

“SPECIAL TESTS” IN THE QME EXAMINATION – UPPER EXTREMITIES



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DWC PROVIDER #1280**



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- Welcome to Today's Program – “Special Tests” in the QME Examination – Upper & Lower Extremities. Today's focus is going to be on the Upper & Lower Extremities. This Program is Approved by the Division of Worker's Compensation for 6 Hours of QME Home Study Continuing Education Credits. For Chiropractors, this Program is also Approved for 6 hours of Board of Chiropractic Examiners Credits under Category A (mandatory category)
- This is a narrated PowerPoint Presentation. It is presented just as if you were at a live lecture.
- Your Course Materials also contain copies of the PowerPoint slides with space provided for note taking. Grab those now to get ready.



PRESENTED BY:

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Diplomate, Academy of Chiropractic Orthopedists (DACO)

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- ◉ WE HAVE A GROWING LIBRARY OF TOPICS RELATING TO DAY TO DAY PROCEDURES INVOLVED WITH PERFORMING QME EXAMINATIONS AND PREPARING REPORTS THAT ARE CREDIBLE AND THAT QUALIFY AS SUBSTANTIAL MEDICAL EVIDENCE.
- ◉ CHECK OUR WEBSITE OFTEN FOR NEW PROGRAM RELEASES
- ◉ IF THERE IS A TOPIC THAT INTERESTS YOU THAT YOU WOULD LIKE EXPANDED ON, LEAVE A SUGGESTION ON THE WEBSITE AND WE WILL DO IT!



Additional
Programs
Available from
EZQMECEU.COM:

- **Medical-Legal Report Writing and Technique of the QME Examination (6 hours)**
- **Gait Disturbance & Assistive Devices (3 hours)**
- **The Non-Physiologic Examination (3 hours)**
- **The Deposition Matrix (6 hours)**
- **21 Secrets of the Most Persuasive QME's (6 hours)**
- **Upper Extremity Impairments – Entrapment Neuropathies (6 hours)**
- **Lower Extremity Impairments due to Peripheral Nerve Lesions (6 hours)**
- **The Importance of the Neurologic Examination (6 hours)**
- **Manual Muscle Testing and the AMA Guides 5th Edition (6 hours)**
- **Special Tests in the QME Examination – The Spine (6 hours)**



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Medical-Legal
Report Writing
and Technique
of the QME
Examination (6
hours)

Topics Include:

- Section 1 - Medical Legal Report Writing
- Section 2 – The QME Panel Process
- Section 3 – Technique of the QME Examination



Gait Disturbance & Assistive Devices (3 hours):

Topics:

- AMA Guides - Descriptions of Gait Disturbances in AMA Guides Chapters 13 and Chapters 17
- Procedure for the Gait Analysis and Observation
- Description of the Phases of "Normal" Gait and "Pathologic" Gait
- Causes of Deviations from the Normal Gait
- Named Gait Signs
- Assistive Devices – canes, crutches, pick up frames, ankle foot orthosis, knee ankle foot orthosis
- Gait Conclusions



The Non-Physiologic Examination (3 hours)

Topics Include:

- Practical Considerations for the Quantification of Pain
- Activities of Daily Living Assessments – a Practical Method
- Malingering – Waddell's Signs and DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) Criteria
- Medical Records, and Interview Findings of Inconsistency
- Physical Examination Findings of Inconsistency



The “Deposition Matrix” (6 Hours):

Philosophy: Reasons why
Depositions are called –
Applicant Attorney vs.
Defense Attorney

- Rules for Deposition: Combination of tips and suggestions from 1) my own experience plus 2) communication tips from a Certified Court Reporter
- Case Examples:
 - Mechanism of Injury:
 - Clinical Course:
 - Permanent Impairment/Apportionment Opinions
- Deposition Questions and the responses



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21 Secrets of
the Most
Persuasive
QME's (6
Hours)

Topics:

- Preparatory Secrets (3)
- Interview/Exam Secrets (10)
- Report Writing Secrets (4)
- Deposition Secrets (4)



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UPPER
EXTREMITY
IMPAIRMENTS –
PERIPHERAL
NEUROPATHIES

Topics Include:

- Neurology 101
- Entrapment Neuropathies
- Exam Procedures
- Impairment Calculations
- Case Examples



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Lower
Extremity
Impairments
– Peripheral
Nerve
Lesions

Topics Include:

- Neurology 101
- Entrapment Neuropathies
- Exam Procedures
- Impairment Calculations
- Case Examples



The Importance of the Neurologic Examination (6 hours)

- Part 1
- AMA Guides references to “Neurology”
- Neurology 101:
 - Development of CNS & PNS
 - Spinal Cord, Spinal Nerves, and the Plexuses (4)
 - Named Peripheral Nerves of the Upper & Lower Extremities



Manual Muscle Testing (MMT) and the AMA Guides 5th Edition

PART 1&2

- AMA GUIDES REFERENCES TO MMT
- Myology 101 – Development of the Muscular System
- MMT General Principles and Procedures
- MMT OF NERVE ROOT INNERVATED MUSCLES (Focus on MMT of “Specific Muscles”)
- MMT OF PERIPHERAL NERVE INNERVATED MUSCLES (Focus on MMT of “Specific Motions”)



“Special
Tests” in the
QME
Examination
– The Spine

2 Parts:

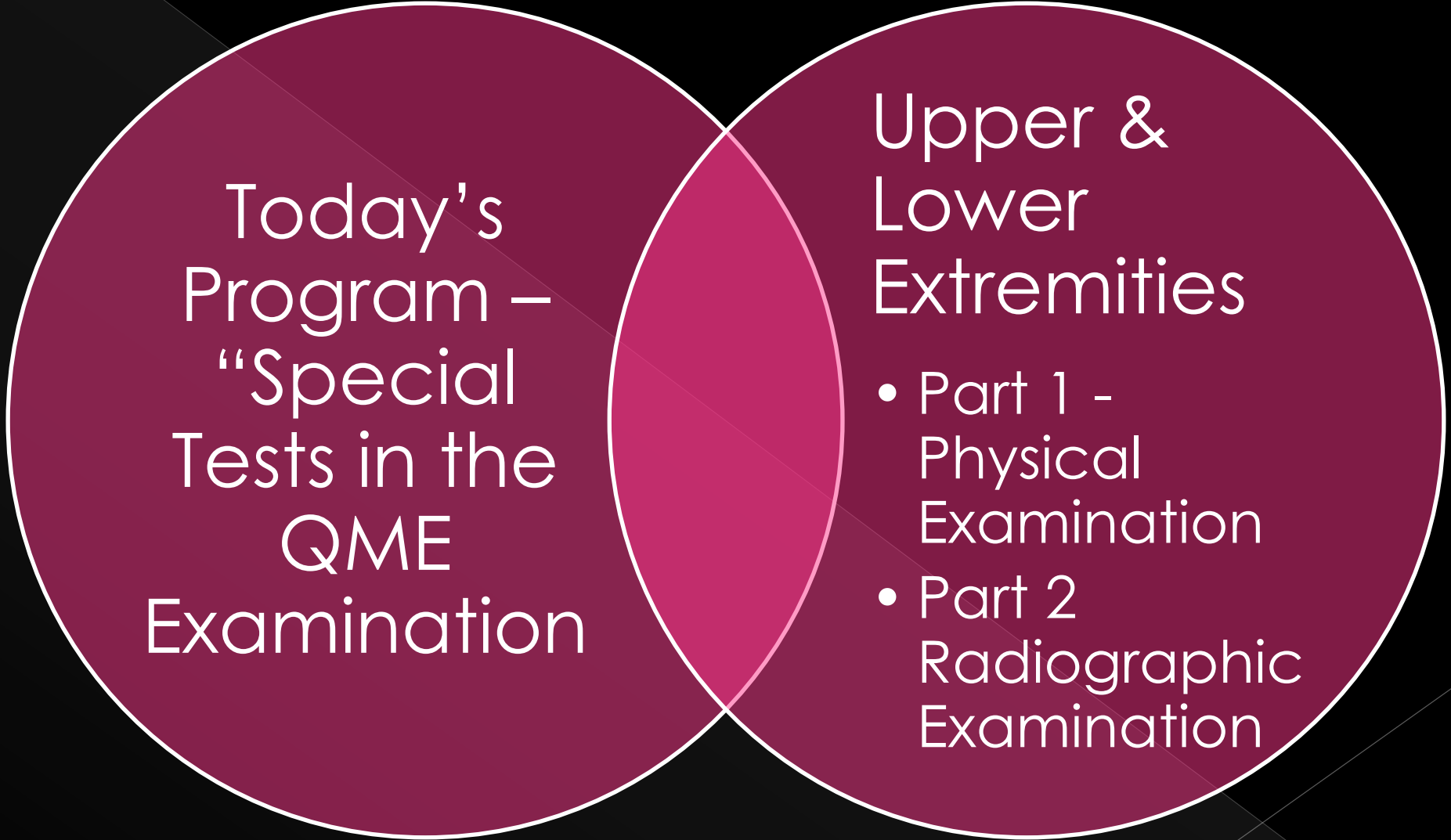
- Physical Examination:
- Radiographic Examination



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- For a brief video introduction to each of the above Programs, click the link below:
- [Gait Disturbance & Assistive Devices](#)
- [The Non-Physiologic Examination](#)
- [The Deposition Matrix](#)
- [21 Secrets of the Most Persuasive QME's](#)
- [Upper Extremity Impairments – Entrapment Neuropathies](#)
- [Lower Extremity Impairments due to Peripheral Nerve Lesions](#)
- [The Importance of the Neurologic Examination](#)
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- [Special Tests in the QME Examination – The Spine](#)





Today's
Program –
“Special
Tests in the
QME
Examination

Upper & Lower Extremities

- Part 1 -
Physical
Examination
- Part 2
Radiographic
Examination



REFERENCES

- ◉ AMA GUIDES 5TH EDITION
- ◉ ACOEM GUIDELINES – 2ND EDITION
- ◉ FUNDAMENTALS OF MUSCULOSKELETAL ASSESSMENT TECHNIQUES – 2ND EDITION BY PALMER & EPLER
- ◉ LIPPINCOTT'S PRIMARY CARE ORTHOPEDICS – 2ND EDITION
- ◉ ESSENTIALS OF SKELETAL RADIOLOGY – 3RD EDITION BY YOCHUM & ROWE
- ◉ Kolber, et al. Characteristics of Anterior Shoulder Instability and Hyperlaxity in the Weight Training Population. *Journal of Strength & Conditioning Research*. May 2013 Pp. 1333-1339
- ◉ Stuart H. Kuschner, MD, et al. Evaluation of Elbow Flexion and Tinel Tests for Cubital Tunnel Syndrome in Asymptomatic Individuals. *In Orthopedics*. April 2006. Vol. 29. No. 4. Pp. 305-308.
- ◉ Buehler, et al. The elbow flexion test. A clinical test for the cubital tunnel syndrome. *Clinical Orthopedics*. August 1988. Pages 213-216
- ◉ Gellman, et al. Carpal tunnel syndrome. An evaluation of the provocative diagnostic tests. *Journal of Bone & Joint Surgery*. June 1986 68(5): Pages 735-737
- ◉



“SPECIAL TESTS” IN THE PHYSICAL EXAMINATION

- Chapter 16 – THE UPPER EXTREMITIES:
 - Shoulder Instability:
 - Upper Extremity Entrapment Syndromes/Compression Neuropathies:
 - Median Nerve:
 - Ulnar Nerve:



“SPECIAL TESTS” IN THE PHYSICAL EXAMINATION

- Chapter 17 – THE LOWER EXTREMITIES:
 - Gait Evaluation: The Formal Gait Analysis
 - Hip Conditions:
 - Trochanteric Bursitis
 - Knee Conditions:
 - Patellar Subluxation/Dislocation/Instability
 - Ligament Injury:
 - ACL/PCL
 - MCL/LCL
 - Chondromalacia Patella:
 - Lower Extremity Peripheral Nerve Lesion (Tarsal Tunnel Syndrome)



“SPECIAL TESTS” IN THE RADIOGRAPHIC EXAMINATION

● Chapter 16 – THE UPPER EXTREMITIES:

- Shoulder Instability:
 - Routine Views
 - Radiographic Findings for Shoulder Instability
- Carpal Instability:
 - Routine Views
 - Radiographic Findings/Measurements for Carpal Instability



“SPECIAL TESTS” IN THE RADIOGRAPHIC EXAMINATION

● Chapter 17 – THE LOWER EXTREMITIES:

- Hip Conditions:
 - Routine Views
 - Trochanteric Bursitis – Cartilage interval measurements
- Knee Conditions:
 - Routine Views
 - Cartilage Interval Measurements
 - Radiographic Findings for:
 - Patellar Subluxation/Dislocation/Instability
 - Ligament Injury:
 - ACL/PCL
 - MCL/LCL
 - Chondromalacia Patella:



GET READY FOR.....SHOULDER INSTABILITY....



SHOULDER FACTS

- ◉ Diarthrodial, Synovial, Joint
- ◉ Multi-axial joint (movement in 3 planes)
- ◉ Suffers more dislocations than all other joints combined
- ◉ Composed of:
 - > Sternoclavicular joint – only articular attachment of shoulder girdle to the axial skeleton
 - > Clavicle – most fractured bone in body
 - > Acromioclavicular joint
 - > Scapula
 - > Scapulothoracic junction
 - > Glenohumeral joint – the focus of dislocations

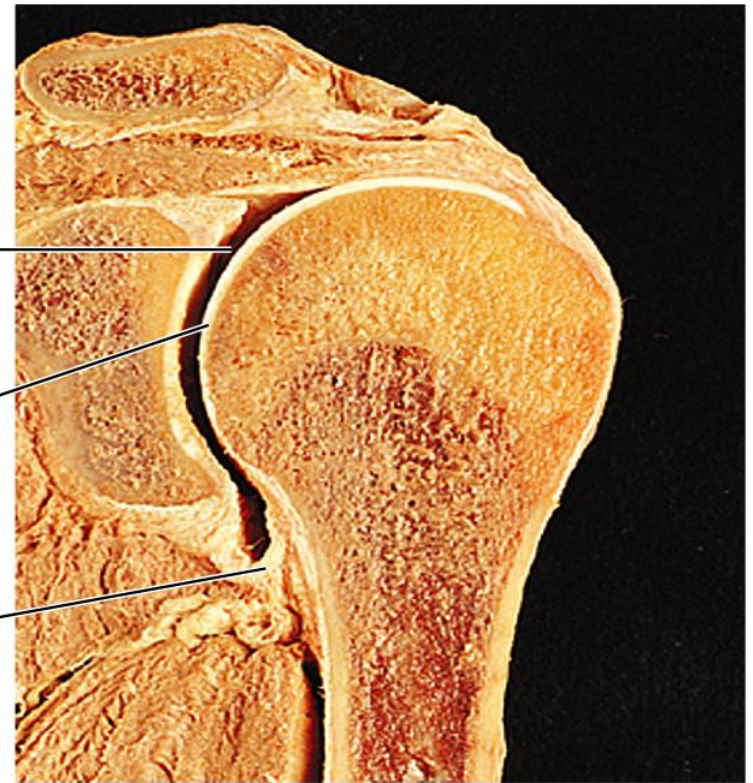
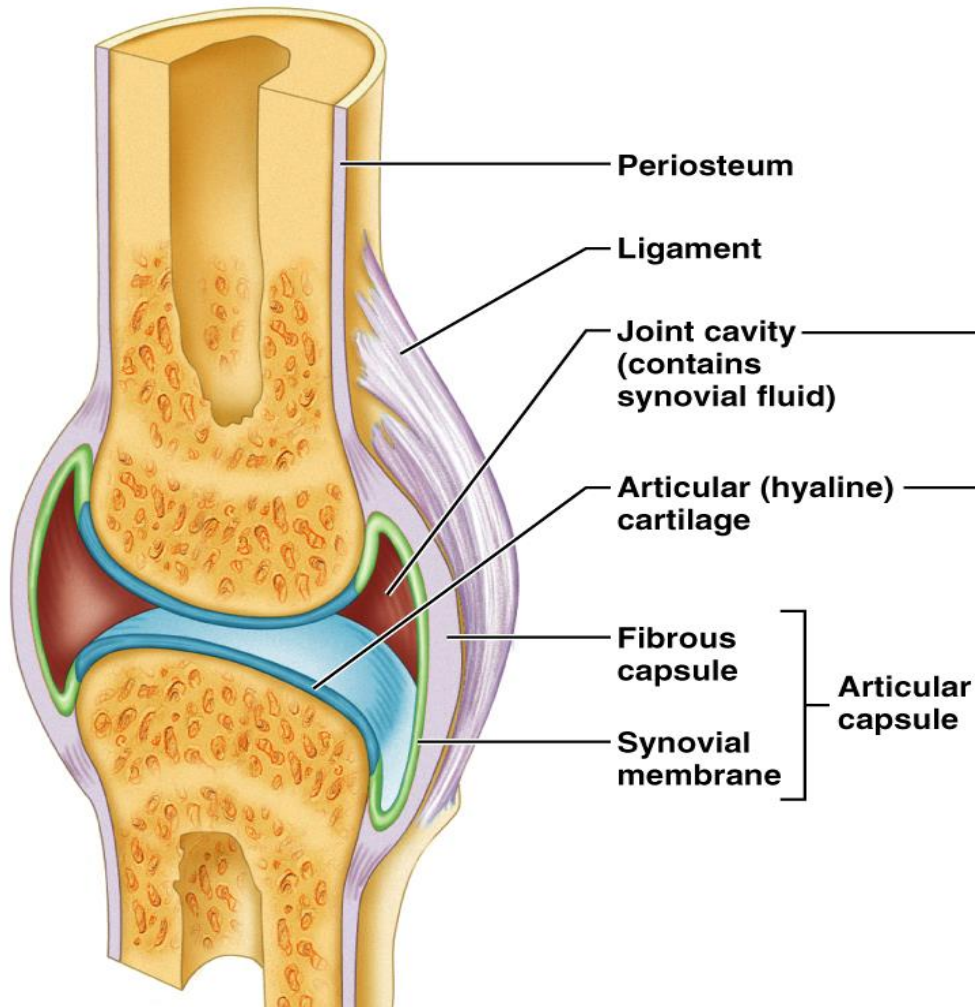


