

Ultrasound of the Shoulder with MRI Correlation

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Disclosures

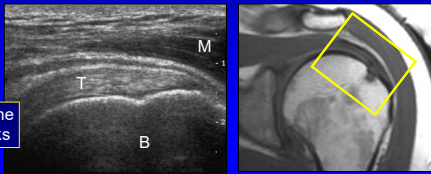
- Book Royalties: Elsevier
- Consultant: Bioclinica
- Advisory Board: POCUSPRO
- Not relevant to this talk

Syllabus on line and other educational material:
www.jacobsonmskus.com

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Ultrasound Appearance:

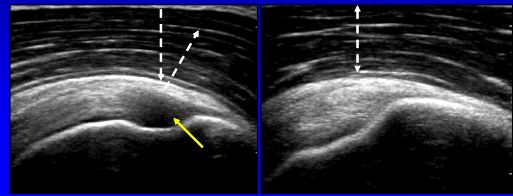
- Tendon: *hyperechoic*, fibrillar
- Muscle: relatively *hypoechoic*
- Bone cortex: *hyperechoic*, shadowing



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Anisotropic Effect

- Tendon is artifactually hypoechoic
- Sound beam is not perpendicular to fibers
- Tendon, ligament > muscle



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Outline:

- Rotator cuff:
 - Cuff tear and tendinosis
 - Secondary signs of cuff tear
 - Calcific tendinosis
- Biceps brachii tendon abnormalities
- Subacromial-subdeltoid bursa

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Rotator Cuff Tears

- Tears are hypoechoic / anechoic
- Indirect signs at ultrasound:
 - Cortical irregularity: supraspinatus footprint
 - If present on radiographs, 75% have tear
 - Volume loss
- Massive tear: non-visualization

AJR 1998; 171:229
Radiology 2004; 230:234

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Rotator Cuff Tear:

- Meta-analysis: 65 articles
- Full-thickness tears:
 - MRA, MRI, US = in sensitivity (92 – 95%)
 - MRA more specific
- Partial-thickness tears:
 - MRA most sensitive (86%) and specific
 - MRI (64%), US (67%)



de Jesus, AJR 2009; 192:1701

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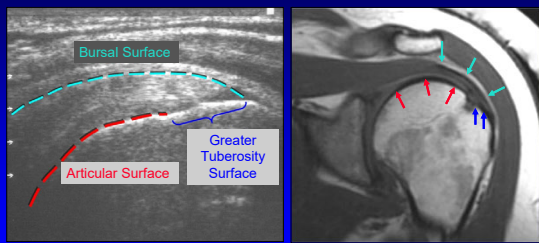
Rotator Cuff Abnormalities:

Categories:

- Partial-thickness tear
 - Articular-sided
 - Bursal-sided
 - Intrasubstance (or interstitial)
- Full-thickness tear
- Tendinosis

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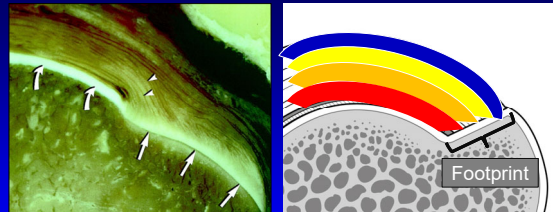
Supraspinatus: normal



Long Axis

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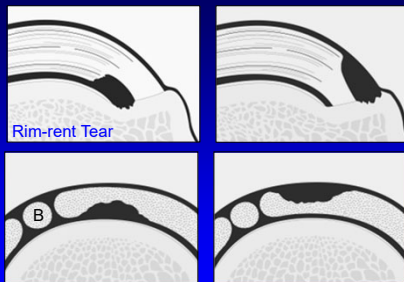
Supraspinatus Insertion



From: Siebold et al.
RadioGraphics
1999; 19:685

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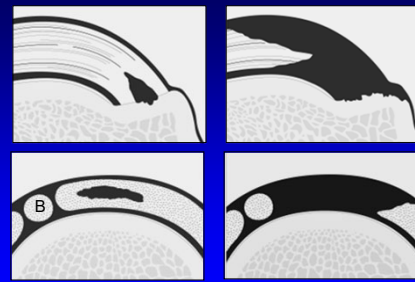
Supraspinatus Tears: extent



