Original Article

The Role of Musculoskeletal Ultrasound in Enhancing Diagnostic Accuracy for Shoulder Disorders: Our experience in a specialized center

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Abstract

Background: Though shoulder pain is one of the most prevalent musculoskeletal symptoms, clinical diagnosis is sometimes difficult due to complex shoulder joint anatomy. Traditional diagnostic methods often fall short, hence advanced imaging techniques such as musculoskeletal ultrasonography is necessary.

Objective: Aim of the study is to assess the impact of MSKUS on diagnosis and management of shoulder pain by comparing pre-scan diagnosis and management plan with post scan assessment. This study also aims to emphasize the use of MSKUS for orthopedic shoulder surgeons.

Methods: This is a cross-sectional study conducted from January 2023 to January 2024. Patients aged 18 and older with acute or chronic shoulder pain were referred for ultrasound evaluation after initial diagnoses by primary clinicians. A total of 250 patients were enrolled. MSKUS examinations were performed by an experienced orthopedic surgeon who was blinded to the initial diagnoses. The changes in diagnosis and management plans pre- and post-ultrasound were statistically analyzed.

Results: Among the 250 patients, 76% had a change in diagnosis after MSKUS, with the most common pre-scan diagnosis being adhesive capsulitis (20.8%), while the post-scan diagnosis predominantly revealed rotator cuff tears (22.4%). Management plans also shifted significantly, with only 34.4% of patients advised conservative treatment post-scan compared to 92.4% pre-scan. Notably, 66% of patients experienced a change in management strategy.

Conclusion: The incorporation of MSKUS significantly alters the clinical diagnosis and management of shoulder pain, emphasizing its role as a valuable tool for orthopedic surgeons. This study advocates for increased utilization of MSKUS in routine clinical practice to enhance diagnostic accuracy and optimize treatment strategies for shoulder conditions.

Keywords: Shoulder pain, musculoskeletal ultrasonography (MSKUS), rotator cuff tears, adhesive capsulitis, imaging techniques, clinical diagnosis, shoulder joint.

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Introduction

Shoulder pain is the 3rd most common musculoskeletal symptom after knee and low back pain affecting 20.9–26% population globally[1]. The underlying causes of shoulder pain is diverse. Rotator cuff arthropathy, major and minor rotator disease, long head biceps and labral pathology, glenohumeral disorders, acromioclavicular joint (ACJ) pathology, and referred neck pain are the most common etiology[2]

Initial method for diagnosing shoulder pathology are clinical examinations and X-rays. However, these approaches often fall short of capturing the full complexity of shoulder disorders highlighting the need for high-resolution imaging techniques, particularly ultrasound and MRI.

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Among these options, Musculoskeletal ultrasound (MSKUS) has emerged as a crucial tool for assessing shoulder pathology. It provides real-time, dynamic, and functional imaging of soft tissues, tendons, and joints, allowing for detailed visualization of shoulder structures during movement. Additionally, MSKUS is more cost-effective than MRI, non-invasive, widely accessible, and has shown diagnostic accuracy comparable to that of MRI[3–5]. On the other hand, Complexity of shoulder anatomy is also a limitation in providing definitive diagnosis in clinical evaluation. As a result, Clinical diagnosis can be inaccurate or incomplete leading to inappropriate management plan.

A key advantage of MSKUS is that it enables an orthopedic surgeon to make bedside diagnosis and develop immediate, effective treatment plans. Surgeons have the benefit of a complete clinical history and shoulder examination, along with a better understanding of the patient's clinical issues. Also, Previous research has shown that shoulder surgeons, with adequate training, can effectively perform ultrasound examinations with similar effectiveness to radiologists[6]. Therefore, they can use ultrasound as an extension of their clinical assessment, increasing diagnostic accuracy and decision-making.

However, despite its advantages MSKUS remains underutilized among orthopedic surgeons[7,8]. particularly due to its operator-dependent nature and the limited ultrasound training

received by many practitioners. Successful implementation requires skill in probe positioning for optimal image acquisition and thorough understanding of shoulder anatomy in standardized planes[3].

This study aims to assess how the introduction of MSK USG impacts the clinical diagnosis and management of patients with shoulder pain. By comparing the initial clinical assessments made by primary physician with subsequent diagnoses obtained through ultrasound made by another, we seek to understand the extent to which MSK USG alters clinical impressions and treatment plans. The study's findings may emphasize the importance of integrating ultrasound into routine clinical practice of an orthopedic shoulder surgeon for the assessment and management of shoulder pain.

Materials & Methods:

Study design:

This cross-sectional study was conducted from January 2023 to January 2024 at a specialized center for minimally invasive spine and orthopedic surgery. Institutional ethics research board approval was obtained for this cross-sectional study.

