

# 中華民國醫用超音波學會 骨骼肌肉系統學超音波基礎講習 ~ 肩關節之超音波檢查 ~

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## Introduction

- The shoulder is one of the most common applications of MSK-USD due to the high incidence of rotator cuff disorders related to increasing aging and sporting activities.
- MSK-USD is now widely recognized as an accurate means to evaluate rotator cuff disease.

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### Accuracy of MRI, MR Arthrography, and Ultrasound in the Diagnosis of Rotator Cuff Tears: A Meta-Analysis

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Loren N. Rotstein

**OBJECTIVE:** The purpose of this study was to compare the diagnostic accuracy of MRI, MR arthrography, and ultrasound for the diagnosis of rotator cuff tears through a meta-analysis of the literature in this domain.

**MATERIALS AND METHODS:** Articles regarding the sensitivity and specificity of MRI, MR arthrography, or ultrasound for the diagnosis of rotator cuff tears were identified. Sensitivity and specificity estimates were pooled using an inverse variance, summary statistic meta-analysis. Specificity estimates were pooled using a bivariate approach. The meta-analysis was performed using a random-effects model. Subgroup analyses were performed to compare the accuracy of each imaging modality in the diagnosis of partial and full-thickness rotator cuff tears. Results were presented as forest plots and summary estimates. Heterogeneity was assessed using the I-squared statistic. Publication bias was assessed using the Egger regression test.

**RESULTS:** Sixty-four articles met the inclusion criteria for this meta-analysis. In diagnosing a full-thickness tear or a partial-thickness rotator cuff tear, MR arthrography is more sensitive and specific than either MRI or ultrasound ( $P < 0.001$ ). There are no significant differences in either sensitivity or specificity between MRI and ultrasound in the diagnosis of partial or full-thickness rotator cuff tears ( $P > 0.05$ ). Summary ROC curves for MR arthrography, MRI, and ultrasound for all tears show the area under the ROC curve is greatest for MR arthrography (0.933), followed by ultrasound (0.889) and then MRI (0.876). Summary estimates of these curves show no significant differences between MRI and MR arthrography ( $P > 0.05$ ).

**CONCLUSION:** MR arthrography is the most sensitive and specific technique for diagnosing both full- and partial-thickness rotator cuff tears. Ultrasound and MRI are comparable in both sensitivity and specificity.

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### Diagnostic accuracy of ultrasonography, MRI and MR arthrography in the characterisation of rotator cuff disorders: a meta-analysis

Joan Silvestre-Ruiz,<sup>1,2</sup> Caroline Beale,<sup>3,4</sup> Juan Latorre,<sup>5</sup> François Denardis,<sup>1,4</sup> Clement E. Dvorak,<sup>6</sup> Jay C. MacDermid,<sup>6</sup> Nathalia J. Bortone,<sup>7</sup> Pierre Fontijn-Tekampel<sup>1,4</sup>

**OBJECTIVE:** Rotator cuff injuries resulting from overuse or trauma are a common cause of shoulder pain and disability. The aim of this meta-analysis was to evaluate the diagnostic accuracy of ultrasonography (US), MRI and MR arthrography (MRA) in the diagnosis of rotator cuff disorders. The meta-analysis was performed using a random-effects model. Subgroup analyses were performed to compare the accuracy of each imaging modality in the diagnosis of partial and full-thickness rotator cuff tears. Results were presented as forest plots and summary estimates. Heterogeneity was assessed using the I-squared statistic. Publication bias was assessed using the Egger regression test.

**RESULTS:** Sixty-four articles met the inclusion criteria for this meta-analysis. In diagnosing a full-thickness tear or a partial-thickness rotator cuff tear, MR arthrography is more sensitive and specific than either MRI or ultrasound ( $P < 0.001$ ). There are no significant differences in either sensitivity or specificity between MRI and ultrasound in the diagnosis of partial or full-thickness rotator cuff tears ( $P > 0.05$ ). Summary ROC curves for MR arthrography, MRI, and ultrasound for all tears show the area under the ROC curve is greatest for MR arthrography (0.933), followed by ultrasound (0.889) and then MRI (0.876). Summary estimates of these curves show no significant differences between MRI and MR arthrography ( $P > 0.05$ ).

