

Rotator Cuff Ultrasound with MRI Correlation

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Syllabus PDF

1

Disclosures

- Consultant: Bioclinica
- Book Royalties: Elsevier
- Not relevant to this lecture

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Fundamentals of Musculoskeletal Ultrasound are
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2

Rotator Cuff

- General comments
- Supraspinatus pathology
- Secondary signs of rotator cuff tear
- Infraspinatus and subscapularis
- Calcific tendinitis

3

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, 2009; 192:1701

4

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

5

Rotator Cuff Tears

- Supraspinatus: most common
- Patients < 40 years old
 - Not common
 - Partial, articular, anterior
 - Associated labral pathology
- Degenerative tears
 - Posterior aspect of supraspinatus
 - May extend anterior or posterior

6

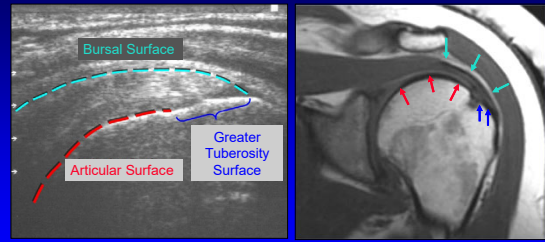
Rotator Cuff Abnormalities:

Categories:

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

7

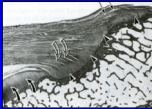
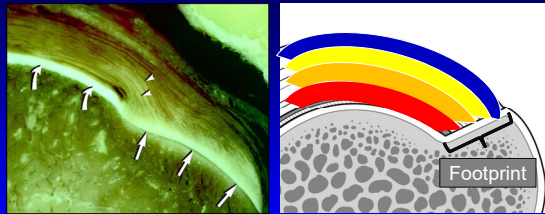
Supraspinatus: normal



Long Axis

8

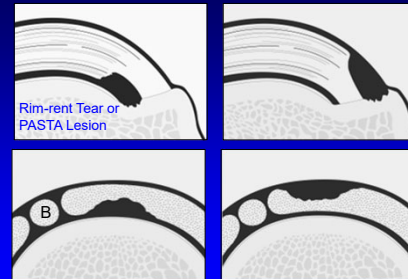
Supraspinatus Insertion



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

9

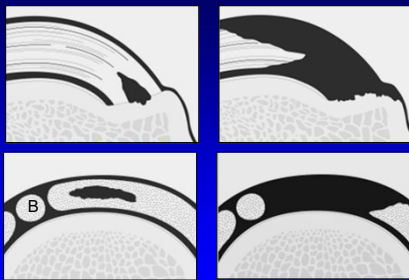
Supraspinatus Tears: extent



From: Fundamentals of Musculoskeletal Ultrasound

10

Supraspinatus Tears: extent

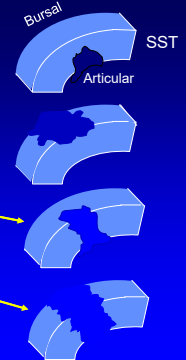


From: Fundamentals of Musculoskeletal Ultrasound

11

Rotator Cuff Tear: Extent

- Partial-thickness:
 - Interstitial
 - Articular
 - Bursal
- Full-thickness, focal:
 - Extends to two surfaces
- Full-thickness, full-width:
 - Entire tendon discontinuous



12

Rotator Cuff

- General comments
- **Supraspinatus pathology**
- Secondary signs of rotator cuff tear
- Infraspinatus and subscapularis
- Calcific tendinitis

13

Articular Partial-thickness Tear: supraspinatus

Long Axis Coronal T2w

*Note: Imaging findings are gray scale inverted

14

Pitfall Alert! Anisotropy

- Sound beam oblique to tendon fibers
- Artificially hypoechoic
- Most common location for this error: rim rent area

