Al-Azhar International Medical Journal

Volume 4 | Issue 11 Article 25

2023
Section: Radiology & Radiodiagnosis

Role of MR arthrography in the evaluation of rotator cuff injuries. A comparative study to high resolution ultrasonography

Mahmoud Mohammed Ahmed El Sharkawe
Department of Radiodiagnosis – Faculty of Medicine – AL Azhar University – Cairo,
msharkawe86@gmail.com

Ahmed Abdel Fattah Mahmoud Abu Rashed
Department of Radiodiagnosis – Faculty of Medicine – AL Azhar University – Cairo

Hytham Mohamed Mahmoud Nafady
Department of Radiodiagnosis – Faculty of Medicine – AL Azhar University – Cairo

How to Cite This Article

Sharkawe, Mahmoud Mohammed Ahmed El; Rashed, Ahmed Abdel Fattah Mahmoud Abu; and Nafady, Hytham Mohamed Mahmoud (2023) "Role of MR arthrography in the evaluation of rotator cuff injuries. A comparative study to high resolution ultrasonography," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 11, Article 25.
DOI: https://doi.org/10.58675/2682-339X.2119

ORIGINAL ARTICLE

Role of MR Arthrography in the Evaluation of Rotator Cuff Injuries: A Comparative Study of High-resolution Ultrasonography

Mahmoud Mohammed Ahmed El Sharkawe*,
Ahmed Abdel Fattah Mahmoud Abu Rashed, Hytham Mohamed Mahmoud Nafady

Department of Radiodiagnosis, Faculty of Medicine, Al Azhar University, Cairo, Egypt

Abstract

Background: **Shoulder pathology is associated with substantial functional limitations that increase with age. Rotator cuff (RC) injuries are the most likely source of shoulder pain.**

Objective: **The purpose of this study is to evaluate the role of MR arthrography in the detection of different abnormalities of rotator cuff muscles, comparing the results to high-resolution static and dynamic ultrasonography (USG).**

Patient and methods: **Our study was conducted in the Radiology Department of Bab Al She'ryya University Hospital between April 2022 and April 2023 on 20 patients with clinically suspected RC pathology (16 males and 4 females). In our study, the patients were examined by ultrasound using a Logiq P9 ultrasound device and 1.5 Tesla Acheiva Magnet.**

Results: **This study revealed that MR arthrography and ultrasound can detect various pathologies involving the RC and the surrounding soft tissue having comparable results with slight superiority of MRA over USG at partial rotator cuff tear.**

Conclusion: **The results of this study concluded that partial RC tears can be diagnosed with greater precision using MR arthrography than with USG. For full-thickness tears and RC tendinosis, ultrasound is roughly equivalent to MRA. These findings, along with the fact that USG is less expensive, suggest that it might be the most cost-effective imaging approach for detecting RC injuries, assuming that the examiner has received the necessary training in this operator-dependent technique.**

Keywords: High-resolution ultrasonography, MR arthrography, Rotator cuff

1. Introduction

Shoulder pathology is associated with substantial functional limitations that increase with age. Adults are most likely to develop shoulder pain from rotator cuff (RC) injuries, which have an incidence of more than 20 % in the general population.[1] A rapid and precise evaluation of RC injuries guides treatment decisions that aim to minimize pain, long-term disability, and additional costs.[2]

With new advances, arthroscopic therapy for even partial-thickness RC injuries provides positive outcomes. Medical imaging modalities, such as ultrasonography (USG) and MR arthrography (MRA) provide clinically important information that can help determine the correct treatment strategy.[3]

Clinical presentation includes a passive range of motion limitation along with generalized shoulder discomfort. Superior shoulder pain, acromioclavicular joint tenderness, and a painful cross-body adduction test are all symptoms of acromioclavicular osteoarthritis. Glenohumeral osteoarthritis typically manifests as slow-moving discomfort and loss of range of motion in patients older than 50 years.