From: Fundamentals of Musculoskeletal Ultrasound

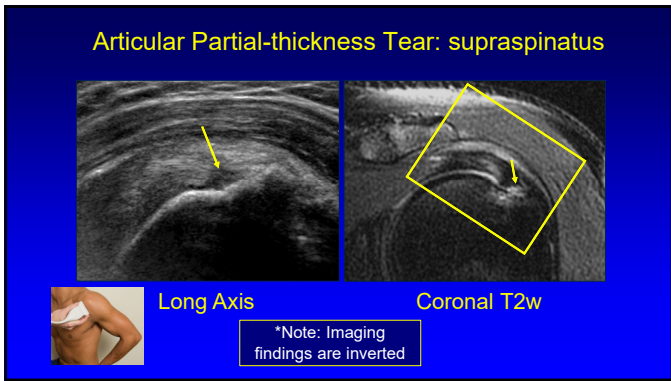
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Supraspinatus Tears: extent



From: Fundamentals of Musculoskeletal Ultrasound

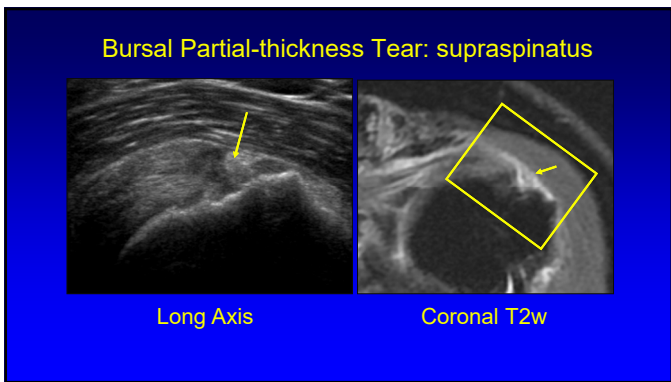
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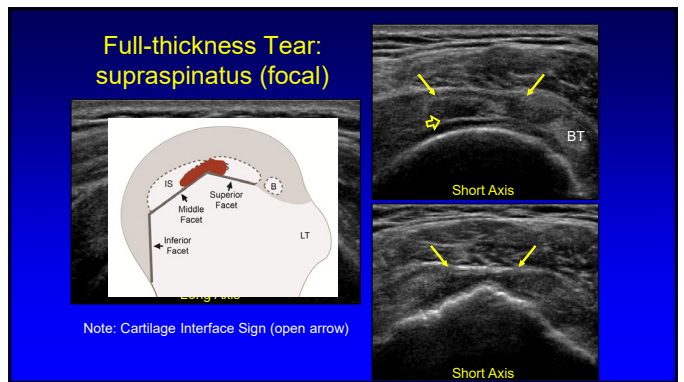
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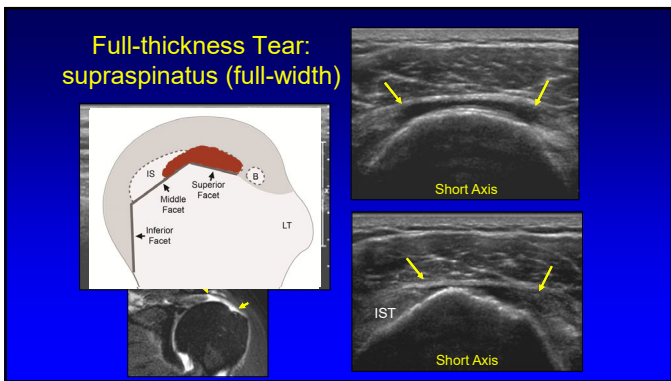
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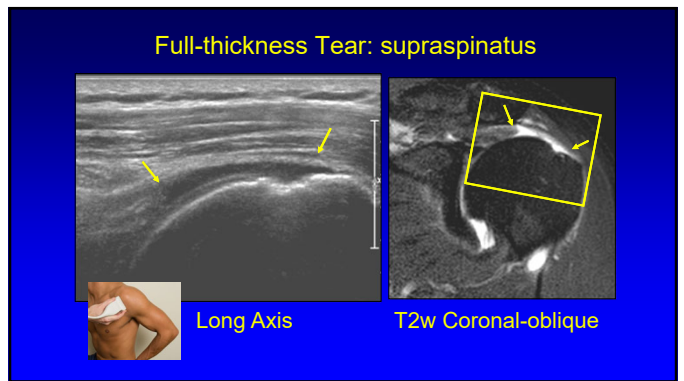
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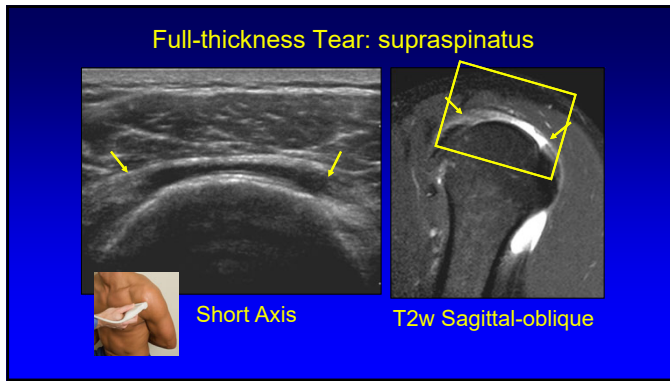
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Fatty Infiltration and Muscle Atrophy

