Upper Extremity Radicular Pain and Tingling

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Disclosure

- NWSL: Chief Medical Officer
- USRowing: Team Physician, Medical and Sports Science Committee
- NFL: Research and Innovations Committee
- AMSSM Foundation: Board Member
- Wu Tsai Human Performance Alliance: Sports Advisory Council
- Korey Stringer Institute: Medical and Science Advisory Board
- Baseline Global: Medical Advisory Board
- Agency for Student Health Research: Medical Advisory Board

The views presented are my own and not reflective of any of the organizations for whom I consult or provide services.

Objectives

- Assess upper extremity pain and tingling with a systematic history and physical exam, and select imaging tests
- Identify management options and indications on when to refer these upper extremity symptoms for subspecialty care

CC: "Arm/shoulder numbness, arm tingling, heaviness"

Case #1

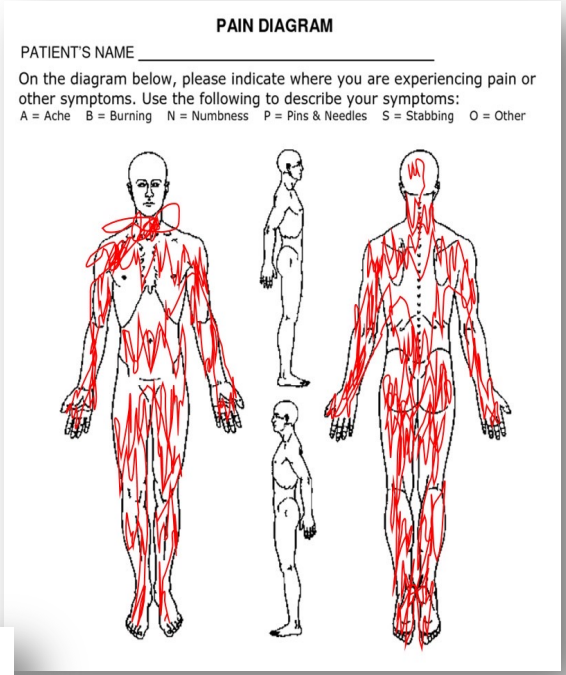
- 1994 AFC Championship Game
- San Diego Chargers upset favored Pittsburgh Steelers 17-13
- Junior Seau recorded 16 tackles and a forced fumble despite:
  - "Not being able to lift his **arm** above his shoulder"
  - "Playing with a bad left **shoulder**"
  - "Having a pinched nerve in his **neck**"

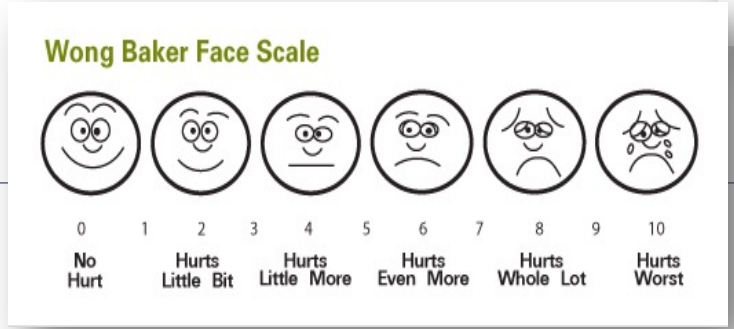
Case #2

- 17 yo F w/ intermittent R shoulder pain x 2 yrs. No known injury.
- During high school cheer, had “muscle pulls” and insignificant minor falls affecting neck and shoulders. Now in community college; also works as restaurant server.
- Pain is posterior upper R shoulder; when painful also has numbness radiating down R medial arm. Denies weakness.
- 5/10 Pain, aching and sharp, constant; can awaken with night pain
- Has not tried anything to improve pain; has not noted anything that makes pain worse

Take the Time…to Take a Good History!

- PQR**S**T
  - Provokes/alleviates, Quality, Radiation, **Severity**, Timing
- MS O**L**DCART**S**
  - Mechanism, Symptoms, Onset, **Location/radiation**, Duration, Character, Aggravating factors, Relieving factors, Timing, **Severity**





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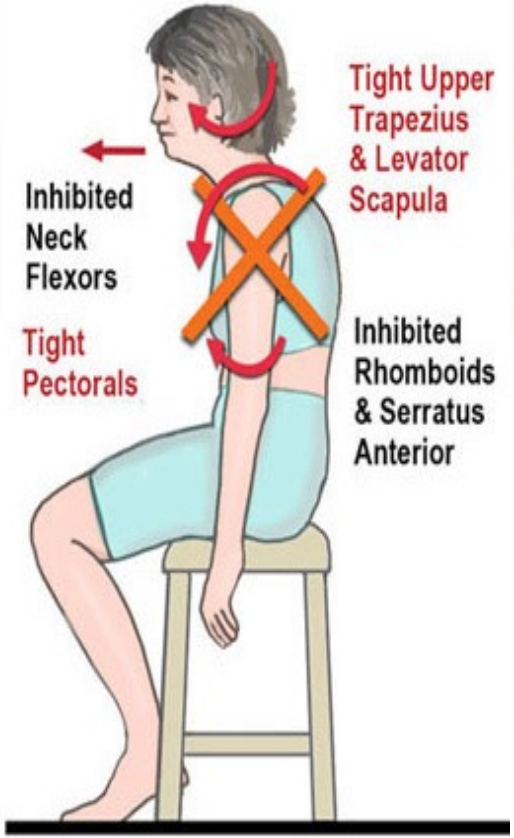
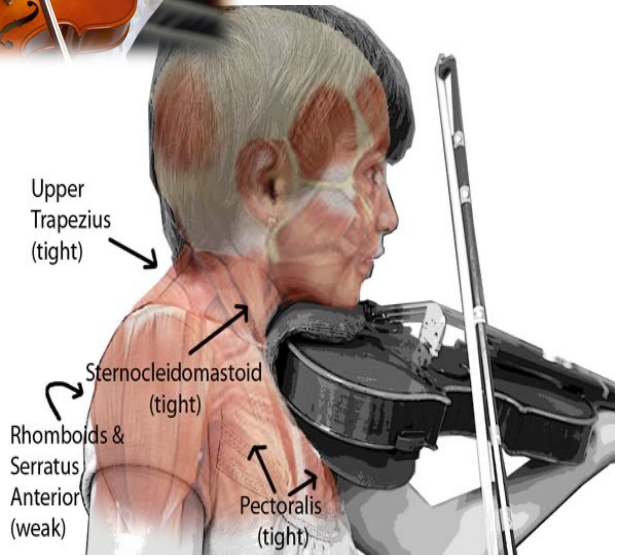
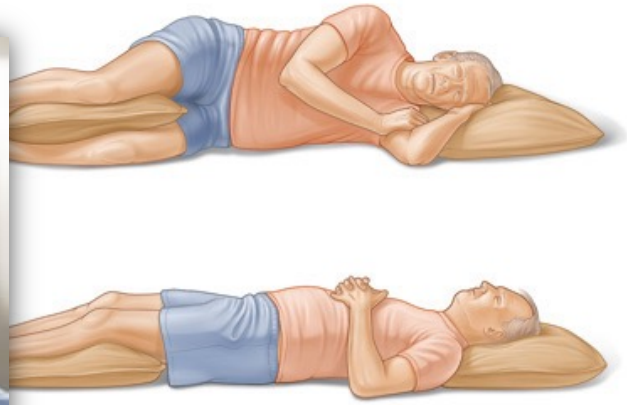
PQRST: Provocation
MS OLDCARTS: Mechanism, Onset and Aggravating factors

- As an athlete:
  - When did injury occur?
  - What activities cause/increase the symptoms?
- As a student or worker:
  - When did symptoms start?
  - What maneuvers/positions/activities cause/increase the symptoms?


Tight Upper Trapezius & Levator Scapula
Inhibited Neck Flexors
Tight Pectorals
Inhibited Rhomboids & Serratus Anterior


Upper Trapezius (tight)
Sternocleidomastoid (tight)
Rhomboids & Serratus Anterior (weak)
Pectoralis (tight)



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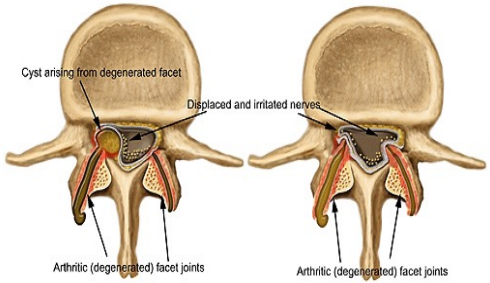
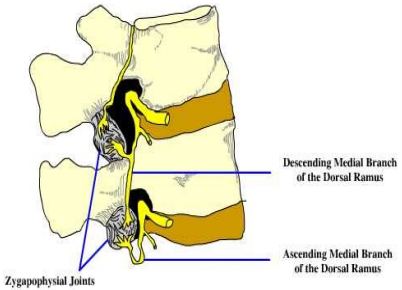
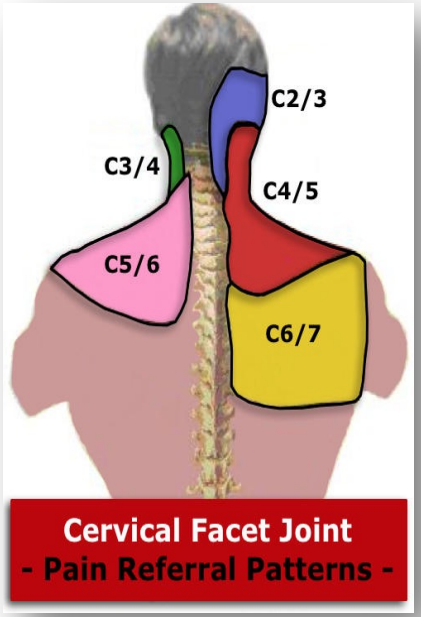
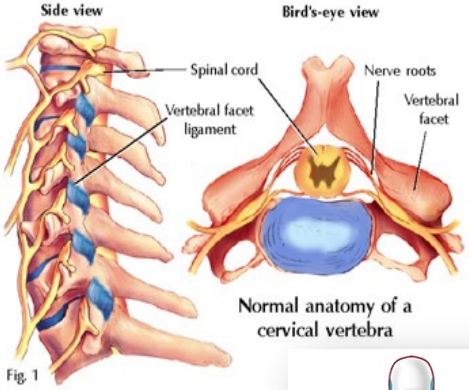
PQRST: **Q**uality and **R**adiation
MS O**LD**CARTS: **C**haracter and **L**ocation/radiation