Synovial Joints: General Structure

- ◉ Synovial joints all have the following 5 features:
 - ◉ 1. Articular cartilage
 - ◉ 2. Joint (synovial) cavity
 - ◉ 3. Articular capsule
 - ◉ 4. Synovial fluid
 - ◉ 5. Reinforcing ligaments



Synovial Joints: General Structure



(b)

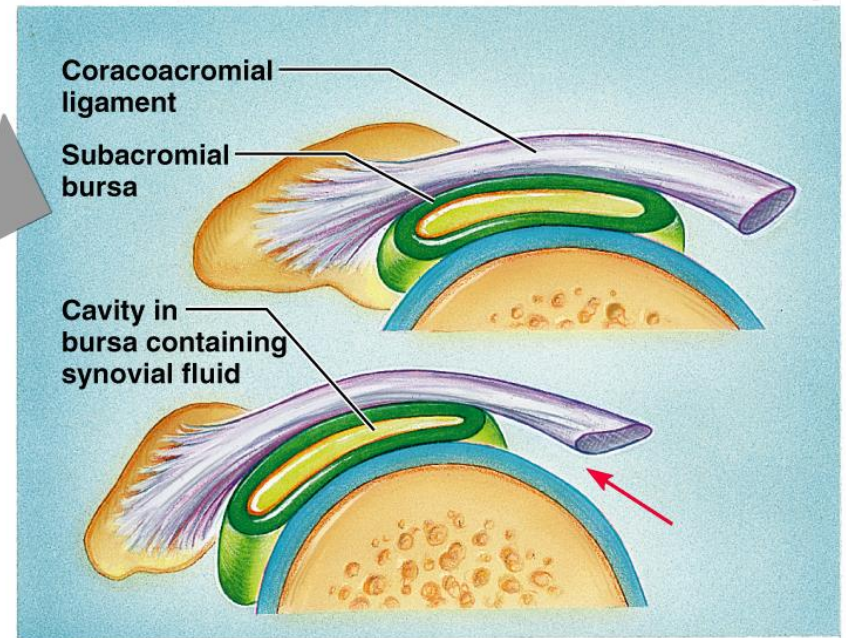
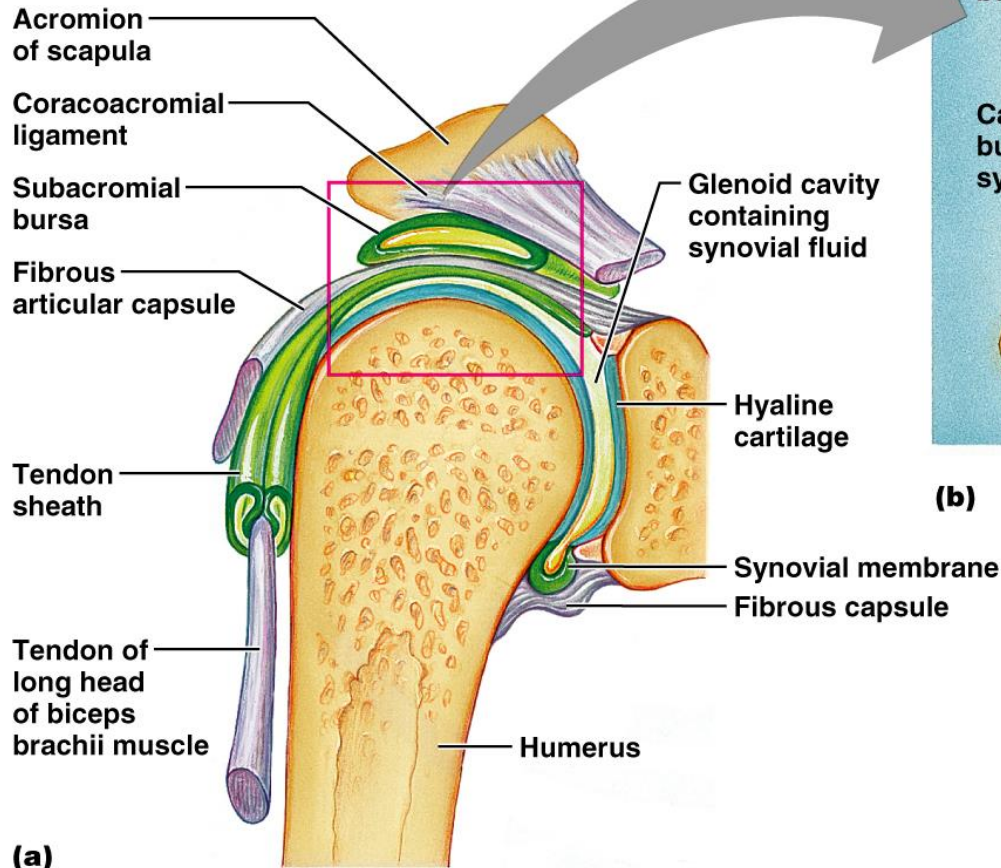


Synovial Joints: Friction-Reducing Structures

- Bursae – flattened, fibrous sacs lined with synovial membranes and containing synovial fluid
- Common where ligaments, muscles, skin, tendons, or bones rub together
- Tendon sheath – flattened, fibrous sacs (bursa) around tendons.
- Common in hands and feet.



Synovial Joints: Friction-Reducing Structures



Synovial Joints: Stability

- ◉ Stability is determined by:
- ◉ Articular surfaces – shape determines what movements are possible
- ◉ Ligaments – unite bones and prevent excessive or undesirable motion
- ◉ Muscle tone – tendons cross joints and provide stability



Synovial Joints: Stability

- Muscle tone -

- > Muscle tendons across joints act as stabilizing factors
- > Tendons are kept tight at all times by muscle tone – especially important in the shoulder, knee, and foot



SHOULDER INSTABILITY

● Chapter 16 – THE UPPER EXTREMITIES:

- AMA GUIDES (Page 503) – “Shoulder instability, Recurrent joint subluxation, or dislocation usually occurs when the integrity of either the glenoid labrum and/or of the surrounding capsulo- ligamentous and musculotendinous structures becomes compromised following either one or more acute traumatic dislocations, repetitive microtrauma, or arthritic conditions.”



SHOULDER INSTABILITY

● Chapter 16 – THE UPPER EXTREMITIES:

- Page 503 – “Predisposing factors can include abnormal contour or alignment of the joint itself from either congenital or posttraumatic origins; congenital laxity of the capsulo ligamentous structures, or musculotendinous imbalances.
- Shoulder instability can be classified by direction, etiology, or volition.”
- Directions?: Ant./Post./Inf.
- Etiologies?: Traumatic/Atraumatic
- Volition?: Voluntary/Involuntary



SHOULDER INSTABILITY

◉ Chapter 16 – THE UPPER EXTREMITIES:

- Page 504 – “Instability is the inability to maintain a normal relationship between the head and the socket and can be manifested by (1) pain and (2) muscular defense induced by provocative movements in the direction of the instability.”
- Physical Exam:
 - Range of Motion Measurements
 - **Laxity Tests**
 - **Provocative Tests**
 - Exam Findings must reproduce the examinee's symptoms to be considered “positive.”



“SPECIAL TESTS” IN THE PHYSICAL EXAMINATION

● Chapter 16 – THE UPPER EXTREMITIES:

- Laxity Test:
 - Sulcus Sign
- Provocative Tests:
 - Loading Anterior/Posterior "Drawer Test"
 - Apprehension Test
 - Jobe's Anterior Relocation Test
 - Additional Tests:
 - Fulcrum Test
 - Labral Clunk Test

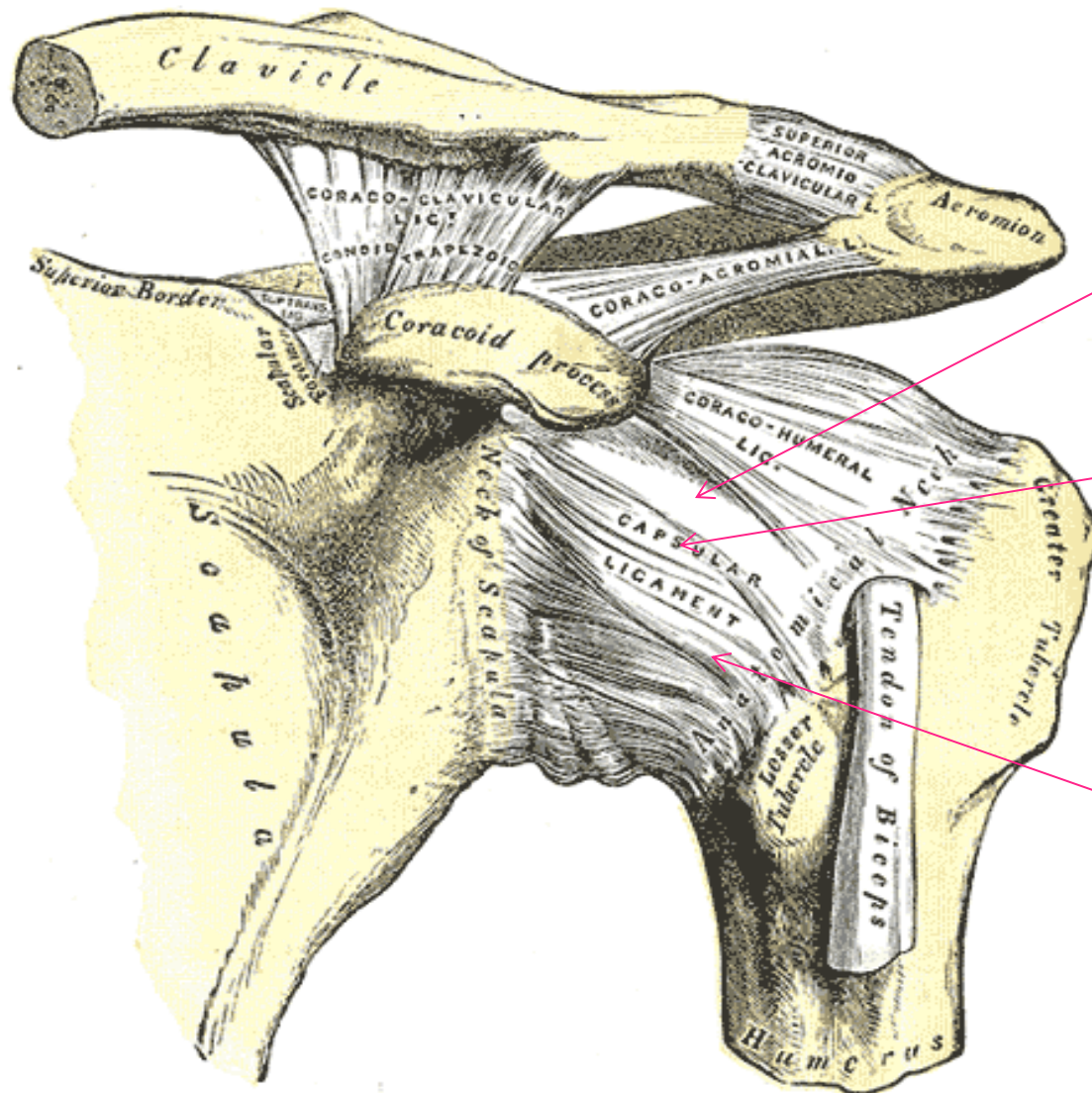


GLENOHUMERAL LIGAMENTS

- 3 Ligaments – all located anteriorly:
 - > Superior glenohumeral ligament
 - > Middle glenohumeral ligament
 - > Inferior glenohumeral ligament
 - > All are simply thickenings of the joint capsule
 - > Capsule also strengthened anteriorly by tendons of pec major and teres major



GLENOHUMERAL LIGAMENTS



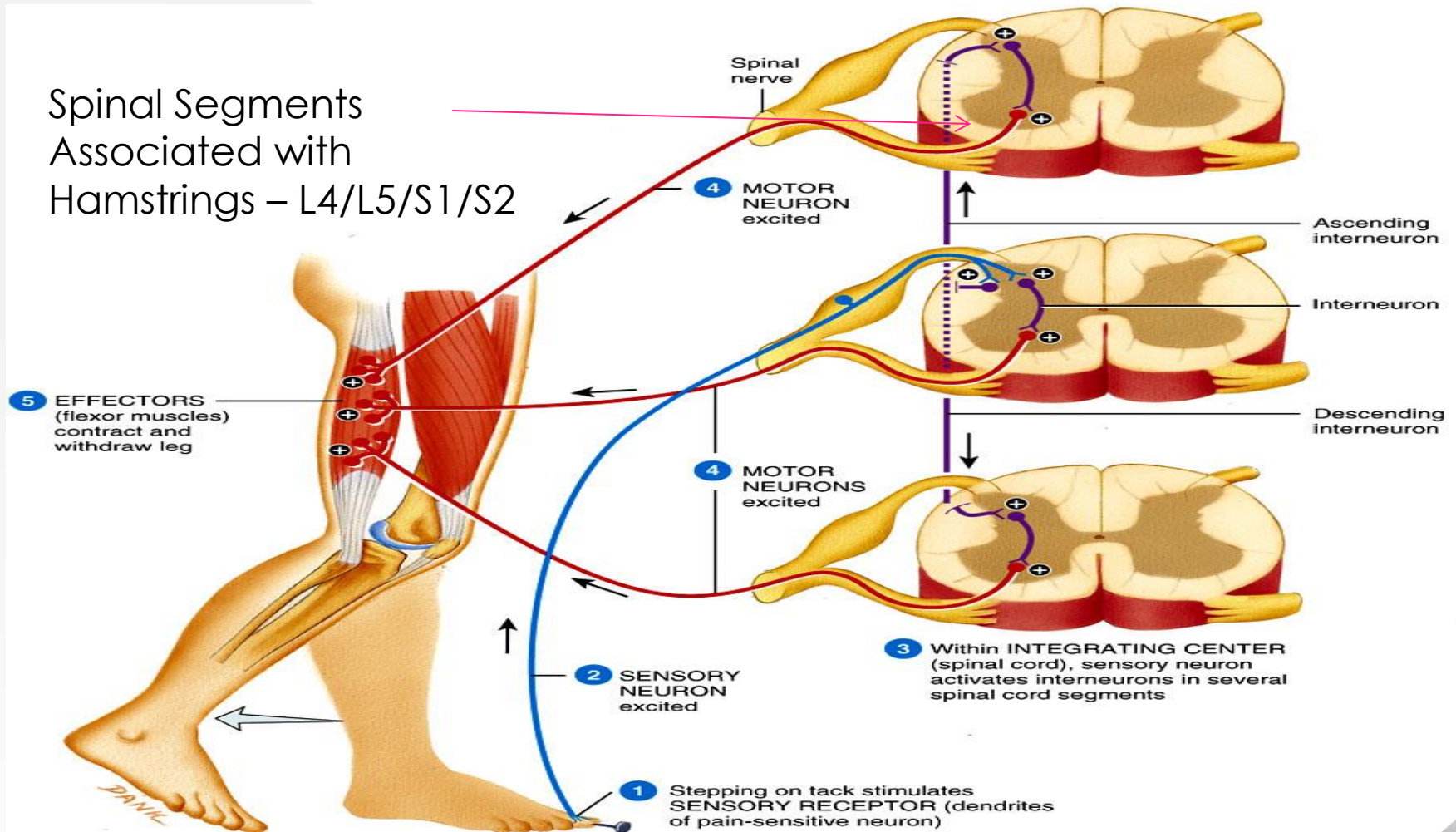
“SULCUS SIGN”

- Used for the assessment of “inferior laxity.”
- Sulcus Sign can be noted with, or without applied traction.
 - > Apply traction with the arm at the side.
 - > Inferior translation of 1 to 2 cm. with noticeable dimpling below the anterolateral acromion (sulcus sign).
 - > **Not considered to be a positive finding unless it reproduces symptoms.**

