Shoulder US: Anatomy, Technique, and Scanning Pitfalls[1]

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The accuracy of shoulder ultrasonography (US) is largely dependent on the US examination technique. It is essential that the individual performing the US examination has an understanding of pertinent anatomy, such as bone surface anatomy and tendon orientation. It is also important to be familiar with imaging pitfalls related to US technique, such as anisotropy. In this article, shoulder US scanning technique, as well as related anatomy and scanning pitfalls, will be reviewed. The use of a protocol-driven shoulder US examination is important to ensure a comprehensive and efficient evaluation. An on-line video tutorial demonstrating a shoulder US also accompanies this article.

Radiology

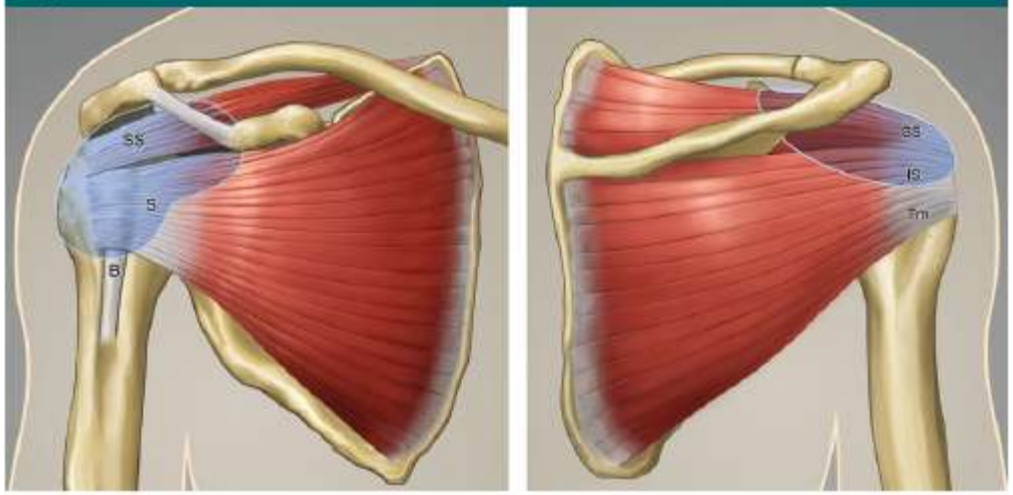
Essentials

- A protocol-driven to approach to shoulder US technique will ensure a comprehensive and efficient examination.
- Understanding bone surface anatomy is important to identify tendon orientation.
- Imaging should be aligned in short and long axis of a tendon.
- Anisotropy must be recognized and avoided.

Shoulder US Protocol

Step No.	Protocol
1	Biceps brachii tendon, long head
2	Subscapularis and biceps brachii tendon, subluxation/dislocation
3	Supraspinatus and rotator interval
4	Acromioclavicular joint, subacromial-subdeltoid bursa, and dynamic evaluation for subacromial impingement
5	Infraspinatus, teres minor, and posterior labrum

Figure 1



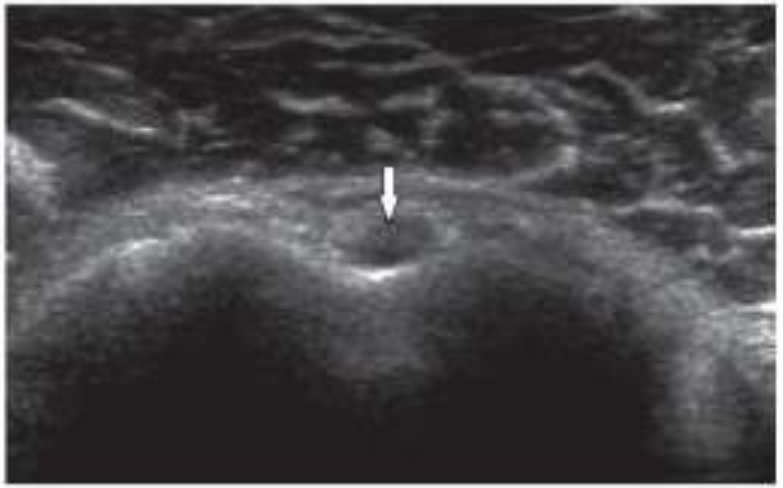
a. b.

