The use of Ultrasound of the shoulder as a screening method for rotator cuff tear; A single institution experience

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Aims and objectives

Background:

Ultrasound of the shoulder has been introduced to clinical practice during the mid to late '80s. Since then, it has been increasingly utilized especially with advances in high resolution ultrasound technology. MRI and Ultrasound of the shoulder are excellent method for diagnosing rotator cuff pathology with comparable sensitivity but still MR arthrogram has the most superior sensitivity.¹

In our practice in Saudi Arabia, rotator cuff pathology is quite common and the preferred exam until now is MRI or MR Arthography. However, because of the relatively limited availability and long waiting lists there is significant delay in the diagnosis of such treatable pathology. Early treatment is associated with better outcome especially in working populations.²

Shoulder ultrasound plays a major role in the evaluation of the native, repaired and totally replaced joint. Good knowledge of the detailed anatomy, good technique, and being aware of the potential pitfalls are crucial prerequisites. One of the most common pitfalls to encounter is anisotropy that may look to the inexperienced eye as a tear.⁵ ⁶

However many local orthopedic surgeons prefer MRI because of the perception that ultrasound is an outdated modality and that MR images are easier for them to interpret. It is felt that MRI may help in the planning for possible intervention.³

However, access to orthopedic surgeons is often also limited and long waiting times prevail. There is increasing evidence that physiotherapy is beneficial in recovery from rotator cuff pathology ⁴. Alternatively, conservative or supportive therapies may be sufficient for management of rotator cuff pathology in the absence of a full thickness tear. ⁸

Shoulder ultrasound is preferred by most patients ⁷, allows dynamic evaluation, and is more cost effective and less invasive compared to the MR arthrogram.

Purpose:
• The purpose of our study is evaluate the usefulness of shoulder ultrasound as a screening tool in patient presented with signs and symptoms if rotator cuff pathology in our institution.
Methods and materials

Method:

Retrospective review of the examinations was done in the past three years where patients who had both, ultrasound and MRI examinations of the same shoulder were included. The ultrasound was performed by a single musculoskeletal radiologist experienced in musculoskeletal ultrasound. For the purpose of consistency, ultrasound examinations done by other less experienced radiologist been excluded from the study. All MR studies have been reported by different experienced musculoskeletal radiologists.

The findings on both studies (including: Partial tear, full-thickness tear, retraction, bursitis, atrophy, calcific tendonitis, AC joint hypertrophic changes) were recorded and compared to look for concordance and disconcordance of findings between two examinations. The time interval between the two examinations ranged from 0 to 6 months with only two cases where the interval was 11 and 12 months.

Technique:

The scan is performed on the symptomatic side. First, the long head of biceps tendon is assessed in a neutral adducted and internally rotated shoulder. Second, subscapularis tendon is assessed in adducted and externally rotated position. Third, supraspinatus tendon is assessed with the patient's placing his/her hand behind the back reaching to the opposite scapula. Then, dynamic evaluation for subacromial impingement is performed with the patient abducting the arm while evaluating the supraspinatus tendon. The acromio-clavicular joint is also evaluated for significant abnormalities and hypertrophic changes. Fourth, infraspinatus tendon is assessed with patient's hand placed over the opposite shoulder anteriorly. Each tendon and any abnormality is assessed in two planes to avoid false positive findings. Evaluation for joint effusion and subacromion-subdeltioid bursa also included.

All patients undergoing shoulder ultrasound are advised to undergo a plain X-ray of the same shoulder at the time of ultrasound examination if this has not already been performed.
Results

Findings:

Of the 29 patients included in this study, 16 patients (55%) were completely concordant, including 4 full thickness tears which were detected by ultrasound. 3 patients (10%) were partially concordant where one case there was missed long head of biceps tendon tear; this is probably due to incomplete evaluation of the tendon fibers during the examination. other case showed that the ultrasound overcalled minimal tendon pathology whereas the MR was perfectly normal. In the third case, the AC joint evaluation was inappropriate. 10 patients (34%) were not concordant (4 cases where full thickness tears were missed).

Limitations:

- Only few referral from physicians who believe in the usefulness of the shoulder ultrasound which explains the small number of patients.
- Limited use of shoulder ultrasound in general with no enough expertise.
Conclusion

Shoulder MRI and MR arthrogram are still the gold standard in diagnosing rotator cuff tear in Saudi Arabia, and this practice is based upon the lack of availability, training and experience of Shoulder ultrasound. However, shoulder ultrasound showed very promising results in diagnosing rotator cuff pathology and offers significant time and financial benefits.

Local steroids injection and lysis of the calcifications in cases of calcific tendinitis under ultrasound guidance add up to the advantage of the use of ultrasound.

In the experienced hands ultrasound is a very powerful diagnostic tool that can reproduce high quality diagnostic images that are comparable to MR exams (Fig. 1, 2, 3, 4). And as mentioned before, full awareness of the common diagnostic pitfalls is crucial (Fig. 5, 6). To our limited experience under- or over- calling an abnormality is not uncommon occurrence (Fig. 7, 8).

Evaluating the glenoid labral injuries is one of the main advantage of the MR arthrography and such injuries can be over looked when only relaying on ultrasound (Fig. 9, 10).

Shoulder ultrasound has a limited use in our local practice and that is mostly because lack of expertise in the radiologists who are more comfortable and used to reporting the MR examinations with better confidence; another reason is because of the general idea in the local orthopedic practice that ultrasound is a limited outdated study. However, what we believe in is that it will allow the referring physician to triage patients with suspected rotator cuff pathology and it will allow early and prompt referral to physiotherapy and conservative management once full thickness tear is excluded; which physiotherapists prefer to be referred to orthopedics for further intervention and management\textsuperscript{(8)}. 
**Fig. 1:** Example 1: The ultrasound showing the linear full thickness tear (asterisk) through the thickness of the supraspinatus tendon.

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Fig. 2: Example 1: The MRI showing the hyperintense full thickness tear which is concordant with the ultrasound findings.

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**Fig. 3:** Example 2: This ultrasound again showing the linear tear (asterisk) that was going along through the full thickness of the supraspinatus tendon.

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Fig. 4: Example 2: The MR arthrography showing the abnormal high signal intensity within the substance of the supraspinatus tendon (arrowheads). This case is considered again as concordant.

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**Fig. 5:** Example 3: This ultrasound is showing quite convincing low echogenicity within the substance of the supraspinatus tendon which was reported as partial thickness tear.

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Fig. 6: Example 3: The MRI is showing normal appearance of the supraspinatus tendon with no evidence of tear. This case was recorded as dis-concordant and the reason of the false positive in the ultrasound is most probably due to anisotropy.

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Fig. 7: Example 4: The ultrasound is partially showing an ill-defined low echogenicity that involves the full thickness of the supraspinatus tendon but it was under-called and reported as partial thickness tear.

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Fig. 8: Example 4: The MRI is clearly showing the full thickness tear that was under-called in the ultrasound. This case was recorded as discordant which was caused by under-calling an abnormality seen in the ultrasound.

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**Fig. 9:** Example 5: The ultrasound is showing the supraspinatus tendon tear (asterisk) however, no labral abnormality identified.

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Fig. 10: Example 5: The MRI is confirming the supraspinatus tendon tear and detecting an additional abnormality in the superior labrum representing Superior labral anterior posterior tear (SLAP injury). This case is showing the advantage of the MR arthrography in identifying the labral injuries and this case was recorded as partial concordance.

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