 - In situ decompression with medial epicondylectomy or in situ decompression





Tardy Ulnar Palsy

- ★ Ulnar neuropathy which can occur months to years after a distal humerus fracture.
- ★ Due to bony overgrowth or scar formation which may increase carrying angle to valgus deformity.
- ★ Muscle and electrodiagnostic findings depend on the site of injury.





Ulnar Nerve Injuries at Guyan's Canal (Ulnar Tunnel Syndrome)

★ Pathophysiology

- Thrombosis or aneurysm of the artery
- Fractures of the hook of hamate can impinge upon the nerve
- Often seen in bicyclists
- Ganglions or Lipomas*
- Repeated blunt trauma from power tools and gripping or hammering with palm of the hand.





Ulnar Nerve Injuries at Guyan's Canal (Ulnar Tunnel Syndrome)

★ Presentation

- Wrist function normal
 - Spares palmaris brevis, flexor carpi ulnaris and flexor digitorum profundus.
- Spares sensation to the dorsal aspects of the medial 1 ½ digits.
- Painless wasting of FDI, claw hand





Treatment

★ Non-surgical:

- Wrist splint
- Avoid constant pressure
- NSAIDS

★ Surgical release of Guyon's canal





Thank You for your Attention