Figure 1: Shoulder anatomy. Illustrations of **(a)** anterior and **(b)** posterior shoulder show supraspinatus *(SS)*, infraspinatus *(IS)*, subscapularis *(S)*, teres minor *(Tm)*, and long head of the biceps brachii tendon *(B)*. Subacromial-subdeltoid bursa is overlying the rotator cuff (light blue). (Image courtesy of Carolyn Nowak, Ann Arbor, Mich.)

Figure 4

a.

b.



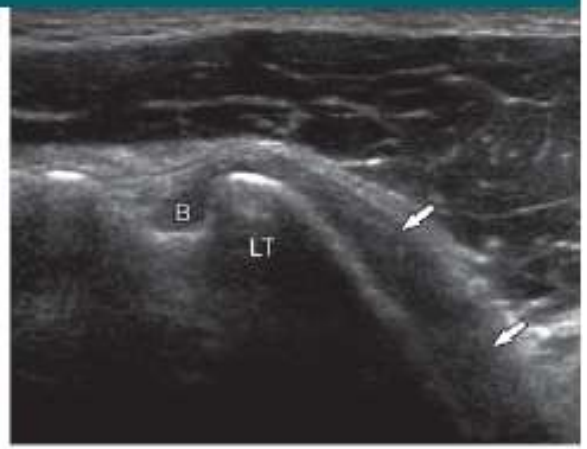
c.

Figure 4: Long head of the biceps brachii tendon (short axis). **(a)** Transducer placement. **(b)** Corresponding US image shows long head of the biceps brachii tendon (arrow) in the bicipital groove (arrowhead). *LT* = lesser tuberosity. Right side of image is medial. **(c)** US image shows hypoechoic appearance of the tendon (arrow) due to anisotropy when not imaged perpendicular to the sound beam.

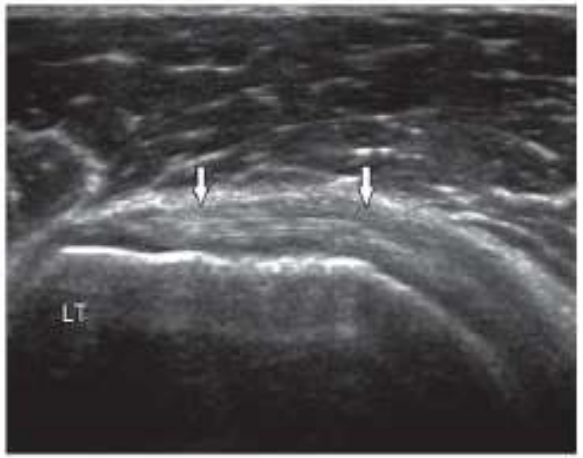
Figure 5

Figure 5: Long head of the biceps brachii tendon (long axis). **(a)** Transducer placement. **(b)** Corresponding US image shows long head of the biceps brachii tendon (straight arrows) in long axis. *D* = deltoid muscle. Curved arrow = subacromial-subdeltoid bursa. Right side of image is distal. **(c)** US image shows hypoechoic appearance of the tendon (arrows) due to anisotropy when not imaged perpendicular to the sound beam.

Figure 6



a.



b.

