MUSCULOSKELETAL ULTRASOUND IN WORKERS COMP

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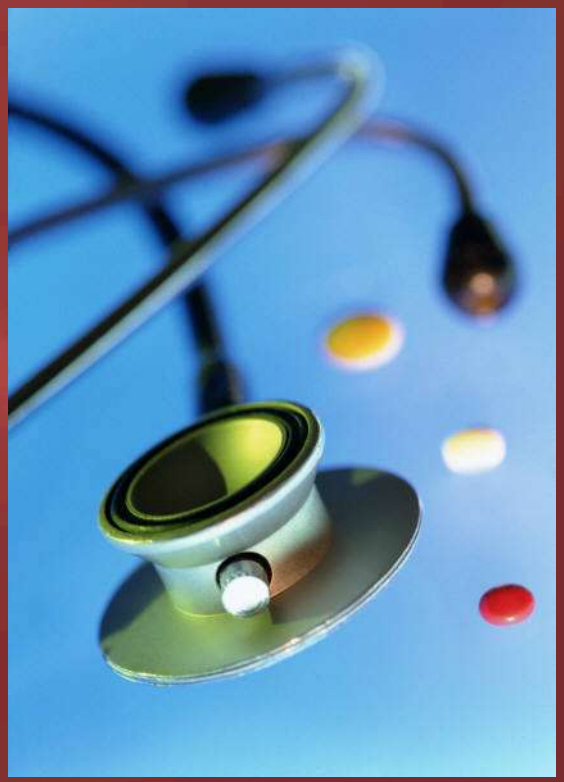
DIVISION OF IBJI

Why Should a PHYSIATRIST do msk us?

- We diagnose and treat muscle, tendon, joint, ligament, bone, (brain) injuries with rehabilitation and without surgery
- PM&R do many spine injections and EMGS so we are good with needles and imaging



Case presentation

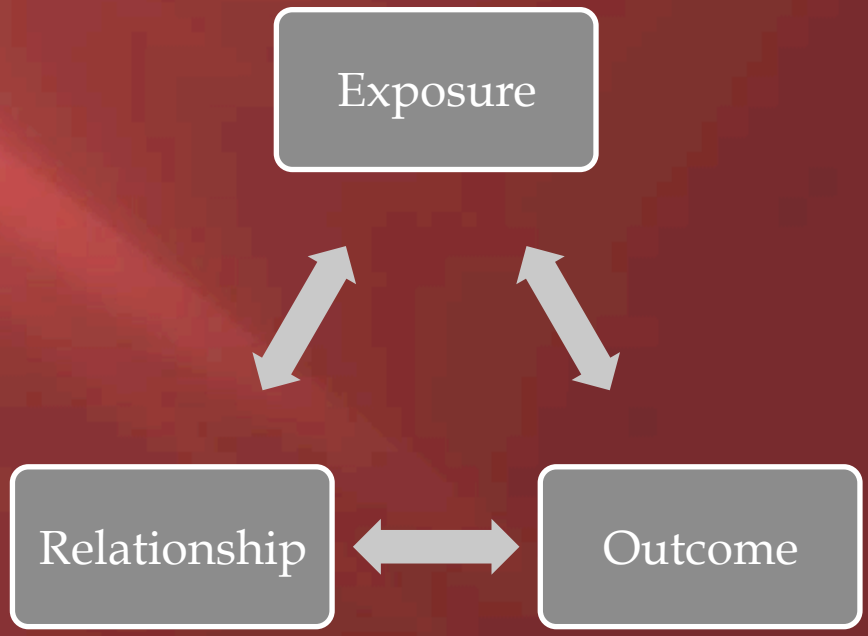
- 35 . y.o.w.m. with a no history of shoulder pain. Works at City Municipality and was moving packages from truck to over head storage and felt a sharp pain in right shoulder and then fell on it 2 weeks ago . Pain is worse when he elevates the shoulder and there it radiates down to the biceps No significant medical or surgical history.
- Exam: loss of full active flexion/ abduction. Positive Neer/hawkins and no instability. Tender over anteriorly. Neg Speeds test.