Supraspinatus: long axis

15

Articular Partial-thickness Tear: supraspinatus

Long Axis Coronal T2w

16

Articular Partial-thickness Tear: supraspinatus

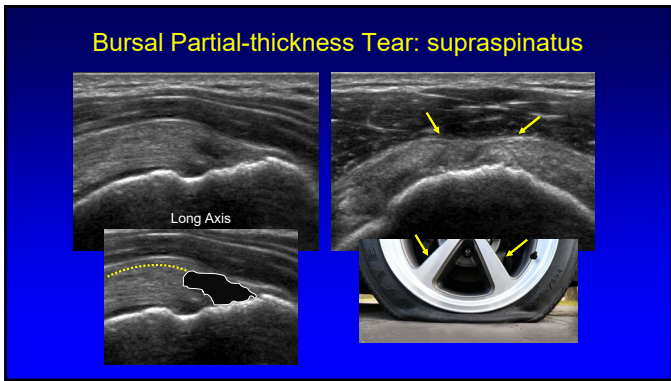
Long Axis Sagittal T2w

17

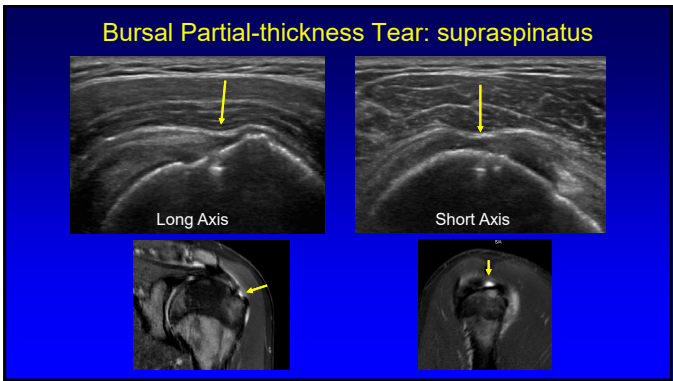
Bursal Partial-thickness Tear: supraspinatus