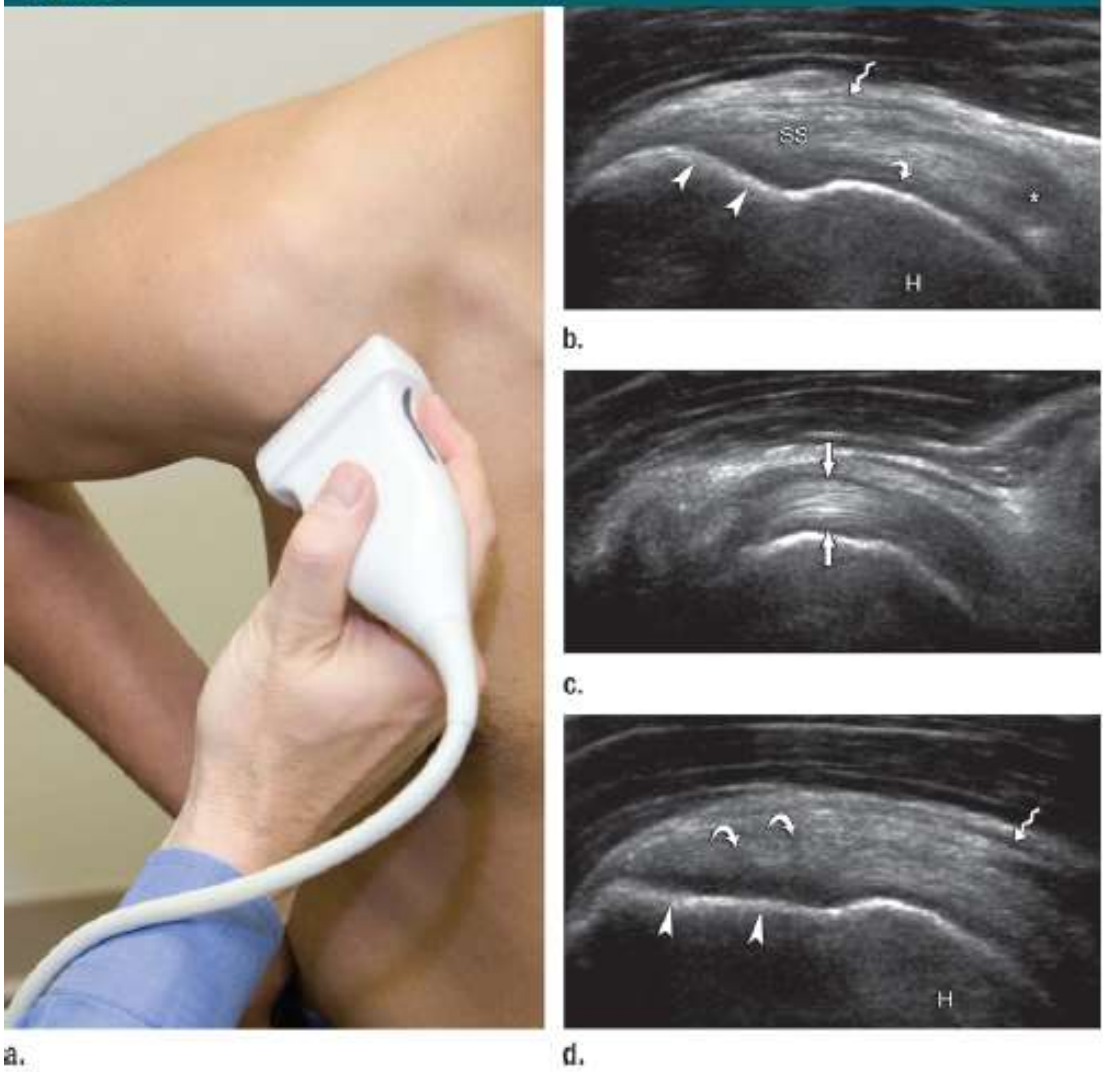
c.

Figure 6: Subscapularis tendon (long axis). **(a)** Centered over lesser tuberosity *(LT)*, US image shows subscapularis tendon (arrows) artifactually hypoechoic from anisotropy. *B* = biceps brachii tendon. Right side of image is medial. **(b)** Transducer placement with shoulder externally rotated. **(c)** Corresponding US image shows hyperechoic and fibrillar subscapularis tendon (arrows). *LT* = lesser tuberosity.

Figure 7

Figure 7: Subscapularis tendon (short axis). **(a)** Transducer placement with shoulder externally rotated. **(b)** Corresponding US image shows hyperechoic and fibrillar subscapularis tendon (arrows). *H* = humeral head. Right side of image is inferior. **(c)** US image shows hypoechoic tendon bundles from anisotropy (arrowheads) when not imaged perpendicular to the sound beam.

Figure 8



a. b. c. d.

Figure 8: Supraspinatus tendon (long axis). **(a)** Transducer placement with shoulder in modified Crass position. **(b)** Corresponding US image over superior facet of greater tuberosity shows hyperechoic and fibrillar supraspinatus tendon *(SS)*, demonstrating hypoechoic anisotropy where the tendon is oblique (*). Note superior facet (arrowheads), hyaline articular cartilage (curved arrow), and collapsed hypoechoic subacromial-subdeltoid bursa (squiggly arrow). *H* = humeral head. Right side of image is medial. **(c)** US image over rotator interval shows long head of biceps brachii tendon (arrows). **(d)** US image over middle facet of greater tuberosity shows flattening of the greater tuberosity (arrowheads) relative to the humeral head *(H)*. Squiggly arrow = subacromial-subdeltoid bursa. Note hypoechoic lines (curved arrows) from anisotropy at the junction of the supraspinatus and infraspinatus.

