Getting a Grip on Life: Understanding Grip Strength and Longevity

Instructor:

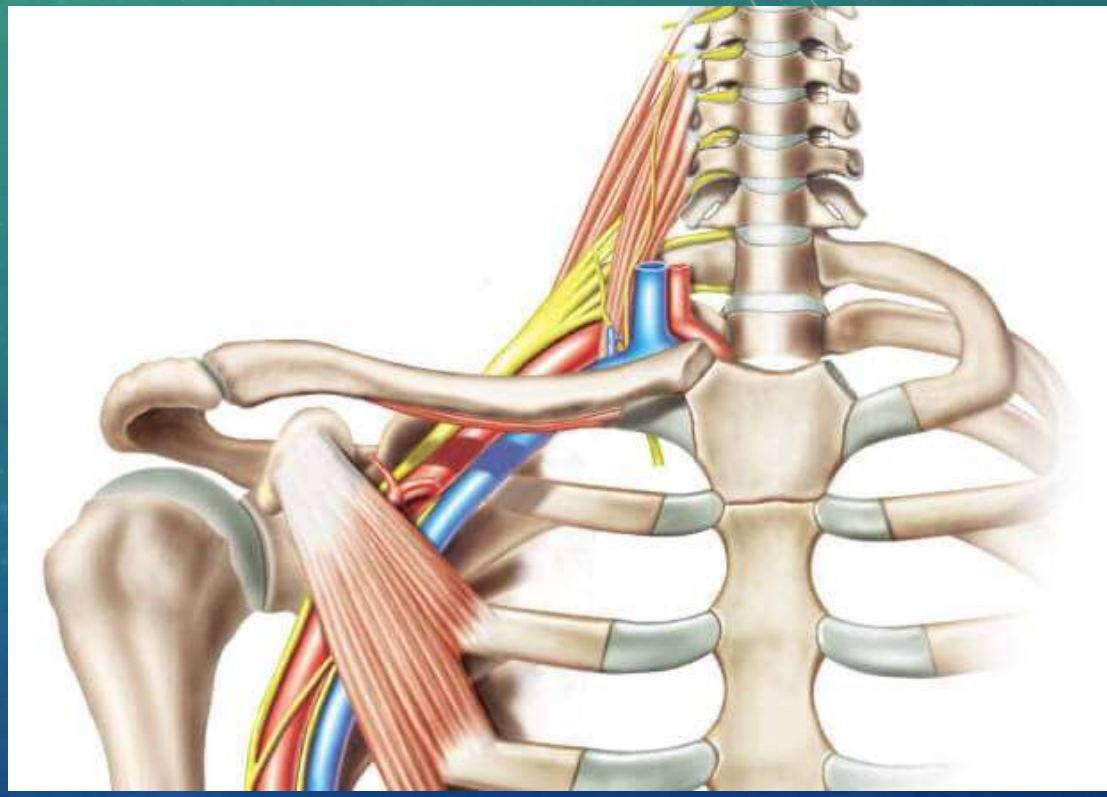
Kathy Dooley, MSc, DC

Kinetikos

Life Without Limits®

Summit

October 21-22, 2023



About the Lecturer

- Dr. Dooley uses anatomy and movement to daily educate her patients in self-sufficiency in proper load sharing
- Dr. Dooley teaches for the Neurokinetic Therapy, Somatic Senses, and Immaculate Dissection seminar series, all based upon human movement optimization
- Dr. Dooley also teaches gross anatomy for four professional institutions: Albert Einstein College of Medicine, Cornell Medical College, St. George's Medical School, NYU College of Dentistry, Sophie Davis College of Biomedical Sciences
- She utilizes her anatomy and rehabilitative knowledge to help students, colleagues, and patients seek the sources of pain, not just the sites.
- Degrees: Doctor of Chiropractic, Masters of Science in Clinical Anatomy
- Movement Certifications: NKT, SFMA, DNS, MPI, FMS, SFG, RKC, SFL, AiM, Flexible Steel

Course Objectives

- **Functional anatomy overview of the cervical spine and brachial plexus of nerves.**
- **Review of the pathway of the major brachial plexus nerves, including their most common impingement sites.**
- **Demonstration of common orthopedic and functional tests for the most common peripheral nerve entrapments th at affect grip.**
- **Corrective exercise strategies for preventing and ameliorating nerve entrapment issues.**
- **Demonstrations on grip challenges**
- **Demonstrating Dynamometer grip measurements (electric and mechanical)**
- **Provide a safe, fun, collegial learning environment to discuss this challenging yet important anatomical region**

Why Is Grip So Important?

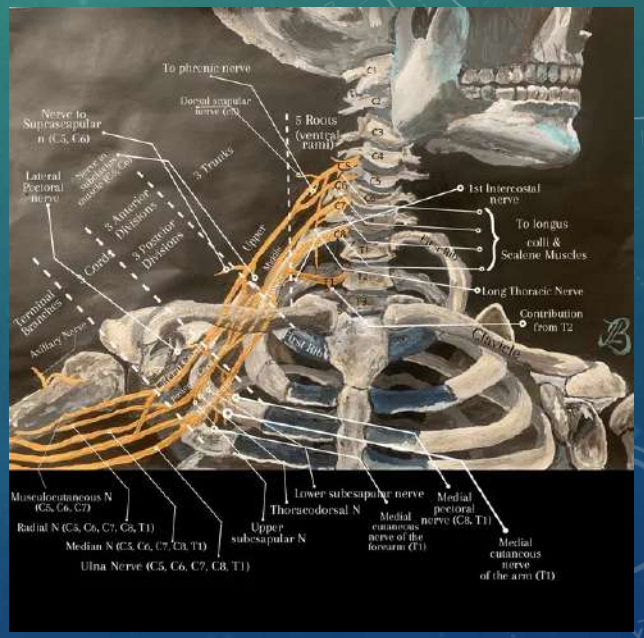
- **Test of neurological patency**
- **Connects three major nerves of the brachial plexus to look for various nerve compression/tension sites**
- **Gives insight into neck and upper body mobility, stability and strength**
- **Insight into multiple organ systems**
  - **neurological**
  - **cardiovascular**
  - **respiratory**
  - **musculoskeletal**

Grip and Longevity

- Correlation to cognitive decline
- Correlation to depression risk
- Used as a biomarker for biological age
- Correlation to brain health/structural integrity

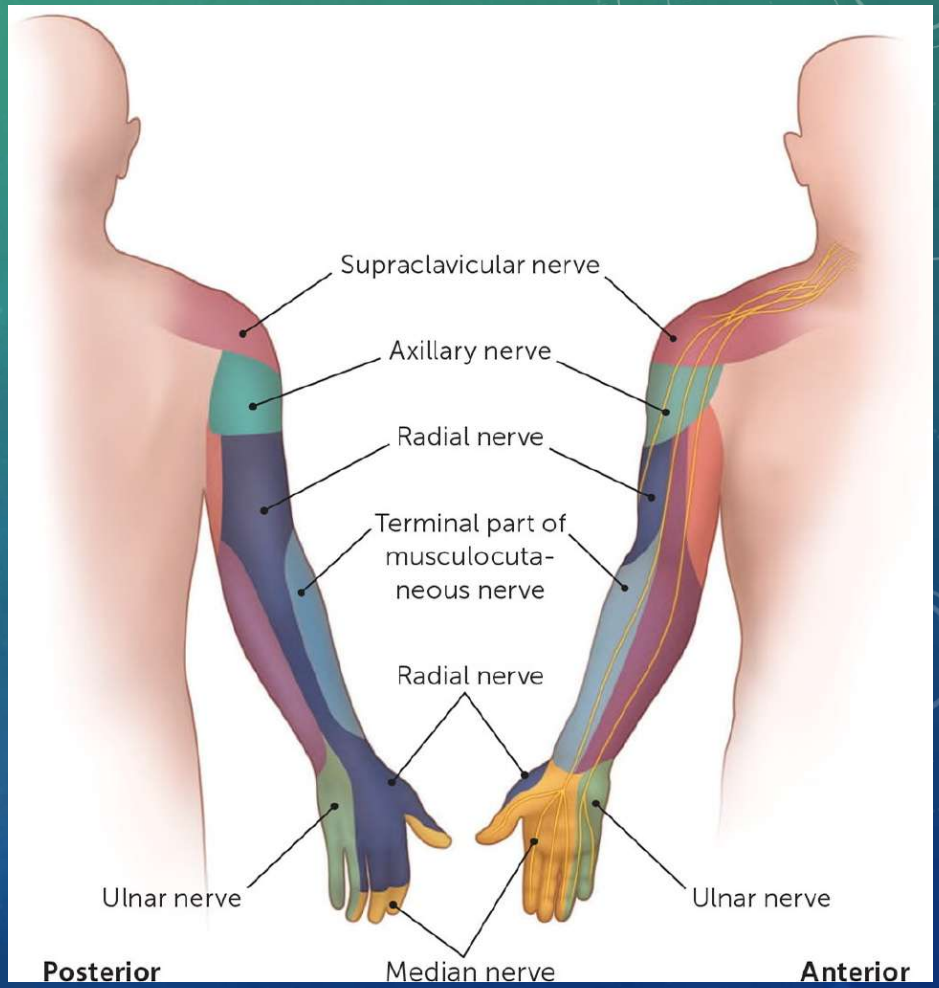
Signs of Peripheral Nerve Entrapment

- **Unilateral upper limb pain greater than neck pain**
- **Pain radiating into upper extremity**
- **Numbness and paresthesia in the same distribution**
- **Nerve tension tests induce more upper limb pain**
- **Doesn't follow one spinal distribution**