Glenohumeral instability is common in people under the age of 40 years with a history of dislocation or subluxation events. Relocation and constructive apprehension are consistent with the diagnosis. Imaging tests, such as conventional

Accepted 17 July 2023.
Available online 24 January 2024

* Corresponding author. Radiodiagnosis Department, Faculty of Medicine for Boys, Al-Azhar University, Cairo, 11884, Egypt.
E-mail address: msharkawe86@gmail.com (M.M.A. El Sharkawe).

https://doi.org/10.58675/2682-339X.2119

Table 1. Ultrasonography scanning steps.

Step	Item
A	Biceps brachii tendon, long head
B	Tendon of subscapularis and subluxation/dislocation of the biceps tendon,
C	Tendon of supraspinatus and rotator interval
D	Acromioclavicular articulation, dynamic assessment for rotator impingement, and subacromial–subdeltoid bursa
E	Teres minor, infraspinatus

radiography, magnetic resonance imaging, USG, and computed tomography scans, are recommended when the diagnosis is still uncertain or when the course of treatment needs to be changed. Simple radiographs can be used to identify severe RC injuries, unstable shoulders, and shoulder arthritis. For RC issues, magnetic resonance imaging and USG are preferable. Magnetic resonance arthrogram is preferred to magnetic resonance imaging for shoulder instability.[4]

The ability to accurately detect a full-thickness RC tear, which is a major indicator for surgical repair, is perhaps the most clinically significant characteristic when choosing a shoulder imaging modality for RC disease evaluation.[5]

This study aimed to detect the role of MR arthrography in detecting RC pathology, comparing these results to results obtained by high-resolution USG.

2. Patients and methods

Twenty patients were enrolled in the study, and written consents were obtained from all patients. They were submitted to high-resolution ultrasound examination followed by conventional MRI, fluoroscopic guided intra-articular contrast injection, and MR arthrography for detecting and comparing RC pathologies.

2.1. Inclusion criteria

All patients complained of shoulder pain with clinically suspected RC injury either traumatic or nontraumatic.

2.2. Exclusion criteria

Patients with pacemakers, biostimulators, and cochlear implants; patients who had undergone any type of shoulder surgery; history of recurrent shoulder dislocation; and with presence of contraindications to arthrography, e.g. septic arthritis of the shoulder joint were excluded.

All patients were subjected to the following:

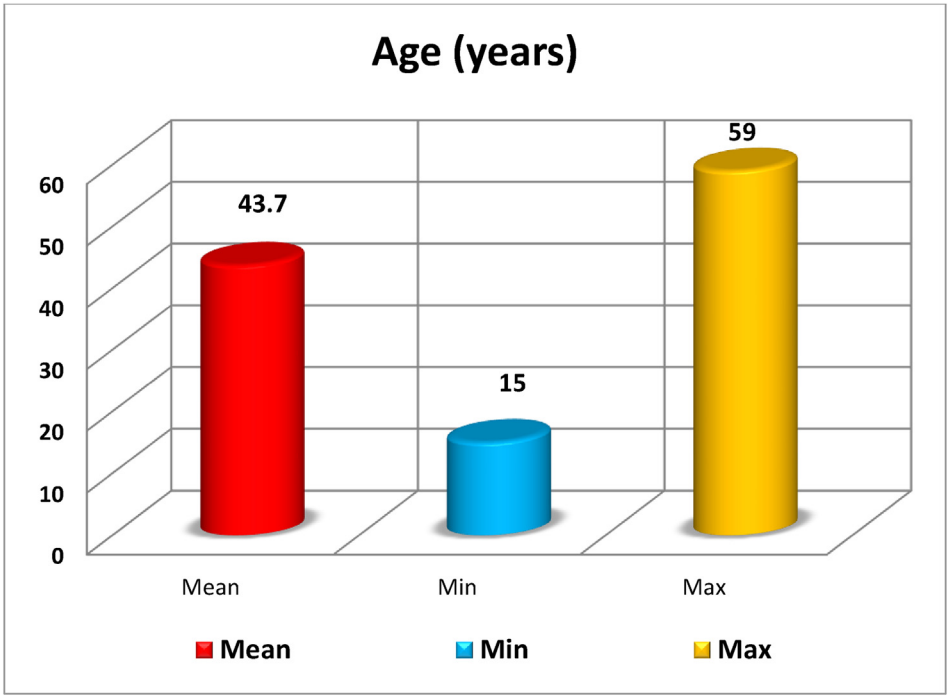

Fig. 1. Description of age in all studied patients.