Figure 9

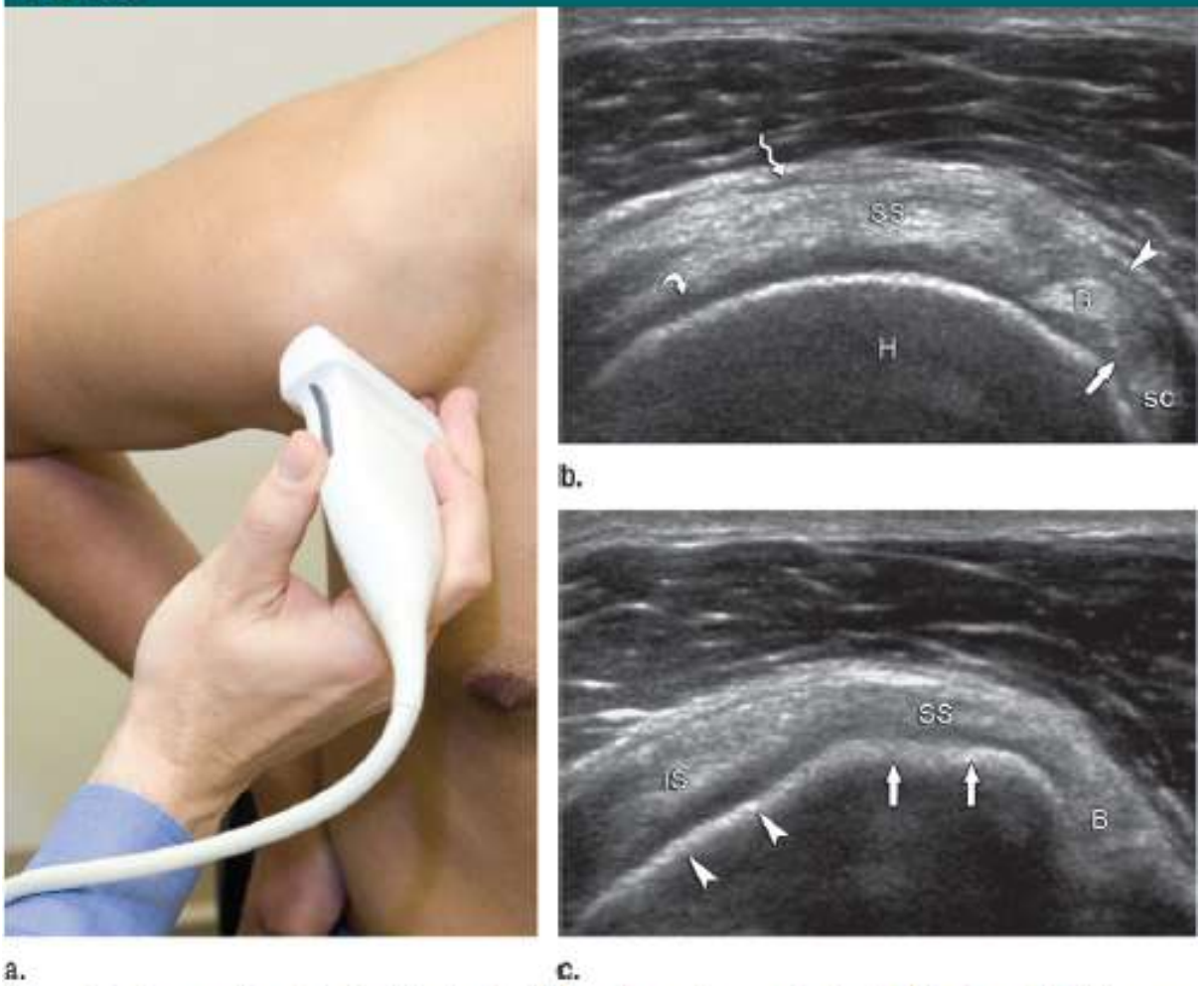