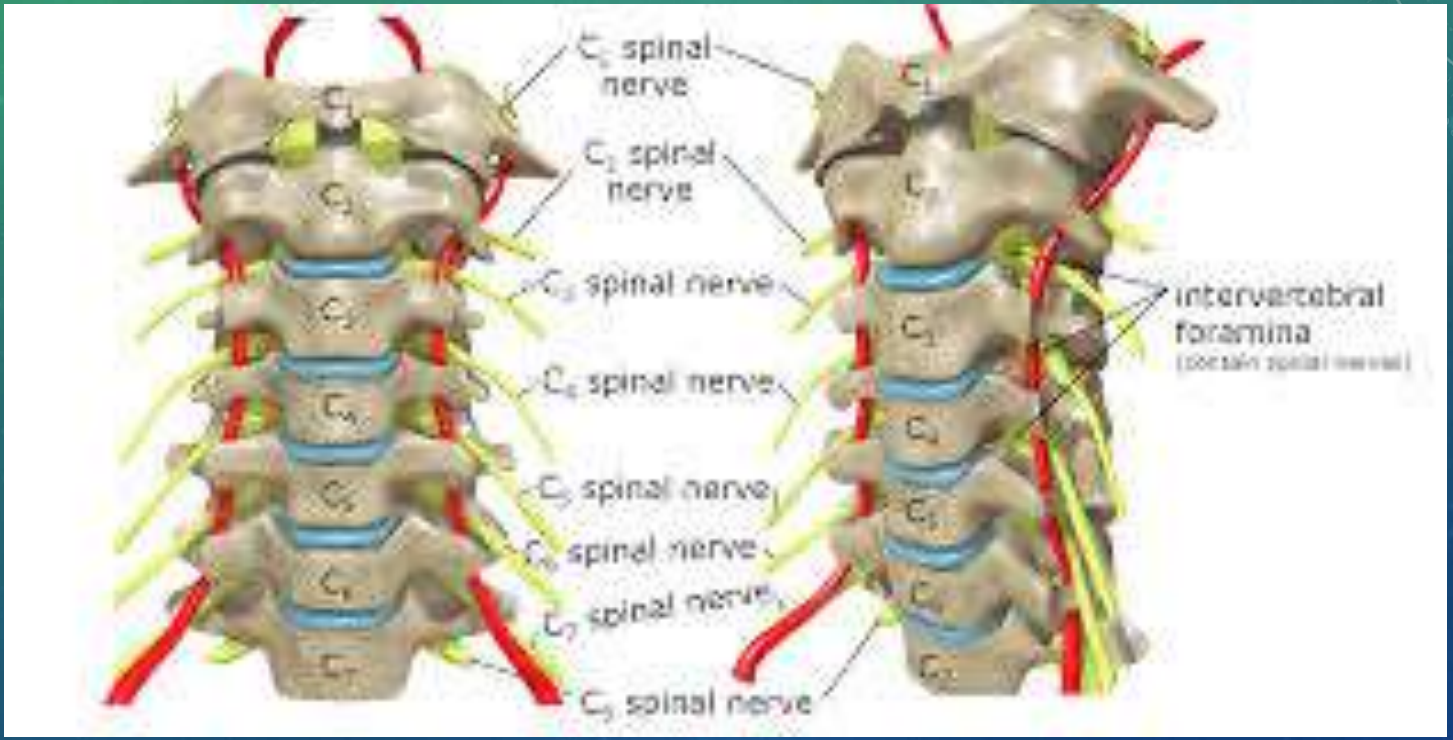


Common Causes of Nerve Entrapment

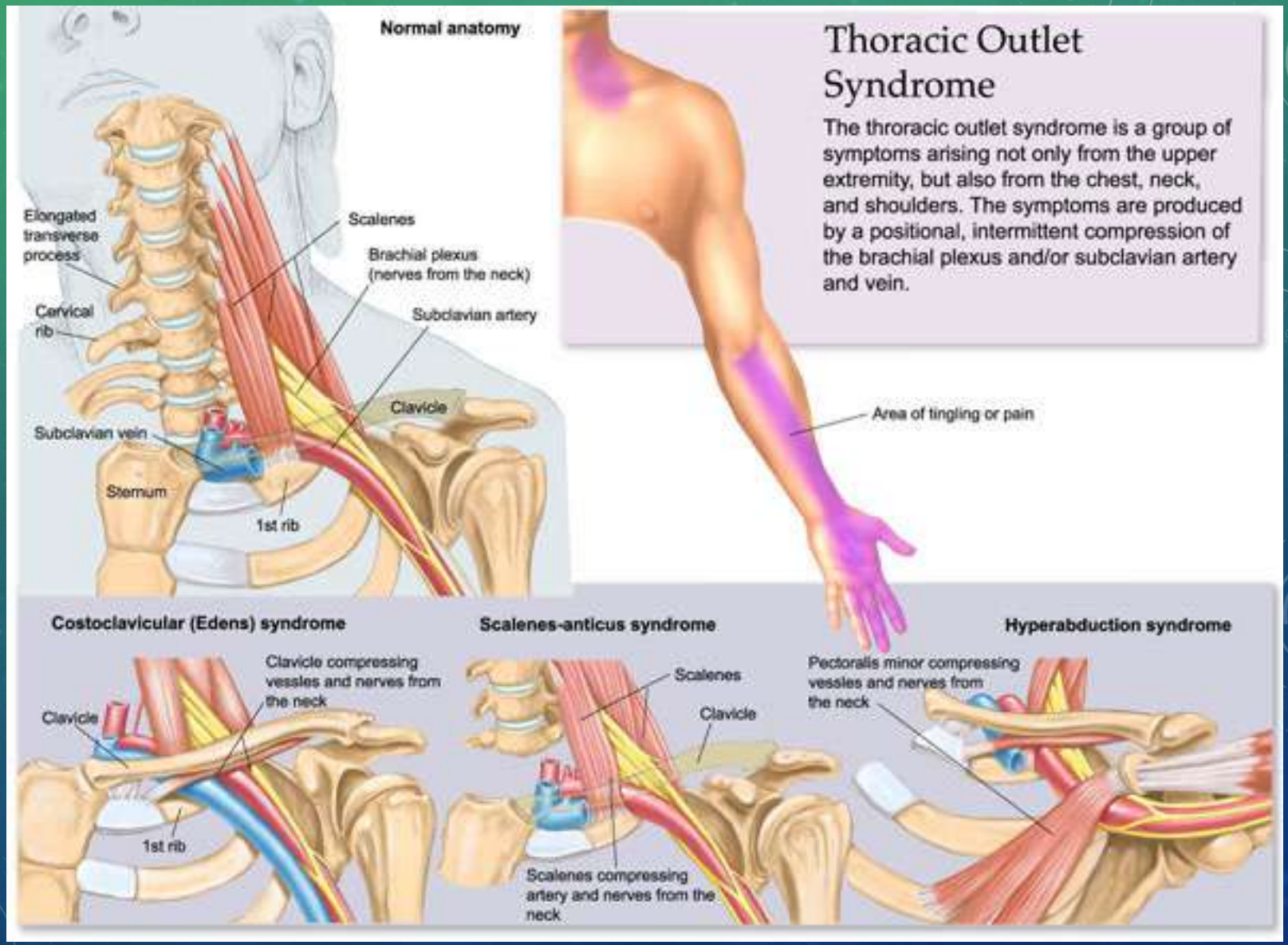
- Bulging or herniated disc
- Spinal stenosis
- Spondylolisthesis
- Trauma (blunt, surgical, traction)
- Fibro-osseous tunnel entrapment
- Muscular functional entrapment
- Spinal tumor



Cervical Spine and Intervertebral Disc Anatomy



Lower Cervical/Upper Thoracic Spinal Anatomy



Spurling's Test

Physical Exam

Spurling Test/Foraminal compression test/
Neck compression test/ Quadrant test

- Extending the neck
- Rotating head
- Downward pressure on head
- Positive finding eliciting reproduction of radicular pain into ipsilateral arm of head rotation
- 92% sensitive, 95% specific
- Low sensitivity but high specificity- not useful as a screening tool, but it does help confirm the diagnosis