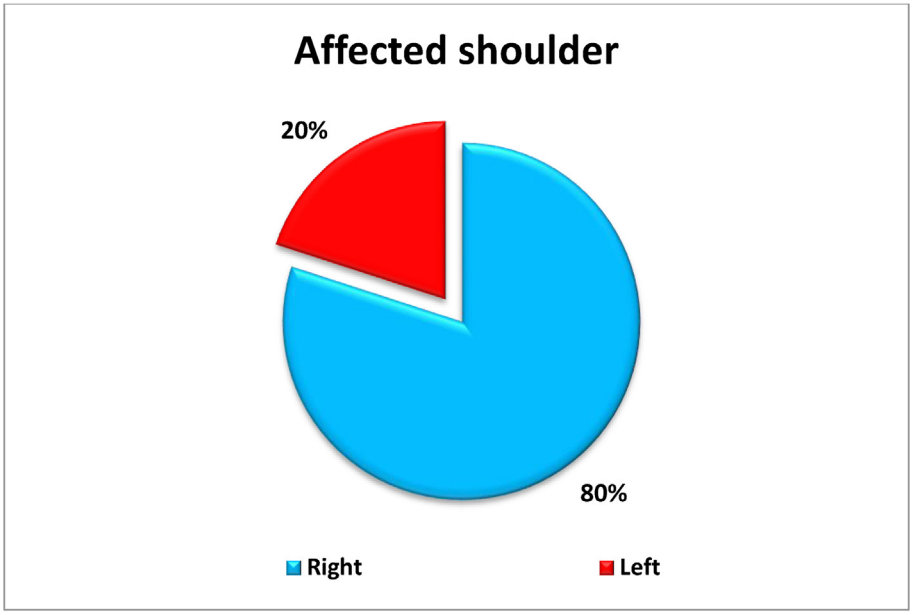

Fig. 2. Description of the affected shoulder in all studied patients.

Full history taking including age, sex, history of trauma and athletic or not, and evaluation of previously done radiological studies, e.g., X-ray, ultrasound, CT, or arthroscopic findings.

All patients have been subjected to:

A preliminary ultrasound examination, conventional MRI examination, and fluoroscopic guided intra-articular contrast injection followed by MR Arthrography examination. The findings of MR arthrography will be compared with ultrasonographic findings.

The study was performed on the Logiq P9 ultrasound device and 1.5 T magnet. The patients were examined at first by ultrasound using the static and dynamic approach, and then examined by conventional MRI followed by intra-articular contrast injection that was done under fluoroscopic guidance to perform MR arthrography. The collected data using these imaging modalities were tabulated and compared with each other (Table 1).

3. Results

This study included 20 patients; 16 males and 4 females in the age range from 15 years to 59 years (mean age 44 years, mode 50 and median 44.5 and range 44), suffering from symptoms of RC injures in terms of shoulder pain with limited movement whether traumatic or nontraumatic.

All of the 20 patients were examined with high-resolution ultrasound and MRI arthrography.