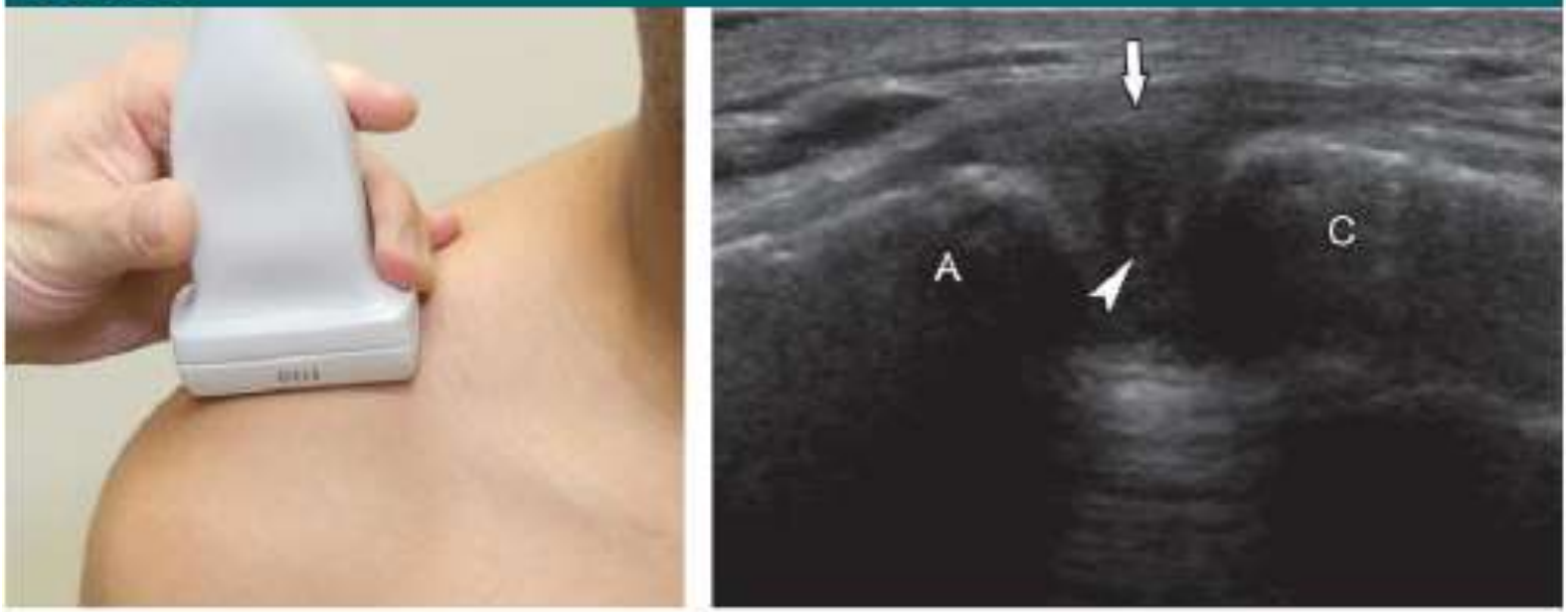