- Supraspinatus and infraspinatus
 - Infraspinatus: only variable to predict cuff healing¹
- Associations:
 - Chronic, large, anterior supraspinatus tears²
- Ultrasound:
 - Moderate to good correlation with MRI³
 - Improved reliability with extended field-of-view⁴

¹Chung et al. Am J Sports Med; 2013; 41:16764
²Hodler et al. Radiology 2005; 237:584.
³Khoury et al. AJR 2008; 190:1105.
⁴Nazarian et al. 2008; 190:27.

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Fatty Infiltration and Muscle Atrophy

- Indistinct tendon-muscle border
- Increased muscle echogenicity
 - Compare to teres minor
- Decreased muscle bulk
 - Compared to teres minor
 - Bone landmark: ridge in scapula
 - Short axis: infraspinatus 2x size

Short Axis Long Axis

Teres Minor

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Atrophy: supraspinatus and infraspinatus

Supraspinatus Infraspinatus Teres Minor

Supraspinatus Infraspinatus

Normal

Short Axis (extended field-of-view)

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Tendinosis

- No inflammatory cells
 - Mucoïd degeneration, chondroid metaplasia
- Hypoechoic, ill-defined
- Possible increased thickness
- No cortical irregularity*

From: Hodler J, et al. J MRI; 2010; 32:165

*Radiology 2004; 230:234

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Tendon Tear versus Tendinosis

**both may appear hypoechoic*

Tear	Tendinosis
• Anechoic	• Hypoechoic
• Well-defined	• Ill-defined
• Homogeneous	• Heterogeneous
• Thinned	• Swollen
• Bone irregularity*	• Smooth cortex

*At supraspinatus tendon footprint in patients over 40 years old

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Secondary Findings of Rotator Cuff Tears:

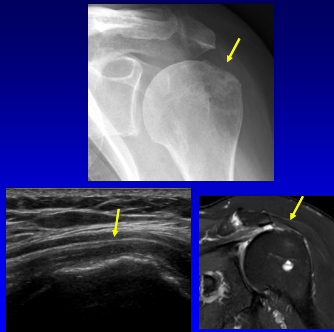
- Cortical irregularity
- Volume loss of tendon substance
- Cartilage interface sign
- Effusion (articular & bursal)

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Cortical Irregularity:

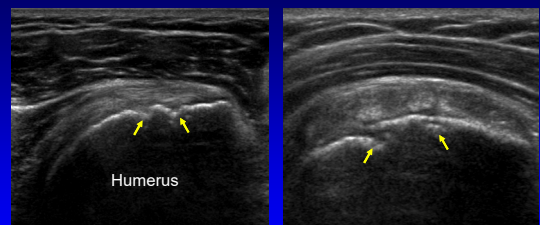
- Greater tuberosity: at **supraspinatus** insertion
- When present: 75% have rotator cuff tears
 - Patient over 40 years old
- When absent: 96% normal cuffs by sonography

AJR 1998; 171:229
Radiology 2004; 230:234



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Cortical Irregularity: no significance