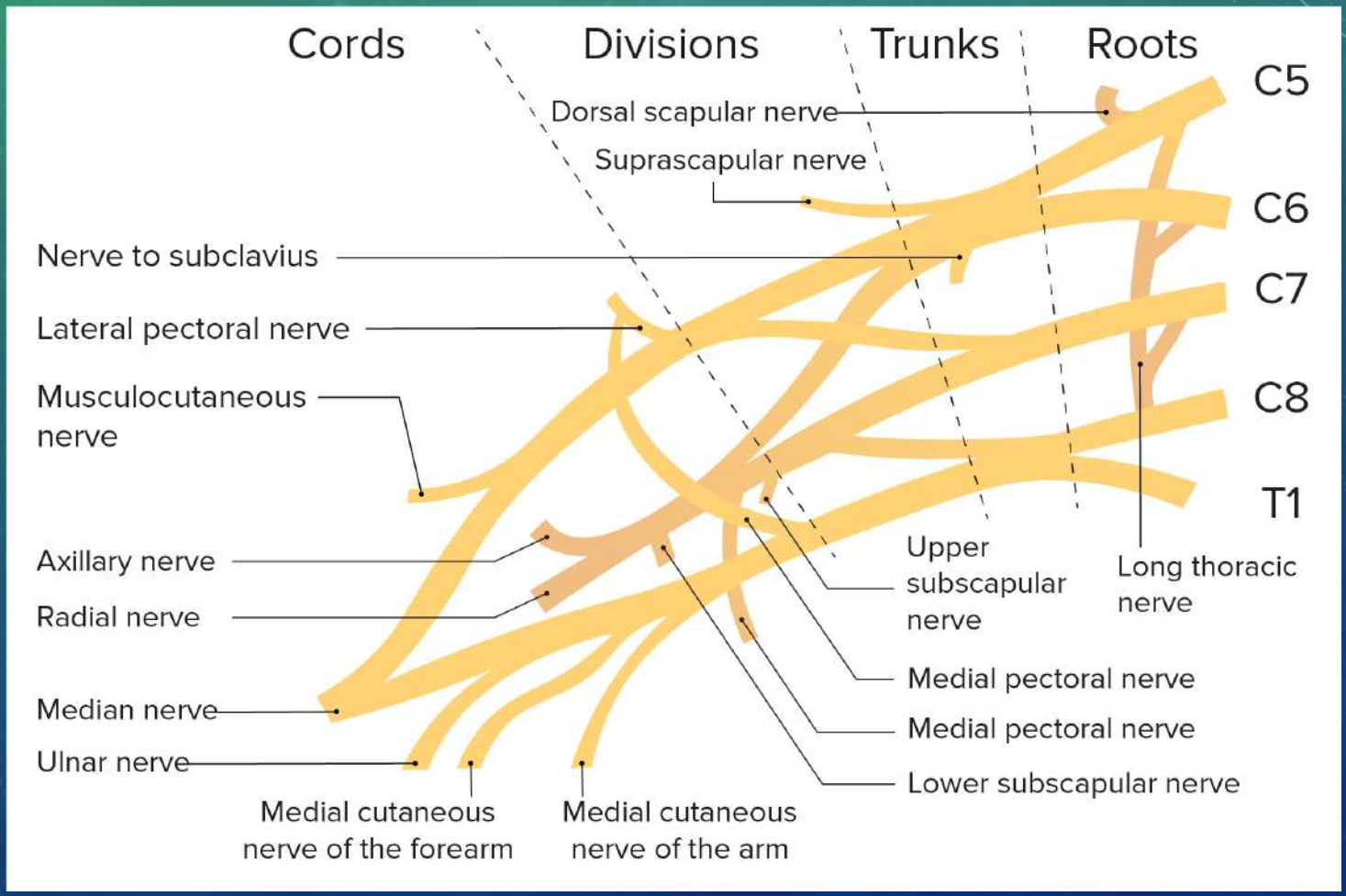
Distraction Test

Axial cervical distraction test

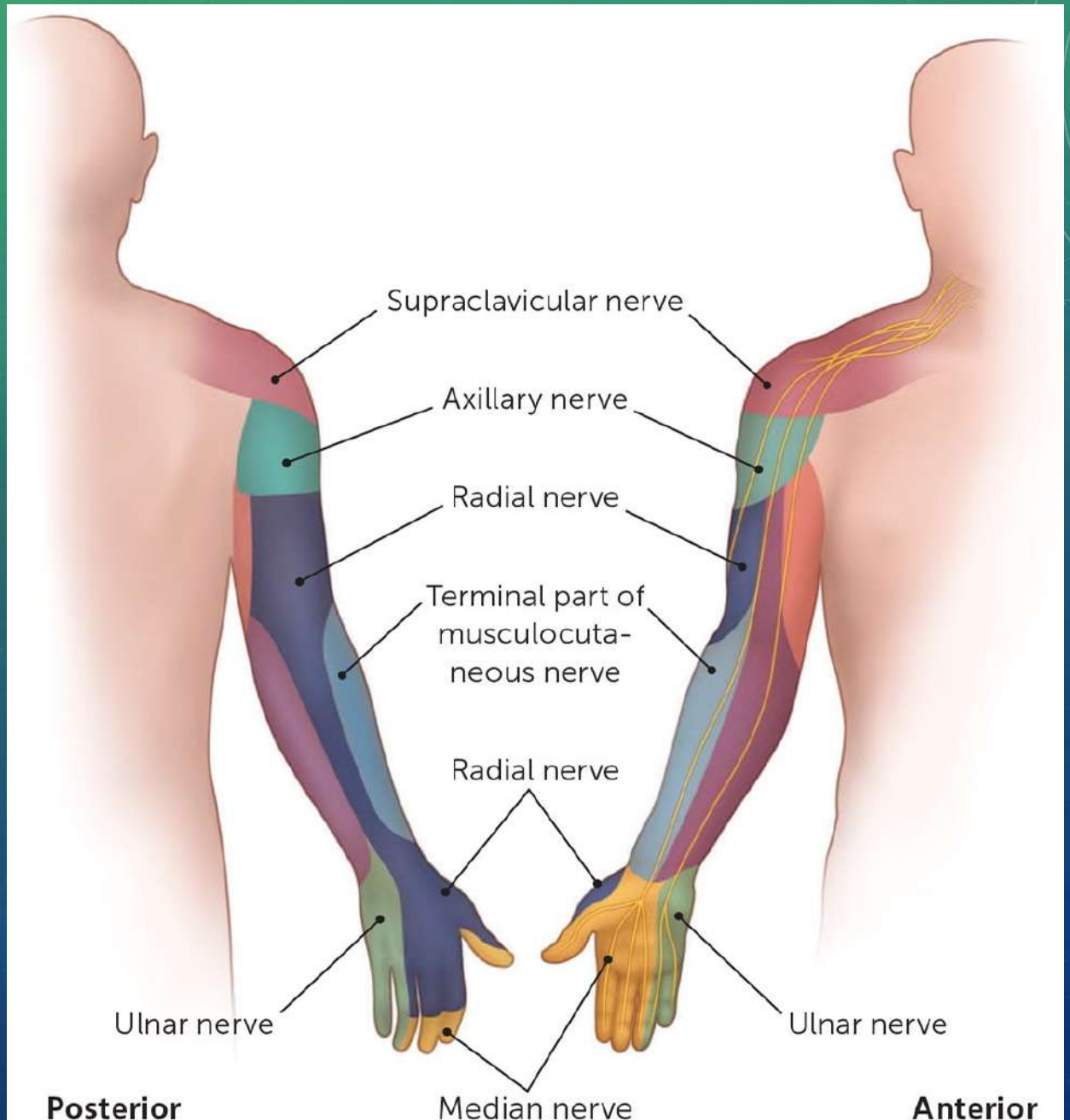
- Examiner pulls up on the head to theoretically decrease the pressure on the cervical root
- Performed in neutral and slight flexion and extension

3. Brachial plexus (C5-T1)

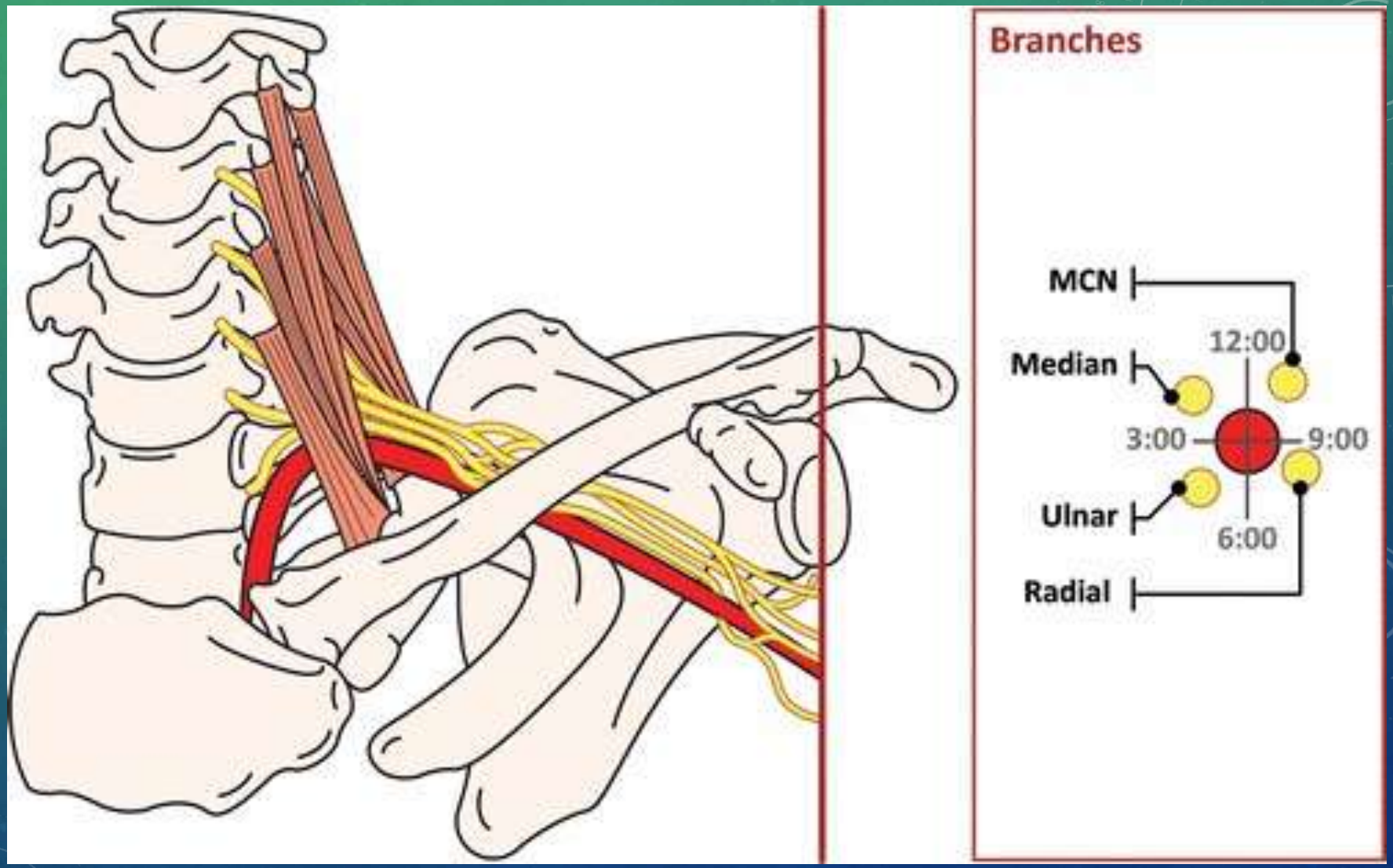
- *Nuclei found in the C5-T1 spinal cord ventral horns (lower motor neurons)*
- *Axons then travel on spinal nerves to then join with multiple peripheral nerves of this plexus*
- *Sensory and motor to upper limb structures*