Long Axis Coronal T2w

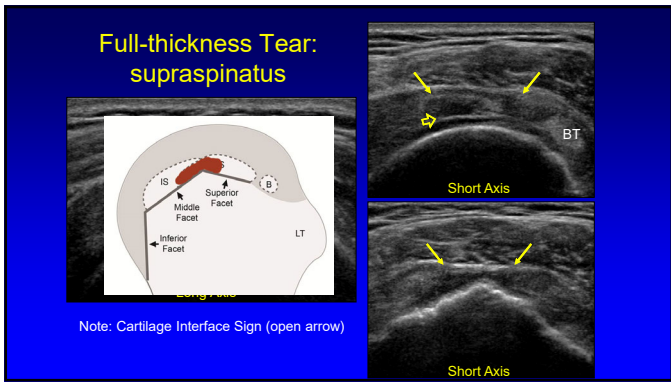
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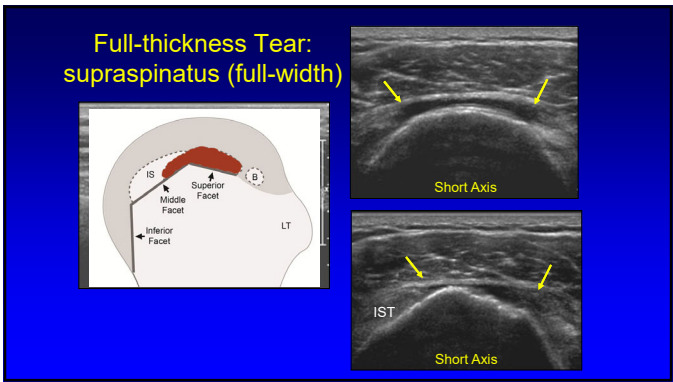
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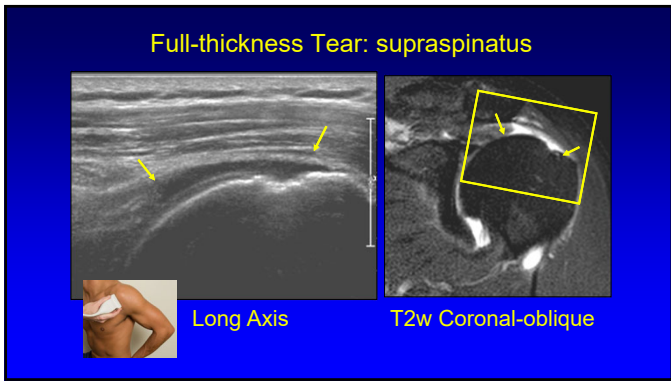
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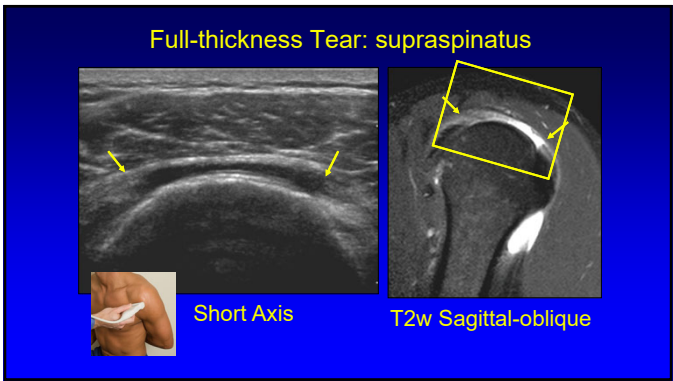
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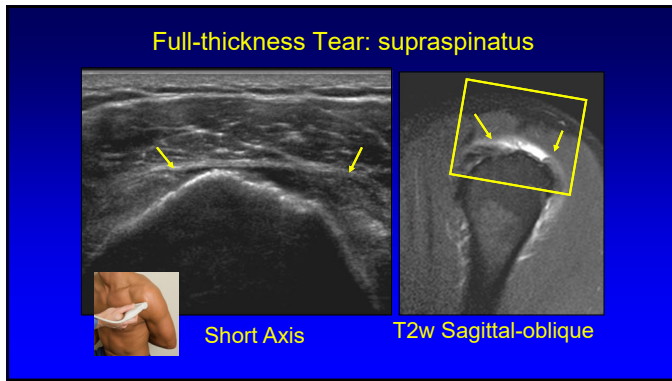
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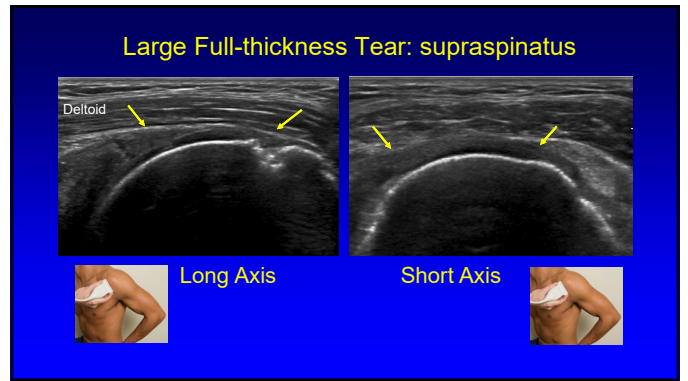
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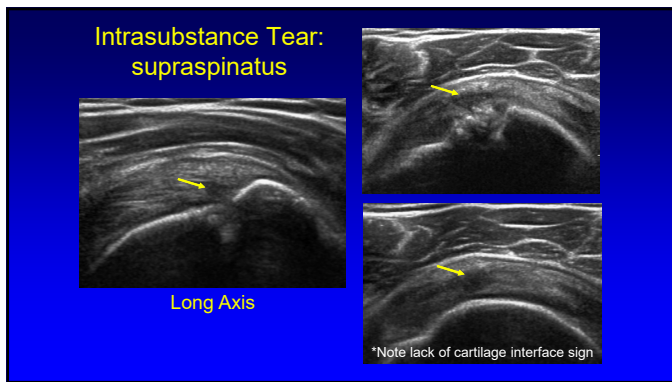
24