Long Axis

Short Axis

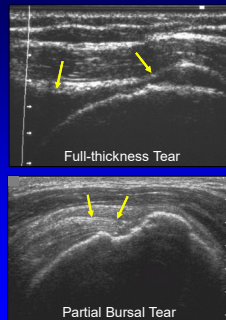
Subscapularis Tendon

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Tendon Volume Loss

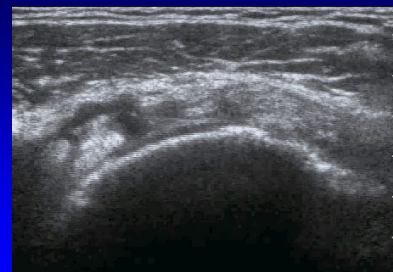
- Flat or concave outer margin of supraspinatus*
 - Deltoid muscle dips into tendon gap
- Full-thickness tears
- Bursal sided partial-thickness tears
- Not seen in tendinosis

*Hodler et al. Radiology 1988; 169:791



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Full-thickness Tear: supraspinatus



Short Axis

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Cartilage Interface Sign

- Reflective interface between hypoechoic hyaline cartilage and adjacent fluid
- Indicates articular tear extension
- Limited value: seen normally but not as pronounced

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Joint & Bursal Effusions

- Joint effusion (biceps tendon)
- Subacromial-subdeltoid bursal fluid: >1 mm distention
- If both: 95% positive predictive value for rotator cuff tear*

*Hollister et al. AJR 1995; 165:605

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Degenerative Calcification

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Calcific Tendinosis/Tendinitis

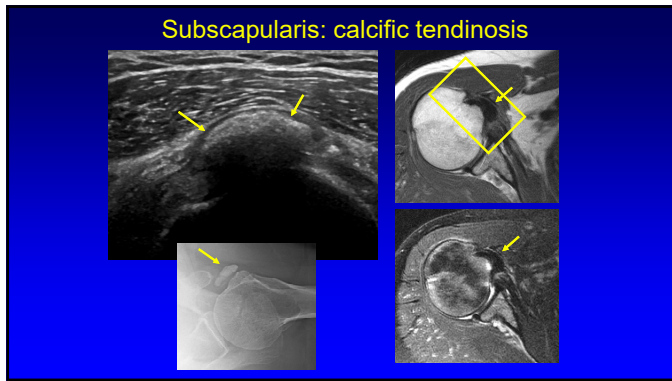
- Tendon metaplasia: calcium hydroxyapatite deposition
- Two phases:
 - Formative: well-defined, dense shadow
 - Resorptive: amorphous
- Percutaneous US-guided lavage/aspiration

Uthoff. J Am Acad Ortho Surg 1997; 5:183

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Calcific Tendinosis/Tendinitis

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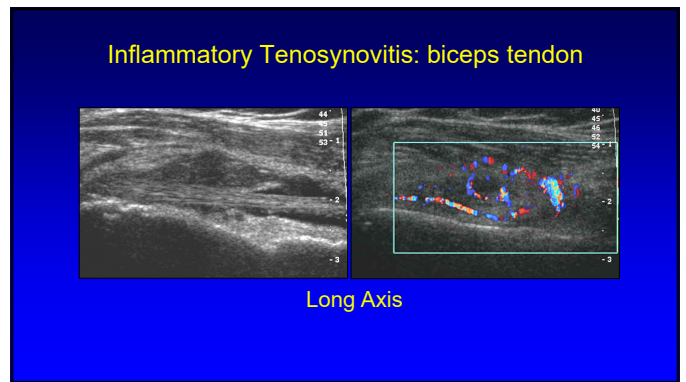
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- ### Outline:
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- ### Biceps Tendon:
- Shoulder joint effusion:
 - Collects around biceps tendon
 - Tendon sheath communication
 - Joint fluid collects dependently
-