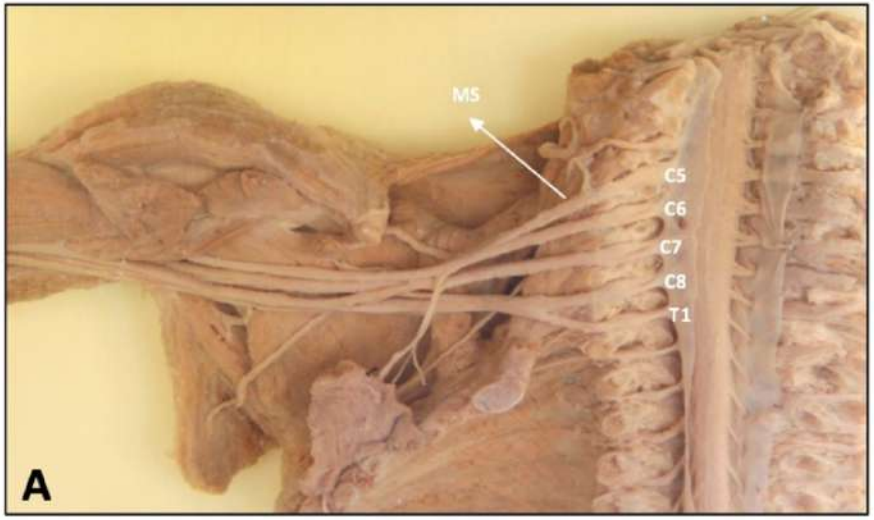
Brachial Plexus Distributions

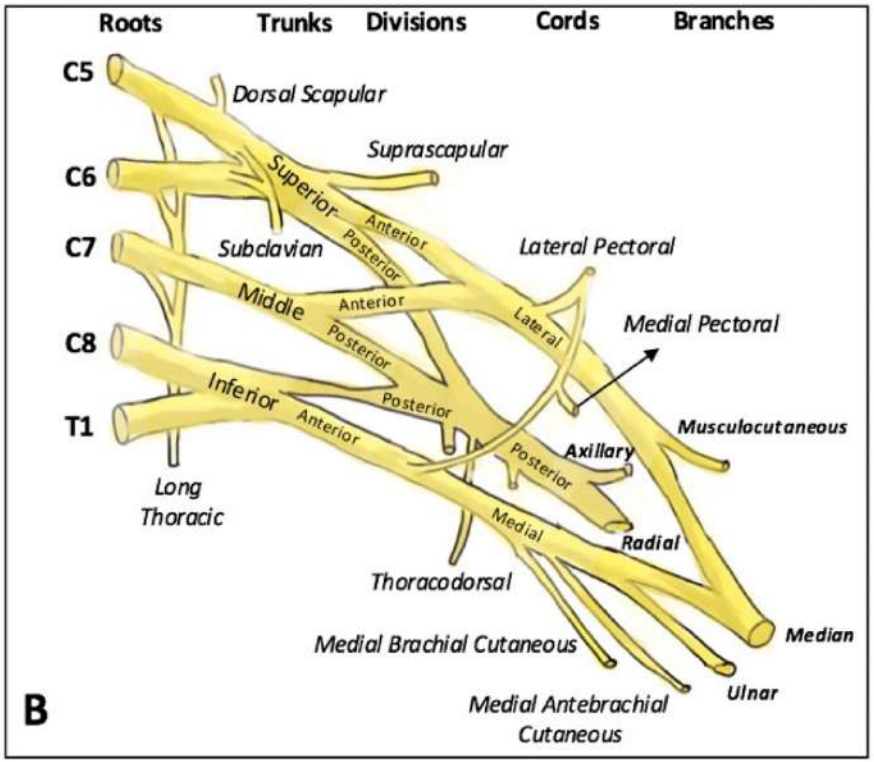


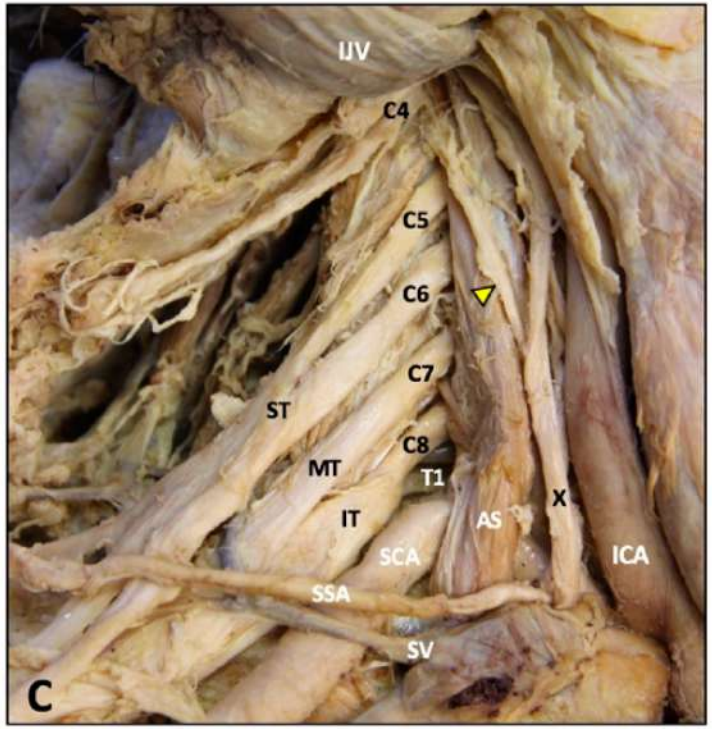
Brachial Plexus Nerves

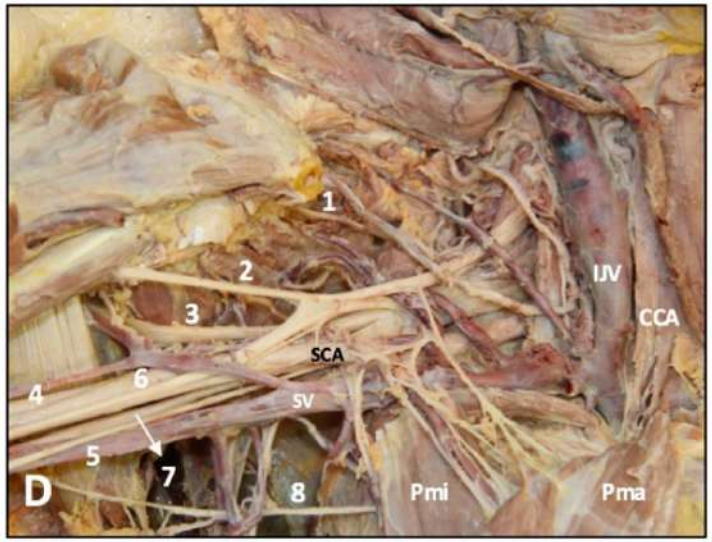


Brachial Plexus Nerves









Optimizing Testing for Peripheral Nerve Entrapment

***To optimize testing*:**

- **Make sure keep the person as comfortable as possible during testing, so pain is not provoked. Remember you have prone, side-lying, seated and supine options for testing.**

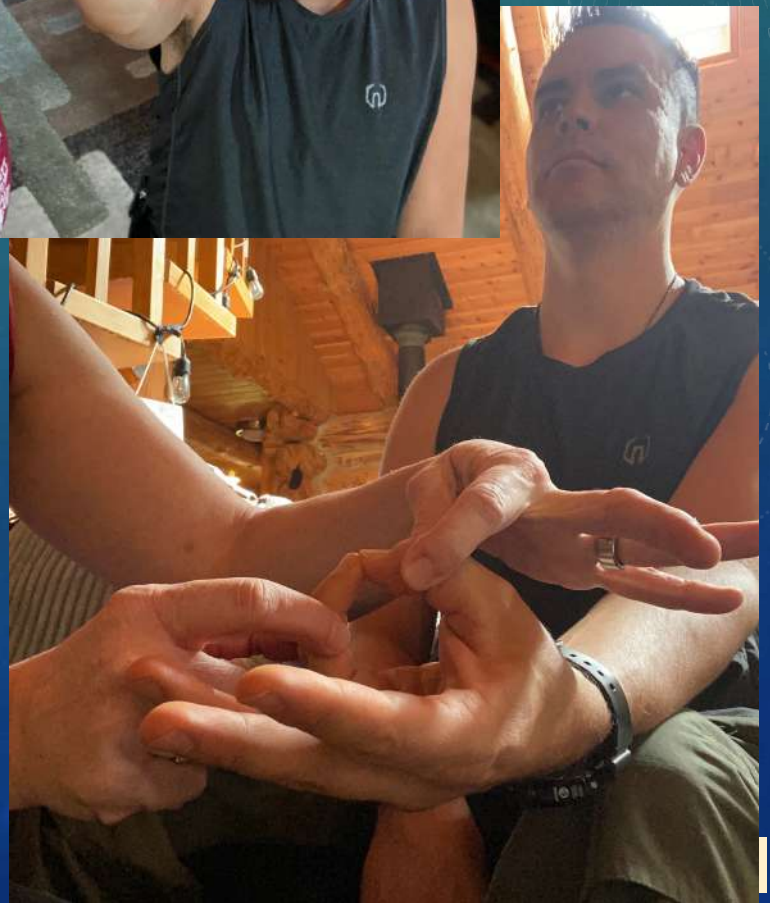
- **Make sure the person is in proper positioning and is not holding onto compensations during testing.**

- **Make sure to assign exercises regarding the specific patient. Don't just give general releases or activations, if the person has neuropathy.**

- **Use neural flosses to help the nerve to glide and thus, reduce symptoms**

Grip Testing via Muscle Testing

- Have the client push the tips of the pinky and thumb together
- Gently try to pull the fingers apart at the nailbed
- Ask the person to meet, and not beat, your pressure.
- Pinky side only loss: ulnar nerve
- Thumb side only loss: median nerve
- Whole hand, high and low loss: pec
- Whole hand, high loss only: costoclsvicular
- Whole hand, low loss only: scalenes



Grip Testing via Dynamometer

Dynamometer measuring:

- ***Goal: to measure grip (read: concentric flexion, adduction, and opposition).***
- *Document primary findings bilaterally.*
- *Cross-compare with missing ROMs from assessment to determine what digit(s) may not be fully participating in grip.*

Rules for Nerve Floss Pendulums

(neural mobilization/sliding/gliding)

- *Make sure you have differentiated the PNE from a Sclerotome, Dermatome, and Organ Referral Patterns*
- *KISS: Keep It Simple, Sweetheart! Remember the nerve pathway, and think of what stretched or constricted the pathway. Use the pictures to help visualize it on the client.*
- *Never put the nerve into a position where the proximal and distal ends can be both stretched or constricted at the same time.*
- *Try to keep the muscles from over-tensing around the nerve. Keep the client breathing long, slow breaths, inhaling before you floss, and exhaling slowly and gently as you floss.*
- *Start the client in the most comfortable position in which they can tolerate the flossing.*
- *Do only repetitions to client tolerance, increasing the reps and range of motion.*
- *If symptoms are recreated, do a smaller range until client comfort is achieved.*
- *Palpate possible entrapment sites when applicable, and ask questions related to the site with possible nerve awarenesses/losses. Make sure these areas decrease in tone during flossing, and check to see if symptomatology is reducing.*
- *Always tension ACROSS a nerve pathway, not COMPRESSING the nerve pathway. Never induce sensory or motor loss.*
- *Teach the patient how to execute their own flossing to reduce their symptoms.*
- *See Vimeos for nerve flossing video demonstrations.*

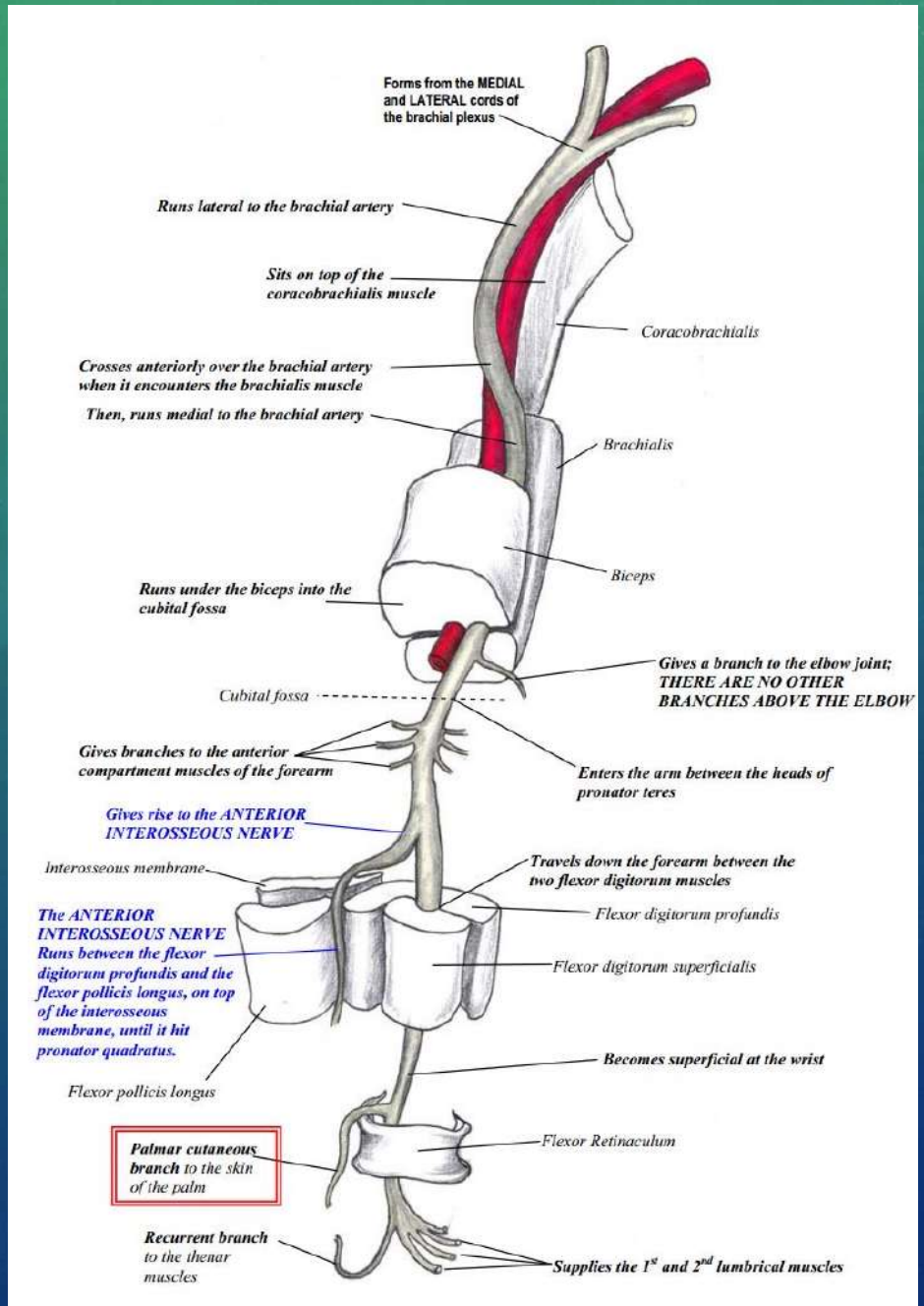
Median Nerve: Distribution

Ventral rami (Cords and Branches)

Branch	Modalities	Target Structures	Entrapment Sites	Symptoms
7. Median nerve (C5/6-T1) *This nerve receives a lateral contribution from C5-C7, as well as a medial cord contribution from C7-8/T1*	- GSA - GSE - GVE	- GSA: Somatosensory to central palmar aspect of hand; palmar aspect of digits 1-3 and lateral 1/2 of 4, dorsal skin of digits 1-3, 1/2 of 4 to the DIP level; sensation to the joint capsules the nerve crosses - GSE: Somatomotor to (Via main trunk): Pronator teres, Flexor carpi radialis, Palmaris longus, Flexor digitorum superficialis, lumbricals 1-2 - (Via anterior interosseous nerve): Flexor digitorum profundas, digits 2-3 only; Flexor pollicis longus, Pronator quadratus, - (Via recurrent branch of median nerve): Abductor pollicis brevis, Flexor pollicis brevis, Opponens pollicis - GVE: Visceromotor to brachial artery and Visceromotor branches to the sweat glands of the skin distributed by GSA fibers	A. Axillary fascia, at axilla (all GSA/GSE, GVE affected) B. Cubital fossa, between biceps brachii and brachialis (GVE to brachial artery spared, all other GSA/GVE/GSE affected C. Between the heads of pronator teres (GSA/GVE/GSE at and distal to entrapment site affected) D. Deep to flexor digitorum superficialis (GSA/GVE/GSE at and distal to entrapment site affected) E. Carpal tunnel (GSA/GVE/GSE at and distal to entrapment site affected) F. Palmar aponeurosis (GSA/GVE only affected) G. Transverse carpal ligament (GSE only to thenar eminence)	- GSA: Somatosensory changes to aforementioned skin distribution - GSE: Somatomotor loss to aforementioned muscular distribution - GVE: Changes in sweat distribution to the areas supplied by the GSA fibers