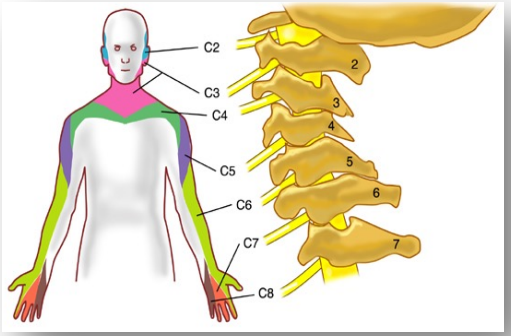


Zygaphopyseal Joints and Their Innervation









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Past Medical History

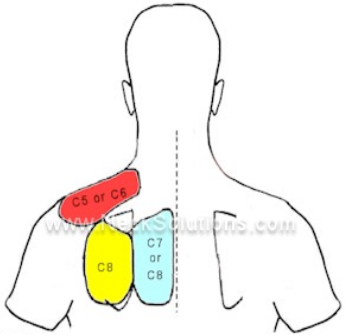
- Has the patient experienced previous episodes of similar symptoms or localized neck pain?
  - When and for how long?
  - What helped at that time?

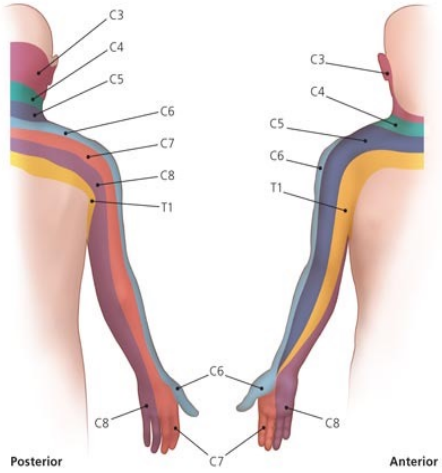
Past Medical History

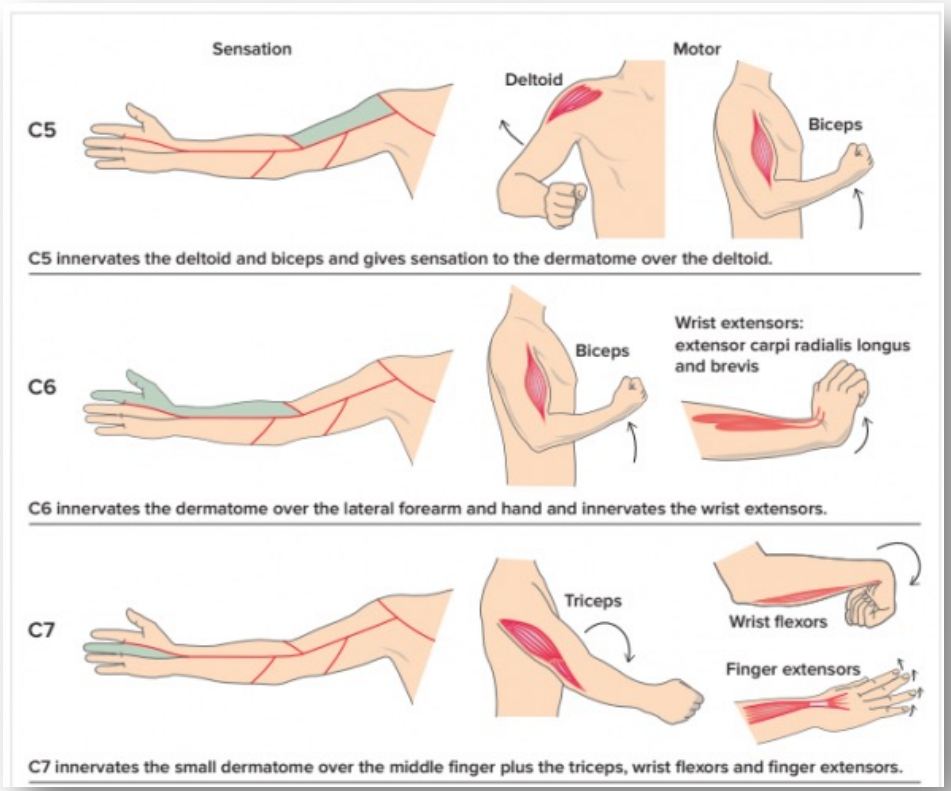
- Does the patient have symptoms suggestive of a cervical myelopathy?
  - changes in gait
  - bowel or bladder dysfunction
  - sensory changes or weakness

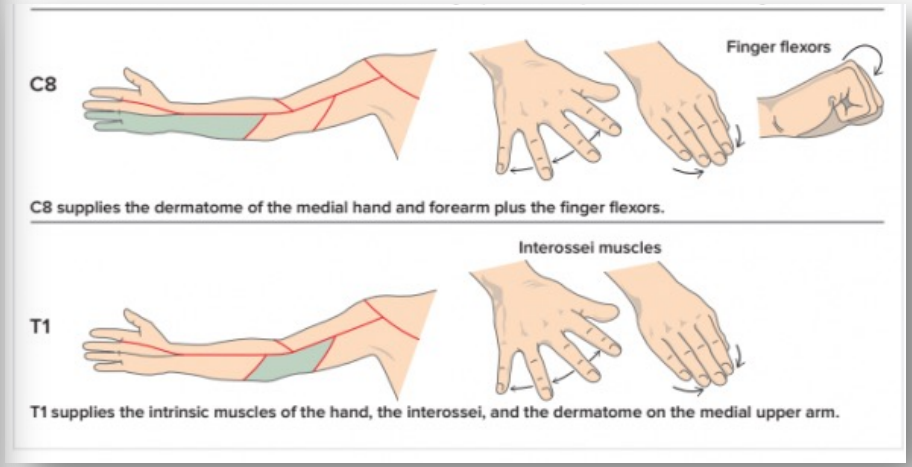
Typical History for Cervical Radiculopathy

- Initially, pain can be referred to medial border of scapula; CC of posterior shoulder pain
- Insidious onset of neck and/or arm discomfort ranging from dull ache to severe burning pain
- As radiculopathy progresses, pain radiates to upper or lower arm into hand, *along sensory distribution of involved nerve root*
  - Can include tingling, numbness, loss of sensation
- May complain of motor weakness only



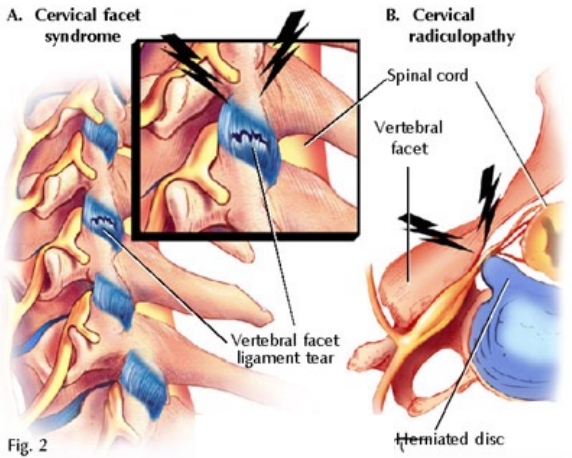



Sensation
Motor
C5
Deltoid
Biceps
C5 innervates the deltoid and biceps and gives sensation to the dermatome over the deltoid.
C6
Biceps
Wrist extensors:
extensor carpi radialis longus
and brevis
C6 innervates the dermatome over the lateral forearm and hand and innervates the wrist extensors.
C7
Triceps
Wrist flexors
Finger extensors
C7 innervates the small dermatome over the middle finger plus the triceps, wrist flexors and finger extensors.


C8
Finger flexors
C8 supplies the dermatome of the medial hand and forearm plus the finger flexors.
Interossei muscles
T1
T1 supplies the intrinsic muscles of the hand, the interossei, and the dermatome on the medial upper arm.