Study population:

Our study population consisted of patients who were referred to our center for ultrasonographic evaluation with a prior diagnosis and management plan made by the index clinicians. Adult individuals of either sex, aged 18 years and older, with acute or chronic shoulder pain, who were referred to our center for sonographic evaluation and had provided written informed consent to participate in the study, were considered for enrollment. However, patients who had undergone recent surgery within the last 6 weeks, had acute shoulder injuries (e.g., fractures, dislocations) requiring immediate surgical intervention, or were unable to provide consent were excluded from the study. A total of 250 patients met the inclusion criteria, and 102 patients were excluded.

Evaluation method:

The referred patients were evaluated through ultrasound by the corresponding author of this study, an orthopedic surgeon with 10 years of experience in musculoskeletal ultrasonography, using a standardized and widely accepted protocol and technique (9). He was blinded to the diagnosis and management plan made by the index clinician. After performing MSKUS, the corresponding author then made his diagnosis and management plan according to sonographic findings. Both the pre- and post-ultrasound diagnoses, along with the management plans, were analyzed by other authors of this study, doctors and research associates of the study center. The treatment plans considered were, 1. conservative; 2. non-surgical intervention; 3. Surgery. Then the information was updated on the standard record sheet whether the diagnosis and management plan had changed or remained unchanged.

Imaging Method:

All ultrasound examinations were conducted using a LOGIQ P6 Pro scanner (GE Healthcare) equipped with a 6-15 MHz linear array transducer. The patient was seated comfortably in a chair, while the examiner either stood behind or sat beside the patient. Static and dynamic assessments of the shoulder joint were performed in both the transverse and longitudinal planes. Bilateral examination was also done when required.

Statistical analysis:

Data were analyzed for changes in diagnosis and management plan based on US results by nonparametric statistical methods using SPSS© version 27. 11

Results:

Baseline Characteristics:

A total of 250 referred patients were enrolled for this study. The majority of the patients were female (56.8%), aged ≥ 41 years (63.2%), with anterior shoulder pain (40.4%) and focal restriction of the joint movement (54.8%). A considerable proportion of the patients had diffuse shoulder pain (32.4%) and global restriction of movement (43.6%). The remaining demographic

characteristic and clinical findings are summarized in Table 1.

Baseline characteristics	N=250	P (%)
Age in years		
Mean ± SD (years)	48.63±13.82	
18-30 years	36	14.4
31-40 years	56	22.4
≥41 years	158	63.2
Sex		
Female	142	56.8
Chief Complaints		
Pain		
Diffuse	81	32.4
Anterior	101	40.4
Lateral	48	19.2
Posterior	16	6.4
Superior	4	1.6
Range of motion (ROM)		
Normal	4	1.6
Focal restriction	137	54.8
Global restriction	109	43.6

Pre-scan and post-scan diagnosis:

The study involved 250 patients initially diagnosed with various shoulder conditions. Majority (76%) of our patients' diagnosis status changed after their shoulder sonography. However, the diagnosis status of the remain ing (24%) patients remains unchanged even after sonography. (Figure 1)

Figure 1: Diagnosis status of overall patients after shoulder sonography

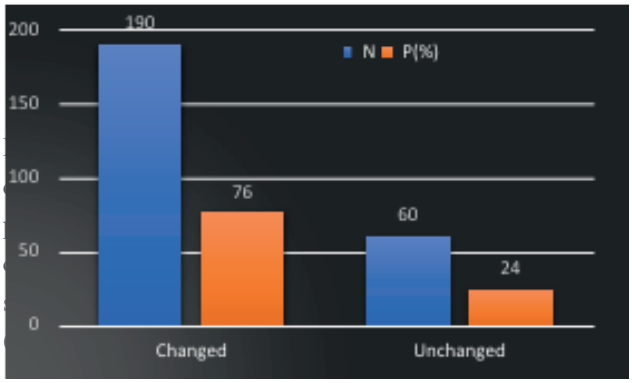


Table 2: Distribution of our study patients by pre-scan diagnosis

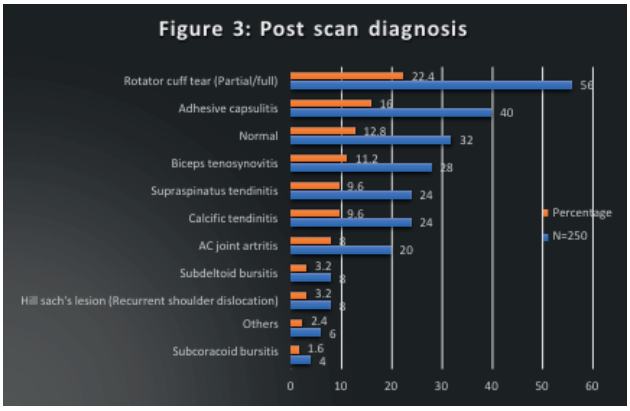
In pre-scan, the most frequent diagnosis was adhesive capsulitis, affecting 20.8% of patients, followed by post-traumatic right shoulder pain (14.4%), and rotator cuff tears (9.6%). Other common diagnoses included supraspinatus tendinitis (6.4%) and painful Arc syndrome (1.6%) (Table 2).