77

Median Nerve: Entrapment Sites



Median Nerve Testing

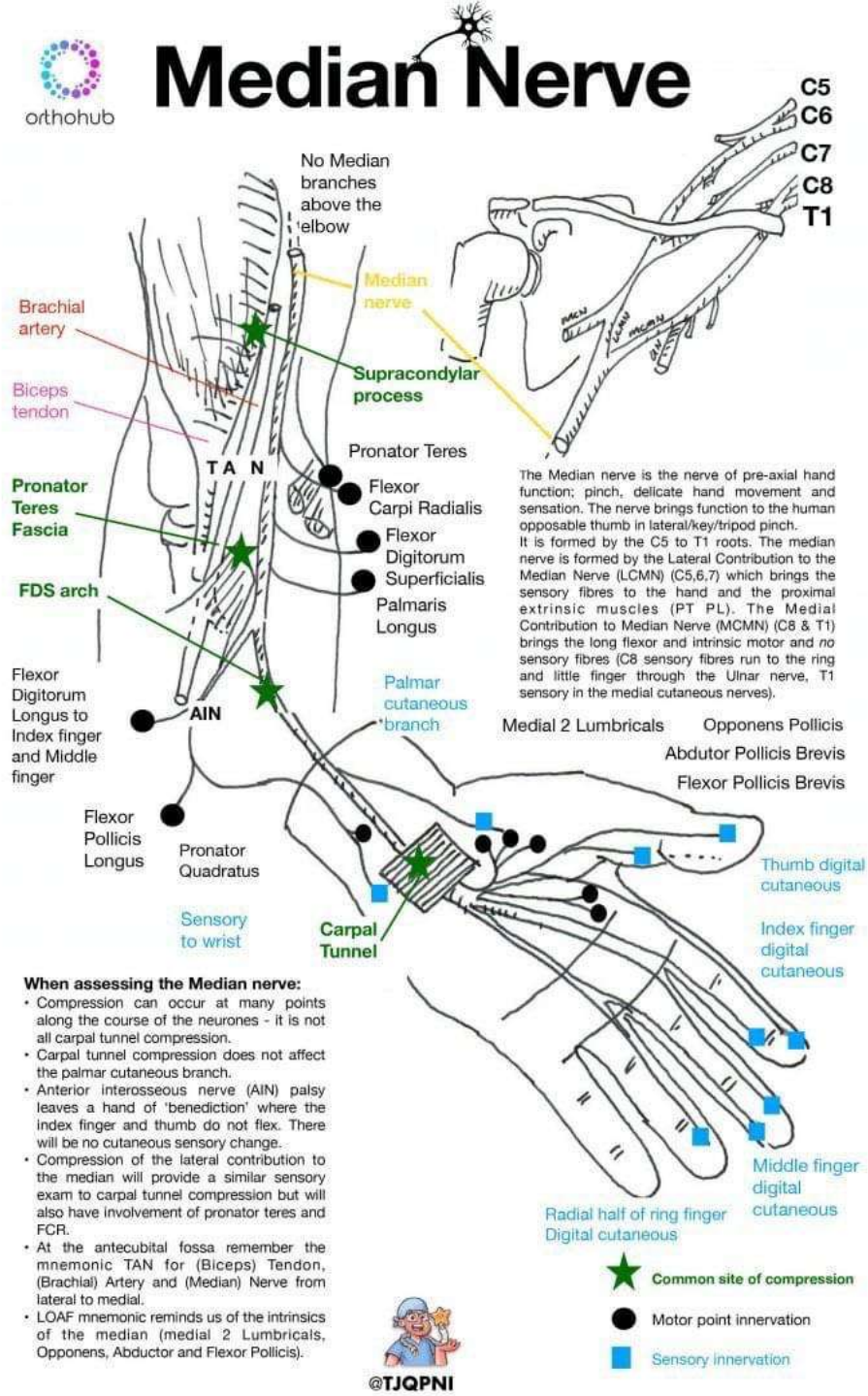
Sensory
Sensation at volar tip of index finger

Motor
Opposition of thumb and fifth finger

Function/Exam	Median Nerve
Motor	Muscles involving fine precision and pinch function of the hand, thenar muscles, index and long finger lumbricals
Clinical Exam	Opposition of the thumb to the fifth finger while watching the thenar muscles contract
Sensory	Thumb, index, long, and radial side of the ring finger
Clinical Exam	Sensation at the volar tip of the index finger

Median Nerve

orthohub



The Median nerve is the nerve of pre-axial hand function; pinch, delicate hand movement and sensation. The nerve brings function to the human opposable thumb in lateral/key/tripod pinch.
It is formed by the C5 to T1 roots. The median nerve is formed by the Lateral Contribution to the Median Nerve (LCMN) (C5,6,7) which brings the sensory fibres to the hand and the proximal extrinsic muscles (PT PL). The Medial Contribution to Median Nerve (MCMN) (C8 & T1) brings the long flexor and intrinsic motor and *no* sensory fibres (C8 sensory fibres run to the ring and little finger through the Ulnar nerve, T1 sensory in the medial cutaneous nerves).

When assessing the Median nerve:

- Compression can occur at many points along the course of the neurones - it is not all carpal tunnel compression.
- Carpal tunnel compression does not affect the palmar cutaneous branch.
- Anterior interosseous nerve (AIN) palsy leaves a hand of 'benediction' where the index finger and thumb do not flex. There will be no cutaneous sensory change.
- Compression of the lateral contribution to the median will provide a similar sensory exam to carpal tunnel compression but will also have involvement of pronator teres and FCR.
- At the antecubital fossa remember the mnemonic TAN for (Biceps) Tendon, (Brachial) Artery and (Median) Nerve from lateral to medial.
- LOAF mnemonic reminds us of the intrinsics of the median (medial 2 Lumbricals, Opponens, Abductor and Flexor Pollicis).

@TJQPNI

Median Nerve: Entrapment Test

Median Nerve: Nerve Glide

Ulnar Nerve: Distribution

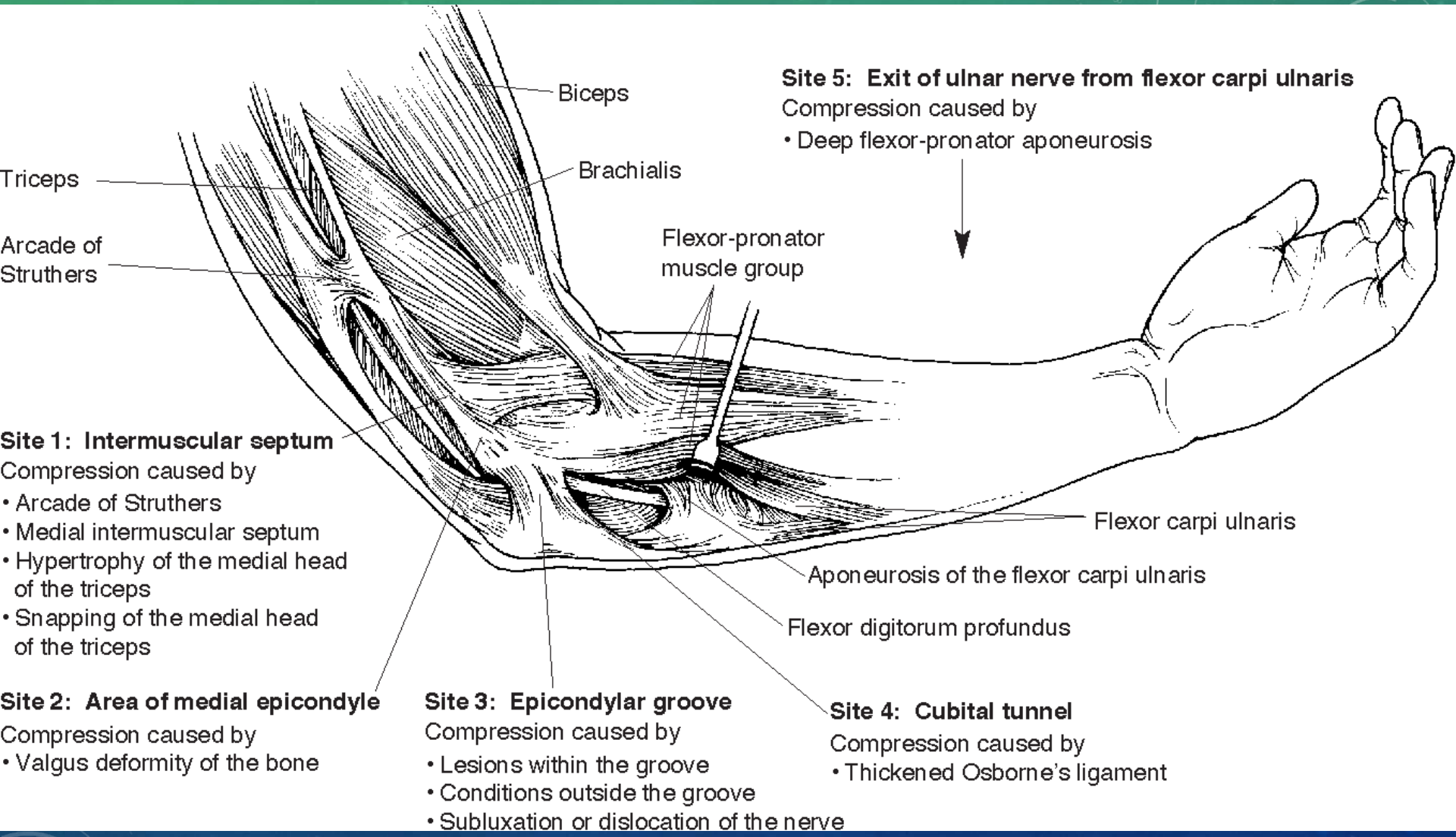
Ventral rami (Cords and Branches)

Brachial Plexus

Branch	Modalities	Target Structures	Entrapment Sites	Symptoms
Medial Cord 9. Ulnar nerve (C7/C8-T1)	· GSA · GSE · GVE	· GSA: (Via Main trunk) dorsal branch: To the dorsal aspect of digit five and the medial 1/2 of digit 4; Palmar branch: To the palm proximal to digits 4-5; (Via Superficial branch): Common and proper palmar digital nerves: To the palmar aspect of digit five and the medial 1/2 of digit 4 · GSE (somatomotor): Via Main trunk: flexor carpi ulnaris, Digits 4-5 of Flexor digitorum profundis · Via Superficial branch: palmaris brevis · Via Deep branch: extrinsic hand muscles: Lumbricals 3-4, abductor digiti minimi, flexor digiti minimi, opponens digiti minimi. Intrinsic hand muscles · Adductor pollicis, 3 palmar interossei muscles, 4 dorsal Interossei muscles · GVE-Visceromotor to sweat glands supplied by the GSA fibers	A. Axillary fascia, at axilla (all GSA/GSE, GVE affected) B. Medial brachial intermuscular septum (all GSA/GSE, GVE affected) C. Cubital tunnel, behind medial epicondyle of humerus (all GSA/GSE, GVE affected) D. Lateral to Flexor carpi ulnaris ((all GSA/GSE, GVE affected) E. Between pronator quadratus and flexor carpi ulnaris, proximal to wrist (all GSA/GSE, GVE affected EXCEPT dorsal hand and medial palm) F. Guyon's tunnel (GSE distal to entrapment site and palmar digits GSA/GVE) G. Palmar aponeurosis (GSA/GVE only affected)	· GSA: Somatosensory changes to aforementioned skin distribution · GSE: Somatomotor loss to aforementioned muscular distribution · GVE: Changes in sweat distribution to the areas supplied by the GSA fibers