25



26



27

Tendinosis

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

From: Wilson JJ, et al. Am Fam Physician; 2005; 32:165

From: Hodler J, et al. J MRI; 2010; 72:811

*Radiology 2004; 230:234

28

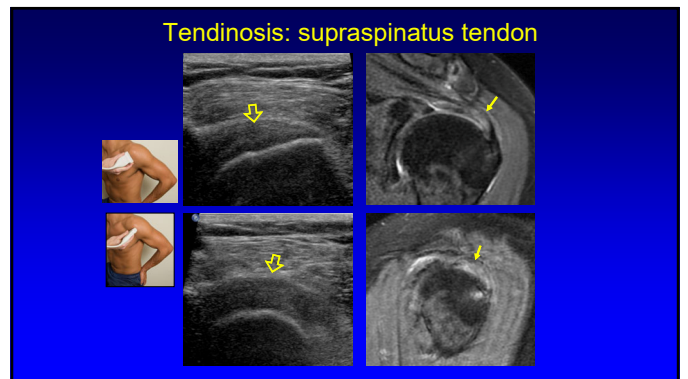
Tendon Tear versus Tendinosis

**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

29



30

Fatty Infiltration and Muscle Atrophy

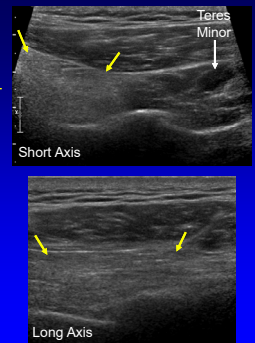
- Supraspinatus and infraspinatus
 - Infraspinatus: only variable to predict cuff healing¹
- Associations:
 - Chronic, large, anterior supraspinatus tears²
- Ultrasound:
 - Comparable to MRI³
 - Improved reliability with extended field-of-view⁴

¹Chung et al. Am J Sports Med 2013; 41:16764
²Hodler et al. Radiology 2005; 237:584.
³Wall LB et al. JBJS 2012; 94:e83.
⁴Nazarian et al. 2008; 190:27.

31

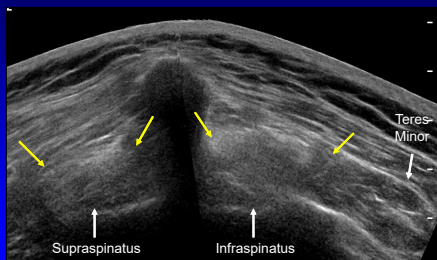
Fatty Infiltration and Muscle Atrophy

- 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



32

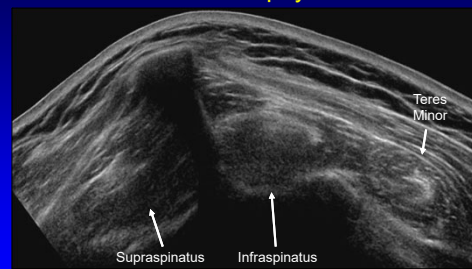
Atrophy: supraspinatus and infraspinatus



Short Axis (extended field-of-view)

33

No Atrophy



Short Axis (extended field-of-view)

34

Rotator Cuff Tears

- General comments
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- Calcific tendinitis

35

Secondary Findings of Rotator Cuff Tears:

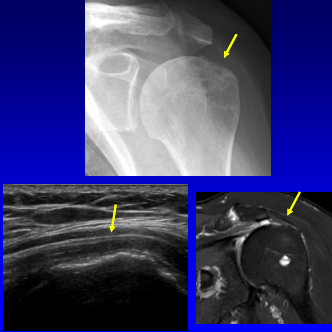
- Cortical irregularity
- Volume loss of tendon substance
- Effusion (articular & bursal)
- Cartilage interface sign

36

Cortical Irregularity:

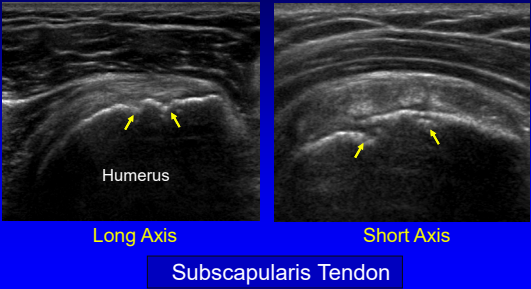
- Greater tuberosity: at **supraspinatus** insertion
- When present: 75% have rotator cuff tears
 - Patient over 40 years old
- When absent: 96% normal cuffs by sonography

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



37

Cortical Irregularity: no significance



Long Axis Short Axis

Humerus

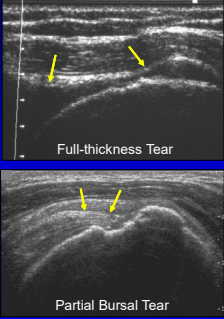
Subscapularis Tendon

38

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



Full-thickness Tear

Partial Bursal Tear

39

Full-thickness Tear: supraspinatus



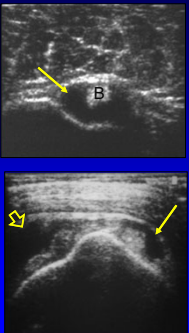
Short Axis

40

Joint & Bursal Effusions

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

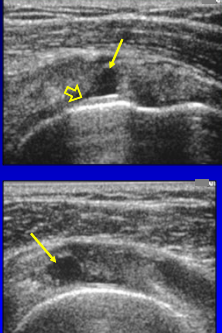
*Hollister et al. AJR 1995; 165:605



41

Cartilage Interface Sign

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



42

Rotator Cuff Tears

- General comments
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- **Infraspinatus and subscapularis**
- Calcific tendinitis