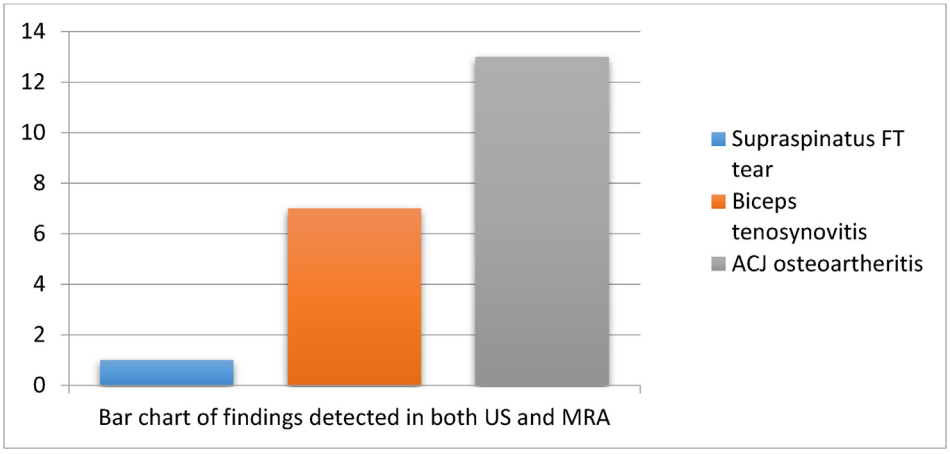

Fig. 3. Bar chart of findings that were detected in both ultrasound and MRA.