Exam Findings for Cervical Radiculopathy

- Symptoms **provoked** with Spurling's Maneuver
  - Increased pain occurs when foramina narrowed
    - Neck extension, lateral bending, or rotation toward symptomatic side
- Radicular symptoms **reduced** with Shoulder Abduction Test
  - Relieves symptoms by decreasing tension at nerve root



Rubenstein SM et al. Euro Spine Journal 2007

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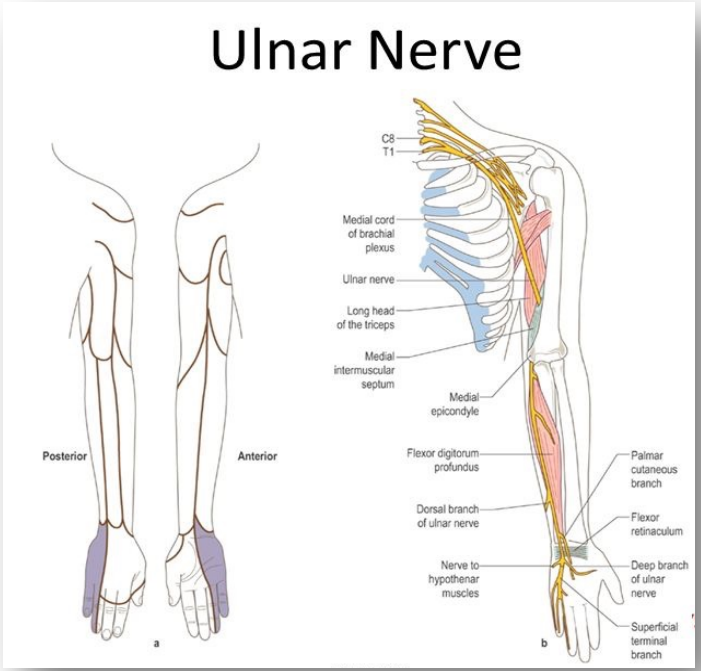
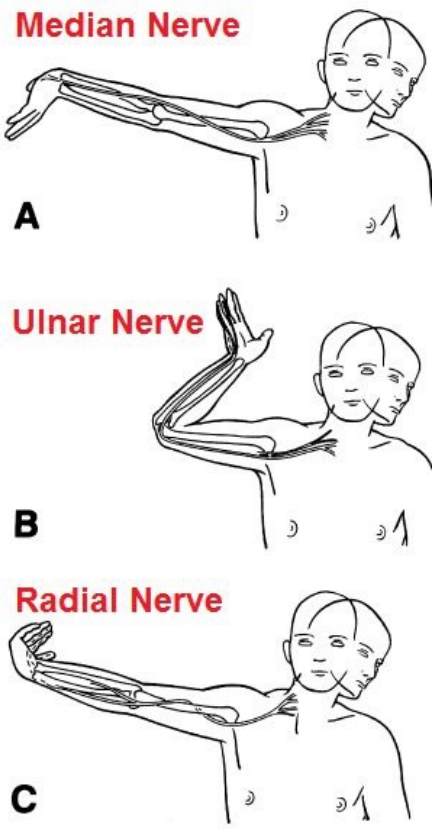
Exam Findings for Cervical Radiculopathy

- Upper Limb Tension Test (ULLT)





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Rubenstein SM et al. Euro Spine Journal 2007

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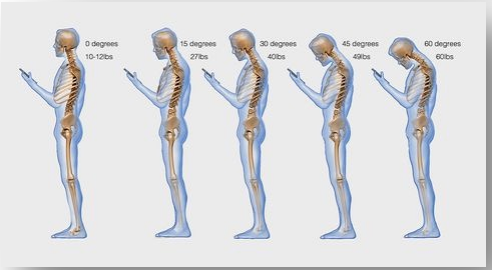
If you think it's Cervical Radiculopathy…

- MRI most useful imaging choice; C-spine XR including oblique views ("5 views") show degenerative changes
  - "7 views" if h/o trauma to neck (flexion and extension to evaluate ligamentous instability)
- Patients <35 yo do well with trial of conservative management (time, meds, rehab/modalities)
- Emphasize time. Emphasize activity. Emphasize posture. Emphasize restful sleep. *Emphasize time.*



"The art of medicine consists of amusing the patient while nature cures the disease." - Voltaire

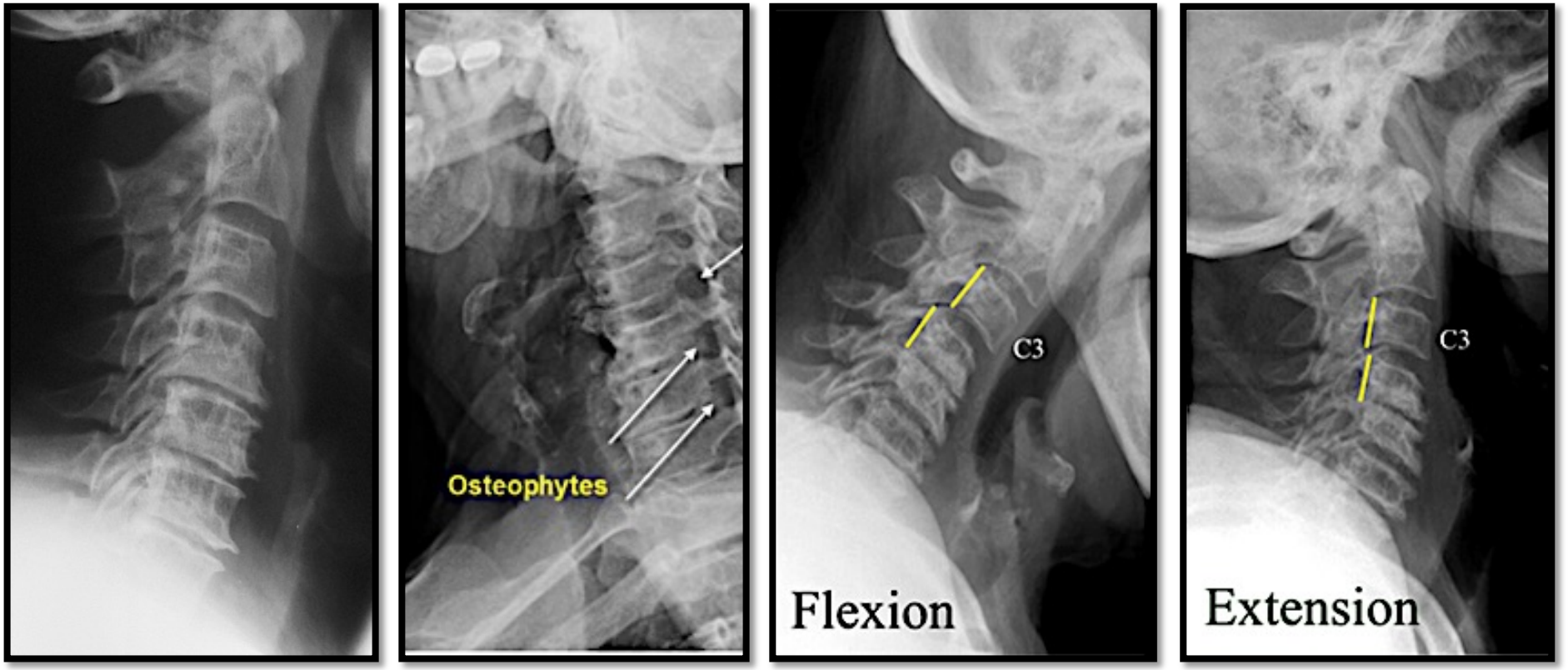
If you think it's Cervical Radiculopathy…

SORT: KEY RECOMMENDATIONS FOR PRACTICE

Clinical recommendation	*Evidence rating*	*References*
Acute radicular pain		
A short period (one week) of immobilization in a cervical collar may relieve radicular pain.	C	9
Home cervical traction units may provide temporary relief of radicular pain.	C	10, 11
Opioids may help alleviate neuropathic pain of up to eight weeks duration.	A	13, 14
In patients with cervical radiculopathy, exercises and manipulation should focus on stretching and strengthening after the acute pain has subsided.	C	17-19
Selective nerve root blocks may relieve radicular pain, but rare serious complications may occur.	B	20-24
Chronic radicular pain		
Antidepressants (tricyclic antidepressants, and venlafaxine [Effexor]) and tramadol (Ultram) may alleviate chronic neuropathic pain.	A	15, 16

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to http://www.aafp.org/afpsort.xml.

