Shoulder Ultrasound: Anatomy and Scanning Technique

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Disclosures

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

See www.jacobsonmskus.com for syllabus other educational material

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Rotator Cuff Anatomy:

- Supraspinatus
- Infraspinatus
- Teres Minor
- Subscapularis

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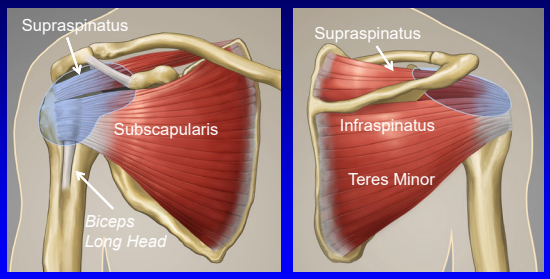
Rotator Cuff



Note: Subacromial-subdeltoid Bursa (light blue)

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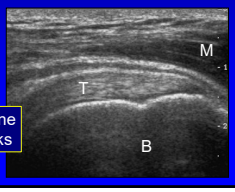
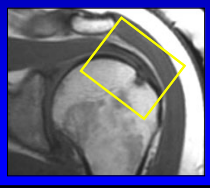
Ultrasound Appearance:

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





*Note: Bone Landmarks

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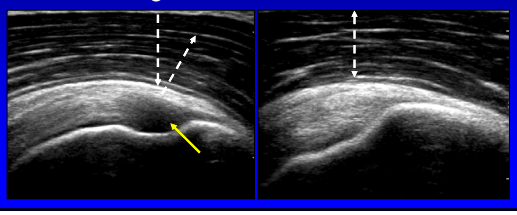
Anisotropic Effect

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



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Shoulder Ultrasound Examination

Left Shoulder

Right Shoulder

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Shoulder Ultrasound: 5 steps

1. Biceps Brachii: 2 images (short and long axis)
2. Subscapularis: 2 images (long and short axis)
3. Supraspinatus and infraspinatus: 6 images (long and short axis)
4. AC joint and impingement: 2 images
5. Posterior shoulder: 4 images
   A. Joint recess and spinoglenoid notch
   B. Infraspinatus and teres minor muscles
   C. Supraspinatus muscle, suprascapular notch

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Technique: position #1

- Neutral, supination
  - Hand on lap, palm up
  - Anterior (10-17 MHz)
  - Biceps tendon:
    - Transverse, longitudinal

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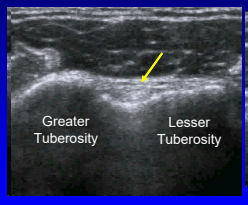
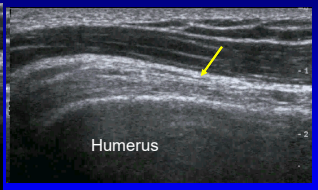
Long Head of Biceps Brachii Tendon



Short Axis



Long Axis

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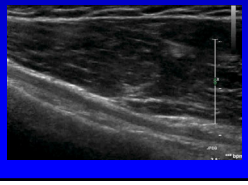
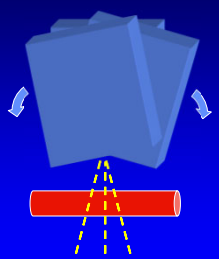
Scanning: basics

- Heel-toe maneuver
  - Evaluating long axis of tendon
  - Eliminate anisotropy





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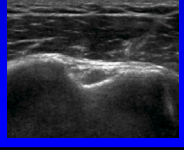
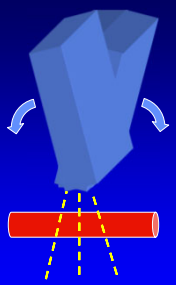
Scanning: basics

- Toggle
  - Evaluating short axis of tendon
  - Help identify tendon
  - Eliminate anisotropy





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Technique: position #1

- To find biceps longitudinal
  - Use bone landmarks
  - Find lesser tuberosity: pyramid shape
  - Move lateral to bicipital groove

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Long Head of Biceps Brachii Tendon

Long Axis

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Technique: position #2

- External Rotation
  - Anterior
  - 10-17 MHz linear
- Subscapularis tendon
  - Longitudinal, transverse
- Biceps dislocation

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External Shoulder Rotation

Subscapularis

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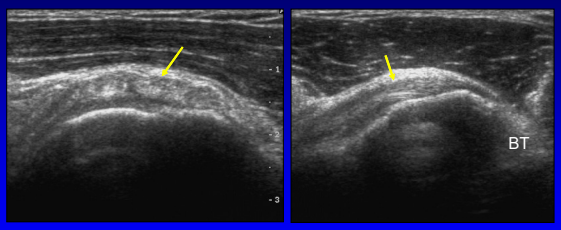
Subscapularis Tendon



Short Axis Long Axis

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Technique: position #3

- Internal rotation, extension
  - Hand at back pocket
  - Anterior (7-13 MHz linear)
  - Supraspinatus
    - Start longitudinal
  - Infraspinatus