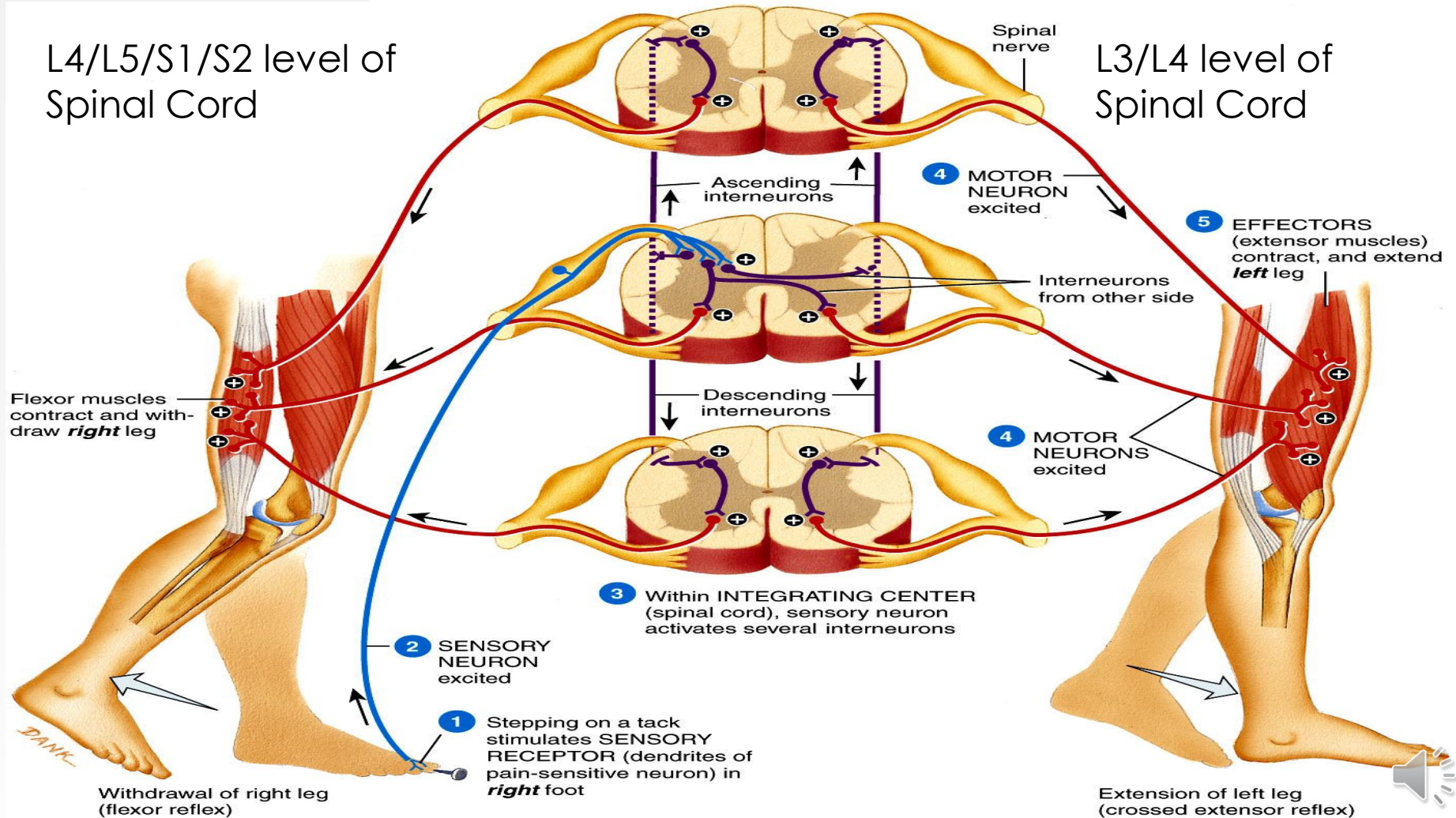


FLEXOR WITHDRAWAL RESPONSE

Spinal Segments
Associated with
Hamstrings – L4/L5/S1/S2



CROSSED EXTENSOR REFLEX





LOADING POSTERIOR/ANTERIOR DRAWER SIGN

- AMA Guides – “Performed supine.”
 - > Shoulder is maintained in neutral rotation, with 60° abduction, and 30° flexion.
 - > One hand stabilizes the extremity in neutral rotation, the other applies a **posteriorly** directed force to attempt to sublunate the shoulder posteriorly.
 - > The position of the examiner's hands is reversed to reproduce the maneuver applying an **anteriorly** directed force.



LOADING ANTERIOR/POSTERIOR DRAWER SIGN

- Lippincott's Primary Care Orthopedics:
 - > Grab proximal humerus and apply gentle compressive force into the glenoid fossa
 - > Free hand supports the elbow.
 - > The humeral head is then translated both **anteriorly** and **posteriorly** as far over the glenoid rim as possible.
 - > Medial translation of the head with this maneuver typically indicates that subluxation has occurred.
 - > Document amount of subluxation.



LOADING ANTERIOR/POSTERIOR DRAWER SIGN

- **“Reproduction of the patient’s symptoms with this maneuver is key to establishing a diagnosis of uni or multidirectional instability.”**
- Sensitivity = 50%....Specificity = 100%
- AMA Guides (page 504) – Amount of Translation:
 - > Trace: Small movement of the humeral head (=“hyperlaxity”).
 - > Class I: Humeral head rides up the glenoid but not over the rim (=“hyperlaxity”).
 - > Class II: Humeral head subluxes over the glenoid rim but reduces spontaneously in position when the axial load is withdrawn (=+“anterior instability”).
 - > Class III: Humeral head frankly dislocates over the glenoid rim and remains dislocated with removal of force (=“anterior instability”).



“APPREHENSION” SIGN

- AMA Guides (page 504):
 - > “Examinee supine. The **anterior** apprehension test is performed by applying external rotation as the shoulder is held in 90° abduction.
 - > If the test is positive, the individual fears that the humeral head will slide out, causing pain.
 - > Muscular defense against the motion is usually present. However, presence of pain alone is not necessarily diagnostic of instability.”
 - > Inferior glenohumeral ligament becomes slack with external rotation as greater tubercle clears upper glenoid and acromion....



“APPREHENSION” SIGN

- Lippincott's Primary Care Orthopedics (page 170):
 - > “Patients with unidirectional instability in the anterior plane will typically demonstrate anxiety (“**apprehension sign**”) as their shoulder is abducted and externally rotated while in the supine position.”
 - > This maneuver reproduces the sensation of an impending dislocation.
 - > Positive test is indicative of AI of the GH joint and has sensitivity of 53-68% and specificity of 99%.



ANTERIOR RELOCATION SIGN (JOBE'S) – A CONFIRMATORY MANEUVER

- AMA Guides (page 504):
 - >"is performed by applying a posteriorly directed force to the proximal humerus while the shoulder is in 90° abduction and external rotation with the individual supine. This posterior stabilizing force should reduce the humeral head and relieve any apprehension of anterior instability."
- Lippincott:
 - > Relief of apprehension (**VALIDITY MANEUVER**) with a posteriorly directed force on the humeral head in this same position is also a confirmatory test for anterior instability (relocation test).
- Relocation test has sensitivity of 57% and 100% specificity for diagnosing AI in the presence of a + apprehension sign.



FULCRUM TEST

- ◉ Used to assess for anterior instability:
 - > Examinee is supine with shoulder abducted to 90 degrees and externally rotated. The examiner places one hand posterior to the humeral head while externally rotating and extending the arm over the fulcrum, which further stresses the capsuloligamentous complex.
 - > Pain, apprehension, or excessive humeral head displacement is representative of a positive test.



LABRAL CLUNK TEST

- ◉ Useful for assessing instability due to glenoid labral tear
 - > Examinee supine with the shoulder fully abducted (180 degrees overhead). The examiner grasps the distal humerus with one hand while the other hand is placed proximally under the posterior shoulder.
 - > Simultaneously, the examiner moves the humeral head anteriorly with the proximal hand while externally rotating the humerus with the distal hand.
 - > Clunk, grinding sensation, apprehension, reproduction of symptoms is positive test for labral tear.



Video of Examination Maneuvers

- ◉ Loading Posterior/Anterior Drawer
- ◉ Apprehension Maneuver
- ◉ Relocation (Jobe's Maneuver)
- ◉ Fulcrum Test
- ◉ Labral Clunk Test



SHOULDER INSTABILITY TESTS PHILOSOPHY

UPPER EXTREMITY ENTRAPMENT SYNDROMES



UPPER EXTREMITY NERVE ENTRAPMENTS/COMPRESSION NEUROPATHIES

- ◉ AMA GUIDES (page 492)
- ◉ “Peripheral nerves can become compressed at any level from the hand to the thoracocervical region.
- ◉ One nerve can be trapped simultaneously at two levels, or more than one nerve can be trapped. Certain anatomic constraints make particular nerves at specific sites more vulnerable, leading to well-defined patterns or syndromes.
- ◉ Generally, each nerve lesion can be described clinically as a **high** or a **low** lesion, that is, a **high** or a **low** median, radial, or ulnar lesion. The most frequently encountered entrapment is of the median nerve at the wrist, leading to the carpal tunnel syndrome, followed by the ulnar nerve at the elbow.”



TRANSITION TO UPPER EXTREMITY PERIPHERAL NERVE ENTRAPMENT SYNDROMES

- Lesions of Ulnar Nerve:
 - > “High” Ulnar Nerve Lesions – Cubital Tunnel Syndrome
 - > “Low” Ulnar Nerve Lesions – Tunnel of Guyon Syndrome
- Lesions of Median Nerve:
 - > “High” Median Nerve Lesions – Pronator Teres Syndrome
 - > “Low” Median Nerve Lesions – Carpal Tunnel Syndrome



PERIPHERAL NERVE DISORDERS

- ◉ Chapter 16 – Section 16.5: Peripheral Nerve Disorders - Entrapment Neuropathies:
 - Page 493: “Only individuals with an **objectively verifiable diagnosis** should qualify for a permanent impairment rating. The diagnosis is made not only on believable symptoms but, **more important**, on the presence of **positive clinical findings** and **loss of function**.”
 - **Positive Clinical Findings???**
 - **Evidence of Loss of Function??**



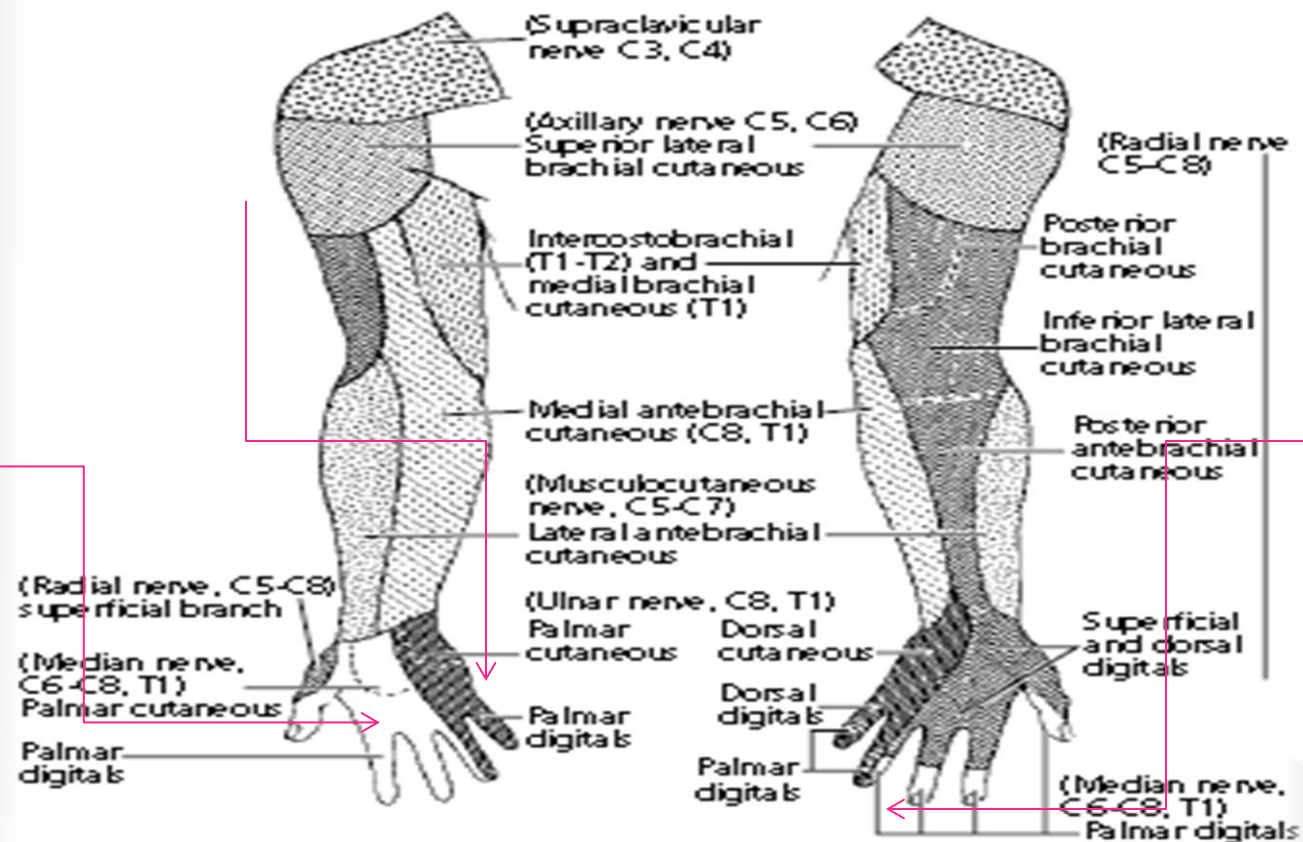
PERIPHERAL NERVE DISORDERS

- Chapter 16 – Section 16.5: Peripheral Nerve Disorders - Entrapment Neuropathies (page 493):
 - > Physical Exam:
 - “Sensibility alterations” – sensory examination
 - “Muscle power” – motor examination
 - “Range of Motion”
 - “Grip Strength”
 - “Tendon reflexes”
 - **Provocative Tests** – “Increased pressure over an entrapped nerve, or irritation by tapping or stretching” (a.k.a. “**Provocative Tests**”) - is reflected by paresthesia (sensation of electrical shock) in its autonomous zone, and possibly by limitation of motion because of pain.”

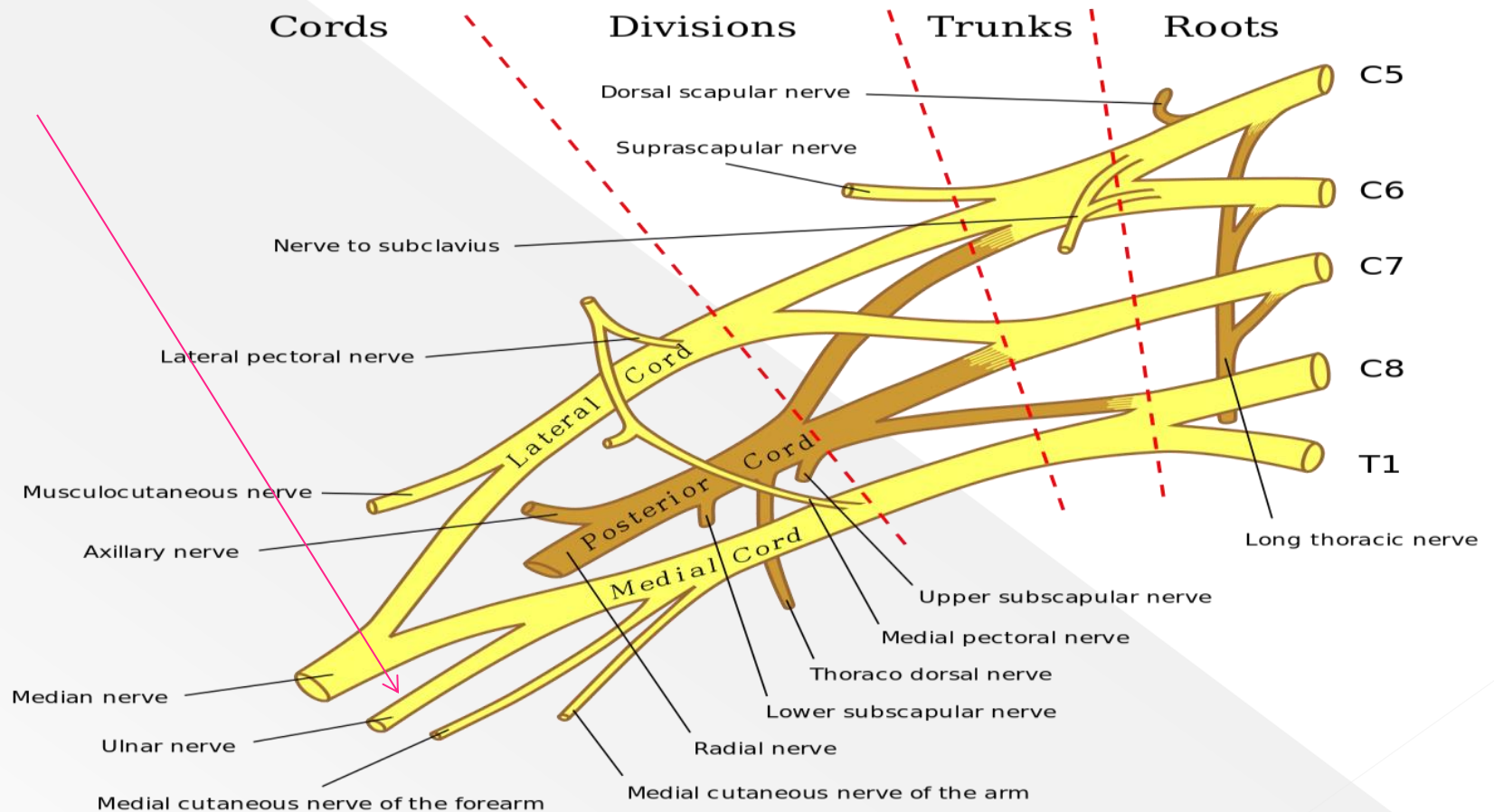


AUTONOMOUS ZONES

Figure 16-48 Cutaneous Innervation of the Upper Extremity and Related Peripheral Nerves and Roots



ULNAR NERVE



MEDIAL

POSTERIOR

LATERAL

TRICEPS BRACHII
(LONG HEAD)