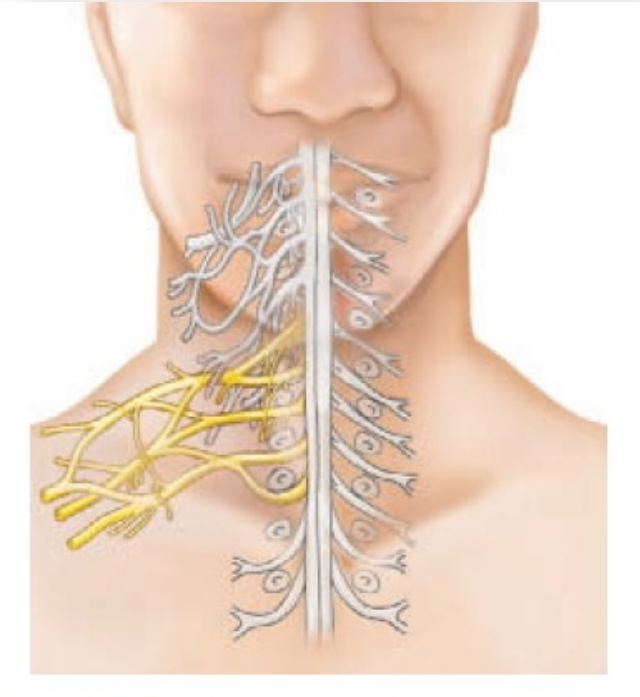
Eubanks JD et al, AFP 2010

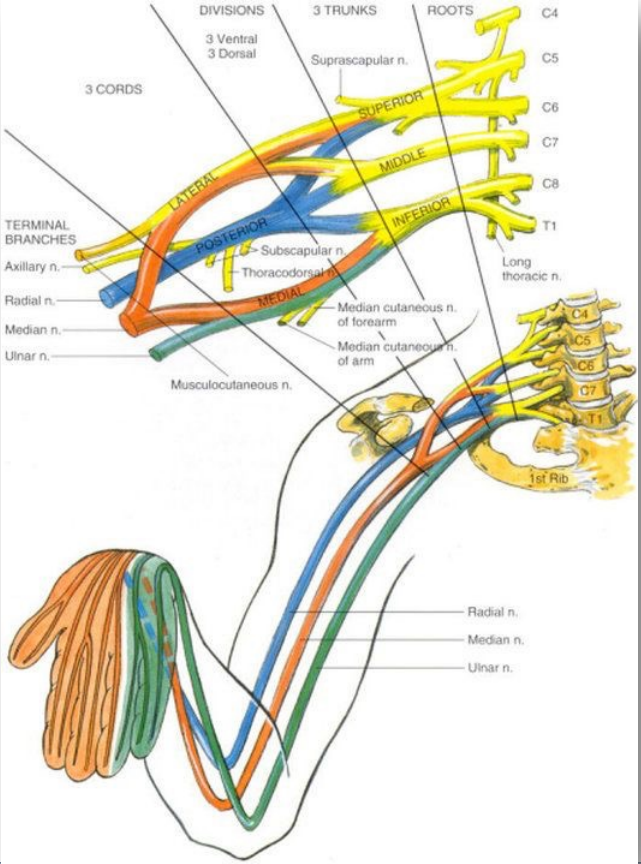

Osteophytes
C3
Flexion
C3
Extension

When to refer to spine subspecialist?

- Red flag symptoms
- XR - bone lesion, spine instability
- Progressive neurologic deficit
- Signs of myelopathy (*compression of spinal cord)*
  - Difficulty with manual dexterity, gait disturbance
  - UMN signs - Hoffman, Babinski, hyperreflexia, clonus
- Intractable symptoms e.g. pain and weakness after 6-8 wks of conservative management
  - MRI findings correlate with clinical exam
- *Patient desire*

The Brachial Plexus





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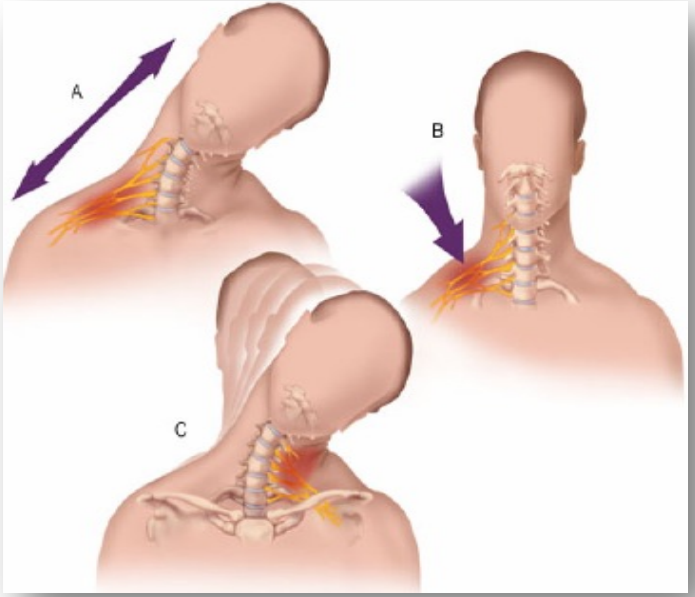
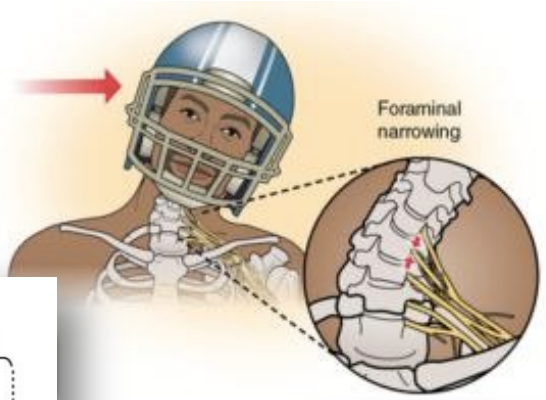
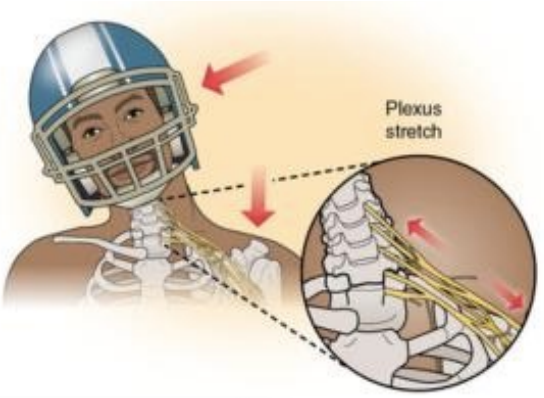
Burners/Stingers

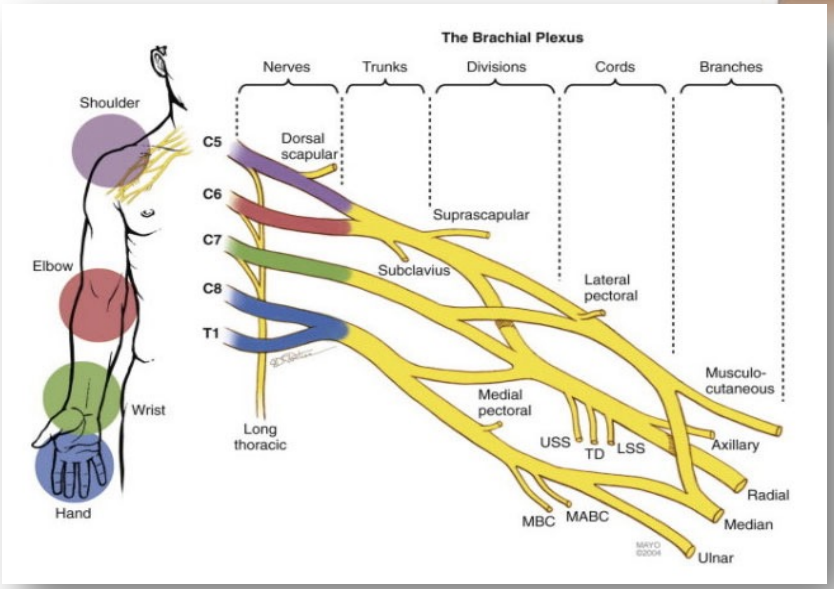
- Definition:
  - Nerve injuries resulting from trauma to neck or shoulder area
  - Cause a *traction or compression* along brachial plexus or cervical neck roots
- Diagnosis
  - Immediate onset of burning pain down unilateral arm
  - Associated with numbness or weakness

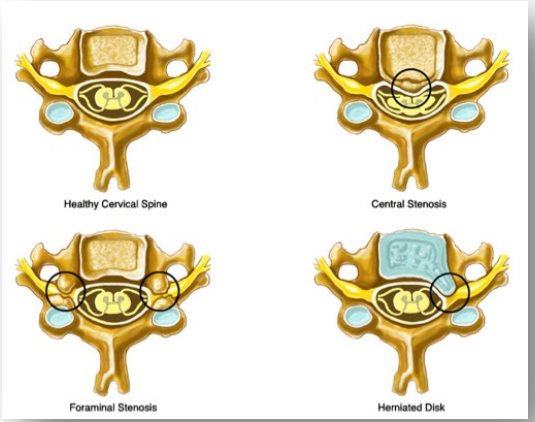


Burners/Stingers



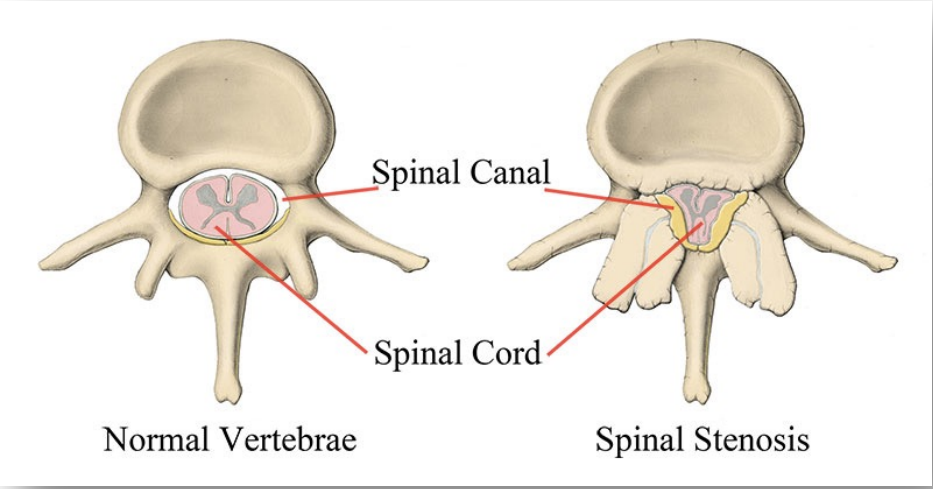






Burners/Stingers

- Risk factors
  - Contact sports
  - Spinal stenosis
- Symptoms
  - Usually last seconds to minutes
  - In 5-10%, can last hours to days or longer
  - Burning, electric shock, warmth, tingling
  - Numbness, weakness