Shoulder conditions

- Industrial Injures
  - Provider must give a clear description of the traumatic event
- Occupational Disease
- Work related activities may cause or contribute to the development of condition caused by chronic exposure

Occupational Disease

- Conditions that support development of shoulder conditions
  - Carrying /lifting above the shoulder
  - Push/pull heavy loads
  - Working arms above shoulder > 15 minutes intervals



What's the next step?

- Start medication and order a MRI?
- Preform an US of the shoulder?
- Order therapy

US of the shoulder

Compared to other imaging

ADVANTAGES

- No x ray exposure
- Higher **resolution** than MRI 150 UM VS 469 UM (1.5t)
- Quicker than MRI
- Lower cost than MRI/CT
- 1/3 to ¼ the cost
- **No CONTRAINDICATIONS** with pacemaker or prosthetics/ not degraded by some implants (shoulder)
- Can use in real time for biopsy, dynamic impingement and injections
- Can image with hardware
- Better at differentiated solid versus fluid

DISADVANTAGES

- Operator dependent
- Cant see thru bone well
- Gray scale only
- No scout films
- Poorer resolution at greater depth

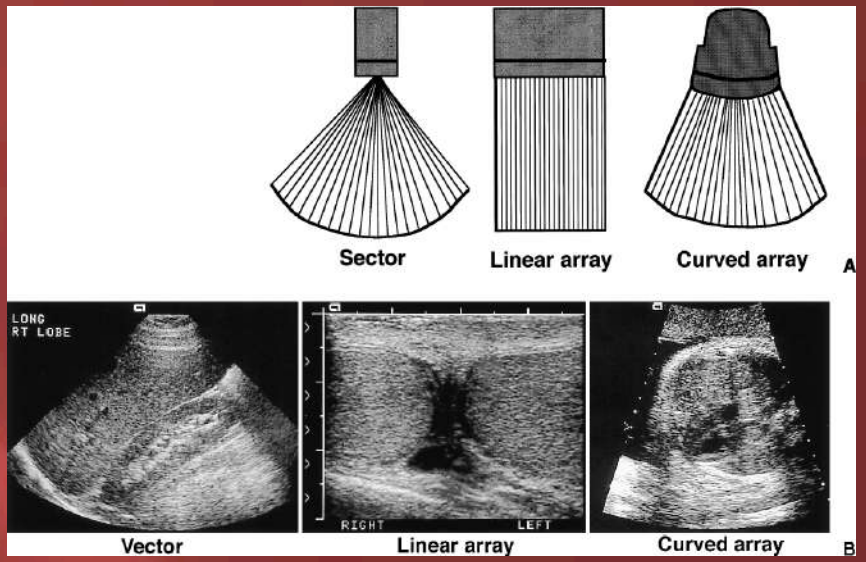
Cost savings

COMPARED TO MRI

- From 1996 to 2005 MRI costs increased 353%
- Projected MRI costs are 2.0 bill in 2020
- Using US would save 6.9 billion from 2006 to 2020

WRIST, HAND, ELBOW, SHOULDER, ANKLE, FOOT, LE, UE, HIP

How does US work ?????????



- US waves are send out from transducer and reflected back and recorded
- When there is a density change in the tissue (bone versus tendon) the amount of reflection depends on the density difference
- Large density deltas reflect bright signal and smaller deltas reflect gray signal

Echogenicty\Echotexture from muscle, tendon, ligament, nerve

- Tendon: parallel collagen bundles are brightly echogenic and fibrillar echotexture pattern
- Nerve is similar to tendon
- But has a fascicular and honeycomb echotexture
- Muscle fibers are dark hypoechoic bundles with hyperechoic connective tissue between
- Bone is bright hyperechoic surface with posterior shadowing.