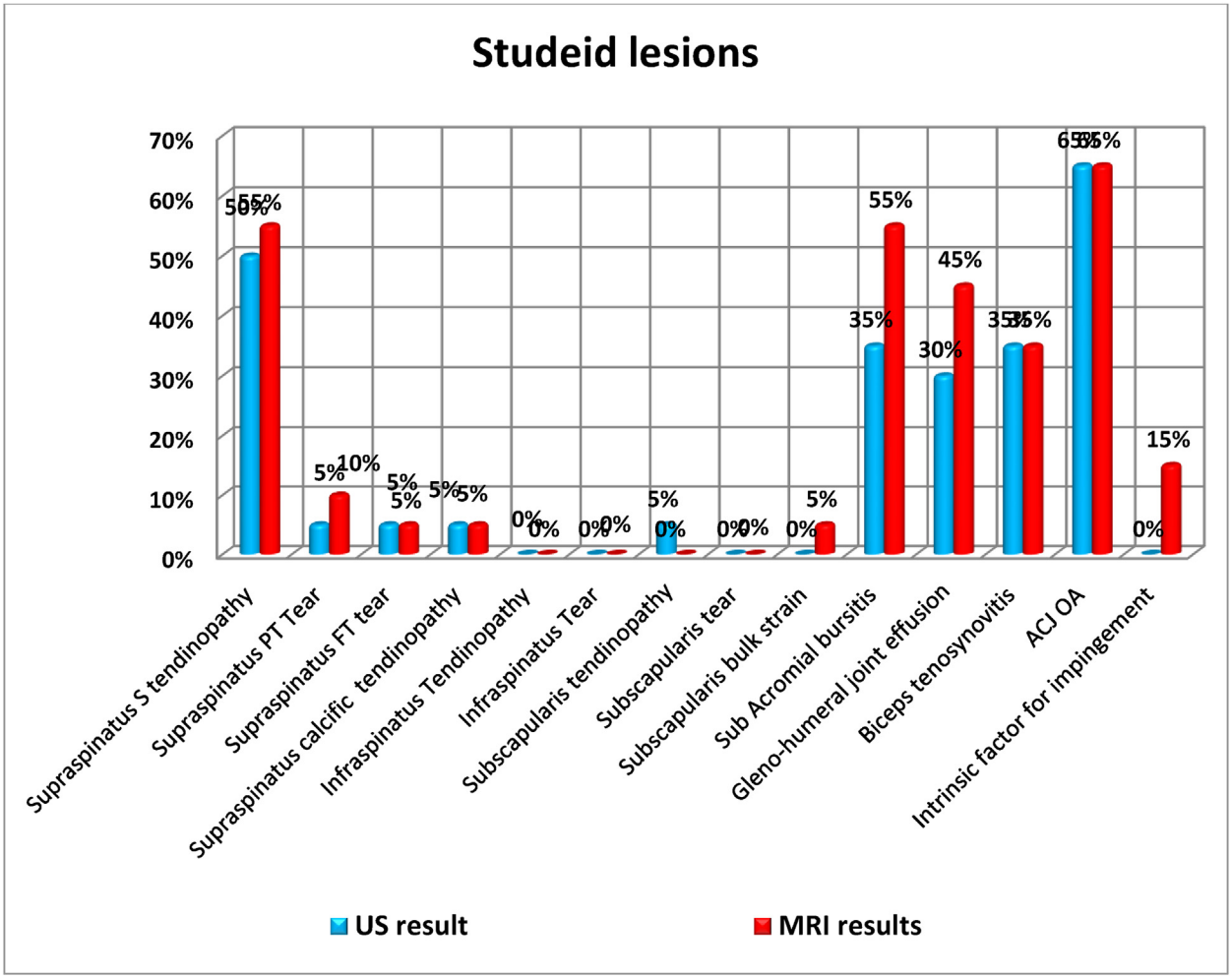

Fig. 4. Description of studied lesions in all studied patients.

The MRA results were then compared with the collected data in an US.

Some patients may have more than one pathology (Figs. 1–6 and Tables 2–4).

4. Discussion

Adults with RC injuries are significantly more disabled as they are unable to move their arms overhead. To administer proper care for these injuries, a proper diagnosis is essential. Three different types of lesions can lead to shoulder pain and dysfunction: RC tears, impingement syndromes, and cuff strains.[6]

For RC issues in particular, establishing the proper source of shoulder pain is essential to obtaining a therapy plan. The most commonly used imaging techniques for assessing patients with shoulder pain include radiography, USG, arthrograms, computed tomography (CT) scans, and MRIs. Although arthrography is the gold standard method, it has the drawback of being invasive. Despite its high cost, MRI is less ideal as the initial line of investigation, despite its great effectiveness. All of these issues are resolved by USG because it is a noninvasive diagnostic technique, which is also very efficient in terms of cost. This makes it a good starting point for investigation.[7]

Subacromial–subdeltoid bursitis, calcific tendinitis, tendinosis, and other conditions that may all be identified with USG can all be misinterpreted for RC tears. When it comes to detecting RC injuries, USG is thought of as a low-cost alternative to MRA and also has the advantage of dynamic real-time assessment. The current research compares the two imaging modalities to establish which is more accurate at detecting RC issues, USG or MRA.[8]

From our findings, for the diagnosis of RC injuries, USG and MRA can be considered highly specific imaging modalities; they tend to be extremely sensitive to full-thickness RC tears. To understand the clinical significance of such results,