Burners/Stingers

- Tests
  - Radiographs to include flexion/extension views, obliques
  - MRI C-Spine
  - EMG/NCS if > 3 weeks post injury and weakness persisting
- Work-up/Refer to subspecialist
  - Prolonged symptoms > 48°
  - ≥ 3 stingers
  - Neck pain with imaging findings
  - Increasing ease of injury, recovery time
  - Atypical symptoms, e.g. bilat UE involved

Cantu RC et al, CSMR 2013

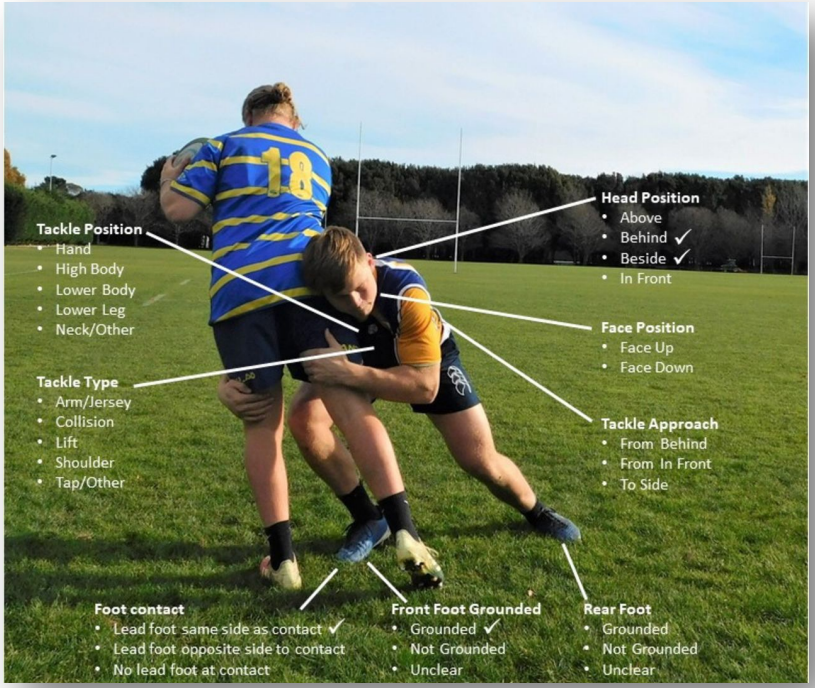
Cervical cord neurapraxia

- Definition:
  - Transient neurological deficit after trauma
    - Burning and tingling pain, loss of strength, or loss of sensation in both arms and/or legs
  - Caused by hyperextension, hyperflexion, and/or axial load
  - symptoms last < 15 minutes to 48 hrs in adults and as long as 5d in children
    - prolonged depolarization of neural tissue, inhibiting further action potentials

Clark AJ et al, Neurosurg Focus 2011; Jabola R et al, Clin Prac & Cases in Emerg Med 2021

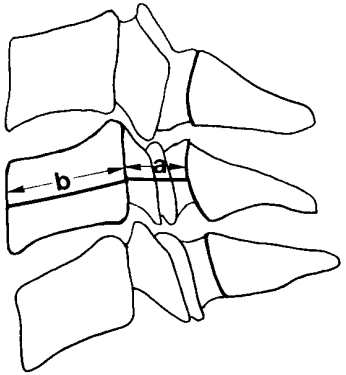
Cervical cord neurapraxia

- Exam:
  - Usually no neck pain
  - Full range of motion C-spine
  - 75% resolution of neural symptoms within 15 min
  - 10% symptoms lasting > 24 hrs
  - 80% have neural deficits in all 4 limbs



Clark AJ et al, Neurosurg Focus 2011; Jabola R et al, Clin Prac & Cases in Emerg Med 2021

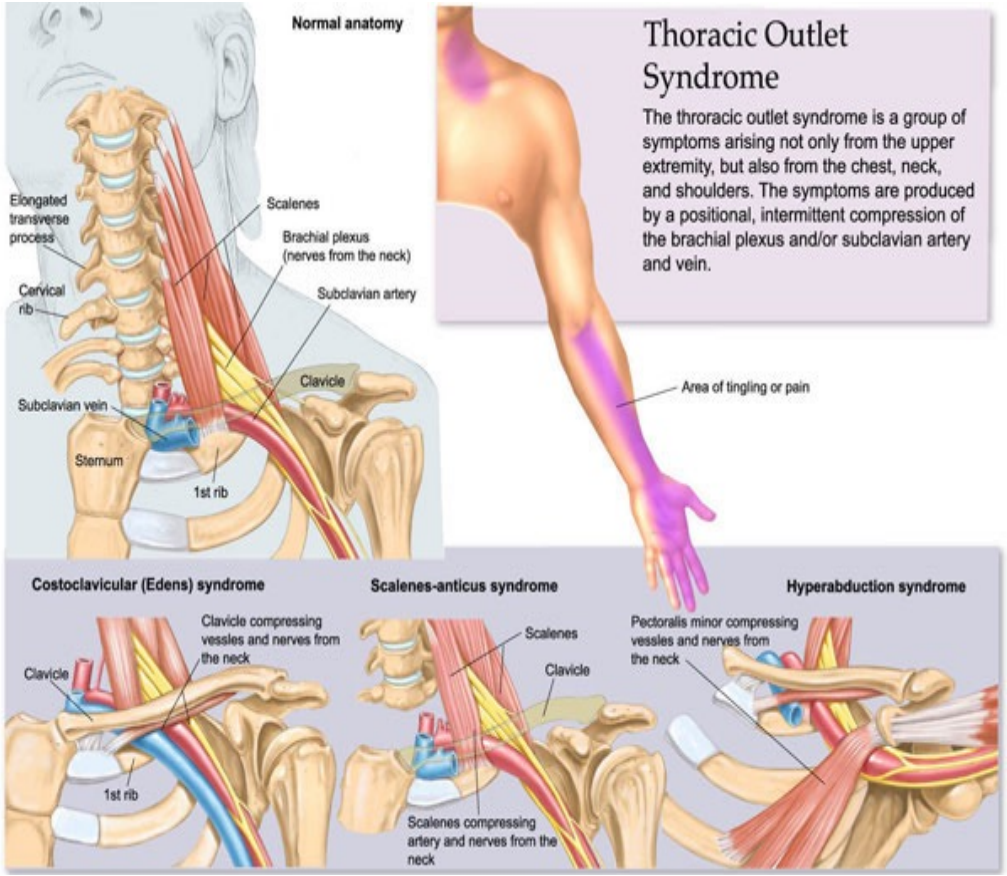
Cervical cord neurapraxia



- Strong causal relationship between C-spine stenosis and cervical cord neurapraxia in adult patients; has not been observed in children
- Radiographs negative for fractures
  - Torg-Pavlov Ratio a/b < 0.8 for significant spinal stenosis
- Axial CT and MRI C-Spine
  - Congenital fusion, cervical instability, disc protrusion with ↓ in AP diam of spinal canal

Torg J et al, JBJS (Am) 1986

Thoracic Outlet



#1: Costoclavicular triangle

#2: Interscalene triangle

#3: Subcoracoid space

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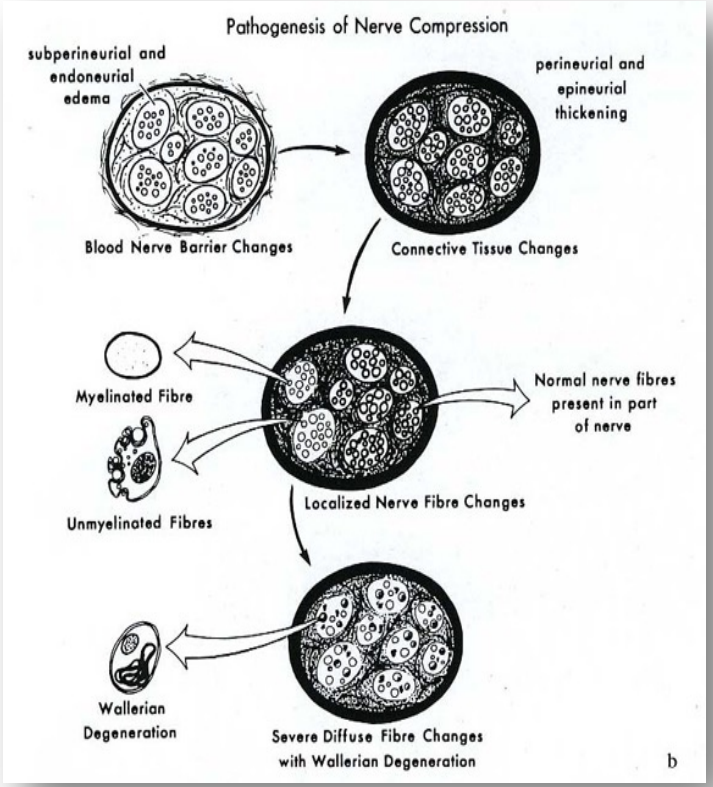
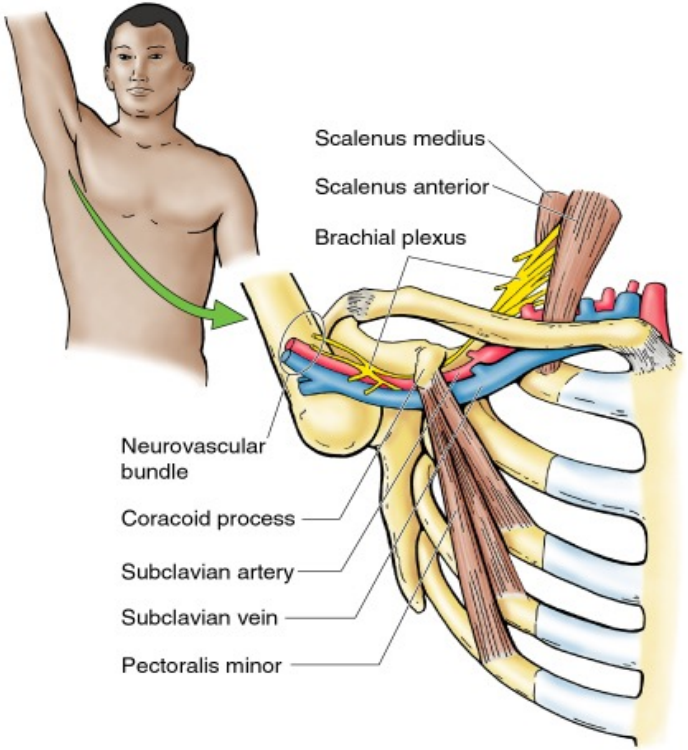
Thoracic Outlet Syndrome