TRICEPS BRACHII
(LATERAL HEAD)

TRICEPS BRACHII
(MEDIAL HEAD)

Radial nerve

Ulnar nerve

Humerus

Brachial artery

Coracobrachialis

Basilic vein

BRACHIALIS

Median nerve

Musculocutaneous nerve

BICEPS
BRACHII:

Fascia

SHORT HEAD

Subcutaneous layer

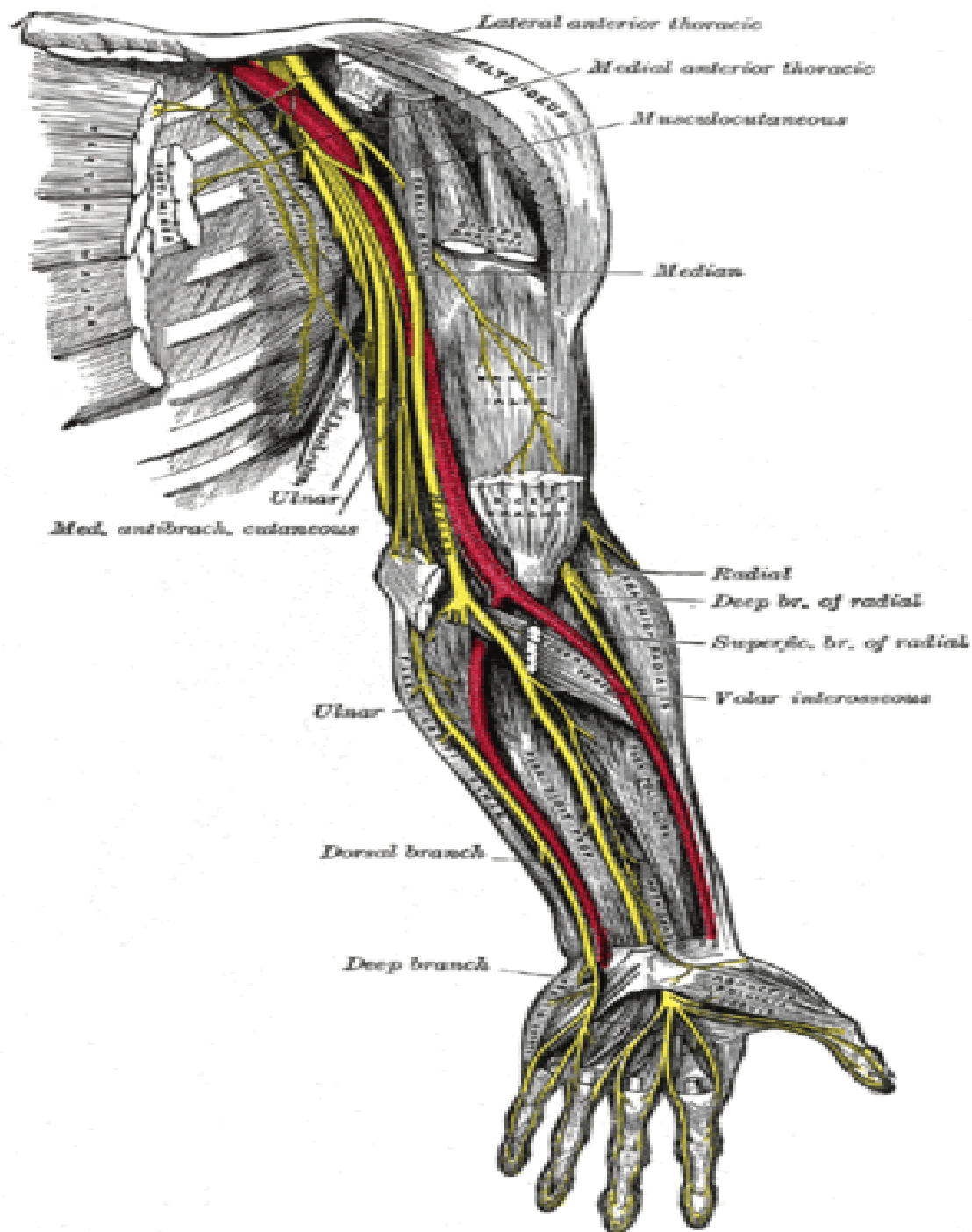
LONG HEAD

Cephalic vein

Skin

ANTERIOR





ULNAR NERVE ENTRAPMENT SYNDROME

- ◉ Review of Functions (“Evidence of Loss of Function”) of Ulnar Nerve:
 - > Motor:
 - > Sensory:
 - > Autonomic:



Peripheral Nerve	Associated Nerve Roots	Muscles Supplied	Muscle Action
Ulnar Nerve - forearm	C7/C8	Flexor Carpi Ulnaris Flexor Digitorum Profundus (3 rd & 4 th)	Ulnar wrist flexion/adduction Flexion of distal phalanges of distal ring and pinky fingers
Ulnar Nerve - hand	C8/T1	Hypothenar muscles (3) Dorsal (4) & Palmar (3) interossei Adductor Pollicis FPB (ulnar head) Medial 2 lumbricals	Adduction & Opposition of 5 th finger Abduction/Adduction of 2 nd – 4 th fingers Thumb adduction Flexion proximal thumb phalanx Extension of middle



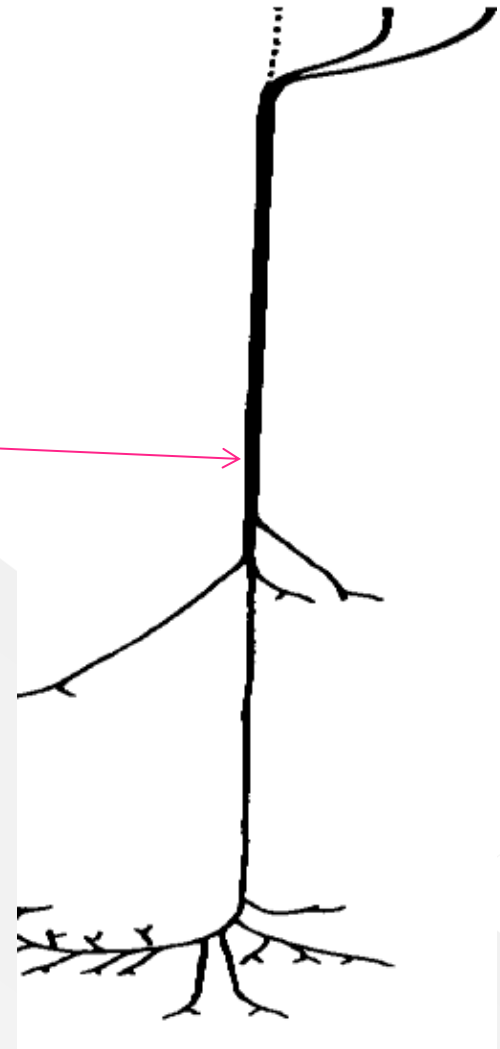
Peripheral Nerve	Motor Branch	Muscle
Ulnar Nerve (below elbow) (C7/C8/T1)	Branch to Flexor Carpi Ulnaris	Flexor carpi ulnaris – ulnar wrist flexion with wrist adduction (ulnar deviation)
	Branch to Flexor Digitorum Profundus	Flexion of distal phalanges of ring and pinky fingers
Below Wrist (tunnel of Guyon)	Hypothenar Branch: 1. Abductor digiti minimi 2. Flexor digiti minimi 3. Opponens digiti minimi Deep Branch: 1. 4 dorsal interossei 2. 3 Volar interossei 3. Adductor pollicis 4. Flexor pollicis brevis (ulnar head)	1. Pinky abduction 2. Pinky flexion of the MCP joint 3. Pinky opposition 4. 2 nd -4 th finger abduction 5. 2 nd -4 th finger adduction 6. Thumb adduction against 2 nd finger 7. Flexion of 1 st thumb phalanx



Peripheral Nerve	Branch	Skin Supplied
Ulnar Nerve – below elbow	Dorsal Sensory Branch (5cm. Proximal to wrist)	Ulnar surface of pinky finger 4 th web space: • Radial surface of pinky finger • Ulnar surface of ring finger
Below wrist	Dorsal Sensory Branch	Ulnar surface of pinky finger 4 th web space: • Radial surface of pinky finger • Ulnar surface of ring finger Motor branch to 3 rd /4 th lumbricals
		

ULNAR NERVE

- ◉ ANATOMIC COURSE (AMA GUIDES pg. 487)
- ◉ Below Elbow:
 - > FCU
 - > FDP (ring/pinky)



ULNAR NERVE

- ◉ ANATOMIC COURSE (AMA GUIDES pg. 487)
- ◉ Below Wrist:
 - > Palmaris brevis
 - > 3 hypothenar mm.
 - > Lumbricals to digits 4 & 5
 - > All 7 interossei
 - > Adductor Pollicis
 - > Flexor pollicis



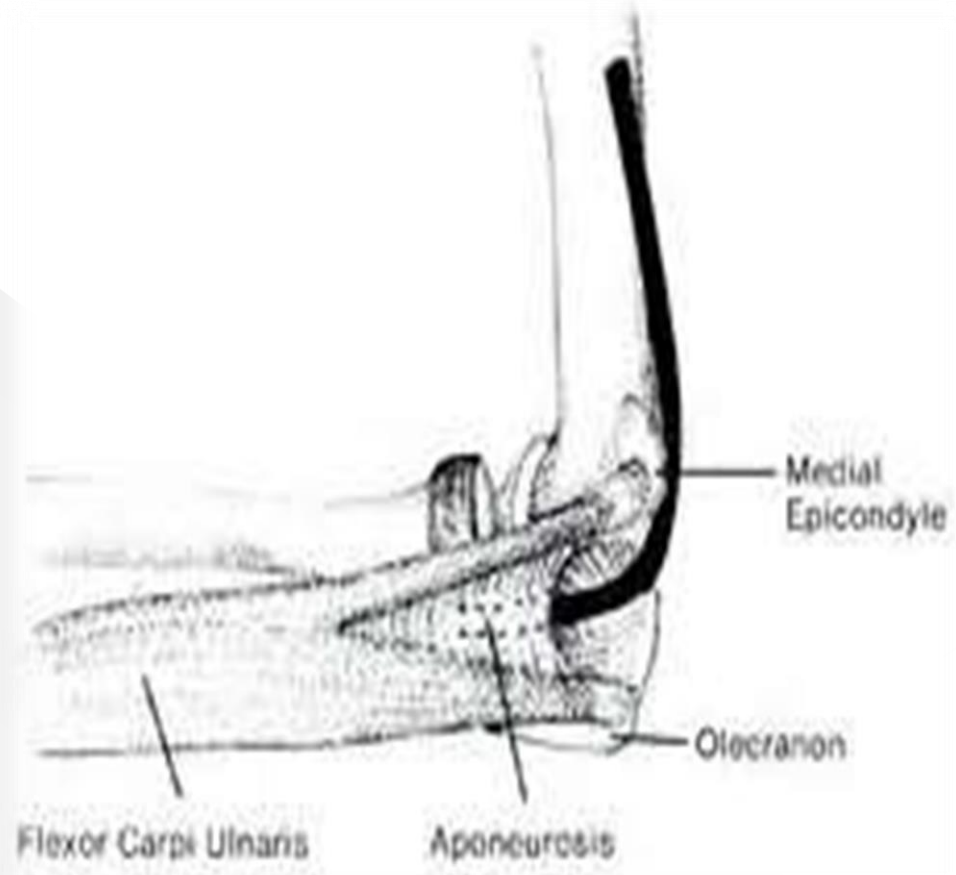
ULNAR NERVE COMPRESSION/IRRITATION

- 3 Possible Locations of Entrapment:
- Below Elbow:
 - Cubital tunnel:
 1. Arcuate Ligament
 2. Head of Flexor Carpi Ulnaris mm.
- Below Wrist:
 - Tunnel of Guyon:
 3. Hook of hamate and pisiform



ULNAR NERVE COMPRESSION/IRRITATION

- Cubital Tunnel:
 - > Borders:
 - > Medially is bordered by the medial epicondyle
 - > Laterally by the olecranon process
 - > Floor is formed by MCL
 - > Covered by:
 - Ulnar collateral ligament
 - Aponeurotic roof
 - Tendon of FCU (Arcuate Ligament/Osborne's ligament)



CUBITAL TUNNEL SYNDROME

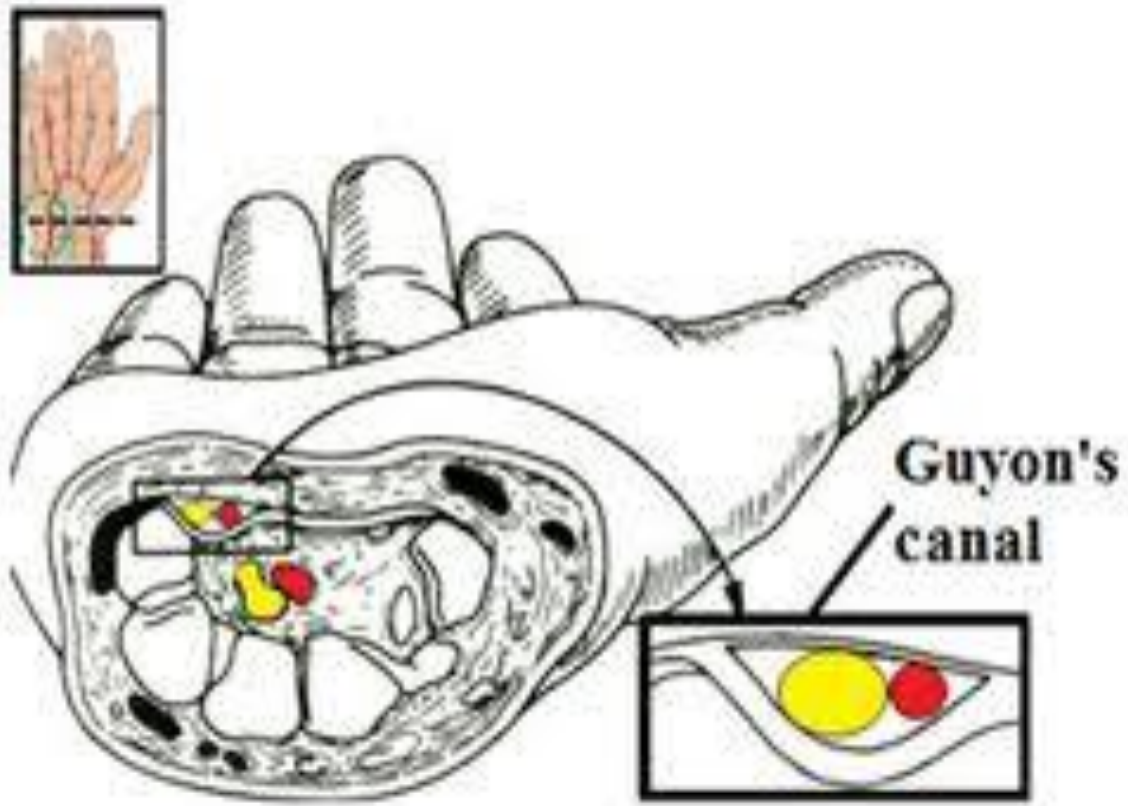
- Cubital tunnel is slack during extension and become progressively more taut during flexion, contributing to ulnar nerve symptoms - point of constriction is 1.5-3.5 cm. distal to medial epicondyle
- FCU and FDP usually spared
- Aching pain at the medial elbow – sensory findings at 4th (ulnar side) & 5th finger, motor findings rare/late



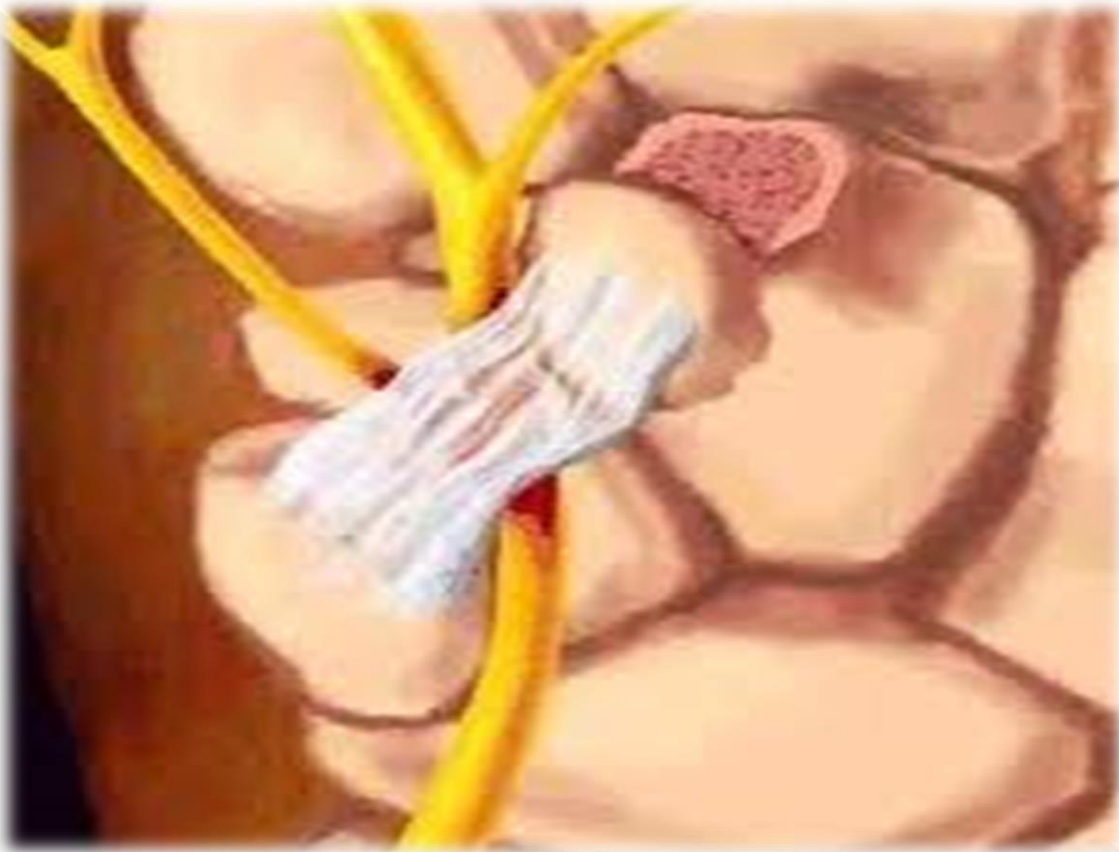
ULNAR NERVE COMPRESSION/IRRITATION

- Tunnel of Guyon:
- Approximately 4 cm long
- Begins at the proximal extent of transverse carpal ligament - ends at the aponeurotic arch of hypothenar muscles
- Depression between pisiform & hook of hamate is converted into fibrous tunnel (the tunnel of Guyon) by pisohamate ligament;
- Roof is formed by volar carpal ligament and pisohamate ligament;
- The ulnar nerve bifurcates within the canal into superficial (more ulnar and sensory) and deep (more radial and motor) branches;