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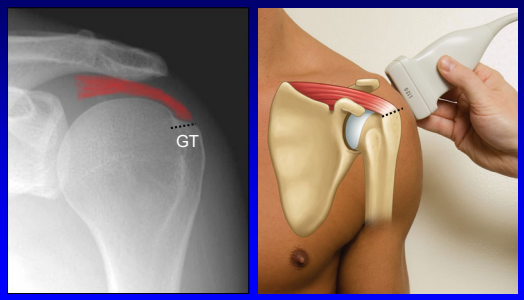
Neutral Position



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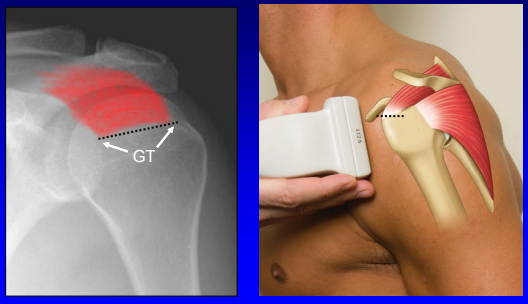
Internal Rotation



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Technique: position #3

- Modified Crass (or Middleton)
  - Hand at closest hip pocket
  - Easier to tolerate
  - Long axis: aim toward ear
  - Improved biceps visualization
  - Overestimates size*

Ferri, AJR 2005; 184:180

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Modified Crass Position

Long Axis

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Modified Crass Position

Short Axis

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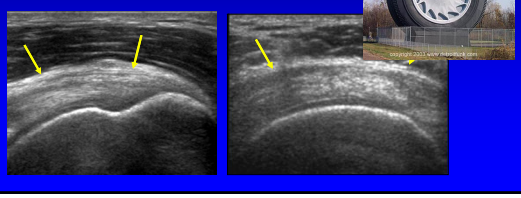
Supraspinatus Tendon: normal

- Hyperechoic and fibrillar echotexture
- Convex superior surface
- Uniform thickness: transverse



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Technical Considerations

- > 10 Mhz (prefer at least 12 Mhz)
- Supraspinatus: long axis most important plane
  - Less pitfalls, easy recognition of anatomy
  - >90% accuracy long axis alone[1]
- Biceps tendon (intra-articular)
  - Important landmark: complete evaluation

[1]Arend CF et al. J Ultrasound Med 2010; 29:1725

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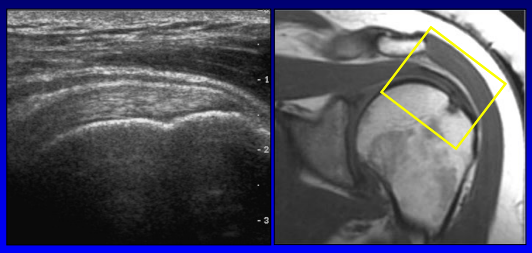
Supraspinatus: normal



Long Axis

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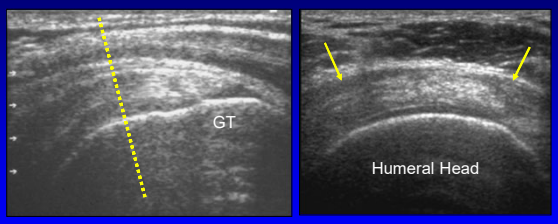
Supraspinatus Tendon: proximal



Long Axis

Short Axis
(Intra-articular)

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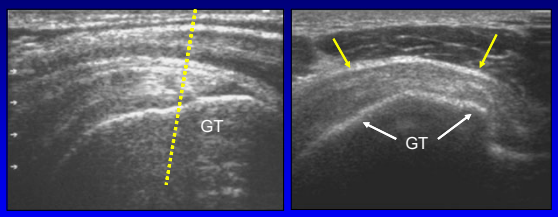
Supraspinatus Tendon: distal



Long Axis

Short Axis
(Greater Tuberosity)

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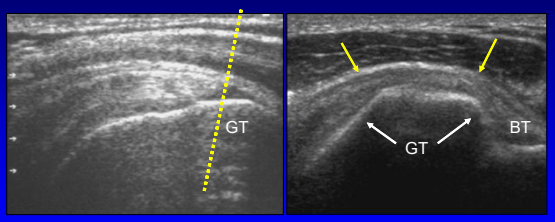
Supraspinatus Tendon: distal



Long Axis

Short Axis
(Greater Tuberosity)

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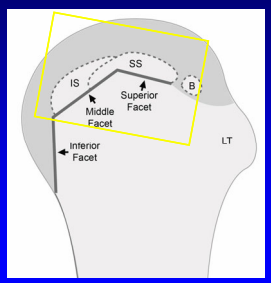
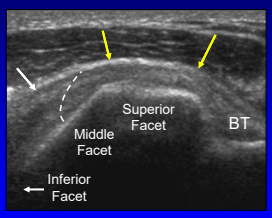
Supraspinatus and Infraspinatus Tendons