- Initial presentation dependent on whether compression is *vascular and/or neurogenic*
  - *Nonspecific-type TOS* is functional/ dynamic and intermittent
- Symptoms dependent on histopathologic changes from chronic nerve compression
  - intermittent to constant
  - “pain-immobility-fibrosis loop”



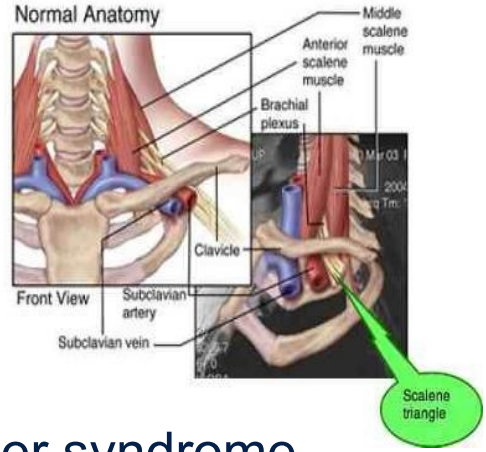
Classification of Thoracic Outlet Syndrome

1. By **Affected structure**:
   - *Neurogenic* or *vascular* (arterial or venous) or *combination*
2. By **Cause of compression:**
   - Scalene, Cervical rib
3. By **Event:**
   - Trauma, Repetitive stress, Posture



Twaij H et al. BJSM 2013

Vascular TOS

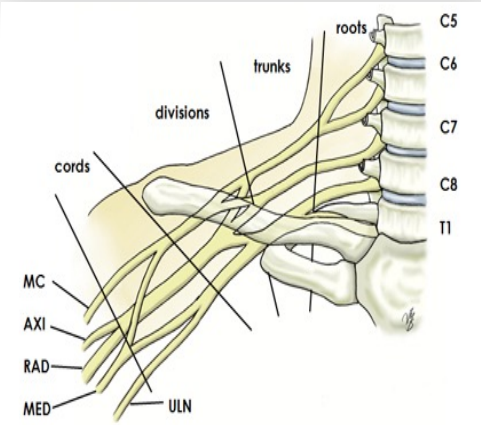


- Rare; involves subclavian artery and/or vein
  - More likely younger; vigorous overhead arm activity
  - *Venous* obstruction
    - May be secondary to thrombosis, Paget-von Schrötter syndrome
    - Diffuse arm, forearm, or hand pain (“tourniquet”); UE swelling; venous distention in chest/shoulder
  - *Arterial* obstruction
    - Color changes; claudication; diffuse arm, forearm, or hand pain
    - Initial symptoms mild (arm ache/fatigue, esp. after overhead activity)

Neurogenic TOS

- Compression of brachial plexus; pure neurogenic presentation rare
  - Overhead and repetitive activities
  - Can present with
    - painless atrophy of intrinsic muscles of hand
    - difficulty grasping racket or ball due to weakness
    - sensory loss or paresthesias
  - Pain usually mild

Combined -- overactive SNS causing vascular sx



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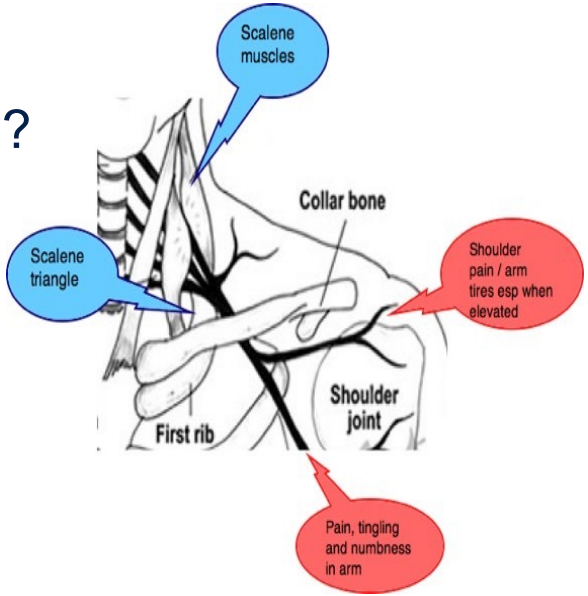
Nonspecific-type or Functional/Dynamic TOS

- Pain in arm or both arms, scapular region, cervical region
- Dynamic ***transient*** mechanical restriction
- *What* ***event*** caused/causes/worsens the symptoms?
  - Traumatic event (eg, MVA, fall)
  - Computer work
  - Mobile device



Special TOS Signs and Tests

Nonspecific TOS:

- Weakness and decreased sensation, tingling, heaviness, fatigue, achiness, coolness
- Non-focal and non-radicular findings
- Diffuse UE pain w/ or w/o guarding
- Poor posture
- Tenderness over coracoid, pectoralis mm, scalenes; tightness of mm
- Fullness in supraclavicular space from elevated rib

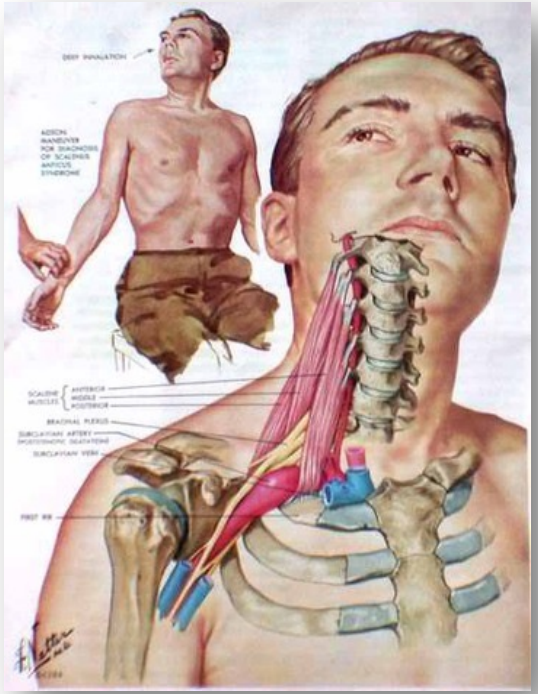
Special TOS Tests

- **Adson's** maneuver - Neck extended and rotated to **Affected side** w/ **Arm at side** then deeply inspiring and holding the breath; pulse checked
- **Wright's** test – ("***Airplane"***) Affected arm slowly abducted and externally rotated, pulse checked, while taking a deep breath
- **Roos** stress test – ("***Raise the Roof"***) Shoulders abducted above the head, forearms pronated, and repetitive opening and closing both hands into fists for at least 1 min

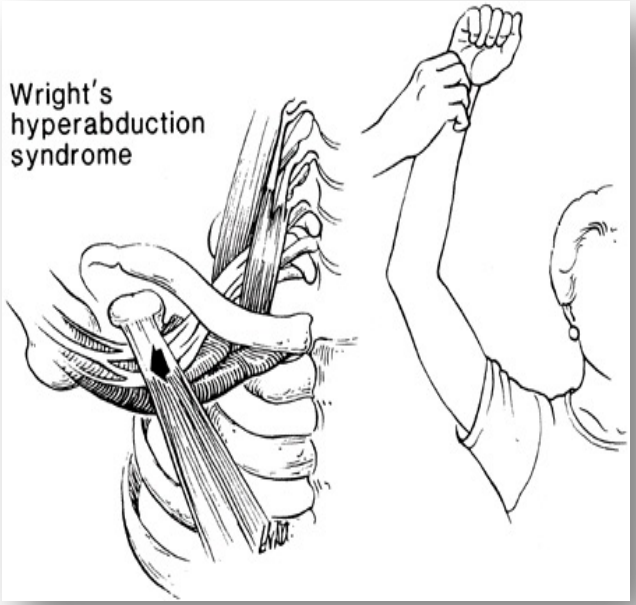
Tests considered + if reproduce symptoms and/or a decrease in pulse detected, or paresthesias, or can't complete Roos