**CONCLUSION:** MR arthrography is the most sensitive and specific technique for diagnosing both full- and partial-thickness rotator cuff tears. Ultrasound and MRI are comparable in both sensitivity and specificity.

**Conclusions** Our results show the diagnostic accuracy of US, MRI and MRA in the characterisation of full-thickness RC tears. Since full thickness tear constitutes a key consideration for surgical repair, this is an important characteristic when selecting an imaging modality for RC disorder. When considering accuracy, cost, and safety, US is the best option.

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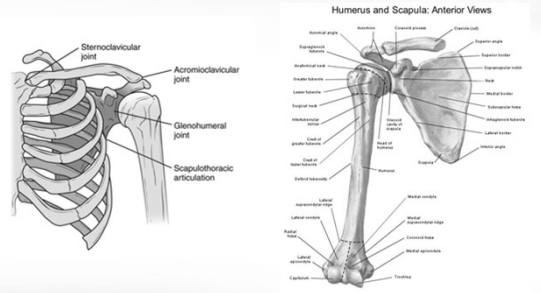
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- In addition to the rotator cuff, interest is also growing in the MSK-USD evaluation of a variety of abnormalities of articular and para-articular structures located in and around the shoulder area.
- A deep knowledge of anatomy, of the proper scanning technique and of the normal imaging findings is essential in order to perform an accurate shoulder examination with MSK-USD.

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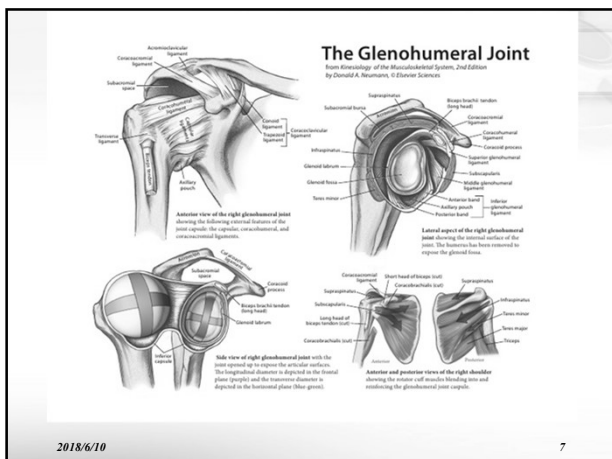
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## Clinical Anatomy



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### A Checklist for the Beginners

- Tendon
  - Biceps tendon
  - Rotator Cuff tendons
    1. Subscapularis tendon
    2. Supraspinatus tendon
    3. Infraspinatus tendon
    4. Teres minor tendon
- Joint
  - Acromioclavicular joint
  - Glenohumeral joint (posterior glenoid labrum)
- Ligament
  - Coracoacromial ligament

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### Biceps Tendon - Biceps Long Head

- Patient's elbow in flexion to 90 degrees
- Anatomic landmark
  - Bicipital groove
  - Biceps long head lies in the groove between the greater tuberosity and lesser tuberosity
- Scanning in 2 planes
  - Transverse view
  - Longitudinal view

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### Biceps Long Head - Transverse View

- Hyperechoic oval structure
- Image throughout its length
  - Rotator interval
  - Mid-tendon
  - Musculo-tendinous junction

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### Biceps Long Head - Longitudinal View

- Hyperechoic, parallel and fibrillar structure

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### Pitfall on Biceps Long Head

- Anisotropy
  - The echogenicity of the tendon is angle dependent

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### Subscapularis Tendon

- Anatomic landmark
  - Lesser tuberosity
  - Subscapularis tendon inserts to the lesser tuberosity
- Scanning in 2 planes
  - Transverse view
  - Longitudinal view