US basics

Hypoechoic: when fewer sound waves are reflected back to the transducer= high water content

Hyperechoic: brighter image when sound waves are strongly reflected back = lower water content tissue

Echogenicity

- Fluid is anechoic (black)
- Articular cartilage is anechoic thin layer above bright cortical bone

MSK Terminology

Long axis or longitudinal plane

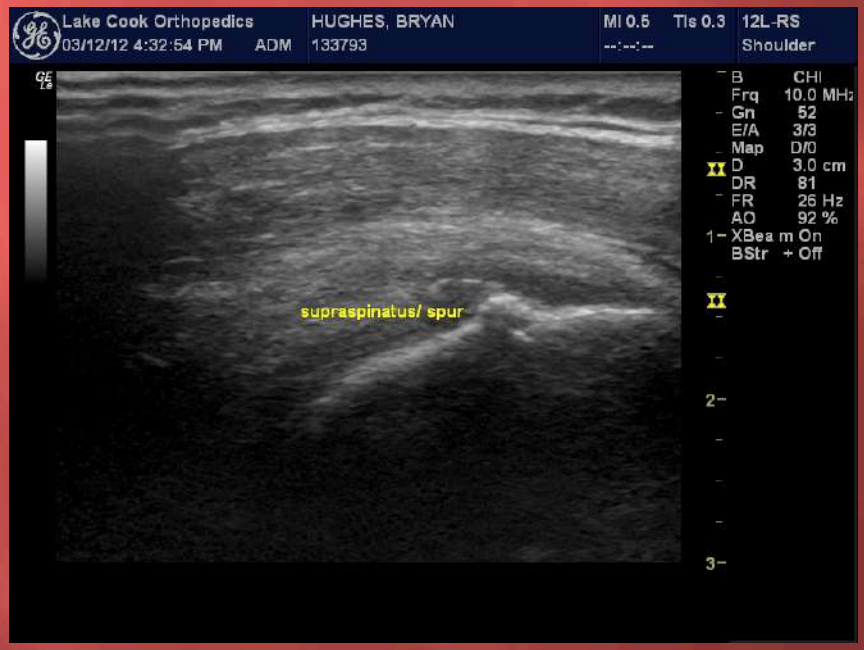
US terminology

SHORT AXIS VIEW OR TRANSVERSE PLANE

SHORT AXIS OR TRANSVERSE PLANE

Diagnose and treatment with MSK US

Pathology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HUGHES, BRYAN