Nord KM et al. Electromyog Clin Neurophys 2008

Special TOS Signs and Tests



Adson's

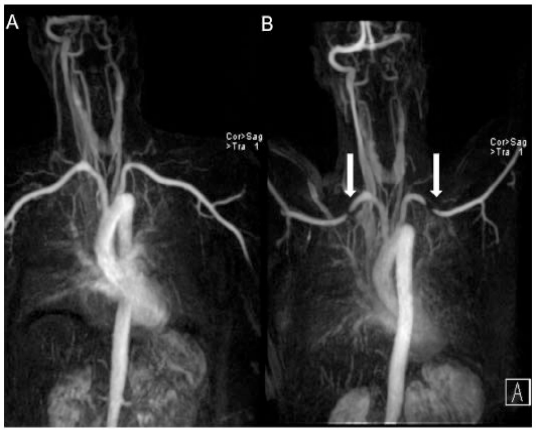


Wright's

Roos

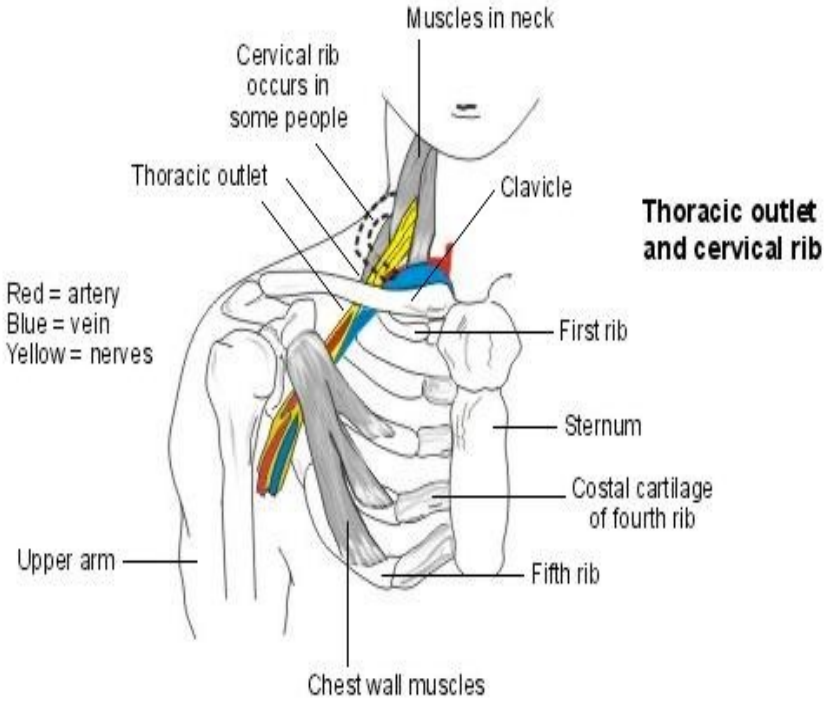
TOS Diagnostic Testing

- Plain XR films:
  - cervical rib, clavicle/upper rib callus, apical tumor
- Venous US studies, Doppler US, angiogram, Venogram, CT/CTA, NCS/EMG, NeuroMSK US
- MRI/MRA: brachial plexus anatomy, subclavian vein anatomy, vascular occlusion/compression
  - Positional scans with arm in dynamic position can improve validity of tests
  - *MRI alone: 41% sensitivity, 33% specificity*

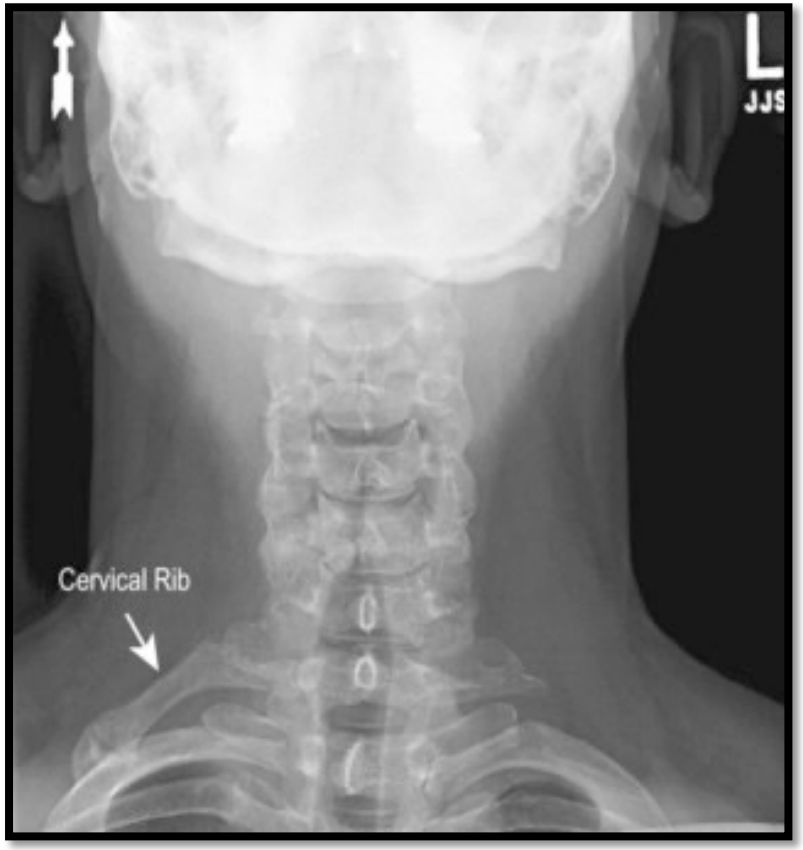


Lewis M et al. J Vasc Diag 2014; Singh VK et al. J Ortho Surg 2014

Cervical Rib



Thoracic outlet and cervical rib



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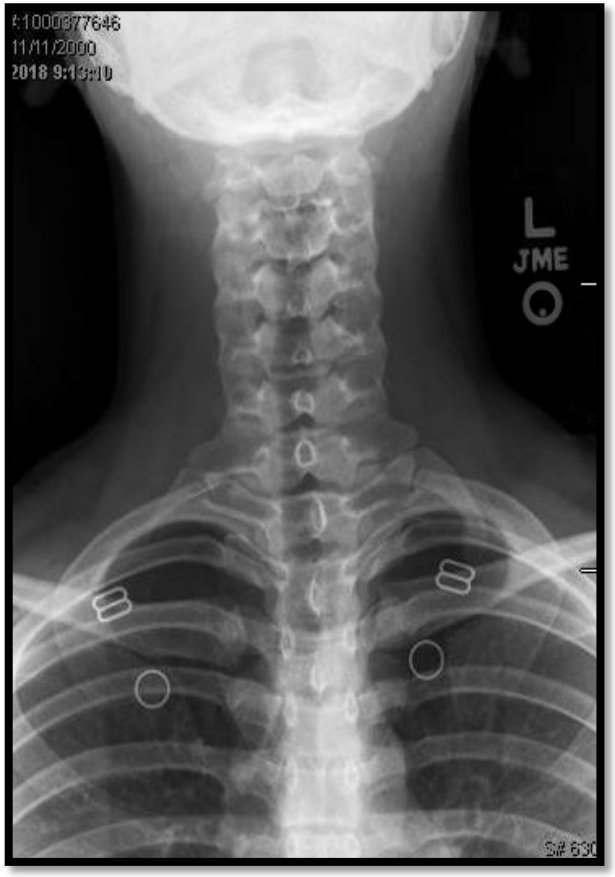
Case #2



Case #2

- 6 wk follow-up:
  - Pain worse; now has coldness ulnar side R arm to ring/ pinky fingers and still has numbness. Denies swelling or blue tint in arm.
  - PT helping with decreased pain when walking
  - Quit job to focus on school


eries #:1403
age #:77108
R

Case #3

- 21 yo M, RHD, first onset 3 yrs ago during bench and overhead press, w/ shoulder pain and tingling in long, ring and pinky fingers
  - MRI of the C-spine and L shoulder nl
  - PT x 5 mos; pain did not fully resolve
- Transferred colleges; began playing club soccer
  - Tripped during game, landing directly onto L shoulder
  - All symptoms exacerbated

Case #3

C-Spine:

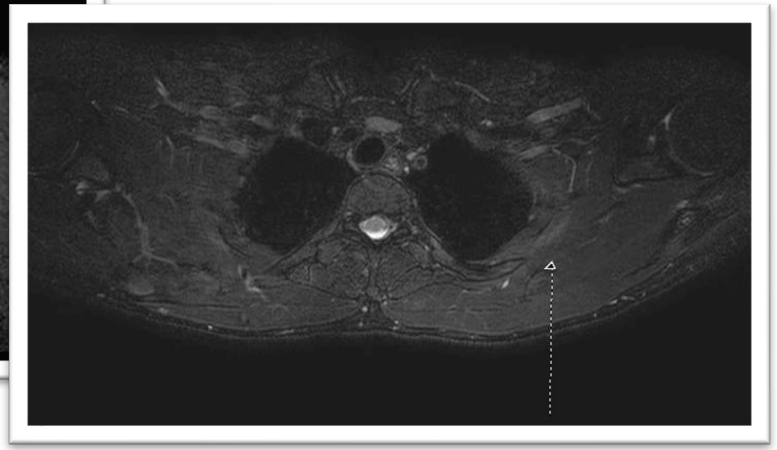
- R rotation 50%: + radicular pain L post shoulder / Left **Spurling's:** + radicular pain L post shoulder / L sidebend to 45°: + radicular pain L post shoulder / R sidebend, + anterior stretch sensation of L shoulder