Figure 9: Supraspinatus tendon (short axis). **(a)** Transducer placement with shoulder in modified Crass position. **(b)** Corresponding US image over humeral head shows hyperechoic and fibrillar supraspinatus tendon *(SS)*. Note biceps brachii tendon *(B)* in the rotator interval with superficial coracohumeral ligament (arrowhead) and medial superior glenohumeral ligament (arrow). *SC* = subscapularis tendon, curved arrow = hyaline articular cartilage, squiggly arrow = subacromial-subdeltoid bursa, *H* = humeral head. Right side of image is anterior. **(c)** US image distal to articular surface over greater tuberosity facets shows supraspinatus tendon *(SS)* adjacent to superior facet (arrows), and infraspinatus tendon *(IS)* adjacent to middle facet of greater tuberosity (arrowheads). Note biceps brachii tendon *(B)*. Right side of image is anterior.

Figure 10



a. b.

Figure 10: Acromioclavicular joint. **(a)** Transducer placement over superior aspect of the shoulder. **(b)** Corresponding US image shows acromioclavicular joint (arrow) with characteristic hyperechoic bone contours of the distal clavicle *(C)* and acromion *(A)*. Note echogenic fibrocartilage disc (arrowhead). Left side of image is lateral.

Figure 11

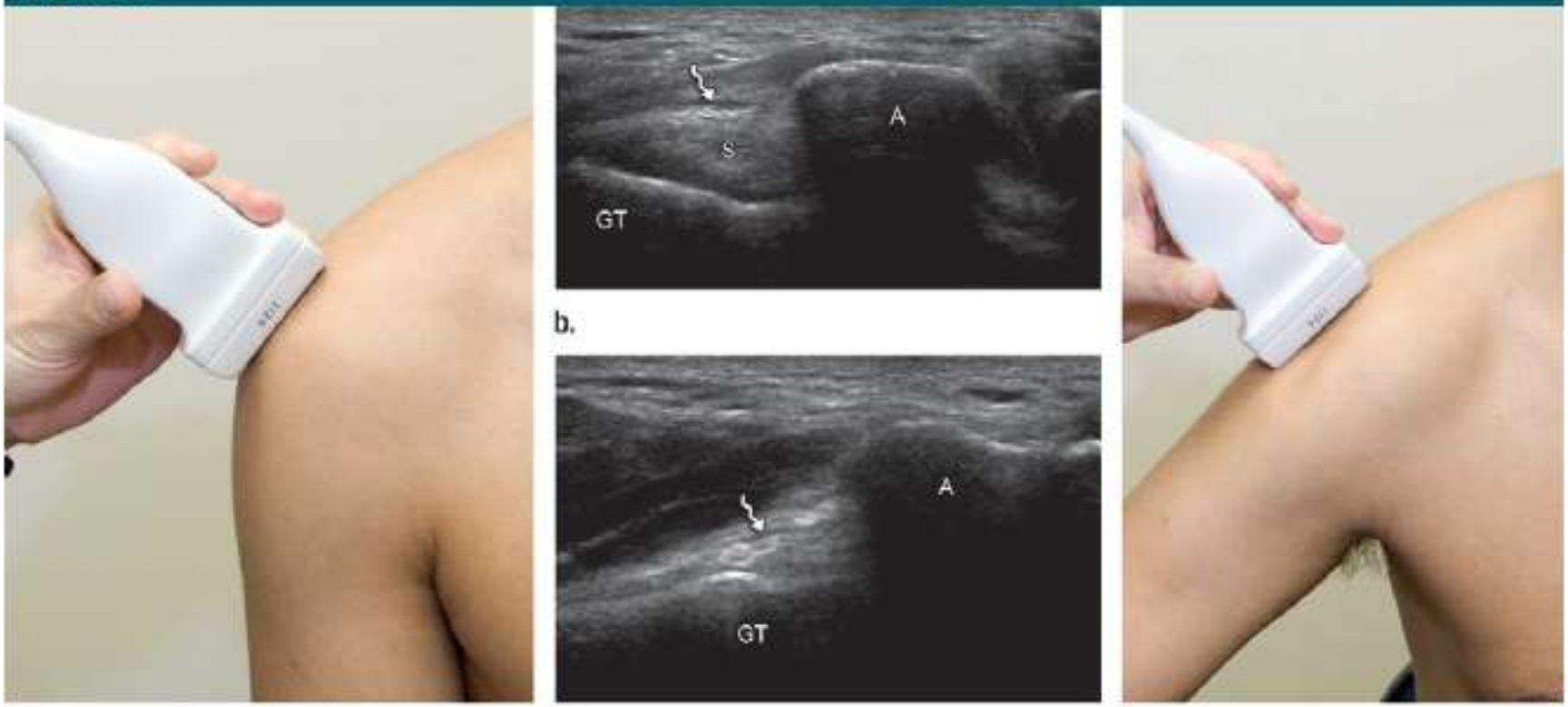


Figure 11: Dynamic assessment for subacromial impingement. **(a)** Transducer placement over superolateral aspect of shoulder in neutral position. **(b)** Corresponding US image shows acromion *(A)* and greater tuberosity *(GT)* with supraspinatus tendon *(S)* and collapsed subacromial-subdeltoid bursa (arrow). **(c)** Transducer placement after abduction of the shoulder. **(d)** US image shows acromion *(A)*, greater tuberosity *(GT)*, and normal collapsed subacromial-subdeltoid bursa (arrow). Left side of images is lateral.

Figure 12

Figure 12: Infraspinatus tendon (long axis), posterior glenohumeral joint, and spinoglenoid notch. **(a)** Transducer placement over posterior aspect of the shoulder in neutral position. **(b)** Corresponding US image shows characteristic contours of the humeral head *(H)* with adjacent infraspinatus tendon (arrows) and glenoid labrum (arrowheads). **(c)** US image medial to **b** shows spinoglenoid notch (arrowheads) of scapula with adjacent suprascapular vessels. Note infraspinatus musculotendinous junction (straight arrows) and central tendon (curved arrows). *H* = humeral head, *L* = labrum. Left side of image is medial.