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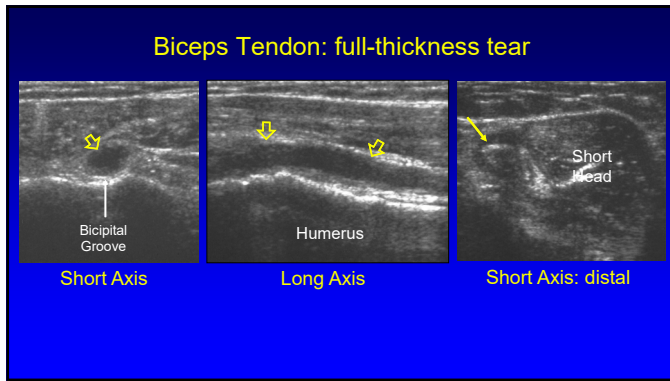
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- ### Biceps Tendon:
- Tendinosis:
 - Hypoechoic
 - Swollen
 - No inflammatory cells (not tendinitis)
 - Possible tenosynovitis
-

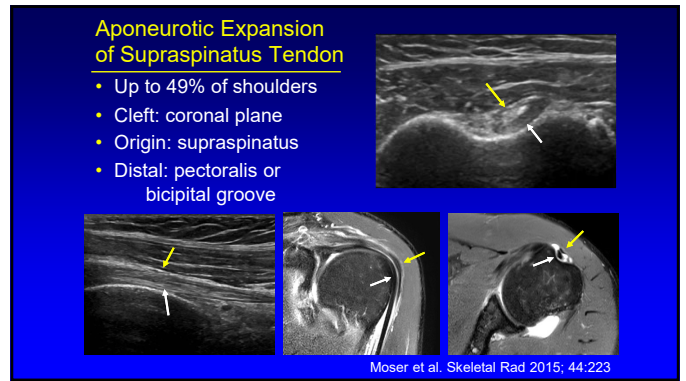
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- ### Biceps Tendon:
- Partial-thickness tear:
 - Hypoechoic / anechoic cleft
 - Tenosynovitis
 - Sensitivity: 27%
 - Accuracy: 88%
 - Subluxation / spur
 - Important secondary signs
- Skendzel J, et al. AJR 2011; 197:942
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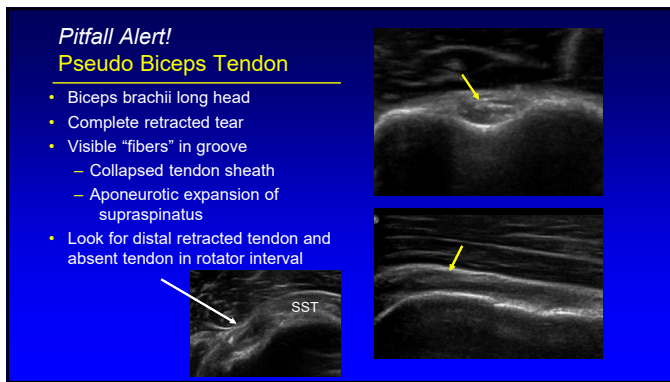
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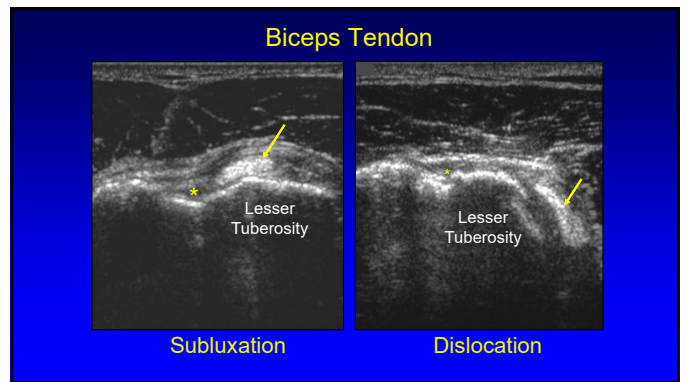
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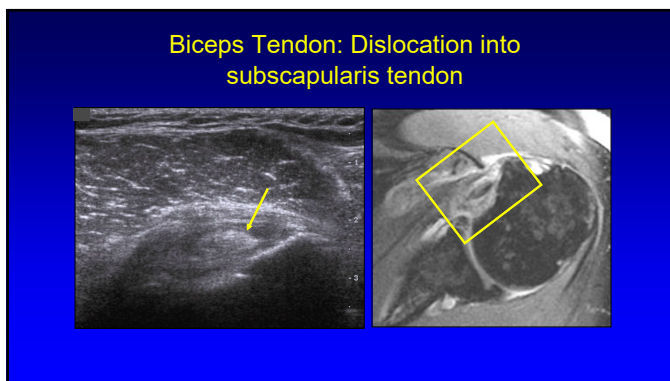