Table 2: Distribution of our study patients by pre-scan diagnosis

	N=250	P(%)
Pre-scan diagnosis		
Unspecified Shoulder pain	117	46.8
Adhesive Capsulitis	52	20.8
Traumatic Shoulder Pain	36	14.4
Rotator Cuff Tear (Partial/Full)	24	9.6
Supraspinatous Tendinitis	16	6.4
Painful Arc Syndrome	4	1.6
Hill Sach's Lesion	4	1.6
(Recurrent Shoulder Dislocation)		

After the scan, the diagnoses shifted significantly. The majority of the patients were found to have rotator cuff tear (Partial/full) (22.4%). Adhesive capsulitis which was most frequent in pre-scan, was found in 16% of the patients in post-scan. (Figure 2)

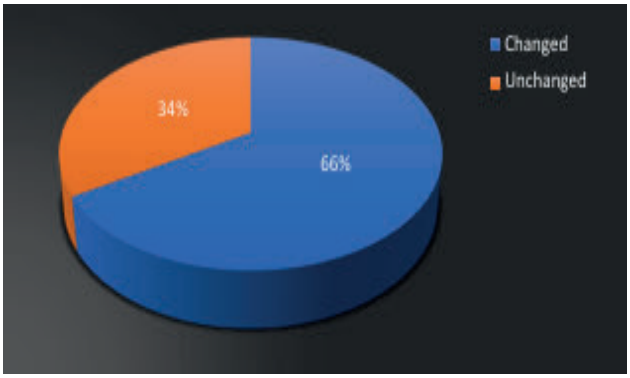
Figure 2: Distribution of our study patients by post-scan diagnosis



Pre-scan and post-scan management plan:

Majority (66%) of our patients' management plans changed after their shoulder sonography. However, the management plan of the remaining (34%) patients remains unchanged even after sonography. (Figure 3)

Figure 3: Management plan of overall patients after shoulder sonography



Before sonography, most of the patients (92.4%) were advised to go for the conservative treatment plan, and 7.6% for the non-surgical intervention. After shoulder sonography, the management plan of these patients changed. Only 34.4% of patients were advised for the conservative treatment plan, 59.6% of patients for the non-surgical intervention method, and 6% of patients were advised for surgery (Table 3).

Table 3: Comparison of management plan between before and after shoulder sonography

Management plan	Pre-scan		Post-scan	
	N	P (%)	N	P (%)
Conservative	231	92.4	86	34.4
Non-Surgical Intervention	19	7.6	149	59.6
Surgical			15	6
Total	250	100	250	100

Discussion:

This study demonstrates the impact of musculoskeletal ultrasonography in the diagnosis and management of shoulder pain. The clinical diagnosis of the majority of patients (76%) was changed after ultrasound scanning. Various studies have also shown that the post-scan diagnosis differs from the pre-scan clinical diagnosis in most shoulder pain patients[10].

Nearly 92.4% of the patients were initially treated conservatively. However, after the diagnostic shoulder US examination was performed, 65.6% of the patients were re-stratified to a more invasive treatment plan including a non-surgical intervention or surgery. These findings support our hypothesis that clinicians should emphasize integrating ultrasound into routine clinical practice for accurate assessment and proper management plan of shoulder pain. In the remaining 7.6% of the patients, the index clinician opted for non-surgical intervention, and no patient was given a surgical management plan. In both of these clinical settings, musculoskeletal shoulder US made a substantial impact. However, to our knowledge, there has been no investigation into the actual therapeutic impact of musculoskeletal shoulder US.

Clinically, most of the patients in our study had unspecified diagnoses. That is because common shoulder disorders often share similar clinical features, and the absence of consensus on diagnostic criteria, as well as inconsistencies in clinical assessments, complicates decisions.[11] Other than that, the most frequent pre-scan diagnosis was adhesive capsulitis, commonly known as "Frozen Shoulder".