Figure 13

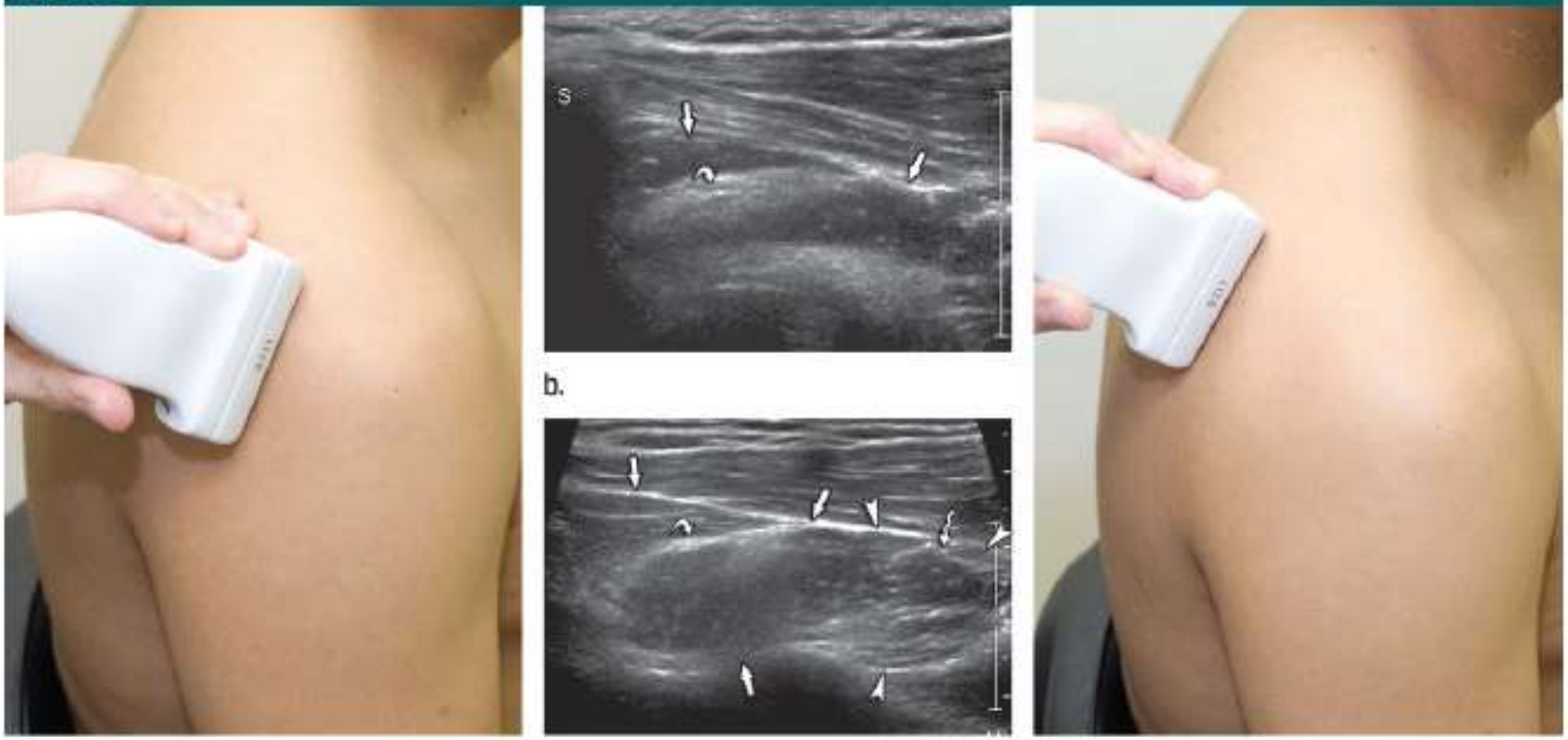


Figure 13: Infraspinatus and teres minor (short axis). **(a)** Transducer placement over posterior aspect of the shoulder in neutral position. **(b)** Corresponding US image shows infraspinatus (straight arrows) and central tendon (curved arrow). *S* = scapular spine. Left side of image is superior. **(c)** Transducer placement medial to **a.** **(d)** Corresponding US image shows infraspinatus (straight arrows) with central tendon (curved arrow) and teres minor (arrowheads) with more superficial tendon (squiggly arrow). Left side of image is cephalad.

http://radiology.rsna.org/content/suppl/2011/06/14/260.1.6.DC1/movie_1.mp4