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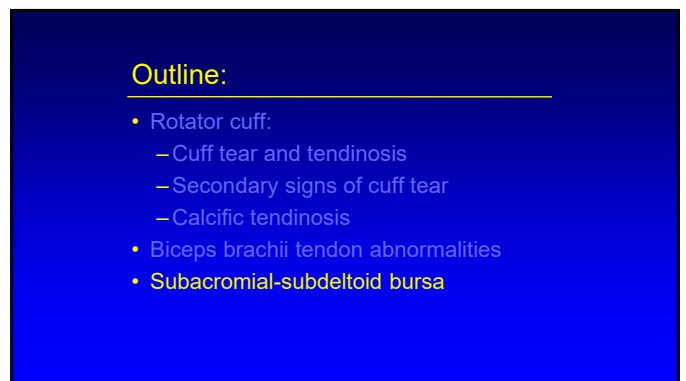
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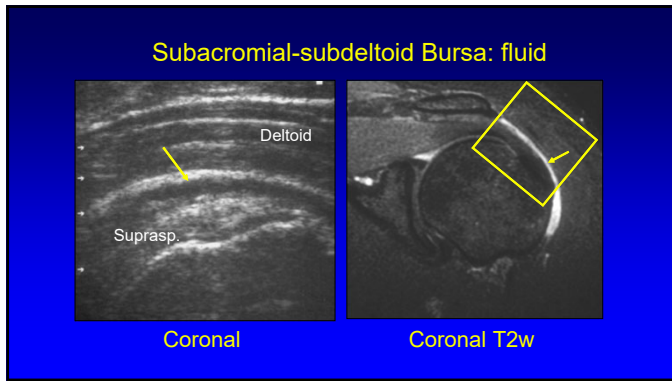
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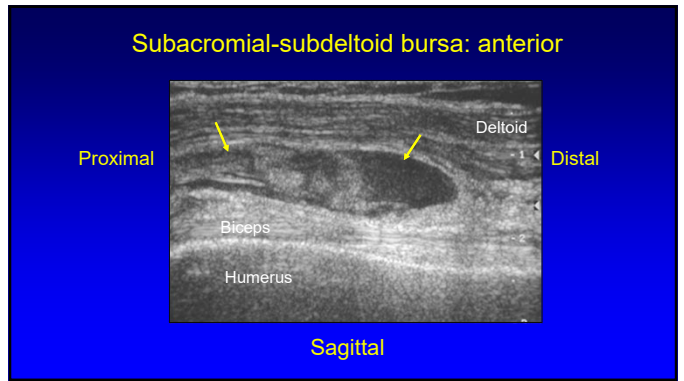
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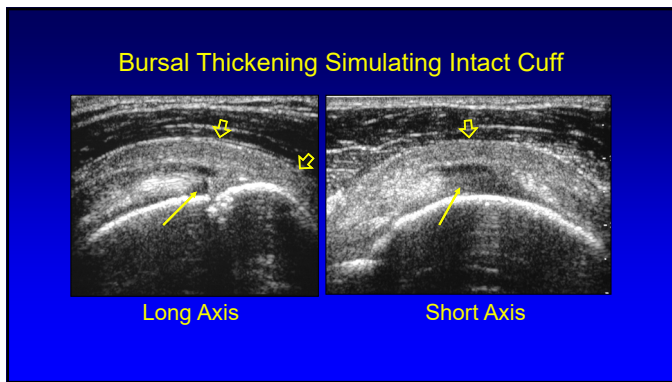
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- Take-home Points**
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- Must follow a protocol
 - Pitfalls:
 - Articular tear: focal anisotropy
 - Bursal tear: synovial hypertrophy
 - Biceps tear: aponeurotic expansion
 - Indirect signs: cuff tear
 - Cortical irregularity
 - Volume loss
 - Cartilage interface sign

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Thank you!

Syllabus on line and other educational material:
www.jacobsonmskus.com

Twitter handle: @jjacobsn

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