**See lateral cord for information on medial cord contribution to the median nerve

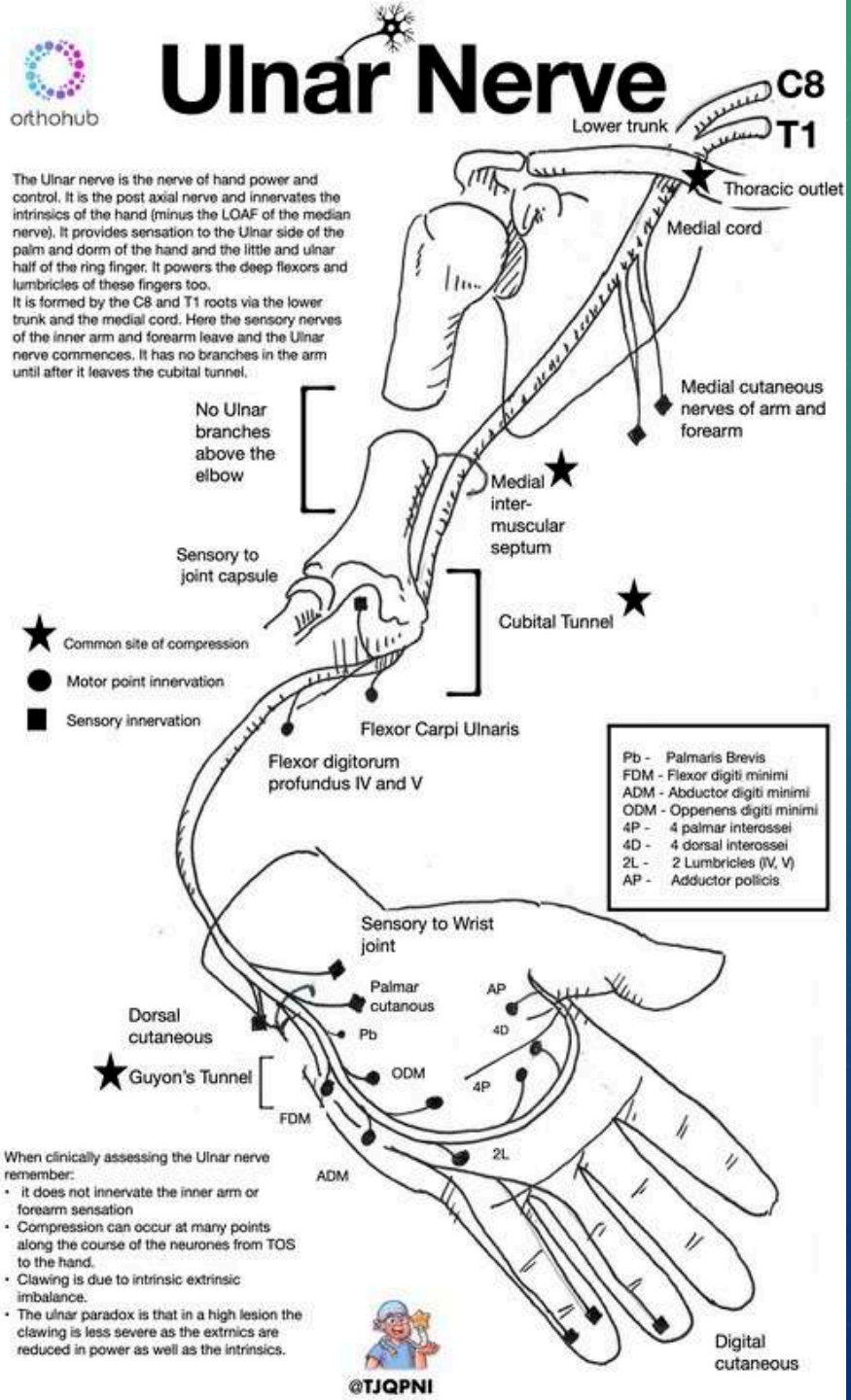
Ulnar Nerve: Entrapment Sites



Ulnar Nerve

orthohub

The Ulnar nerve is the nerve of hand power and control. It is the post axial nerve and innervates the intrinsics of the hand (minus the LOAF of the median nerve). It provides sensation to the Ulnar side of the palm and dorm of the hand and the little and ulnar half of the ring finger. It powers the deep flexors and lumbricles of these fingers too.
It is formed by the C8 and T1 roots via the lower trunk and the medial cord. Here the sensory nerves of the inner arm and forearm leave and the Ulnar nerve commences. It has no branches in the arm until after it leaves the cubital tunnel.



When clinically assessing the Ulnar nerve remember:

- it does not innervate the inner arm or forearm sensation
- Compression can occur at many points along the course of the neurones from TOS to the hand.
- Clawing is due to intrinsic extrinsic imbalance.
- The ulnar paradox is that in a high lesion the clawing is less severe as the extrnics are reduced in power as well as the intrinsics.

@TJQPNI

Ulnar Nerve: Entrapment Test

Ulnar Nerve: Glide

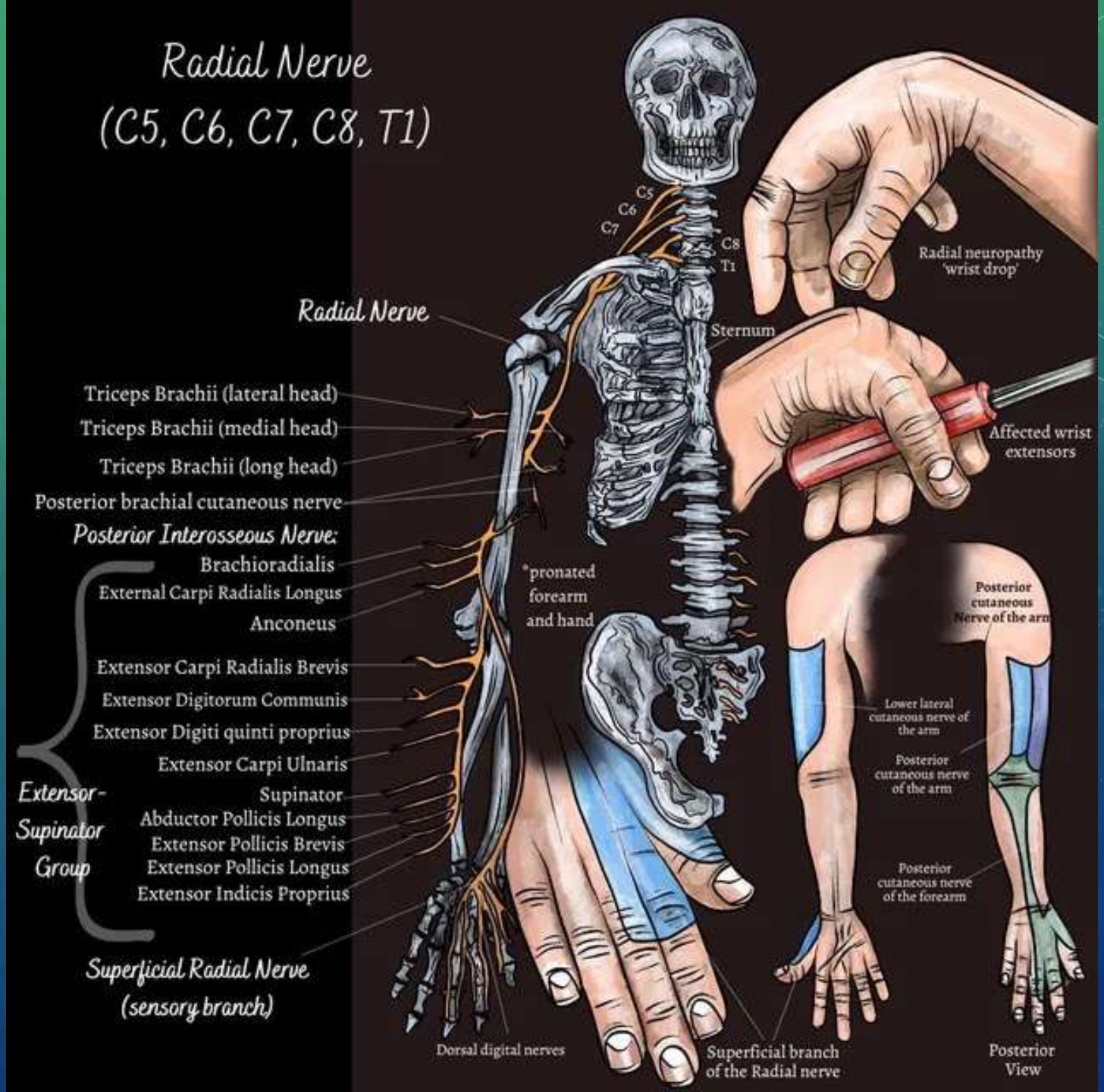
Radial Nerve: Distribution

Ventral rami (Cords and Branches)