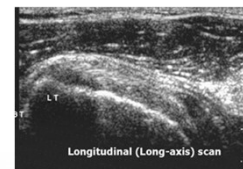


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### Subscapularis Tendon - Longitudinal View

- A band of medium-level echoes deep to the thin, convex echogenic line (subdeltoid fat)
- Subdeltoid bursa
- Dynamic view



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### Subscapularis Tendon - Transverse View



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### Supraspinatus Tendon

- Patient's arm in extension and internal rotation
- Anatomic landmark
  - Acromion of scapula
  - Supraspinatus tendon passes under the acromion and inserts to the greater tuberosity
- Scanning in 2 planes
  - Transverse view
  - Longitudinal view

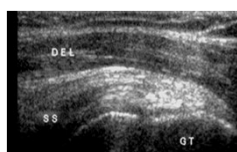


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### Supraspinatus Tendon - Longitudinal View

- Beak-shaped soft-tissue structure
- Subdeltoid fat layer: bright linear echoes
- Subdeltoid bursae: hypoechoic layer (normally < 2 mm)

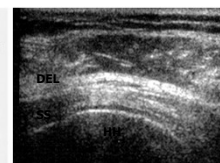


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### Supraspinatus Tendon - Transverse View

- A band of medium-level echoes deep to the subdeltoid bursae and superficial to the bright echoes originating from the bony surface of the greater tuberosity
- Articular cartilage of the humeral head: hypoechoic band



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### Infraspinatus Tendon

- Patient's hand placed on the contralateral shoulder
- Anatomic landmark
  - Spine of the scapula / posterior glenoid labrum
  - Infraspinatus lies inferior to the spine of the scapula and superficial to the posterior glenoid labrum, and the tendon inserts to the greater tuberosity of the humerus
- Scanning in longitudinal view

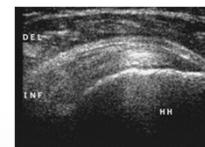


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### Infraspinatus Tendon - Longitudinal View

- A beak-shaped soft-tissue structure
- Posterior glenoid labrum: hyperechoic, triangular structure deep to the tendon
- Articular cartilage of the humeral head: thin, hypoechoic layer



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### Teres Minor Tendon



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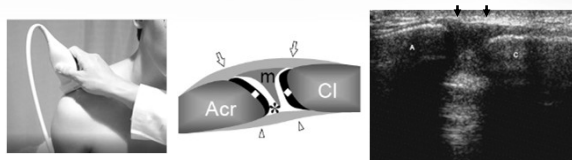
### Coracoacromial Ligament



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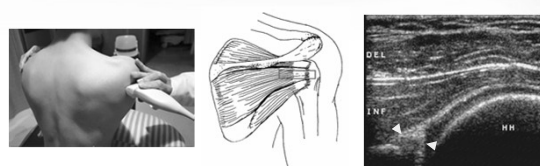
### Acromioclavicular Joint



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### Glenohumeral Joint (Posterior Glenoid Labrum)

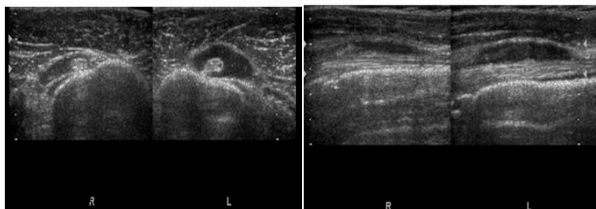


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## Bicipital Tenosynovitis

- Effusion within the tendon sheath



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## Effusion in the Biceps Tendon Sheath

- **Non-specific**
  - Bicipital tenosynovitis
  - Rotator cuff tear
  - Inflammatory arthropathy
  - Trauma
  - Infection

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## Rotator Cuff Tear

- Partial-thickness tear
- Full-thickness tear
- Complete tear

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## Rotator Cuff Partial-Thickness Tear

- The sonographic finding of a partial-thickness tear is a focal hypoechoic area, or more commonly a mixed hyperechoic and hypoechoic area within either the articular side, bursal side or intra-substance of the tendon.