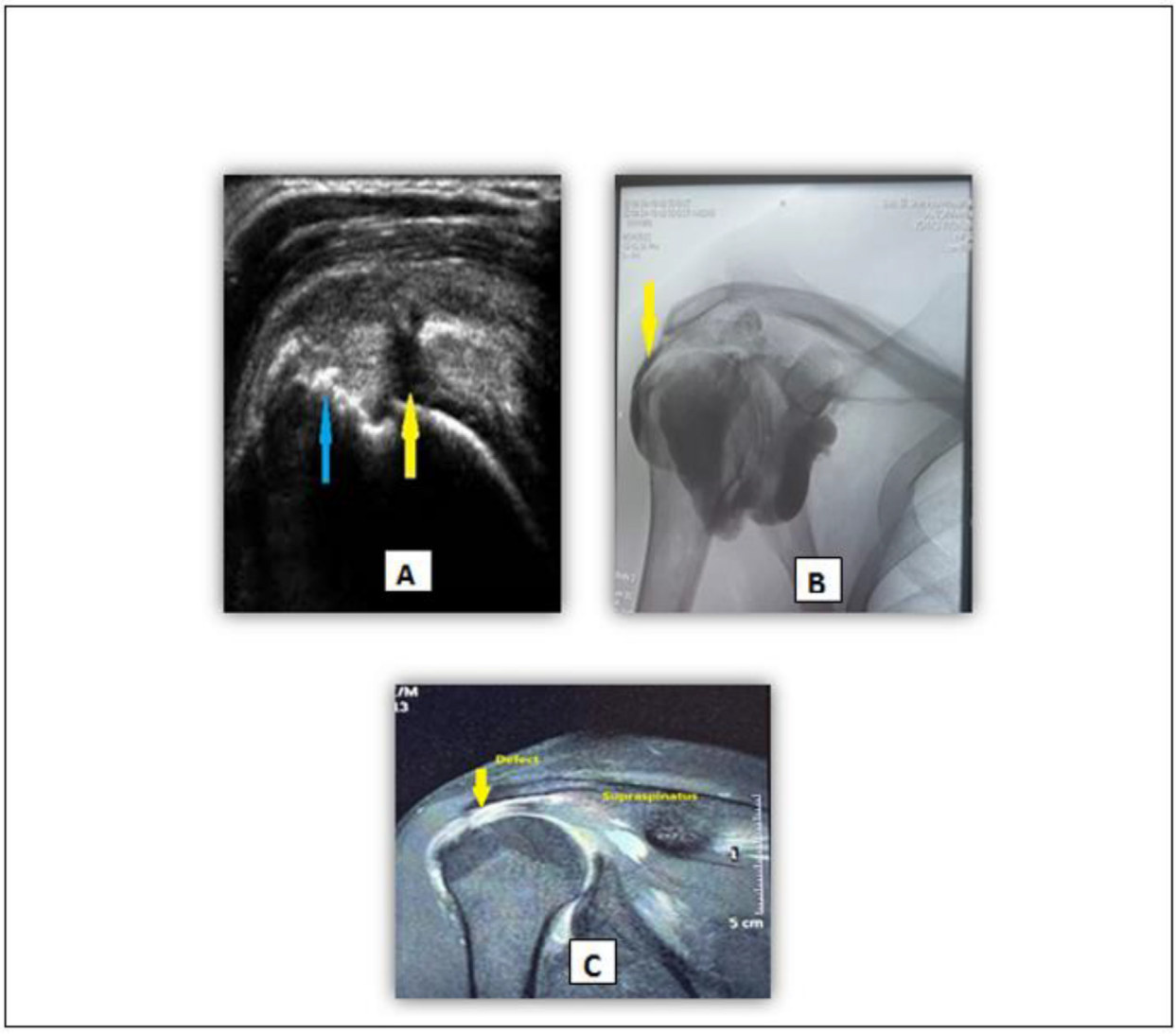

Fig. 5. Example for supraspinatus full thickness tear: (A) The ultrasonography image revealed focal interruption of the supraspinatus tendon by fluid echogenicity near its footprint. (B) Radiography of the shoulder during contrast injection revealed a contrast leak into the subacromial space, which is an indirect sign of supraspinatus full-thickness tear. (C) MR arthrography T1 fat-suppression revealed a contrast-filling defect involving the supraspinatus tendon.

in addition to their diagnostic value, many aspects must be taken into consideration. The basic elements of clinical management include safety, cost, availability, and the impact of outcomes. Apart from a few specific MRA contraindications, the US is a noninvasive test in terms of safety.

Experienced investigators have proved that sonography is an operator-dependent technique.