Short Axis
(Greater Tuberosity)

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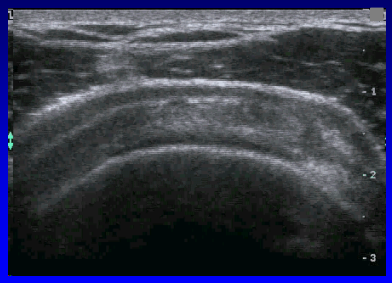
Supraspinatus and Infraspinatus Tendons



Short Axis

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Supraspinatus - Infraspinatus Junction

- Longitudinal:
  - Flattening of greater tuberosity
  - Tendon striations: anisotropy infraspinatus
- Transverse:
  - 1.3 – 2.3 cm posterior to biceps tendon
  - Infraspinatus overlaps supraspinatus
  - Slight volume loss

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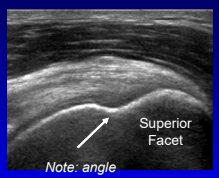
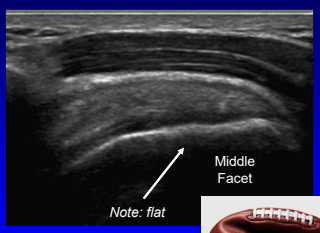
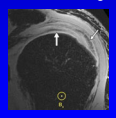
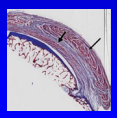
Supraspinatus – Infraspinatus Junction









Middle Facet: Int
overlaps supraspinatus

From: Chang EY et al. AJR 2014; 202:w376

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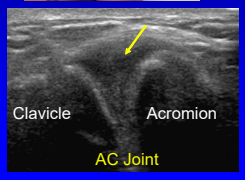
Technique: position #4

- Neutral position
  - 10-17 MHz linear
  - Acromioclavicular joint
  - Subacromial-subdeltoid bursa
  - Dynamic: impingement



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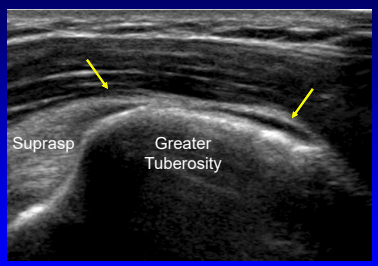
Subacromial-subdeltoid Bursa



Coronal

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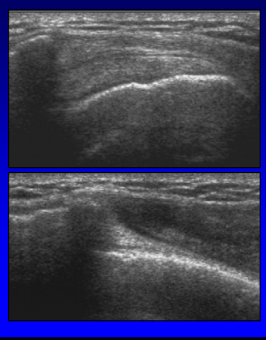
Impingement Test



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Technique: position #5

- Neutral position: posterior (5 – 12 MHz)
  - A. Posterior glenohumeral joint
    - Joint recess, infraspinatus
    - Labrum, spinoglenoid notch
  - B. Muscle atrophy
  - C. Suprascapular notch
    - Superior labrum

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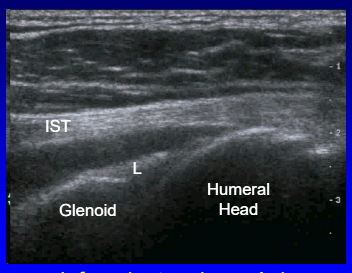
A. Infraspinatus Tendon & Posterior Labrum



Infraspinatus: Long Axis

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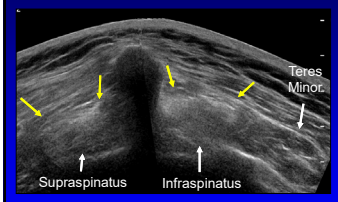
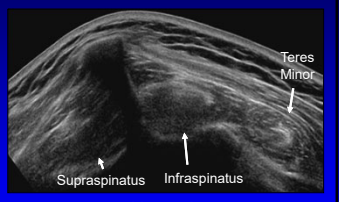
B. Atrophy: supraspinatus and infraspinatus





Normal

Short Axis (extended field-of-view)

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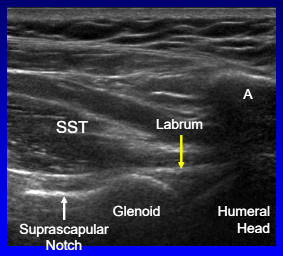
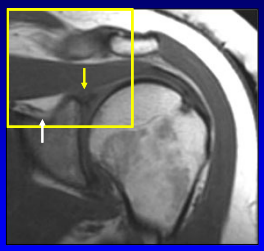
Suprascapular Notch and Superior Labrum





Coronal Plane

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Take-home Points

- Must follow a protocol
- Important landmarks:
  - Greater tuberosity facet anatomy
  - Rotator interval
- Pitfalls:
  - Anisotropy
  - Incomplete evaluation of supraspinatus

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Thank you!

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

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