133793
MI 0.5 TIs 0.3
12L-RS
Shoulder
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Frq 10.0 MHz
Gn 52
E/A 3/3
Map D/0
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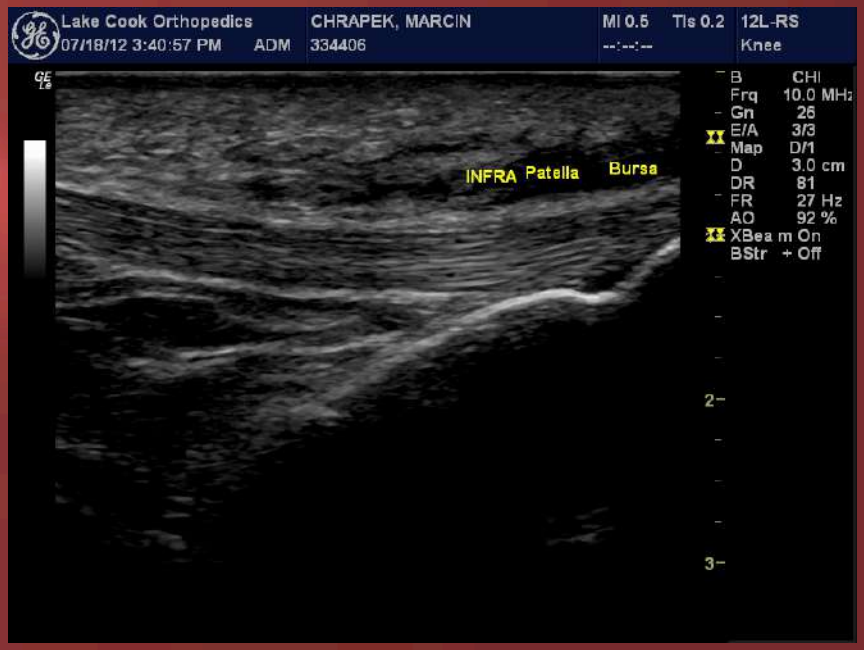
DR 81
FR 26 Hz
AO 92 %
XBeam On
BStr + Off
supraspinatus/ spur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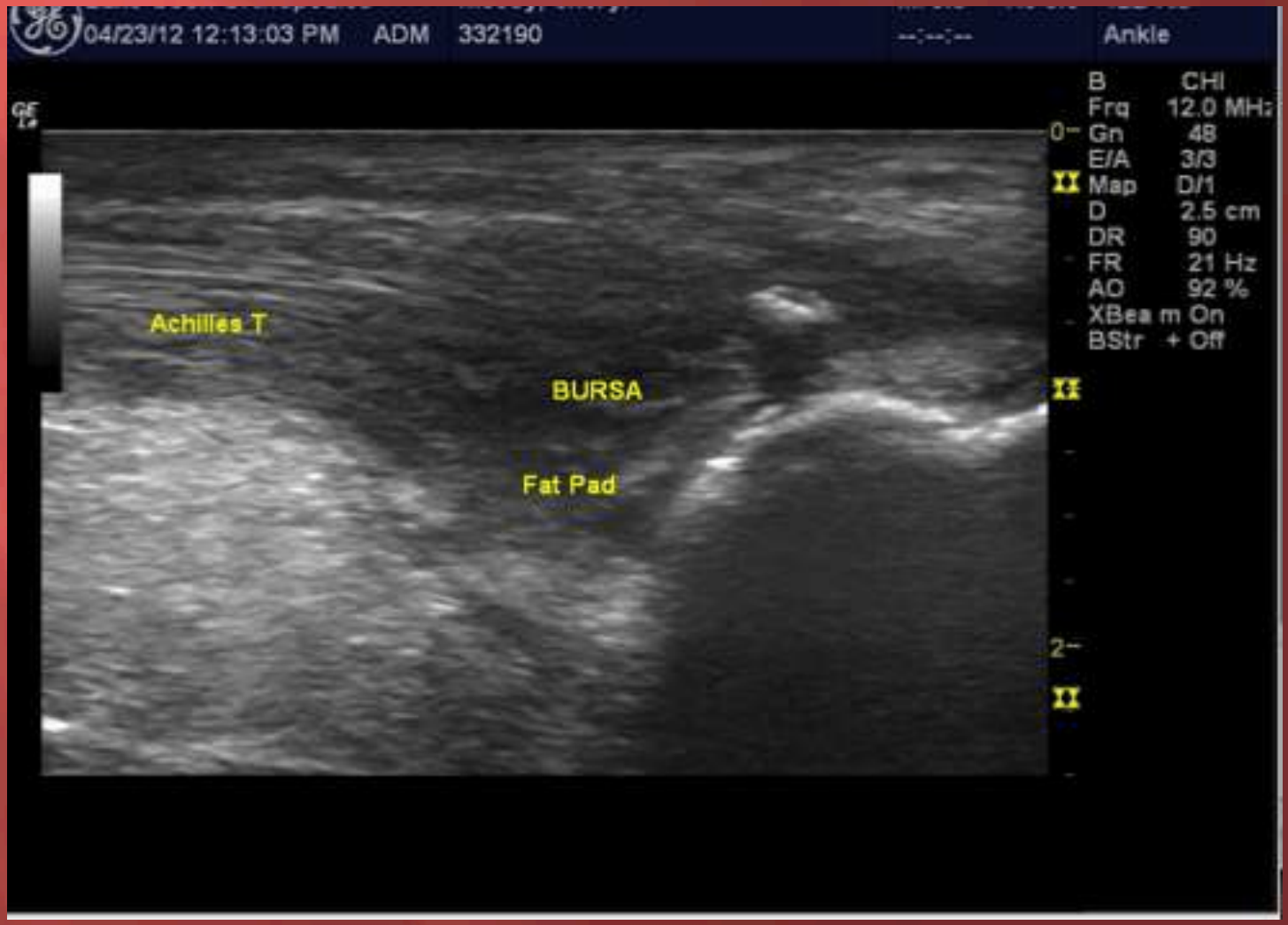
CHRAPEK, MARCIN
334406
MI 0.5 TIs 0.2
12L-RS
Knee
B CHI
Frq 10.0 MHz
Gn 26
E/A 3/3
Map D/1
D 3.0 cm
DR 81
FR 27 Hz
AO 92 %
XBeam On
BStr + Off
INFRA Patella Bursa