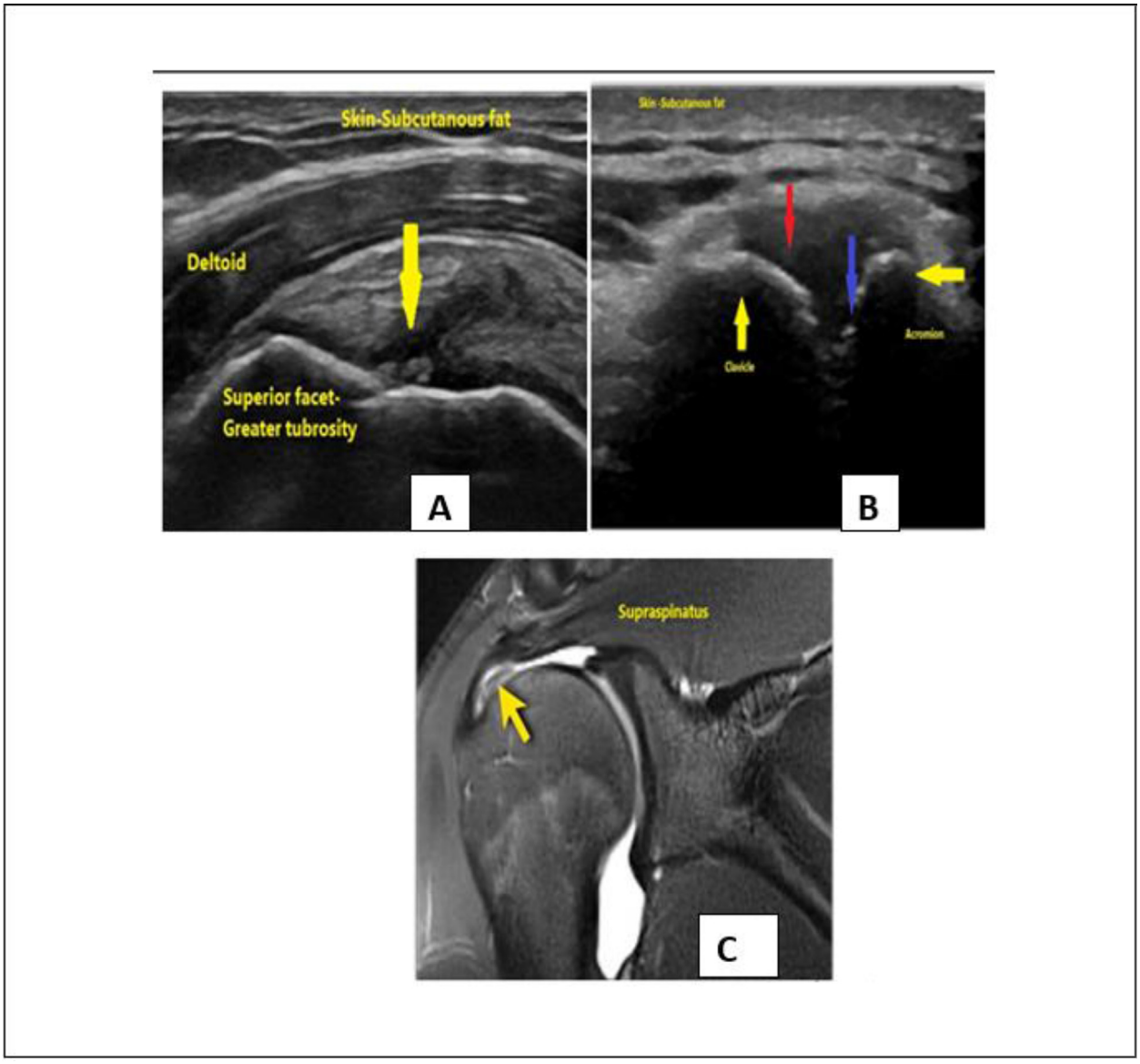

Fig. 6. Example of supraspinatus partial thickness tear: (A) Ultrasonography image revealed focal interruption of the supraspinatus tendon by fluid echogenicity near its footprint. (B) Ultrasonography image revealed acromioclavicular joint osteoarthritic changes. (C) MR arthrography T1 fat-suppression revealed a contrast-filling defect partially affecting the articular surface of the supraspinatus tendon.

Table 2. Description of demographic data in all studied patients.

	Studied patients ($N = 20$)	
Sex		
Male	16	80 %
Female	4	20 %
Age (years)		
Mean ± SD	43.7 ± 11.3	
Min–max	15–59	
Affected shoulder		
Right	16	80 %
Left	4	20 %
Type of patient		
Nonathletic	17	85 %
Athletic	3	15 %

Although it has the benefit of being noninvasive, there is a steep learning curve to achieve satisfactory outcomes.[9]

Table 3. Description of demographic data in all studied patients.