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## Primary Signs of a Rotator Cuff Tear

- Nonvisualization of the cuff
- Localized absence or focal nonvisualization
- Discontinuity
- Focal abnormal echogenicity
- Herniation of the deltoid muscle or of the subacromial-subdeltoid bursa in the cuff

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## Secondary Signs of a Rotator Cuff Tear

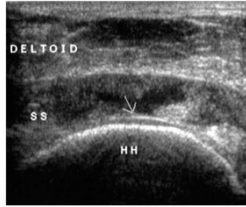
- Cortical irregularity of the greater tuberosity
- Cartilage interface sign
- Effusion in the biceps tendon sheath
- Effusion in the subacromial-subdeltoid bursa
- Glenohumeral joint effusion

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### Cartilage Interface Sign

- Prominent sonographic reflections from the interface between fluid within a defect in the rotator cuff tendon and the adjacent articular cartilage of the humeral head.



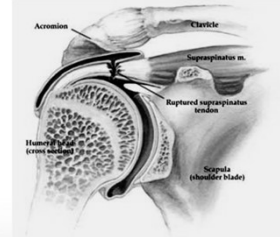
Transverse scan

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### Rotator Cuff Full-Thickness Tear

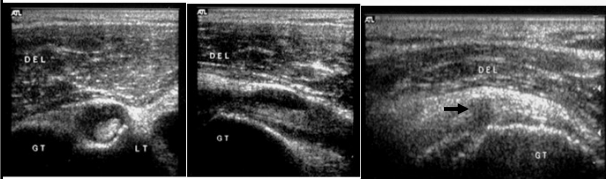
- A focal anechoic or hypoechoic defect through the width of the tendon



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### Effusion in the Biceps Tendon Sheath Associated with Rotator Cuff Full-Thickness Tear



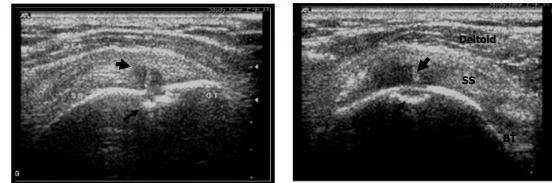
Short Axis (Transverse) Scan

Long Axis (Longitudinal) Scan

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### Supraspinatus Tendon Partial-Thickness Tear (Articular Side Tear)



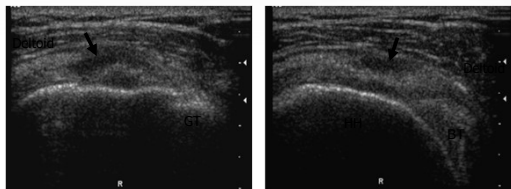
Long Axis (Longitudinal) View

Short Axis (Transverse) View

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### Supraspinatus Tendon Partial-Thickness Tear (Bursal Side Tear)



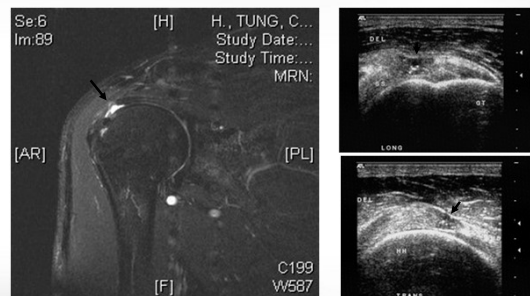
Long Axis (Longitudinal) View

Short Axis (Transverse) View

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### Supraspinatus Tendon Full-Thickness Tear

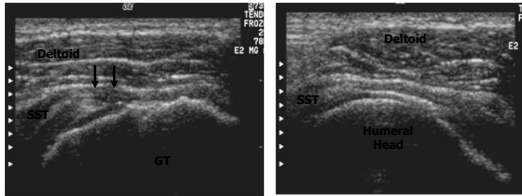


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### Supraspinatus Tendon Complete Tear