43

Infraspinatus: tendinosis

Middle Facet

Long Axis

BT

Greater Tuberosity

Short Axis

44

Infraspinatus Tear: full-thickness

SST

Long Axis

Short Axis

Long Axis

Long Axis

Short Axis

IST

45

Partial-thickness Articular Tear: subscapularis

Lesser Tuberosity

Long Axis

Short Axis

46

Focal Full-thickness Tear: subscapularis

Lesser Tuberosity

Short Axis

Contralateral

47

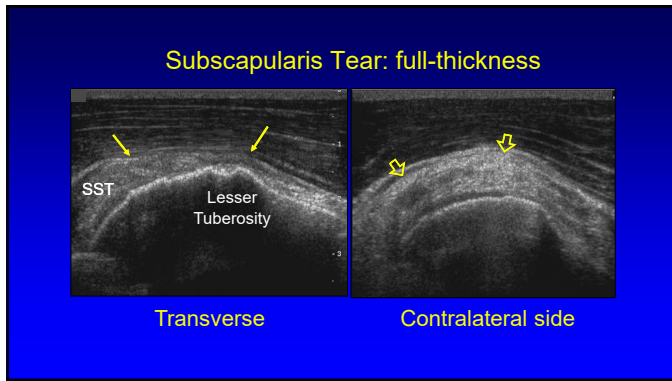
Subscapularis Tear: full-thickness

Lesser Tuberosity

Long Axis

Contralateral side

48



49

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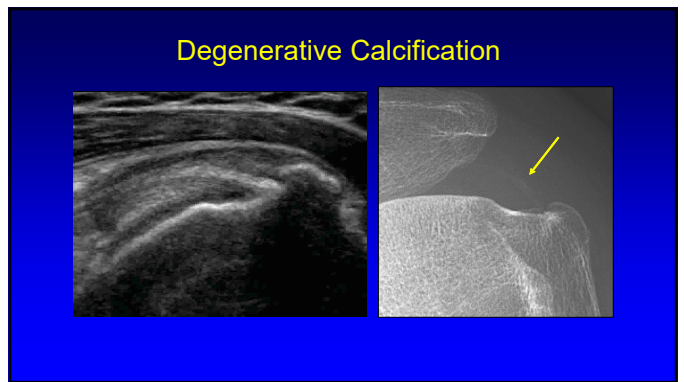
50

Tendon Calcification

- Degenerative:
 - Thin, linear
 - Background of tendinosis
- Calcific tendinosis / tendinitis:
 - Globular
 - Tendon metaplasia
 - Lavage and aspiration

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

51



52

Calcific Tendinosis

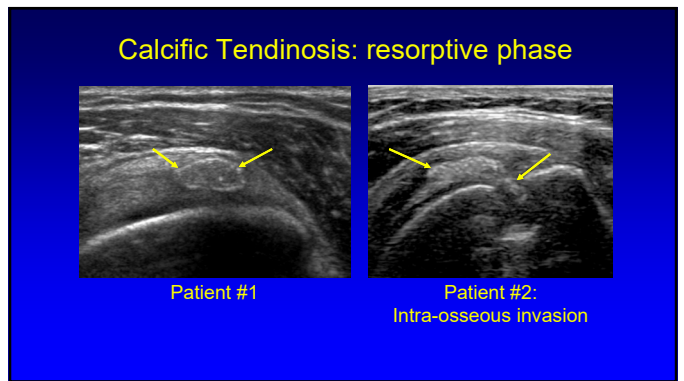
- Hydroxyapatite deposition: metaplasia
 - Usually do not have cuff tear
- Appearance:
 - 79% hyperechoic & shadowing
 - No shadow: 7%
- Two phases:
 - Formative
 - Resorptive: painful