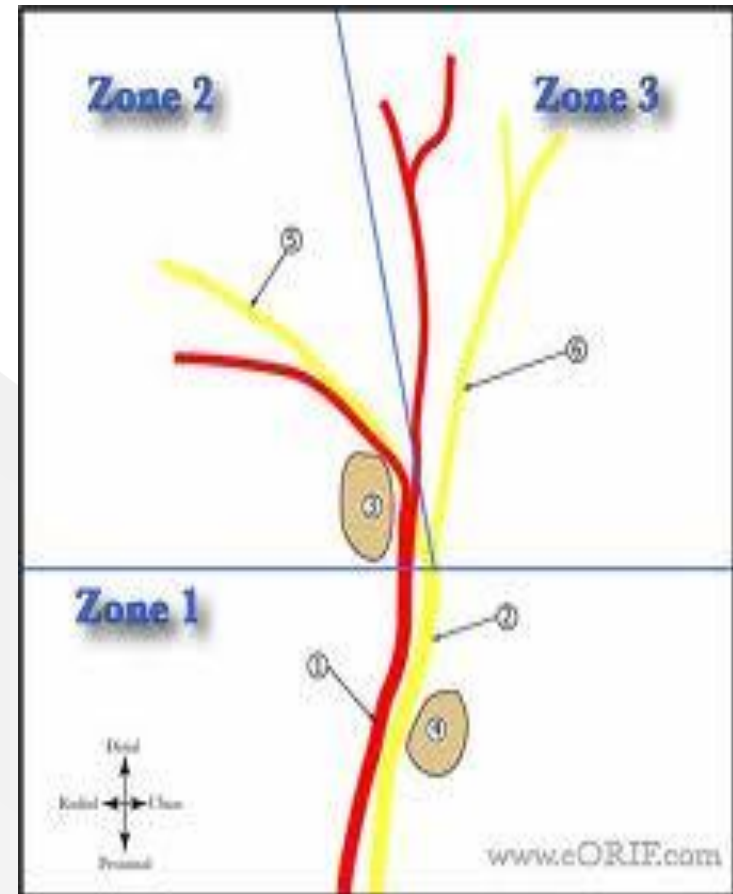




ULNAR NEUROPATHY AT GUYON'S CANAL

◎ Type I

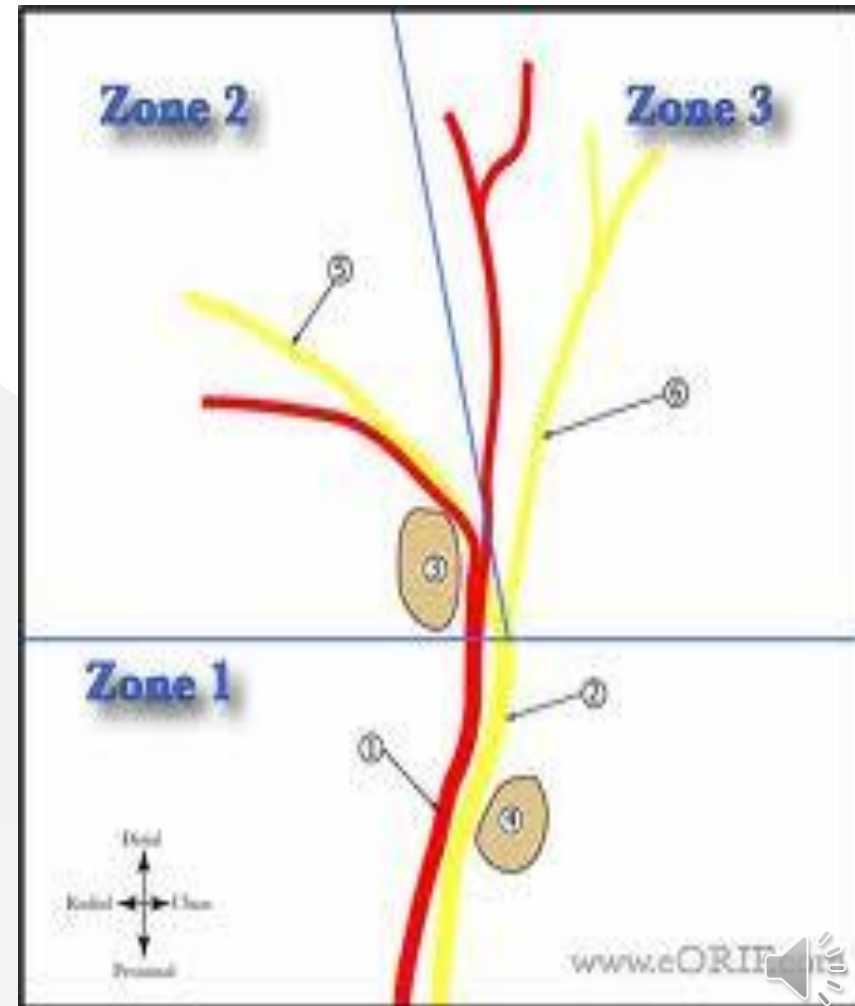
- > Proximal compression (proximal edge of palmar carpal ligament prior to the bifurcation of Ulnar Nerve into sensory and deep motor branches) leads to motor weakness in all of the intrinsic muscles of the hand which are innervated by the [ulnar nerve](#). There is also sensory loss in the territory of the hand served by the ulnar nerve. Most common lesions = ganglions and [hook of hamate fracture](#).



ULNAR NEUROPATHY AT GUYON'S CANAL

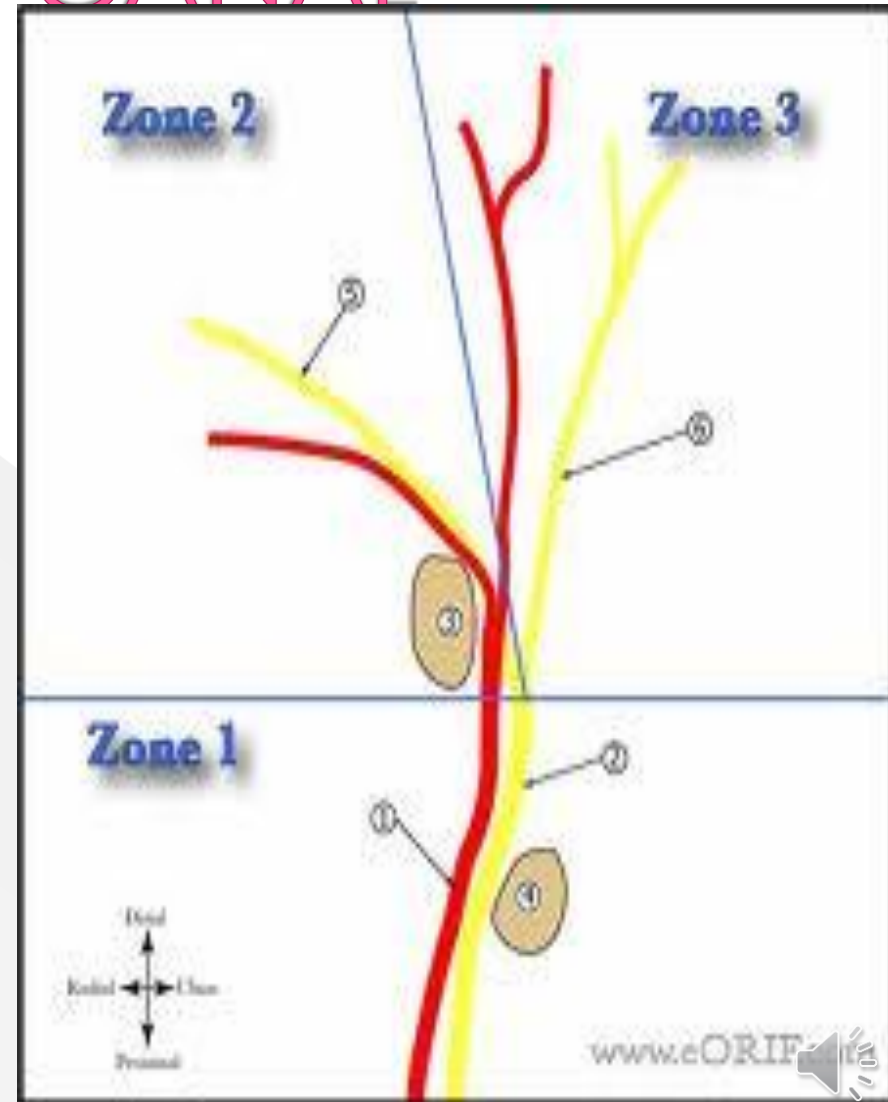
○ Type II

- > Compression at the bifurcation of the ulnar nerve just distal to the fibrous arch of the hypothenar muscles. This is the most common type of Guyon's canal syndrome. This results in symptoms associated with Type I (above), however the sensory branch to the dorsal part of the hand and the motor supply to the muscles of the base of the palm are unaffected. Therefore Type II involves an impairment in motor function of the hand, with sensory innervation unaffected. Most common lesions = ganglions and [hook of hamate fracture](#).



ULNAR NEUROPATHY AT GUYON'S CANAL

- **Type III**
- This is the least common type of Guyon's canal syndrome, and is caused by compression of the superficial branch of the ulnar nerve at the distal portion of Guyon's canal. Type III results in a loss of sensation from the cutaneous territory of the hand which is served by the ulnar nerve. Deep motor branch is spared and there is no motor function impairment. Most common lesions = Ulnar artery thrombosis.



ULNAR NERVE ENTRAPMENT SYNDROMES

◉ Deficits of Function of Ulnar Nerve:

> Motor:

- Weakness of wrist flexion/adduction
- Weakness of finger flexion (DIP joints of 4th & 5th)
- Wasting and weakness of small hand muscles

> Sensory: Tingling/numbness in ring and pinky fingers

> Autonomic: Unknown but likely related to blood vessels and sweat glands



Location of Entrapment	Physical Exam Finding	Explanation
Cubital Tunnel	Sensory findings in 4 th (ulnar side) & 5 th fingers. May see autonomic changes as well. Motor findings uncommon. Positive Tinel's sign at the elbow. Positive forearm flexion test. Positive Fromet's sign (weakness of adductor pollicis). Positive Wartenburg sign (failure of palmar adductors).	Unknown as to how motor lesions are spared in early disease but may become profound in late disease.
Guyon's Tunnel	??????????	



PERIPHERAL NERVE DISORDERS

- Cubital Tunnel Syndrome:
- Provocative Maneuvers:
 - Tinel's Sign (tapping over irritated nerve):
 - Elbow Flexion Test (increases pressure over entrapped nerve by stretching the two heads of the flexor carpi ulnaris – humeral head/ulnar head):
 - Validity of these Tests???

- Stuart H. Kuschner, MD, et al. Evaluation of Elbow Flexion and Tinel Tests for Cubital Tunnel Syndrome in Asymptomatic Individuals. In Orthopedics. April 2006. Vol. 29, No. 4. Pp. 305-308.



MEDIAN NERVE ENTRAPMENT SYNDROMES

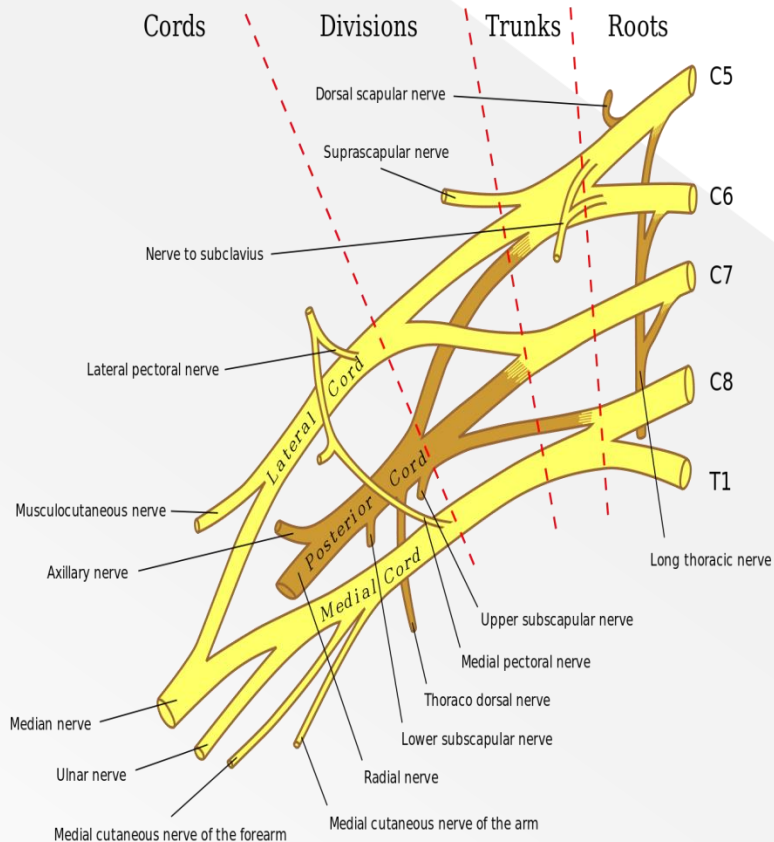


MEDIAN NERVE ENTRAPMENT SYNDROMES

- ◉ Introductory Dialogue
- ◉ “High” Median Nerve Lesion - Pronator Teres Syndrome
- ◉ “Low” Median Nerve Lesion - Carpal Tunnel Syndrome



MEDIAN NERVE



- Formed from a branch from the lateral cord (C5, C6, and C7), and a branch from the medial cord (C8, and T1)



COURSE OF MEDIAN NERVE

◎ Course in the upper arm and cubital fossa

- > After receiving inputs from both the lateral and medial cords of the brachial plexus, the median nerve enters the arm from axilla at the inferior margin of the teres major muscle. it then passes vertically down and courses with brachial artery on medial side of arm between biceps brachii and brachialis.
- > Inside the cubital fossa the median nerve passes medial to the brachial artery, in front of the point of insertion of the brachialis and deep to the biceps.
- > A branch to pronator teres may arise from the median nerve immediately proximal to the elbow joint. The median nerve gives off an articular branch in the upper arm as it passes the elbow joint.