- Full-thickness & full-width tear



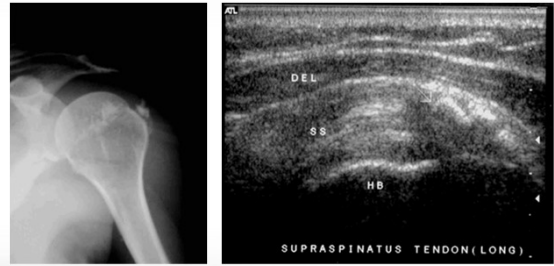
Long Axis (Longitudinal) Scan

Short Axis (Transverse) Scan

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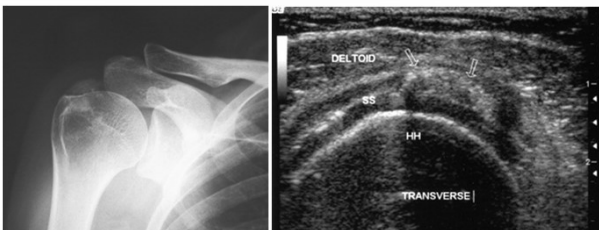
### Supraspinatus Tendon Calcific Tendinopathy



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### Supraspinatus Tendon Calcific Tendinopathy



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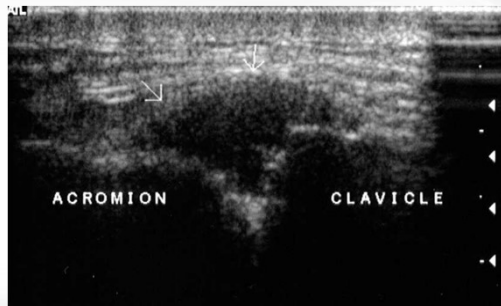
### Infraspinatus Tendon Calcific Tendinopathy



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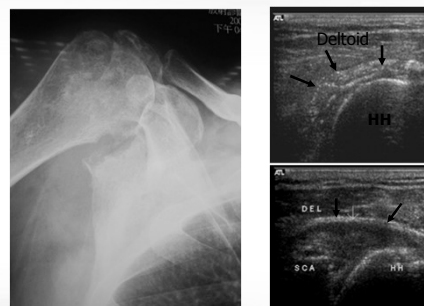
### Acromioclavicular Joint Effusion



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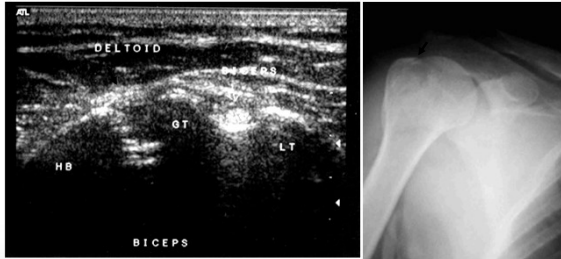
### Septic Arthropathy of the Shoulder Joint



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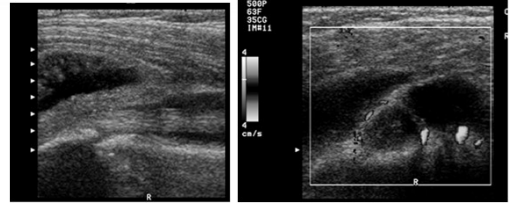
### Tiny Fracture of the Humeral Head



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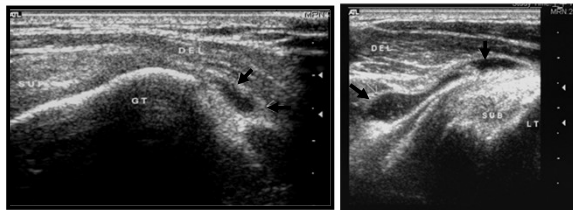
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### Subacromial-Subdeltoid bursitis



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*The End!*  
*Thank You for Your Attention.*