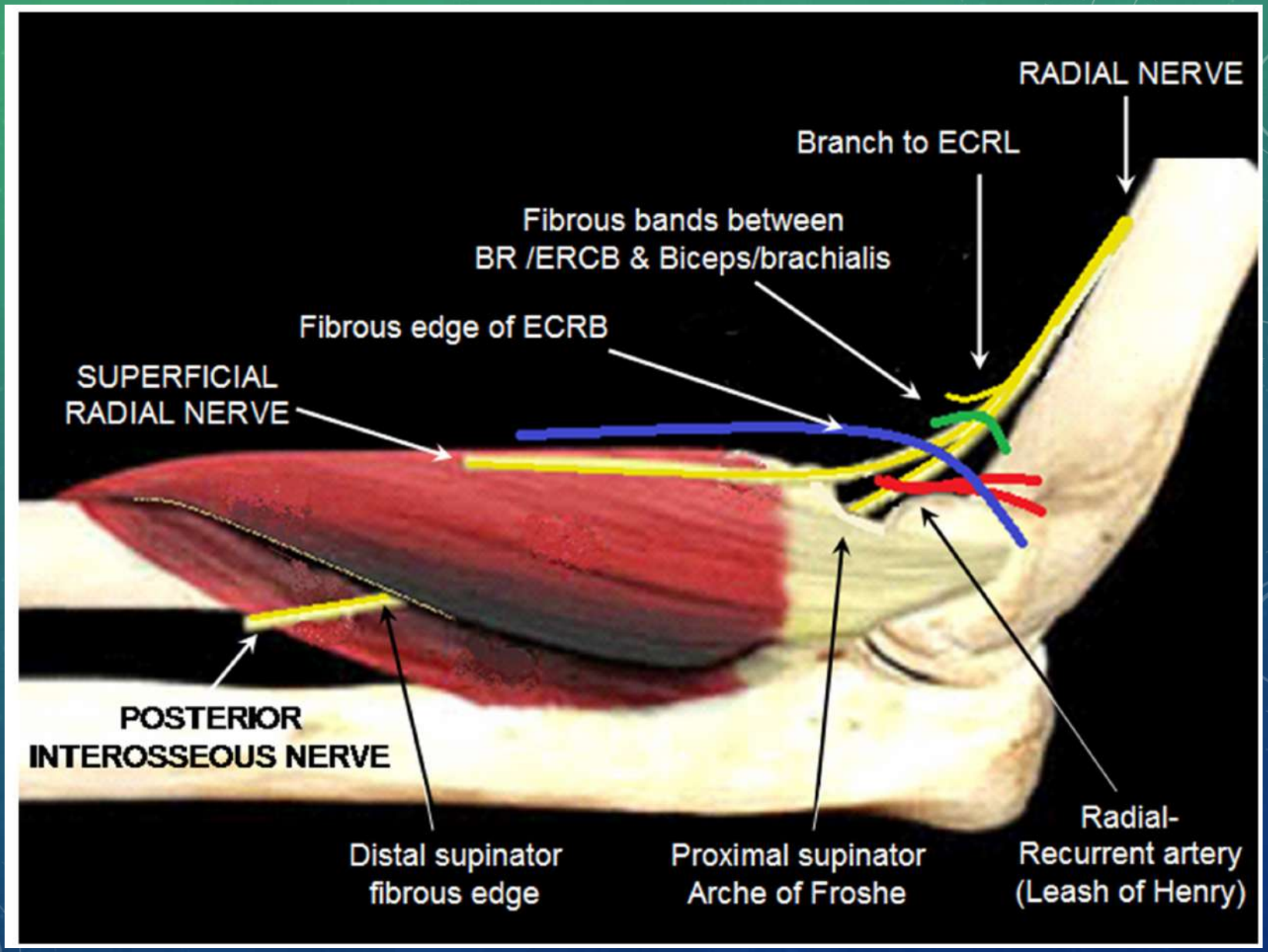
Brachial Plexus

Branch	Modalities	Target Structures	Entrapment Sites	Symptoms
Posterior Cord 13. Radial nerve (C5-T1)	· GSA · GSE · GVE	· GSA: Somatosensory: Articular branches: to elbow joint · Lower lateral brachial cutaneous nerve: skin of lateral lower 1/4 of arm · Posterior antebrachial cutaneous nerve: posterior forearm, intermediate strip · Posterior interosseous nerve: dorsal hand, near and on digits 3-4, up to DIPs · Superficial branch, radial nerve: dorsal hand, near and on digits 1-2, up to DIPs · GSE: Somatomotor: to the following muscles: Triceps brachii, anconeus, and all the muscles of the posterolateral antebrachium (Brachioradialis, extensor carpi radialis longus and brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis, supinator · GVE: Visceromotor to sweat glands of the skin provided by GSA fibers	A. Axillary fascia, at axilla (all GSA/GSE/GVE affected) B. Triangular interval/Spiral (radial) groove of posterior humerus (all GSA/GSE/GVE, sparing triceps C. Cubital fossa, between brachioradialis and brachialis (all GSA/GSE/GVE that are distal to entrapment site) D. Supinator: posterior interosseus nerve's motor and sensory branches E. Brachioradialis: superficial radial nerve's sensory distribution	· GSA: Somatosensory changes to aforementioned skin distribution · GSE: Somatomotor loss to aforementioned muscular distribution · GVE: Changes in sweat distribution to the areas supplied by the GSA fibers

Radial Nerve
(C5, C6, C7, C8, T1)



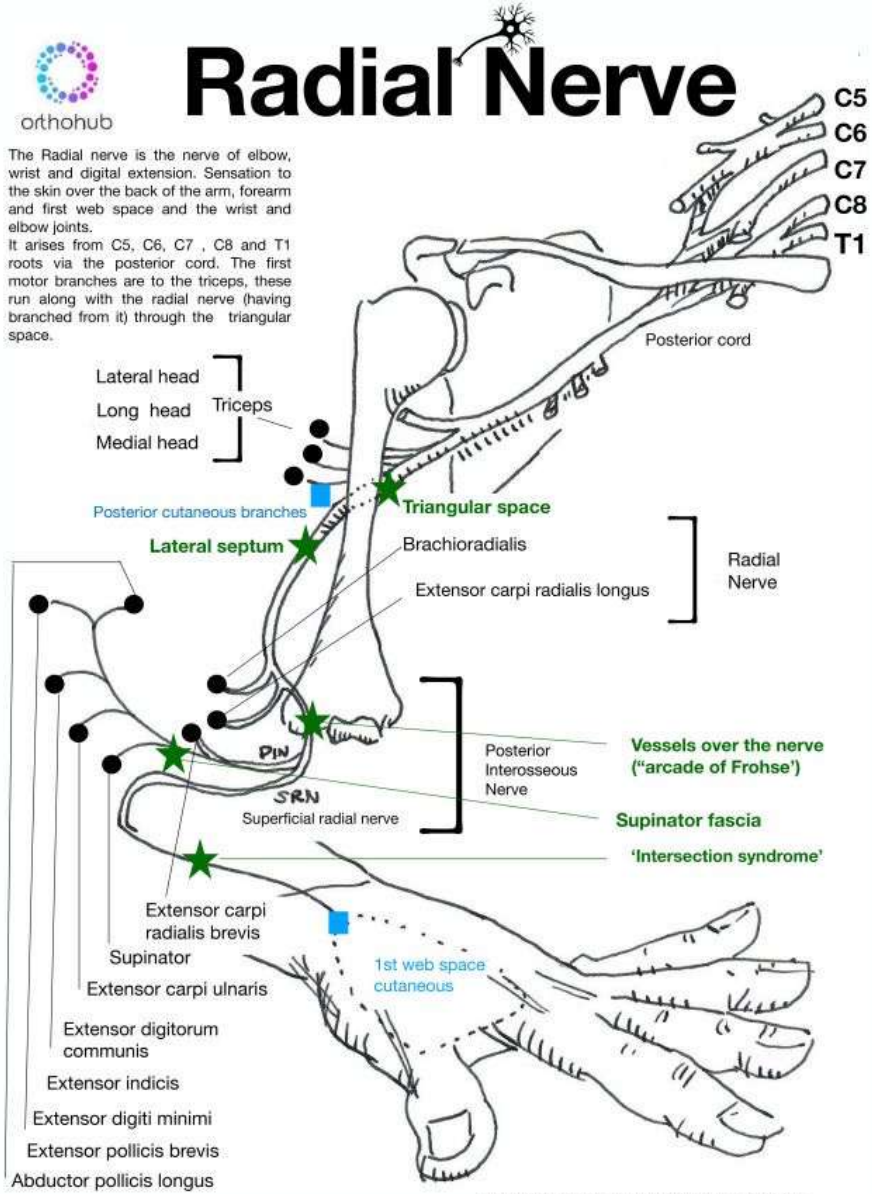
Radial Nerve: Entrapment SIte



Radial Nerve

orthohub

The Radial nerve is the nerve of elbow, wrist and digital extension. Sensation to the skin over the back of the arm, forearm and first web space and the wrist and elbow joints.
It arises from C5, C6, C7 , C8 and T1 roots via the posterior cord. The first motor branches are to the triceps, these run along with the radial nerve (having branched from it) through the triangular space.



Common site of compression

Motor point innervation

Sensory innervation

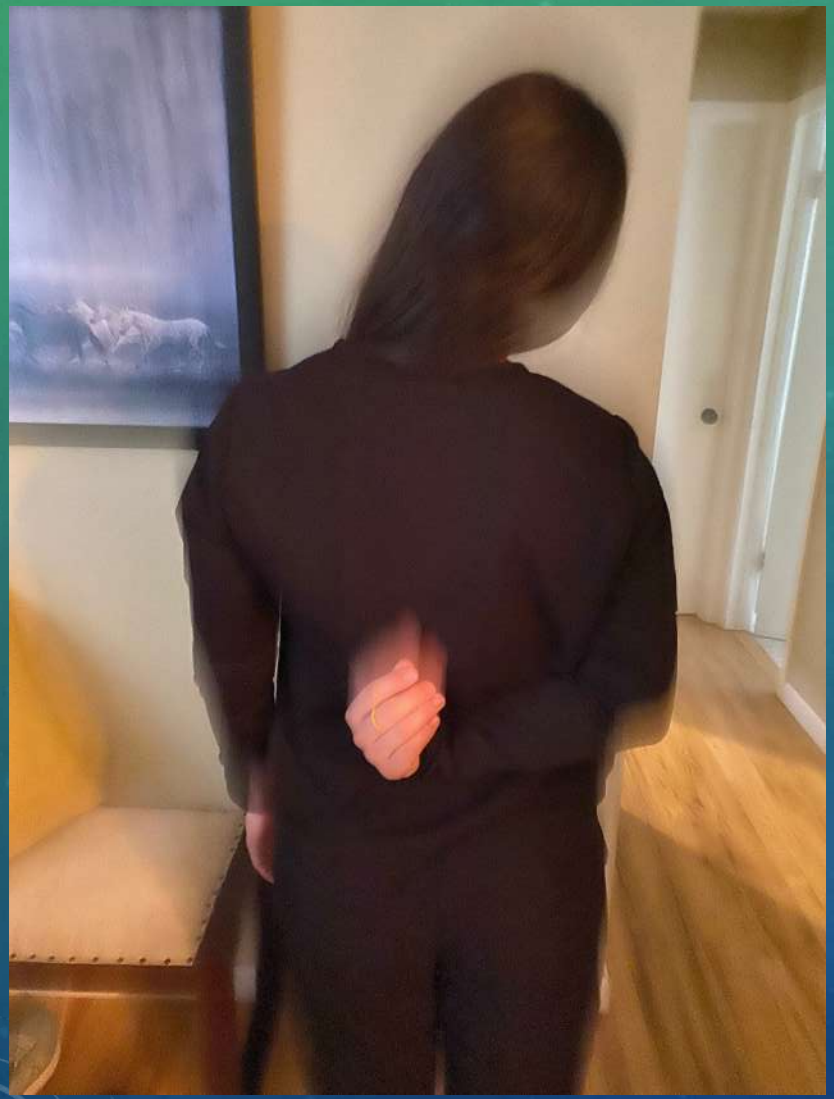
When clinically assessing the Radial nerve remember:

- Triceps branches arise from the radial nerve very high; prior to the triangular space & are not usually affected even in a high radial nerve injury.
- ECRL extends and radially deviates the wrist and it is lost in a radial nerve injury.
- Thus a PIN palsy does not involve a wrist drop: ECRB and ECU are lost (which provide central and ulnarly deviated wrist extension) but ECRL remains leading to a radially deviated wrist when extending.
- As a degenerative Radial nerve (or PIN) palsy recovers there is a progressive recovery of function in this order; (BR, ECRL) ECRB, Sup, ECU, EDC, EI, EPB, APL, EPL.