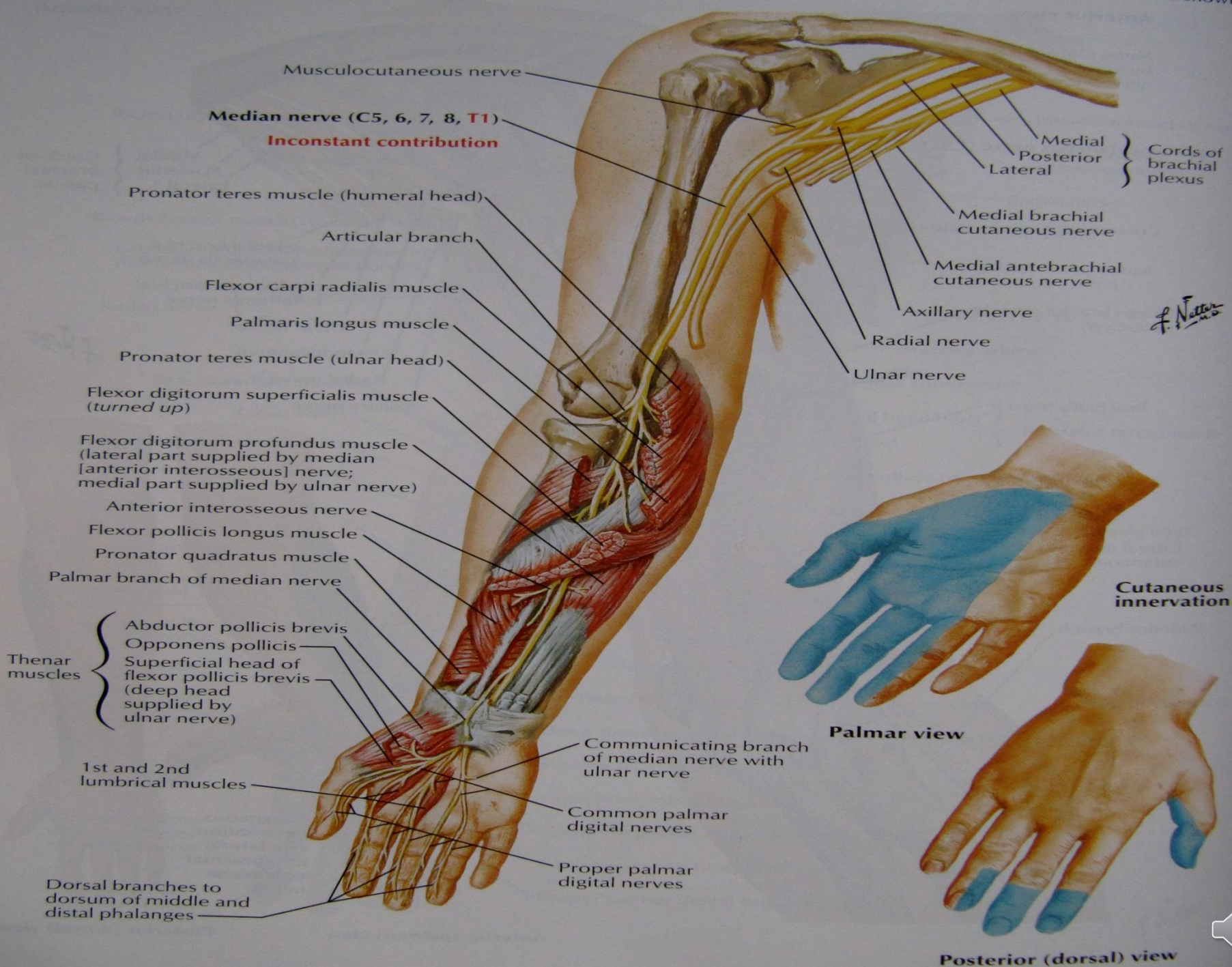


COURSE OF MEDIAN NERVE

● **Course and branches in the forearm**

- The median nerve arises from the cubital fossa and passes between the two heads (humeral head and ulnar head) of pronator teres. It then travels between flexor digitorum superficialis and flexor digitorum profundus before emerging between flexor digitorum superficialis and flexor pollicis longus.





Peripheral Nerve	Associated Nerve Roots	Muscles Supplied	Muscle Action
Median Nerve (C5-T1)	C5	Minimal contribution from C5 because most of C5 has already split off to the 1) Axillary Nerve, and 2) the Musculocutaneous nerve	
Median Nerve	C6	Pronator Teres Pronator Quadratus	Forearm pronation
	C7	Flexor carpi radialis longus/brevis	Radial Wrist flexion
	C8	Flexor digitorum profundus (1&2)	Flexion of DIP joints
	T1	Abductor pollicis brevis, opponens pollicis (thenar muscles)	Thumb abduction and opposition

COURSE OF MEDIAN NERVE

◎ **Course and branches in the forearm**

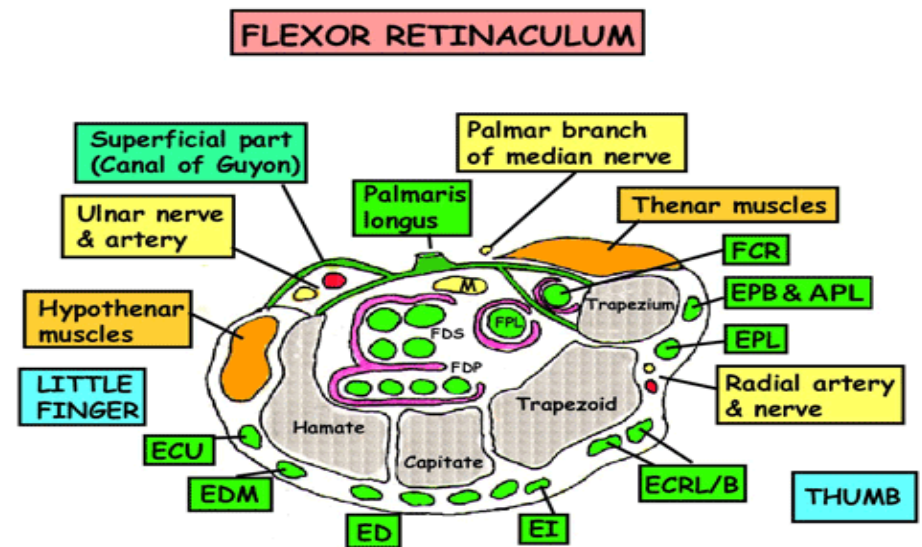
- The unbranched portion of the median nerve (which arises from the cubital fossa) innervates muscles of superficial and intermediate groups of the anterior compartment except flexor carpi ulnaris.
- Then, it gives off two branches as it courses through the forearm:
 - The anterior interosseous branch courses with the anterior interosseous artery and innervates all the muscles of the deep group of the anterior compartment of the forearm except the medial (ulnar) half of flexor digitorum profundus and flexor carpi ulnaris muscle. It ends with its innervation of pronator quadratus.
 - The palmar cutaneous branch of the median nerve arises at the distal part of the forearm. It supplies sensory innervation to the lateral aspect of the skin of the palm (but not the digits).



COURSE OF MEDIAN NERVE

◉ Branches in the hand

- > The median nerve enters the hand through the carpal tunnel, deep to the flexor retinaculum along with the tendons of flexor digitorum superficialis, flexor digitorum profundus, and flexor pollicis longus.



Origin: Tubercle of scaphoid & ridge of trapezium

Insertion: Pisiform & hook of hamate

Into it: Palmaris brevis & palmaris longus, palmar aponeurosis

From it: Thenor & hypothenar muscles

Over it: Ulnar artery & nerve, palmar cutaneous branch of median, palmar branch of radial artery

Deep to it: Median nerve & structures on diagram

Note: Synovial sheaths open laterally to allow access for small vessels to tendons

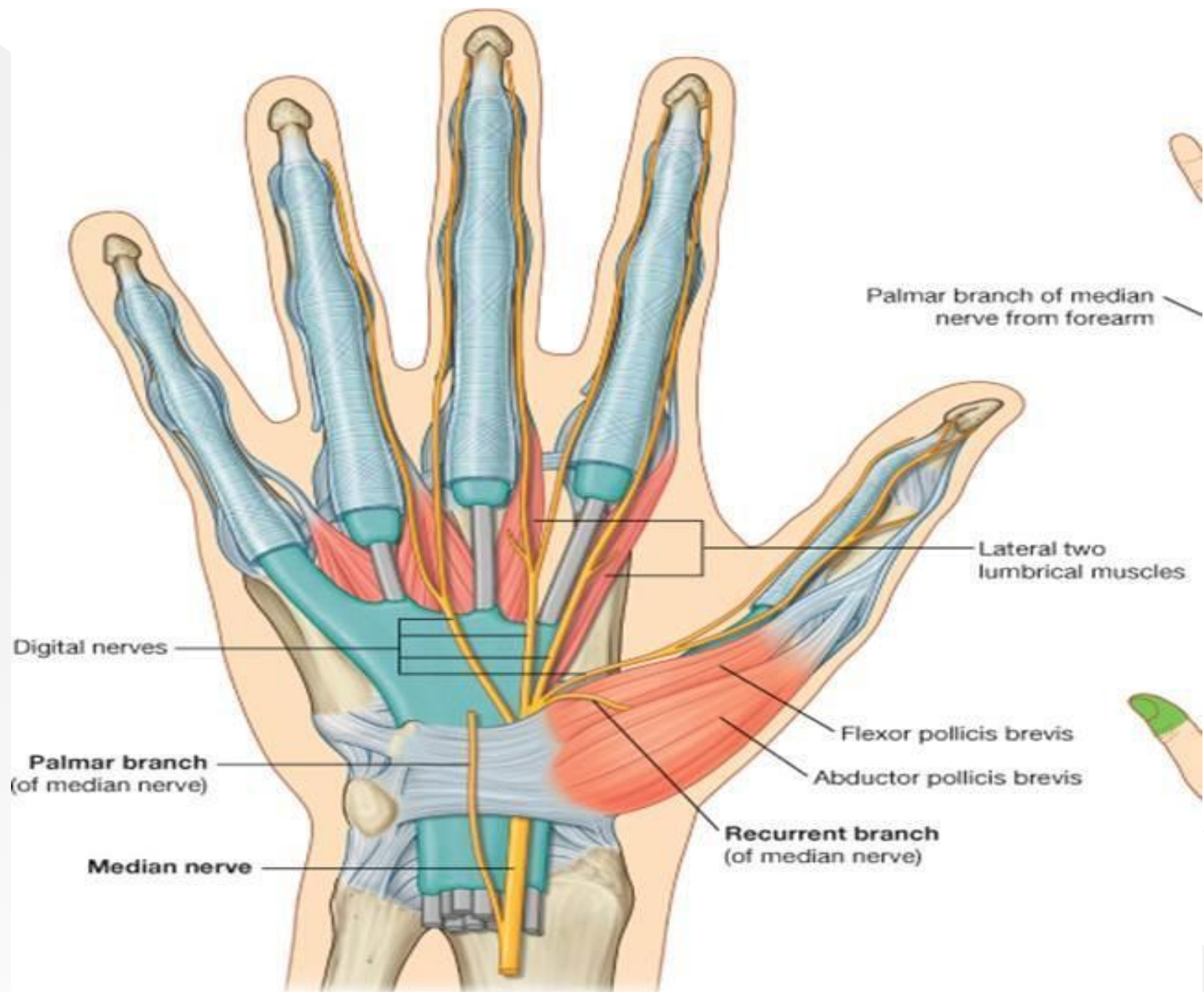


COURSE OF MEDIAN NERVE

◎ Branches in the hand

- > From there it sends off several branches:
- > 1. Recurrent branch to muscles of the thenar compartment (the recurrent branch is also called "the million dollar nerve"). Here it provides motor innervation to opponens pollicis, abductor pollicis brevis and flexor pollicis brevis.
- > 2. *Digital cutaneous branches* to common palmar digital branch and proper palmar digital branch of the median nerve which supply the:
 - a) lateral (radial) three and a half digits on the palmar side
 - b) tips of index, middle and ring finger on dorsum of the hand
- > 3. *Branches* to the first and second Lumbricals of the hand.





Peripheral Nerve	Motor Branch	Muscle
Median Nerve (C6-T1)	Branch to pronator teres	Pronator teres – forearm pronation (weak elbow flexion)
Below elbow	Branch to flexor carpi radialis	Flexor carpi radialis – radial wrist flexion, radial deviation
	Branch to Palmaris longus	Wrist flexion
	Branch to flexor digitorum superficialis	Flexion of PIP joints of all fingers
Anterior Interosseous Nerve	Branch to FDP (to index & middle finger) Branch to FPL Branch to pronator quadratus	Flexion of DIP joints of index & middle finger Flexion of distal phalanx of thumb Forearm pronation

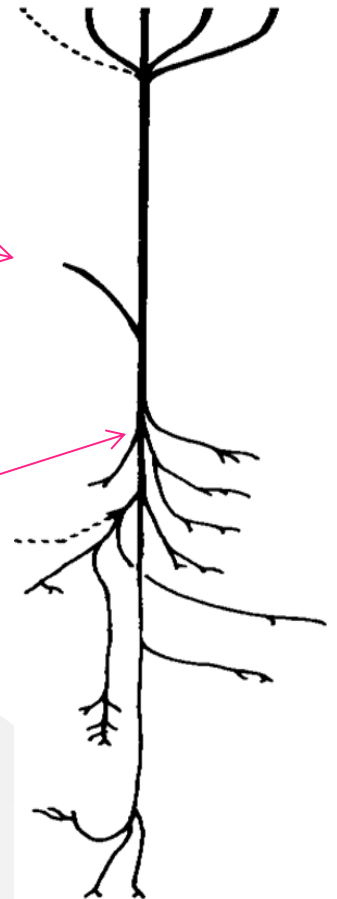


Peripheral Nerve	Branch	Skin Supplied
Median Nerve (C6-T1) – Above wrist	Palmar cutaneous	Central proximal surface of palm
Below wrist	Proper palmar digitals (3 branches)	Sensory to 1st web space (palmar), palmar, and distal dorsal surfaces of thumb (both sides) and index (radial side)
	Proper Palmar digitals (2 branches)	Sensory to 2nd web space (palmar), palmar, and distal dorsal surfaces of contiguous sides of index and middle fingers
	Proper Palmar digitals (2 branches)	Sensory to 3rd web space (palmar), palmar, and distal dorsal surfaces of contiguous sides of middle and ring fingers



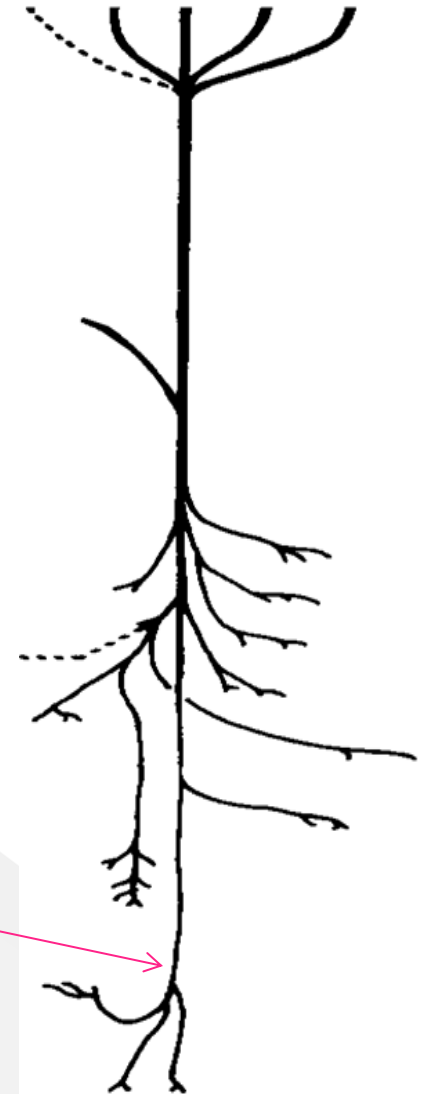
MEDIAN NERVE

- ◉ ANATOMIC COURSE (AMA Guides page 487):
- ◉ Above Elbow: Branch to Pronator teres
- ◉ Below Elbow: Branches to 1) Flexor carpi radialis, Palmaris Longus, Flexor Digitorum Superficialis
- ◉ Anterior Interosseous Nerve:
 - > FDP (Index & Middle)
 - > Flexor Pollicis Longus
 - > Pronator Quadratus



MEDIAN NERVE

- ANATOMIC COURSE:
- Above Wrist: Palmar Cutaneous Branch (Sensory)
- Recurrent Motor Branch ("Million Dollar Nerve") to thenar muscles (abductor pollicis brevis, opponens pollicis, flexor pollicis brevis)
- Sensory Branches (not shown in AMA Guides)
 - > 1st web space:
 - Thumb (radial & ulnar)
 - Index:
 - Sensory to radial half
 - Motor to 1st lumbrical
 - > 2nd web space:
 - Index:
 - Sensory to ulnar half
 - Motor to 2nd lumbrical
 - Middle finger:
 - Sensory to radial half
 - > 3rd web space:
 - Middle finger:
 - Sensory to ulnar half
 - Ring finger:
 - Sensory to radial half



MEDIAN NERVE COMPRESSION/IRRITATION

◉ Locations of Compression:

1. Elbow (Pronator Syndrome):

- > Lacertus Fibrosus
- > Pronator Teres
- > Flexor Digitorum Superficialis
- > Others: Ligament of Struthers or enlarged bicipital bursa

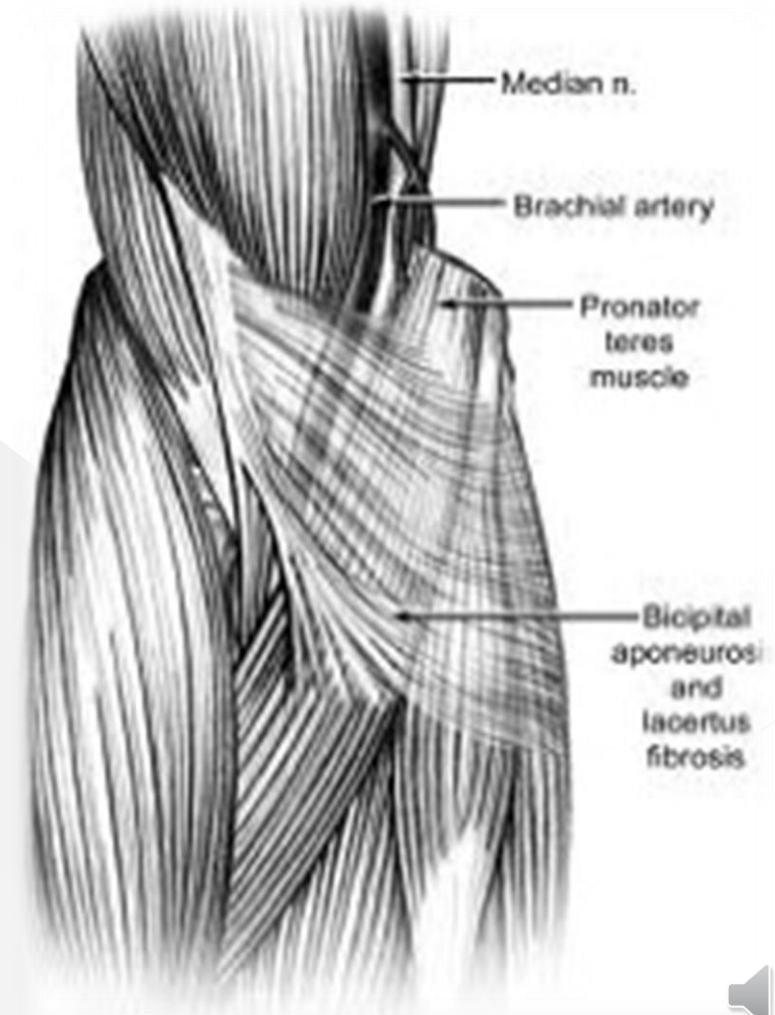
2. Wrist (Carpal Tunnel Syndrome):