More pathology



Shoulder pathology

SUPRASPINATUS
ARTICULAR SIDED TEAR

- More MSK studies written about the shoulder since early use of US for MSK problems due to the anatomy of the shoulder which makes US a great modality.

Shoulder injuries in WC

- 3rd most common injury in workers
- Cause of RTC impingement can be intrinsic or extrinsic
  - Intrinsic can be trauma or degeneration of the RTC with instability
  - Extrinsic can be boney changes or nerve root compression
- Loss of scapular motion or imbalance between the ST and GH muscular or arm elevation >90 degrees increase risk of RTC pathology

Shoulder conditions in WC

- RTC TEARS
  - Full thickness/partial thickness
- AC dislocations
- Subacromial impingement with RTC tear
- GH dislocation
- Biceps tendon rupture or tendinopathy

MSK US Versus MRI of the Shoulder

Meta analysis by Braen, et al" Diagnostic accuracy of US, MRI and MRI arthrography" Br. Journal of Sports Med. 2015;49(20) 1316-28

Conclusion that US is as sensitive and specific as MRI to diagnose RTC tears.

However, still cant see bone or labral pathology

NERVE INJURY

45 Y.O. CARPTENTER FOR 15 YEARS. COMPLAINES OF NUMBNESS AND PAIN IN THE PALM AND FIRST 2 1/2 DIGITS.

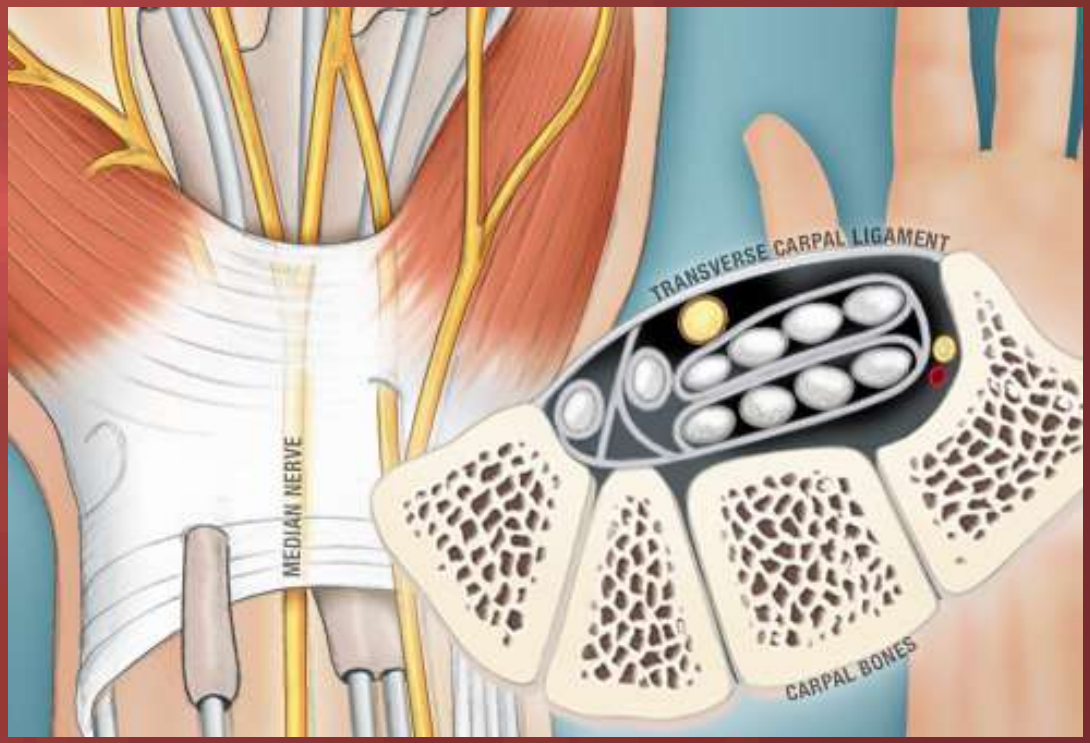
CONSTANTLY GRIPPING AND HAMMERING 20 HOURS PER WEEK.