Shoulders/UE:

- Slight winging of L scapula with shoulder ROM
- No edema or cyanosis or pallor of LUE; no venous distension
- **Adson**: With inhalation, radial pulse diminish on L; paresthesias not reproduced.
- **Wright** test: radial pulse does diminish on L (but not R); paresthesias reproduced
- **Roos** stress test: + symptoms of paresthesias/tingling of fingers (long, ring, and pinky) reproduced; + pain into L shoulder duplicated

Case #3

- MRI findings consistent with “scapular dyskinesis”



Case #3

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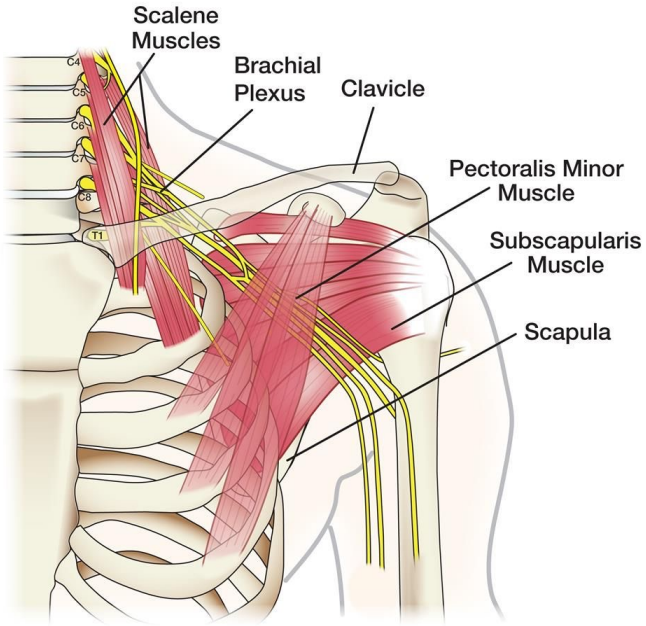
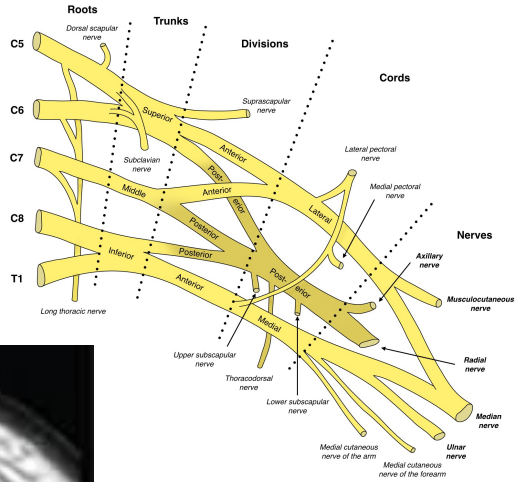
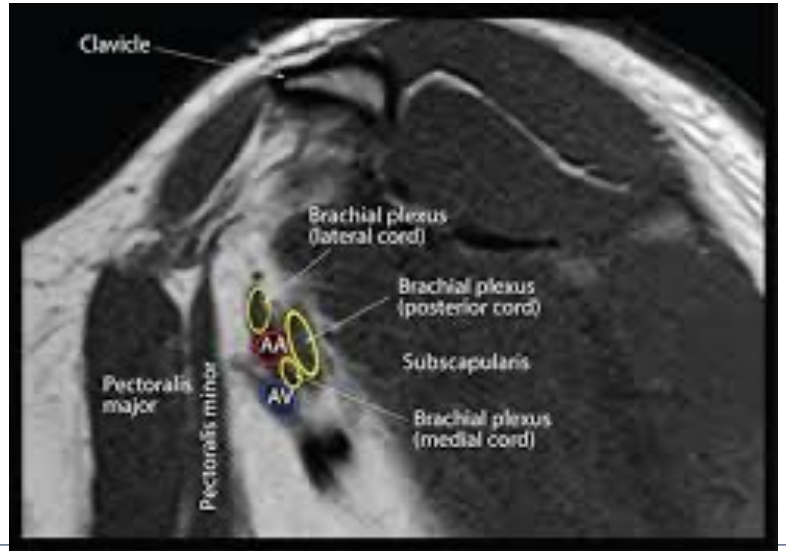
Case #3







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When to Refer?

- Physical Therapy
  - Posture, stretching, strengthening, neural mobilization (“nerve flossing”), ergonomic evaluations, bike-fit, sleep hygiene, breathing
- Counseling and Biofeedback
  - Stress reduction, breathing, depression/anxiety
- Other Subspecialists
  - Management beyond comfort level (meds, scalene/pec minor blocks)
  - Surgery
    - Scalene release, fasciotomy and adhesion/fibrous band release, foramenotomy, discectomy, rib resection, brachial plexus neurolysis/sympathectomy
    - Best outcome: younger age, competitive athlete, improvement with PT

Chandra V et al. J Vasc Surg 2011

Effect of a Short Educational Video on Whiplash on Pain Outcomes

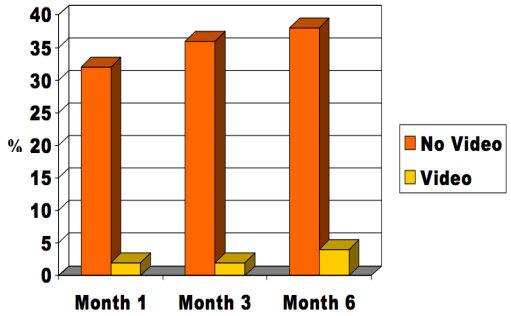
http://www.youtube.com/watch?v=_FsmqHHrGas

- 126 ER pts dx w/ neck strain
  - Randomly assigned 1) watch video or 2) normal ER/UC mgmt
    - All told to use OTC analgesics, ice/heat, f/u with personal physician
  - Video focused on helping patient understand progression from acute to chronic mm pain, how mm trigger points are wired to SNS, how mm pain closely tied to stress rxns
    - Taught stress-relief techniques--abdominal deep breathing, stretching exercises

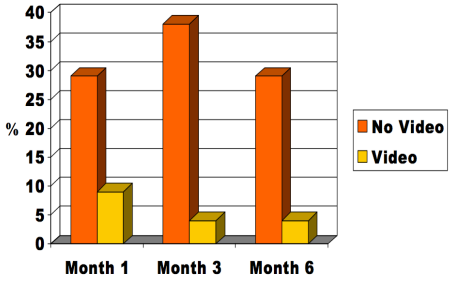
Oliveira et al, Spine 2006

Effect of a Short Educational Video on Whiplash on Pain Outcomes

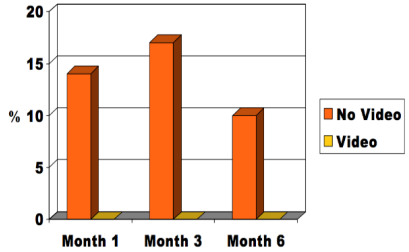
Taking Narcotics



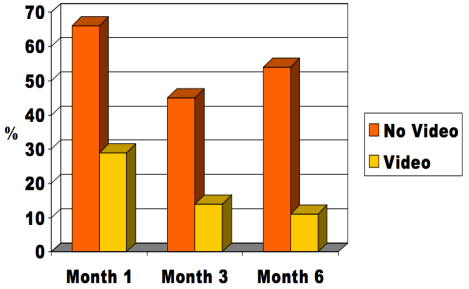
Taking Muscle Relaxant



Urgent Care Visits



Primary Care Doctor Office Visits



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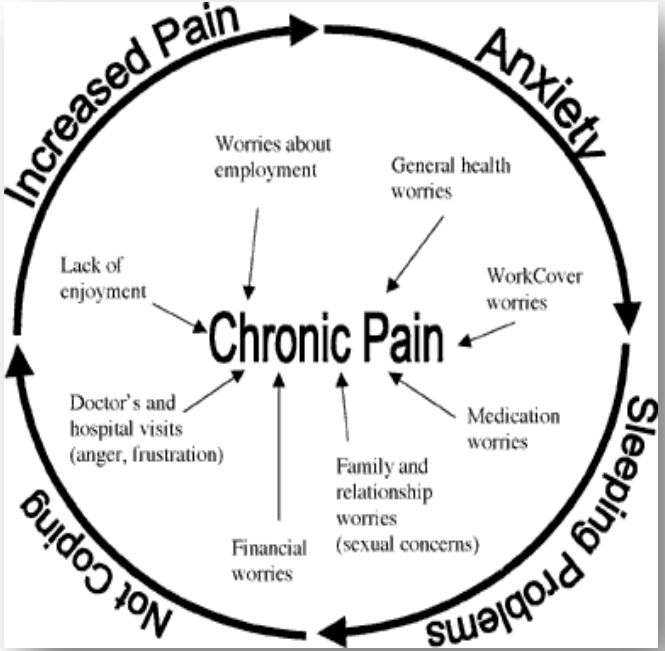
Summary

- Cervical vs. Brachial plexus
- Diagnosis of UE radicular pain can be challenging due to overlap of pain sources
  - Muscle imbalance
  - Neck/upper back pain
  - Neuritis
  - Various compression sites
- A good hx, focused PE, and ***education with management of patient expectations*** is key for accurate dx and excellent prognosis



Questions?


"I like to mix up my exercise routine. Sometimes I right click. Sometimes I double click..."