- > Flexor Retinaculum



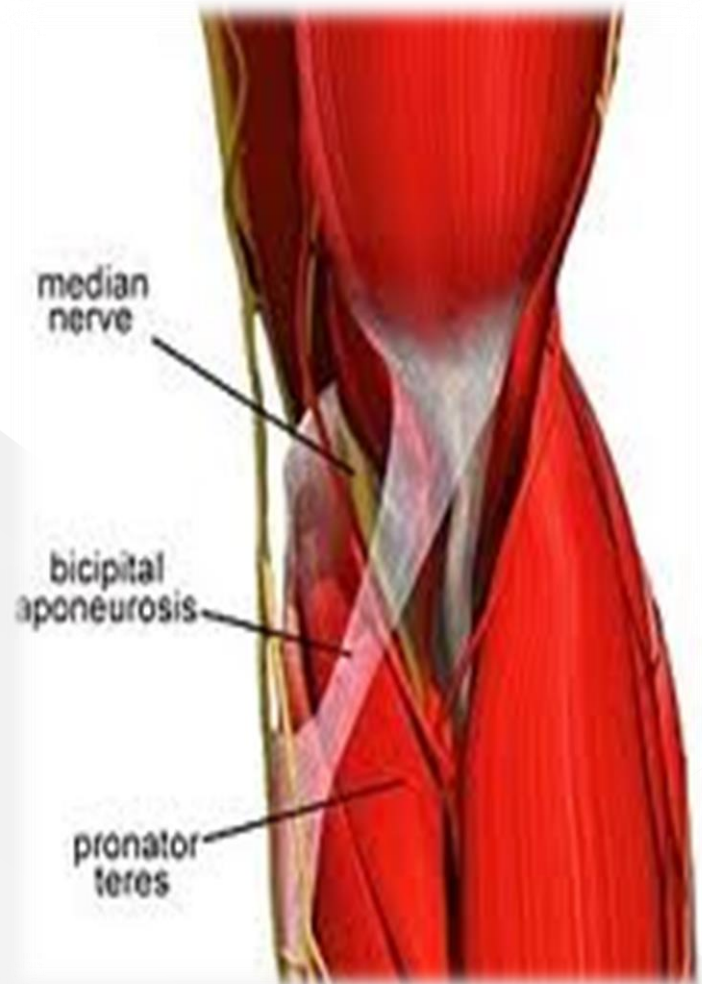
MEDIAN NERVE COMPRESSION/IRRITATION

- Lacertus Fibrosus – a.k.a. bicipital aponeurosis
- Median nerve passes under the bicipital aponeurosis (lacertus fibrosus) into the antecubital region, medial to both the biceps tendon and brachial artery



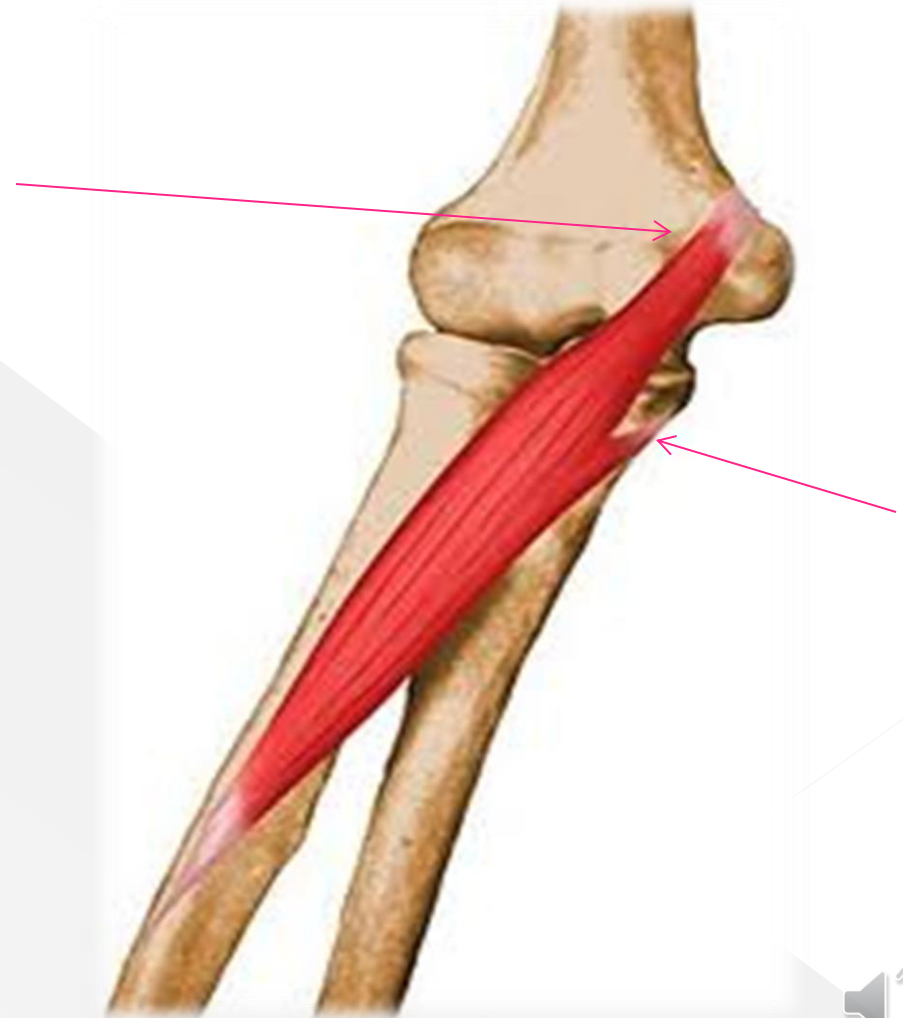
MEDIAN NERVE COMPRESSION/IRRITATION

- Lacertus Fibrosus –
a.k.a. bicipital
aponeurosis



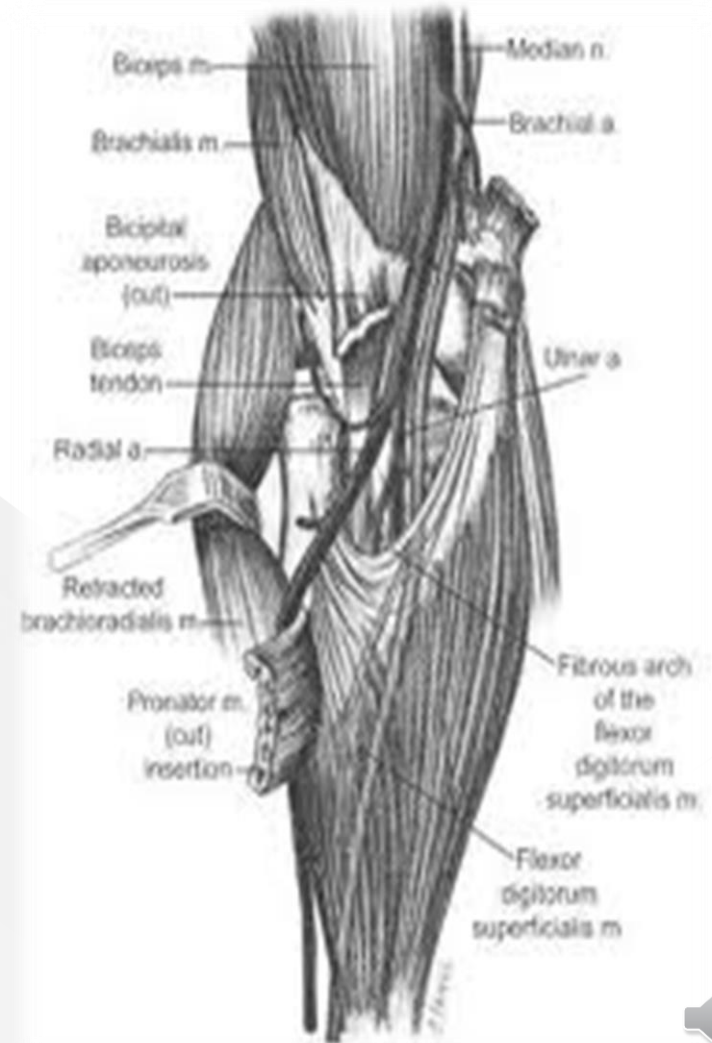
MEDIAN NERVE COMPRESSION/IRRITATION

- Pronator Teres:
- Origin:
 - > Humeral Head: Medial epicondyle of humerus
 - > Ulnar Head: Anterior upper aspect of ulna
- The median nerve passes between the 2 heads of the pronator teres, deep to the humeral head and superficial to the ulnar head; (rarely the ulnar head may be absent)
- Insertion: Anterolateral upper 1/3 of radius
- Action: Pronate forearm



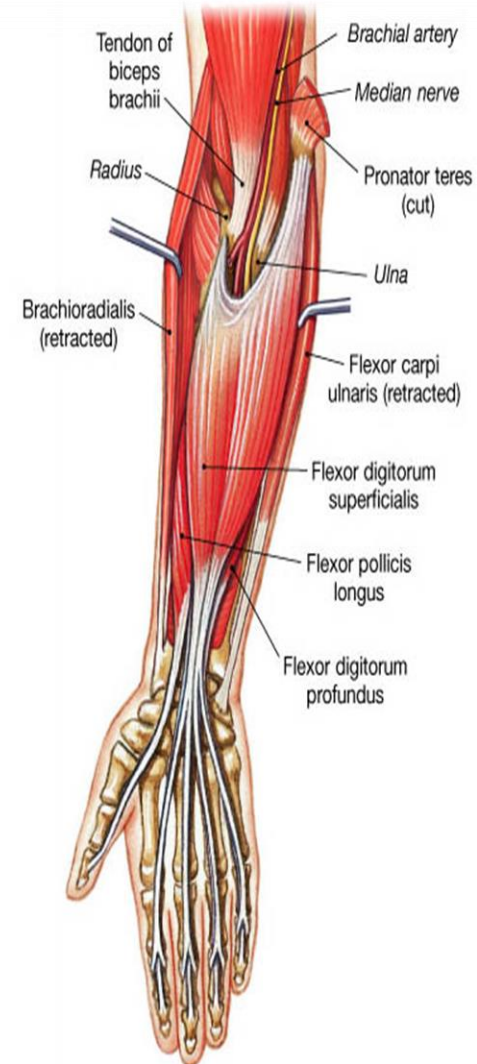
MEDIAN NERVE COMPRESSION/IRRITATION

- Flexor Digitorum Superficialis
- Median nerve travels deep to the proximal fibrous arch of the flexor digitorum superficialis (FDS) before continuing its course through the forearm between the FDS and the flexor digitorum profundus (FDP)



MEDIAN NERVE COMPRESSION/IRRITATION

- Flexor Digitorum Superficialis



(b) Anterior view, middle



MEDIAN NERVE ENTRAPMENT SYNDROME

◉ Deficit of Functions of Median Nerve

> Motor:

- Weakness of 1) wrist flexion, 2) finger flexion of thumb, index, and middle finger, and 3) thumb abduction

> Sensory:

- Pain/Loss of sensation of lateral palm, index finger, middle finger, and radial half of ring finger
- Retrograde pain up the forearm to elbow, even to shoulder (reason unknown)

> Autonomic:

- Sympathetic fibers to blood vessels of 1) brachial artery and 2) all the fingers of the hand (fingers blanch and appear to be swollen)



Location of Entrapment	Physical Exam Finding	Explanation
Lacertus Fibrosus	Pain in proximal forearm is increased by resisted supination/elbow flexion (demonstrate)	Activation of the biceps brachii tightens the aponeurosis and compresses the median nerve from superior
Pronator Teres	Pain in proximal forearm is increased with resisted forearm pronation/wrist flexion	Squeezes nerve between heads of pronator teres, and from FCR inferiorly
Fibrous arch of flexor digitorum superficialis	Pain in proximal forearm is increased with resisted flexion of the PIP joint of the middle finger	Activation of the FDS tightens the fibrous arch and compresses the nerve between the FDS and FDP
Ligament of Struthers	Anomalous ligament above the elbow from supracondylar eminence to medial epicondyle (through which pass the medial nerve and the brachial artery)	
Bicipital bursa		



MEDIAN NERVE COMPRESSION/IRRITATION

- Wrist (Carpal Tunnel Syndrome):
 - > Caused by a combination of genetic and environmental factors. Some of the predisposing factors include: diabetes, obesity, pregnancy, hypothyroidism, and heavy manual work or work with vibrating tools, but not lighter work - even if repetitive.
 - > The main symptom of CTS is intermittent numbness of the thumb, index, long and radial half of the ring finger.



IS CTS WORK RELATED??

- The international debate regarding the relationship between CTS and repetitive motion in work is ongoing. The [Occupational Safety and Health Administration](#) (OSHA) has adopted rules and regulations regarding cumulative trauma disorders. Occupational risk factors of repetitive tasks, force, posture, and vibration have been cited. However, the [American Society for Surgery of the Hand](#) (ASSH) has issued a statement claiming that the current literature does not support a causal relationship between specific work activities and the development of diseases such as CTS.^[23]
- The relationship between work and CTS is controversial; in many locations, workers diagnosed with carpal tunnel syndrome are entitled to time off and compensation.^[24] In the USA, carpal tunnel syndrome results in an average of \$30,000 in lifetime costs (medical bills and lost time from work).^[25]
- Some speculate that carpal tunnel syndrome is provoked by repetitive movement and manipulating activities and that the exposure can be cumulative. It has also been stated that symptoms are commonly exacerbated by forceful and repetitive use of the hand and wrists in industrial occupations,^[26] but it is unclear as to whether this refers to pain (which may not be due to carpal tunnel syndrome) or the more typical numbness symptoms.^[27]

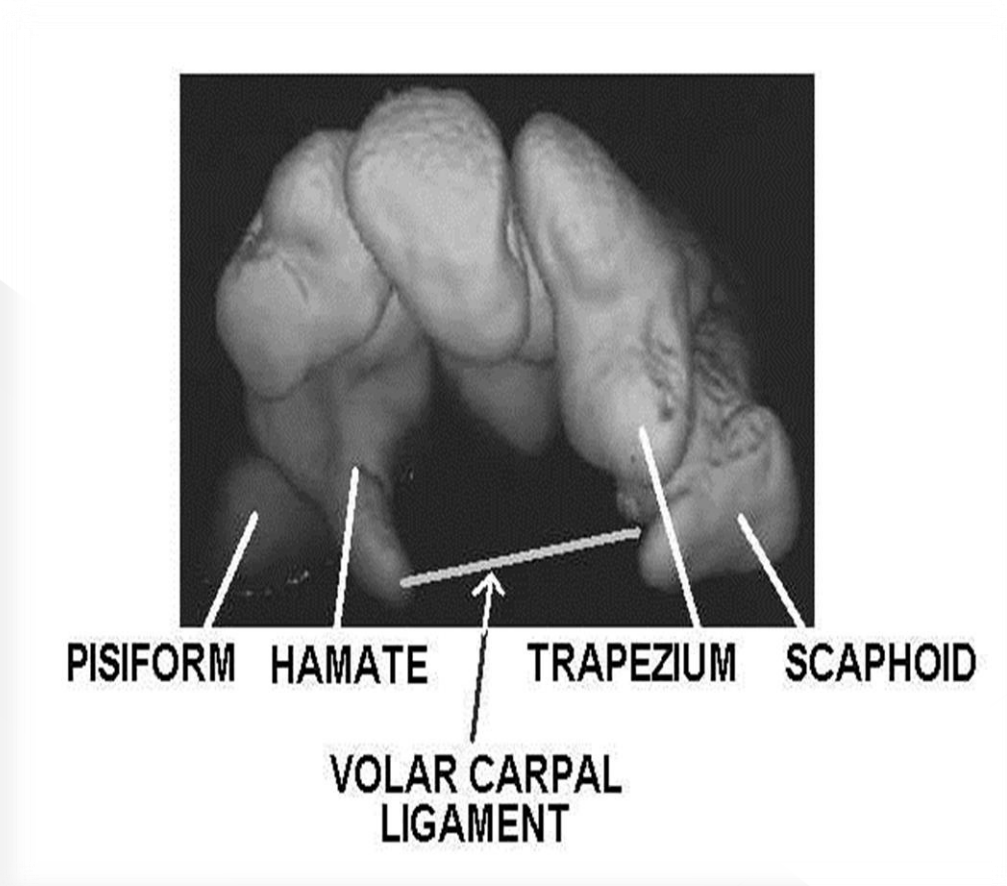


IS CTS WORK RELATED??