	Studied patients ($N = 20$)	
Clinical data		
Pain	15	85 %
Trauma	4	20 %
Limitation of movement	10	50 %

Table 4. Description of studied lesions in all studied patients.

($N = 20$)	US result		MRA results	
Lesions				
Supraspinatus tendinopathy	10	50 %	11	55 %
Supraspinatus PT tear	1	5 %	2	10 %
Supraspinatus FT tear	1	5 %	1	5 %
Supraspinatus calcific tendinopathy	1	5 %	1	5 %
Infraspinatus tendinopathy	0	0 %	0	0 %
Infraspinatus tear	0	0 %	0	0 %
Subscapularis tendinopathy	1	5 %	0	0 %
Subscapularis tear	0	0 %	0	0 %
Subscapularis bulk strain	0	0 %	1	5 %
Subacromial bursitis	7	35 %	11	55 %
Glenohumeral joint effusion	6	30 %	9	45 %
Biceps tenosynovitis	7	35 %	7	35 %
ACJ osteoarthritis	13	65 %	13	65 %
Intrinsic factor for impingement	0	0 %	3	15 %

4.1. Conclusion

When identifying the cause of rotator cuff-related shoulder pain and creating preoperative plans, static, dynamic USG, and MR arthrography are helpful approaches. Both might save patients from obtaining unneeded diagnostic arthroscopy.

The results of this study concluded that partial RC tears can be diagnosed with greater precision using MR arthrography than with USG. For full-thickness tears and RC tendinosis, ultrasound is roughly equivalent to MRA. These findings, along with the fact that USG is less expensive, suggest that it might be the most cost-effective imaging approach for detecting RC injuries, assuming that the examiner has received the necessary training in this operator-dependent technique.

Conflict of interest

The authors have no financial interest to declare in relation to the content of this article.

References

1. Minagawa H, Yamamoto N, Abe H, et al. Prevalence of symptomatic and asymptomatic rotator cuff tears in the general population: from mass-screening in one village. *J Orthop*. 2013;10:8–12. PMID: 24403741; PMCID: PMC3768248.
2. Ramme AJ, Robbins CB, Patel KA, et al. Surgical versus nonsurgical management of rotator cuff tears: a matched-pair analysis. *J Bone Joint Surg Am*. 2019;101:1775–1782. PMID: 31577683.
3. Pan Y-W, Mok D, Tsiouri C, Chidambaram R. The association between radiographic greater tuberosity cystic change and rotator cuff tears: a study of 105 consecutive cases. *Shoulder Elbow*. 2011;3:205–209.
4. De Filippo M, Schirò S, Sarohia D, et al. Imaging of shoulder instability. *Skeletal Radiol*. 2020;49:1505–1523. Epub 2020 May 23. PMID: 32447469.
5. Lambers Heerspink FO, Dorrestijn O, van Raay JJ, Diercks RL. Specific patient-related prognostic factors for rotator cuff repair: a systematic review. *J Shoulder Elbow Surg*. 2014;23:1073–1080. Epub 2014 Apr 13. PMID: 24725900.
6. Varacallo M, El Bitar Y, Mair SD. Rotator cuff syndrome. 2022 Sep 4. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2023 Jan. PMID: 30285401.
7. Liu F, Cheng X, Dong J, Zhou D, Han S, Yang Y. Comparison of MRI and MRA for the diagnosis of rotator cuff tears: a meta-analysis. *Medicine (Baltim)*. 2020;99:e19579. PMID: 32195972; PMCID: PMC7220562.
8. Singh JP. Shoulder ultrasound: what you need to know. *Indian J Radiol Imag*. 2012;22:284–292. PMID: 23833420; PMCID: PMC3698891.
9. Zlatkin MB, Dalinka MK, Kressel HY. Magnetic resonance imaging of the shoulder. *Magn Reson Q*. 1989;5:3–22. PMID: 2701276.