@TJQPNI

Radial Nerve: Entrapment Test

Radial Nerve: Glide



Grip Optimization – Open Chain

Closed chain triplanar digital corrective

- *Start in Quadruped or Diamond pose.*
- *Follow ID cues at all times.*
- *Make sure scapula is protracted in Quadruped or neutral in Diamond.*
- *Start with DIP flexion/extension.*
- *Move to PIP flexion/extension.*
- *Move to MCP flexion/extension, abduction/adduction, opposition/reposition.*

Grip Optimization – Open Chain

Open chain rice drill for triplanar digital training

- *Start in Quadruped, Diamond pose, or seated spinal protected position.*
- *Follow ID cues at all times.*
- *Make sure Scapula is protracted in Quadruped or neutral in Diamond/seated positions.*
- *Start with DIP flexion/extension.*
- *Move to PIP flexion/extension.*
- *Move to MCP flexion/extension, abduction/adduction, opposition/reposition.*

Grip Optimization – Closed Chain, Tool Assisted

Closed chain tool-assisted x plane digital corrective (Sylvis adjustable torsion spring grip, adjustable spring grip, scissor grips, rubber band, iron mind egg, rice)

- *Start in preferred position, with ID cues in check at all times.*
- *Using tool, check flexion of each individual MCP/PIP/DIP.*
- *Using rubber bands or equivalent, check extension of each individual MCP/PIP/DIP.*

60

Grip Optimization – Closed Chain, Tool Assisted

Pinch grip (using plates, scissor grips)

- *Start in hinge position.*
- *Follow ID cues at all times.*
- *Make sure scapula is neutral.*
- *Pinch a plate with digital tips, using all tips equally.*

Grip Optimization – Closed Chain, Tool Assisted

Closed chain tool-assisted x plane digital corrective (Sylvis adjustable torsion spring grip, adjustable spring grip, scissor grips, rubber band, iron mind egg, rice)

- *Start in preferred position, with ID cues in check at all times.*
- *Using tool, check flexion of each individual MCP/PIP/DIP.*
- *Using rubber bands or equivalent, check extension of each individual MCP/PIP/DIP.*

60

Grip Optimization – Closed Chain, Bottoms-Up KB

Dissecting neutral wrist and flexed/adducted/opposition with bottoms up kettlebell

- *Start in Standing position.*
- *Follow ID cues at all times.*
- *Make sure scapula is neutral and elbow is held close to ribs.*
- *Make sure wrists stays NEUTRAL at all times.*
- *Grip bell and balance as long as possible.*

Nutrition, Supplements

- Anti-inflammatory diet and supplements

- Avoidance of Processed foods, AI diet protocols
- Turmeric, Boswellia, White Willow Bark
- NSAIDS

- Discussion of stress hormones and neurotransmitters: norepinephrine and dopamine

- Heat or ice?

- Exercise or rest?

- Red Light Therapy

- Fasting

Medical Treatments for Neuropathy

- **Oral corticosteroids (max 10 day) vs. localized injections**

- **Nerve medications, like Gabapentin**

- **Radio frequency ablation**

- **Dextrose and lidocaine injections Treatments**

- **Discectomies (endoscopic, micro, macro)**

Helpful Research Links

Dooley's article on grip and its links to nerve impingement
https://drdooleynoted.com/2016/02/26/anatomy-angel-grip-issues-and-nerve-impingement/

Dooley's article on median neuropathy and finger flexor function:
https://drdooleynoted.com/2015/09/06/anatomy-angel-finger-flexion-and-median-neuropathy/

Dooley's article on Flexor Carpi Ulnaris and ulnar grip:
https://drdooleynoted.com/2016/02/15/flexor-carpi-ulnaris-and-the-ulnar-grip/

Dooley's article on grip and scalenes:
https://drdooleynoted.com/2016/11/23/anatomy-angel-scalenes/

Helpful Research Links

Grip and the link to cognitive decline:

Combination of gait speed and grip strength to predict cognitive decline ...

National Institutes of Health (.gov)https://www.ncbi.nlm.nih.gov › pmcGrip Strength and the Risk of Cognitive Decline and Dementia: A Systematic ...

Harvard Healthhttps://www.health.harvard.edu › p...Poor handgrip strength in midlife linked to cognitive decline

National Institutes of Health (.gov)https://www.ncbi.nlm.nih.gov › pmcA Narrative Review of Handgrip Strength and Cognitive Functioning

Grip strength as a biomarker:

National Institutes of Health (.gov)www.ncbi.nlm.nih.govGrip Strength: An Indispensable Biomarker For Older Adults

Grip and brain structure, mental health:

BMC Medicinebmcmedicine.biomedcentral.comAssociations between grip strength, brain structure, and mental health in ...

Helpful Research Links

Grip and healthy aging:

Washington Posthttps://www.washingtonpost.com › ...Grip strength can be a predictor of healthy aging - The Washington Post

Cleveland Clinic Health Essentialshttps://health.clevelandclinic.org › g...What Grip Strength Says About Your Health – Cleveland Clinic

Cleveland Clinic Newsroomhttps://newsroom.clevelandclinic.org › ...How Weak Grip Strength Plays a Role in Aging

Grip strength and mortality:

National Institutes of Health (.gov)https://www.ncbi.nlm.nih.gov › pmcHandgrip strength and mortality in the oldest old population: the Leiden 85- ...

Grip strength and depression rates:

Medscapehttps://www.medscape.com › viewa...Greater Handgrip Strength Tied to Lower Risk for Depression

Ways to strengthen grip:

Ohio State Health & Discoveryhttps://health.osu.edu › wellness › w...Why a strong grip is important, and how to strengthen those muscles

Helpful Research Links

Grip strength and heart health:

Harvard Healthhttps://www.health.harvard.edu › gr...Grip strength may provide clues to heart health

https://www.bmj.com/content/361/bmj.k1651

Peripheral nerve entrapment pathophysiology:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7382548/

https://www.ncbi.nlm.nih.gov/books/NBK230871/

https://www.aafp.org/pubs/afp/issues/2010/0115/p147.html

https://journals.lww.com/jbjsjournal/Fulltext/1999/11000/Pathophysiology_of_Nerve_Compression_Syndromes_.13.aspx

https://my.clevelandclinic.org/health/diseases/22137-nerve-compression-syndrome

https://www.hindawi.com/journals/rrp/2012/230679/

Helpful Research Links

Diagnosis and treatment of peripheral nerve entrapment:
https://www.mayoclinic.org/diseases-conditions/peripheral-neuropathy/diagnosis-treatment/drc-20352067

Nerve glide efficacy:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2565076/

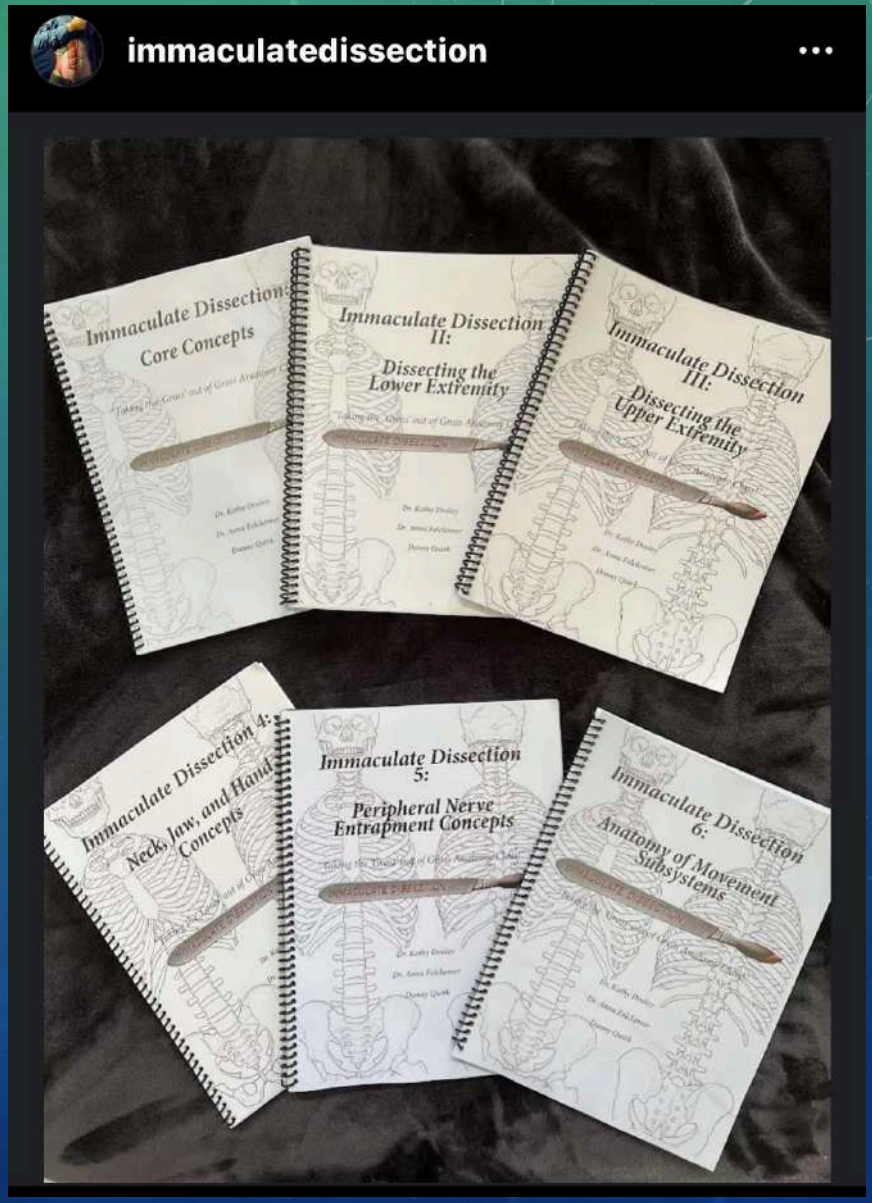
https://pubmed.ncbi.nlm.nih.gov/27842937/

https://www.jospt.org/doi/pdf/10.2519/jospt.2017.7117

ID Courses are online!

- ***$300 each for ID 1-6***
  - *15 hours each*
  - ***Core, UE, LE, Neck/Jaw/Grip, Nerves, Gait/Mvmt Subsystems***
- ***$200 for Anatomy Angels***
  - *5 hours each*
  - ***Pelvic Floor, Menopause, Vestibular, Respiration Meditation, TMJ, Sciatica***

www.immaculatedissection.com



FOLLOW ME ON FACEBOOK!

Kathy Dooley

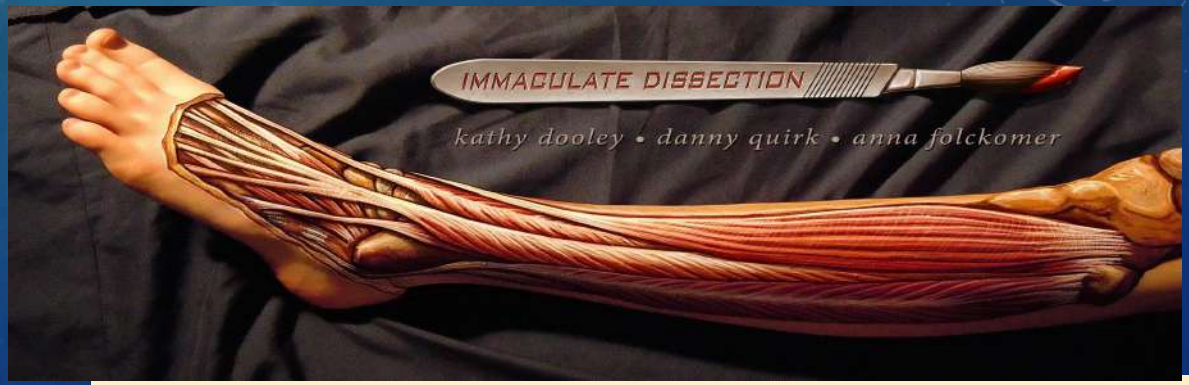
https://www.facebook.com/drkathydooley

FOLLOW ME ON Instagram:

@immaculatedissection

Immaculate Dissection Seminars

www.immaculatedissection.com



THANKS FOR YOUR ATTENTION!

To contact me with any questions, please email me:

drkathydooley@gmail.com