- A review of available scientific data by the [National Institute for Occupational Safety and Health](#) (NIOSH) indicated that job tasks that involve highly repetitive manual acts or specific wrist postures were associated with incidents of CTS, but causation was not established, and the distinction from work-related arm pains that are not carpal tunnel syndrome was not clear. It has been proposed that repetitive use of the arm can affect the [biomechanics](#) of the upper limb or cause damage to tissues. It has also been proposed that postural and spinal assessment along with ergonomic assessments should be included in the overall determination of the condition. Addressing these factors has been found to improve comfort in some studies.^[28]
- Speculation that CTS is work-related is based on claims such as CTS being found mostly in the working adult population, though evidence is lacking for this. For instance, in one recent representative series of a consecutive experience, most patients were older and not working.^[29] Based on the claimed increased incidence in the workplace, arm use is implicated, but the weight of evidence suggests that this is an inherent, genetic, slowly but inevitably progressive idiopathic peripheral mononeuropathy.^[30]

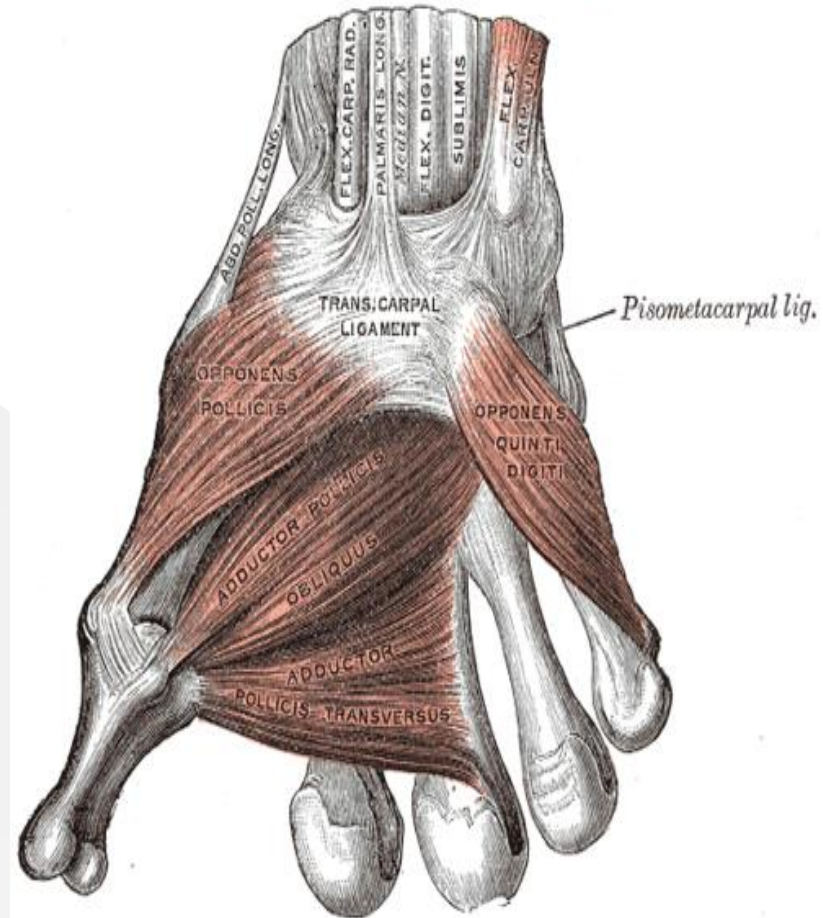
MEDIAN NERVE COMPRESSION/IRRITATION

- ◉ Borders:
- ◉ Carpal bones posteriorly
- ◉ Transverse Carpal ligament anteriorly
- ◉ Hook of Hamate medially
- ◉ Tubercle of scaphoid medially



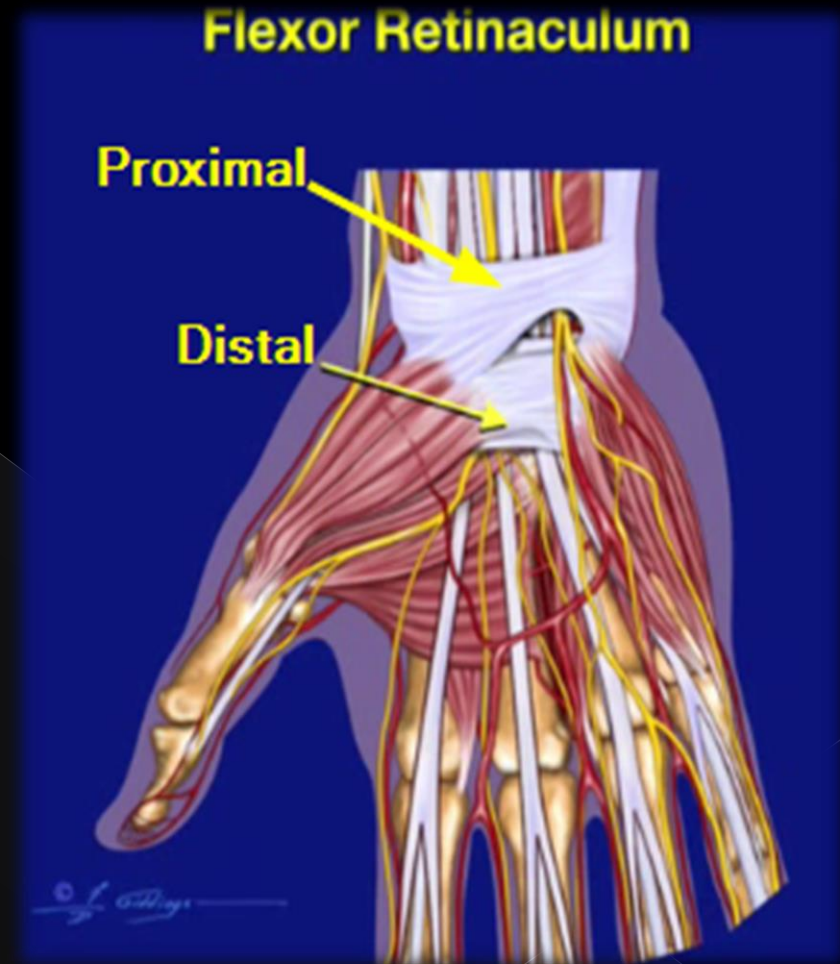
Flexor Retinaculum

- AKA – “Transverse carpal ligament”
- Attached, medially, to the pisiform and the hamulus of the hamate bone; laterally, to the tubercle of the scaphoid, and to the medial part of the volar surface and the ridge of the trapezium.
- On its volar surface the tendons of the palmaris longus and flexor carpi ulnaris are partly inserted; below, it gives origin to the short muscles of the thumb and little finger (thenar and hypothenar muscles).



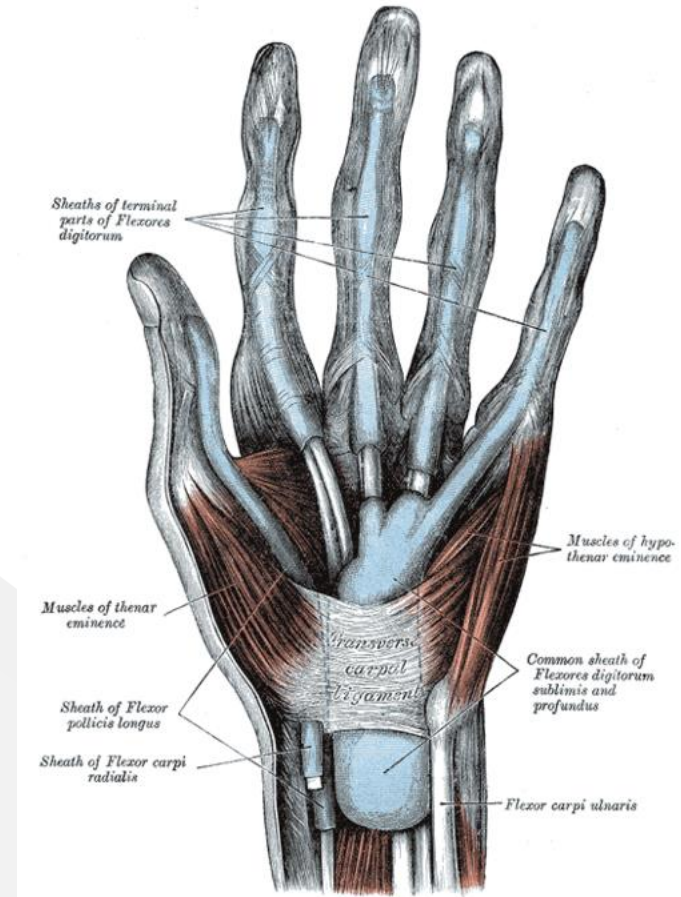
Flexor Retinaculum

- Volar Carpal Ligament:
- AKA _ “Palmar Carpal Ligament”
- The volar carpal ligament is a different structure than the flexor retinaculum of the hand, but the two are frequently confused. The palmar carpal ligament lies superficial and proximal to the flexor retinaculum. The ulnar nerve and the ulnar artery run through the ulnar canal, which is deep to the palmar carpal ligament and superficial to the flexor retinaculum.
- The flexor retinaculum is continuous, superficially, with the volar carpal ligament; and deep, with the palmar aponeurosis. It is crossed by the ulnar vessels and nerve, and the cutaneous branches of the median and ulnar nerves.



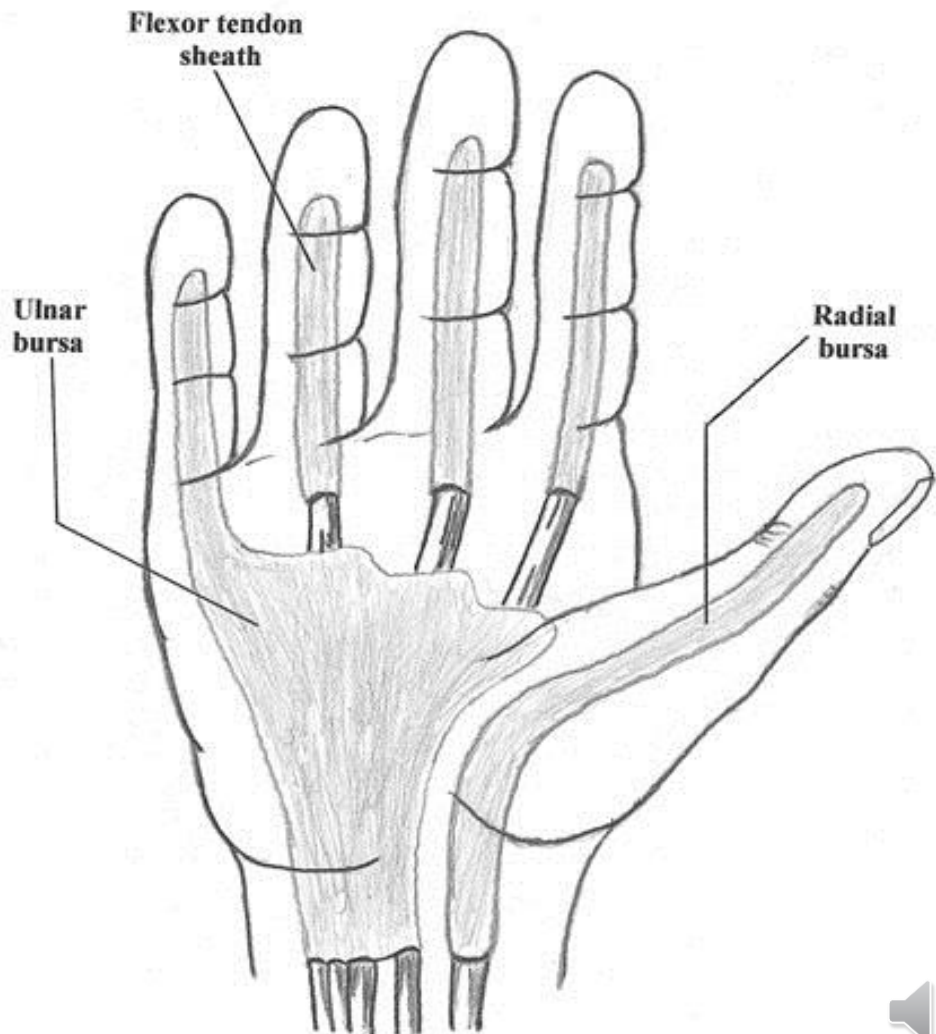
DEEP TO TRANSVERSE CARPAL LIGAMENT

- 9 Finger flexor tendons (of all fingers)
- Synovial sheaths - The **common synovial sheath for the flexor tendons** (a.k.a. “**ulnar bursa**” is a synovial sheath in the carpal tunnel).
- It contains tendons of the FDS and the FDP (but not the FPL – which has its own tendon sheath).
- The sheath which surrounds the flexores digitorum extends downward about halfway along the metacarpal bones, where it ends in blind diverticula around the tendons to the index, middle, and ring fingers. It is prolonged on the tendons to the little finger and usually communicates with the mucous sheath of these tendons.



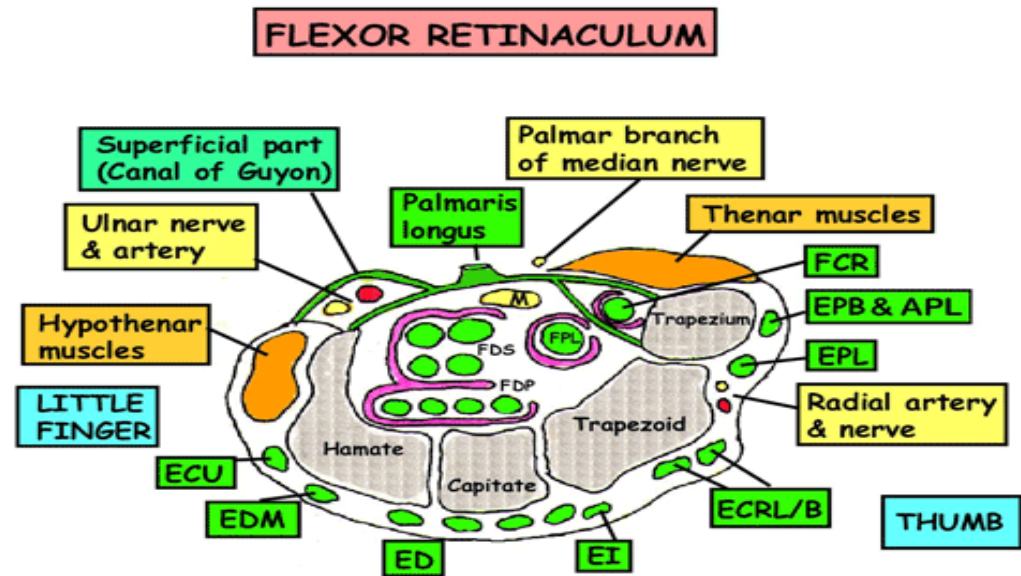
DEEP TO TRANSVERSE CARPAL LIGAMENT

- ◉ Radial Bursa:
- ◉ Is a continuation of the flexor pollicis longus tendon sheath through the flexor retinaculum to a level 2.5 cm above the wrist joint. This frequently communicates with the ulnar bursa.
- ◉ With tenosynovitis, the whole hand is edematous, the palm is moderately swollen, and there may be a fullness immediately above the flexor retinaculum. Flexed fingers resist extension, particularly the little finger.



CARPAL TUNNEL CONTENTS

- Median Nerve
- 4 tendons of FDS
- 4 tendons of FDP
- 1 tendon of FPL



Origin: Tubercle of scaphoid & ridge of trapezium

Insertion: Pisiform & hook of hamate

Into it: Palmaris brevis & palmaris longus, palmar aponeurosis

From it: Thenor & hypothenar muscles

Over it: Ulnar artery & nerve, palmar cutaneous branch of median, palmar branch of radial artery

Deep to it: Median nerve & structures on diagram

Note: Synovial sheaths open laterally to allow access for small vessels to tendons



CARPAL TUNNEL SYNDROME

- Symptoms – both sensory and motor:
 - > Frequent burning, tingling, or itching numbness in the palm of the hand and the fingers, especially the thumb and the index and middle fingers.
 - > Fingers feel useless and swollen (clumsy), even though little or no swelling is apparent.
 - > The symptoms often first appear in one or both hands during the night, since many people sleep with flexed wrists. A person with carpal tunnel syndrome may wake up feeling the need to "shake out" the hand or wrist. As symptoms worsen, people might feel tingling during the day.
 - > Decreased grip strength may make it difficult to form a fist, grasp small objects, or perform other manual tasks. In chronic and/or untreated cases, the muscles at the base of the thumb may waste away. Some people are unable to tell between hot and cold by touch.



CARPAL TUNNEL SYNDROME EXAMINATION MANEUVERS

- ◉ Phalen's maneuver
- ◉ Reverse Phalen's maneuver
- ◉ Three Jaw Chuck Maneuver
- ◉ Tinel's sign
- ◉ Durkan's Compression Test
- ◉ Square Wrist Sign: ACOEM Guidelines (page 261)
- ◉ Motor: Thumb abduction/opposition strength
- ◉ Sensory: Median Nerve Sensory Examination





FINAL REMINDER

- This is Dr. Perry Carpenter. I want to thank you for joining me. I hope you enjoyed the course and I look forward to being with you again for a future course. If ever our paths shall meet, I look forward to speaking with you about all things QME. For now, I have 2 final instructions:
- 1. When you are done with your Course Examination, fax (530-295-9196) or email (admin@ezqmeceu.com) your Examination. Your credit for the course will be immediately processed.
- 2. Remember to visit www.ezqmeceu.com for products designed to make your QME Reports more powerful and persuasive.