Farin et al. Skeletal Radiol 1996; 25:551

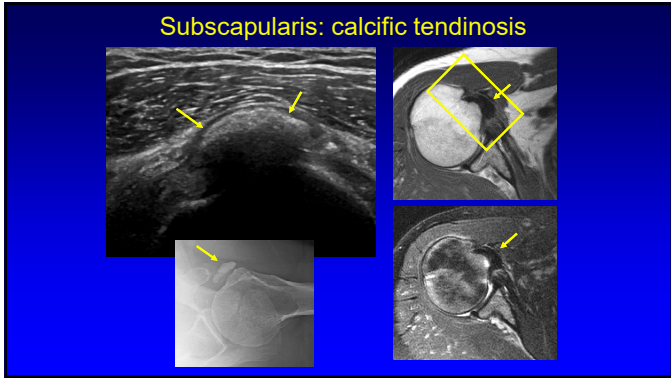
Formative
Defined, shadow

Resorptive
Amorphous, little shadow

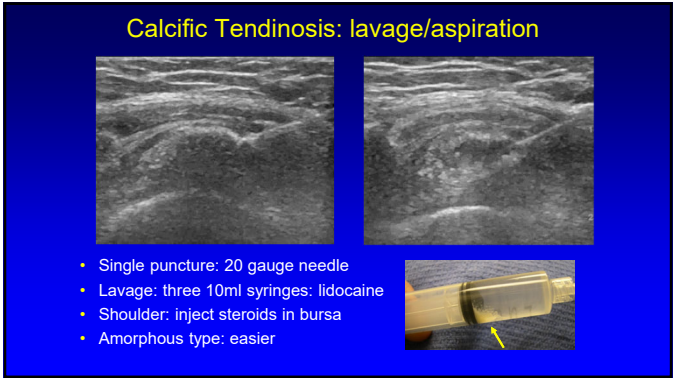
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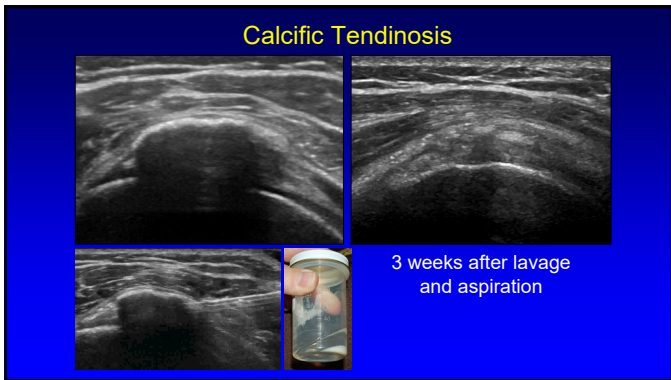
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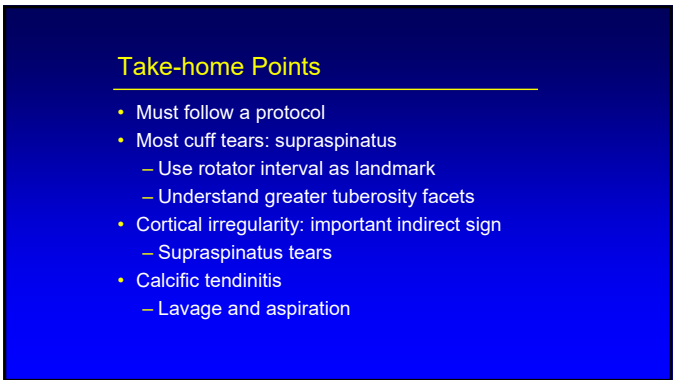
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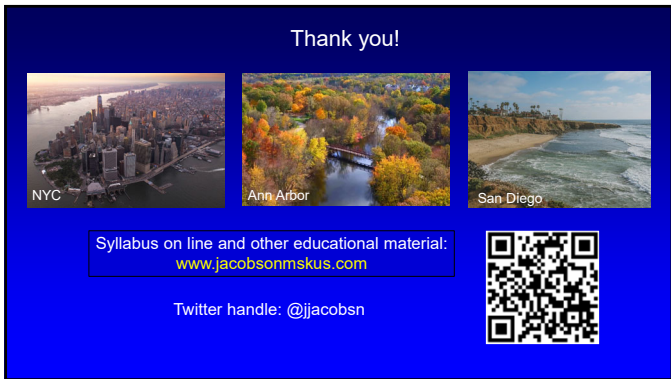
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57



58



59