ALSO USES CORDLESS DRILL AND NAIL GUN THAT VIBRATES ANOTHER 10 HOURS PER WEEK.

DENIES TRAUMA OR SIGNINIFICANT MEDICAL HISTORY BUT DOES SMOKE

EXAM

- LOSS OF SENSATIONT IN THE MEDIAN NERVE DISTRIBUTON
- POSITVE TINEL S SIGN AT THE WRIST
- NEGATIVE PHALENS TEST
- POSITIVE MEDIAN NERVE COMPRESSION TEST
- MMT IS 5/5 IN INTRINSIC HAND MUSCLES
- SPURLING IS NEGATIVE AND DTR ARE NORMAL



CTS

MOST COMMON NERVE ENTRAPMENT SYNDROME

CTR IS TWICE AS COMMON AS RTC REPAIR

ESTABLISHING WORK RELATENESS

- Exposure: workplace activites which cause or contribute to CTS: intense keyboard 12-20 hours/week, constant gripping, forceful /repetitive
- Outcome: a diagnosis of CTS
- Relationship: evidence which establishes 50% probability that workplace activities contributed to the development or worsening of the condition: High –low : probability of work relatedness

Nerve pathology

ABNORMAL US FINDINGS

- Increase cross section area just proximal to site of entrapment
- Nerve flattening at the site of entrapment
- Change in nerve echotexture: hypoechoic, fasicle enlargement, increase vascularity, mobility

COMMON NERVE ENTRAPMENTS

- CTS: US is 85% sensitive and specific in several studies looking at CSA of the median nerve at the wrist or ratio proximal/ distal
- Ulnar neuropathy at elbow: enlargement, hypermobility, ratio 1.4 maximal enlargement to unaffected site

Neuropathy:

CARPAL TUNNEL SYNDROME

NERVE IS FLATTENED, ENLARGED, CSA> .12 CM AND HYPOECHOIC

CSA JUST PROXIMAL TOCT IS 1.2 TIMES LARGER

ULNAR NEUROPATHY AT ELBOW

NERVE IS ANECHOIC AND ENLARGED AREA CSA> .10CM, FLAT, HYPOECHOIC AND SUBLUXATION

Dynamic use of US

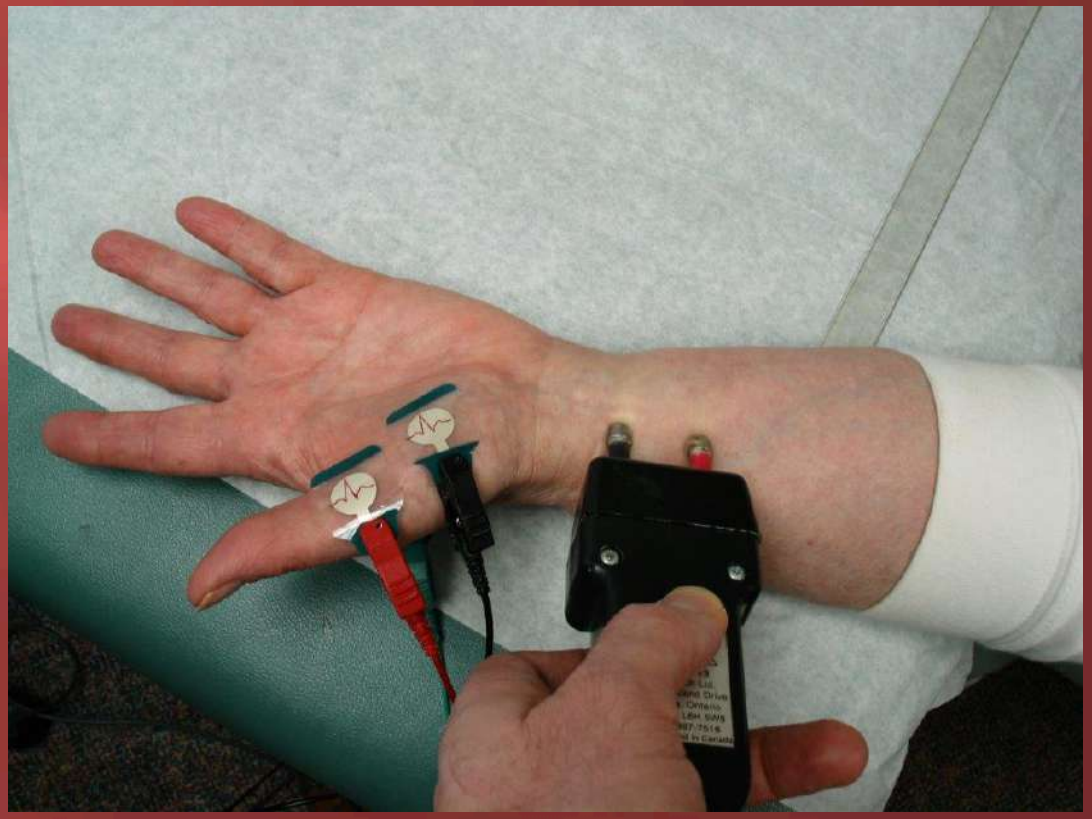
ULNAR NEUROPATHY WITHOUT SUBUXATION

EDX

- Sensitivity for ulnar neuropathy is between 50-75%
- Cant confirm subluxation like US

US / EDX use in CTS

- US COMPARE TO EMG/NCS IN CTS
- QUICKER AND CHEAPER THAN NCS/ EMG
- SENSITIVITY AND SPECIFICITY NOT AS GOOD AS NCT/EMG
- US IS NOT PAINFUL LIKE EMG
- But no measurements of severity with US currently



Nerve entrapment syndromes

Risk factors:

Vibration

Prolonged posture or awark positioning that increases pressure of the carpal tunnel

- Treatment:
- Modify work activities
- Bracing
- Steroid injection
- Ulnar neuropathy
  - Open release
  - Open sub C or sub muscular transposition
- CTR
  - Open
  - Endoscopic

Treatment of WC injuries with US guidance

- The advantage of using real time image guidance to improve accuracy and decrease the risk of injury

- All Joint injections but not great for the spine.
- Tendon sheath injections for steroid. Any tendon sheath can be visualized.
- Aspirations
- Nerve blocks

ACCURACY OF INJECTIONS

1. There is no study that shows that US decreases accuracy of injections

Accucuracy

Joint	US guidance	Blind
Glenohumeral joint	95%	79%
Subdeltoid/ Sub acromial	100%	63%
AC (1)	100%	45%
Knee (2)	99%	79%

- 1.Peck et al: *PMR* 2010; 2 :817-821
- 2. Curtis et al: PMR 2011; 6:

Accuracy

- However, the accuracy also depends on experience of years in practice and experience of using ultrasound : Curtis et al showed that the accuracy of injected the knee was from 55-100% depending on the experience of the physician
- SI joint 60-93%
- In addition when compared to " blind " surface localization, nerve stimulation, or emg, US guidance was superior in placement of needle for chemodenervation
- 1. Henzel et al PMR 2010
- 2. Jordan et al pain Physician, 2007
- 3.Mehmet et al US Med, 2003

Injection into SASD bursa

Hip Injection

Thank you
questions ???????????