Studies found the prevalence of adhesive capsulitis in the general population ranges from 2 to 5%. Generally, women and those over 40 years of age are at a greater risk.[12,13] In our study, rotator cuff tear, either full or partial was the most common diagnosis in post-scan. Several studies support this finding showing that rotator cuff tear is one of the most common causes of shoulder pain[14,15], most prevalent in middle-aged and older patients[16]. Considering the intricacy of shoulder disorders, the use of imaging techniques for diagnosis and management is essential. It is already established that the primary method for visualizing the soft tissues of the shoulder joint is ultrasound imaging[17]. Dynamic, real-time ultrasound imaging has proven effective in assessing both rotator cuff and non-rotator cuff shoulder conditions[18,19]. Also, the diagnostic accuracy of musculoskeletal ultrasound (MSK US) has been validated and shown to be comparable with MRI[20,21]. In an orthopedic surgeon's chamber, MSKUS can serve as a valuable tool for diagnostic accuracy. Additionally, it provides an opportunity to educate the patients and explain various management options[22].

In our study, the majority of the patients were female and aged ≥41 years. Studies support that the prevalence of shoulder pathology is associated with increasing age[23,24]. This may be attributed to the influence of physical activity and job-related factors on shoulder pain, a connection that has been established in other studies[24]. Also, studies showed that shoulder pain is more prevalent in women than in men.[25,26]

Limitations:

There were several limitations to our study. First, as all the patients were referred by different specialty doctors, pre-scan diagnoses were not made following a standard protocol. Therefore, the diagnosis and management plan might have been affected by the particular sequence and techniques used in their practices. This potential limitation could be addressed in a prospective trial including participating in treating clinicians as well as evaluating clinicians in pre- and post-US diagnosis in same setting. Finally, the assessment did not include prolonged patient follow-up for clinically recurring symptoms or responses to treatment. Another limitation of our study is the absence of a cost-effectiveness analysis. Future research should assess the economic benefits of using MSKUS compared to traditional diagnostic methods, such as X-rays or MRI, to better understand its value from both a clinical and financial perspective. This evaluation could provide further justification for the widespread adoption of MSKUS in clinical settings, ensuring that its benefits extend not only to patient outcomes but also to healthcare resource optimization.

Conclusion:

In conclusion, musculoskeletal shoulder ultrasound (MSKUS) is a well-established and validated diagnostic imaging modality for evaluating shoulder pain patients. In line with its recent increased utilization, this study demonstrates that musculoskeletal shoulder US significantly influences both patient treatment and clinician's decision-making processes. So, orthopedic shoulder surgeons should incorporate MSKUS in their routine clinical practice with proper training and skills.

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Declaration of competing interest:

None.

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References:

1. Lucas J, van Doorn P, Hegedus E, Lewis J, van der Windt D. A systematic review of the global prevalence and incidence of shoulder pain. BMC Musculoskelet Disord. 2022 Dec 1;23(1).
2. Crookes T, Wall C, Byrnes J, Johnson T, Gill D. Chronic shoulder pain. Aust J Gen Pract. 2023 Nov 1;52(11):753–8.
3. Tat J, Tat J, Theodoropoulos J. Clinical applications of ultrasonography in the shoulder for the Orthopedic Surgeon: A systematic review. Orthopaedics & Traumatology: Surgery & Research. 2020 Oct;106(6):1141–51.
4. Levine BD, Motamedi K, Seeger LL. Imaging of the Shoulder: A Comparison of MRI and Ultrasound. 2012 [cited 2024 Oct 27]; Available from: www.acsm-csmr.org

5. Refaat MM, Torky A, Salah W, Deen E, Soliman S. Comparing Efficacy of Shoulder Ultrasound and Magnetic Resonance Imaging in Shoulder Impingement. Funk L, Harris J, Jeyam M. Are shoulder surgeons any good at diagnosing rotator cuff tears using ultrasound?: A comparative analysis of surgeon <i> vs</i> radiologist. Int J Shoulder Surg. 2008;2(1):4.
6. Wang WL, Kruse K, Fowler JR. A Survey of the Use of Ultrasound by Upper Extremity Surgeons. HAND. 2017 Jan 7;12(1):31–8.
7. Kruse KK, Dilisio MF, Wang WL, Schmidt CC. Do we really need to order magnetic resonance
   imaging? Shoulder surgeon ultrasound practice patterns and beliefs. JSES Open Access [Internet]. 2019 Jul 1 [cited 2024 Oct 27];3(2):93–8. Available from: http://www.jsesinternational.org/article/S2468602619300063/fulltext
8. Beggs I, Stefano Bianchi U, Angel Bueno S, Michel Cohen S, Michel Court-Payen F, Andrew

Grainger D, et al. European Society of MusculoSkeletal Radiology Musculoskeletal Ultrasound Technical Guidelines I. Shoulder.

9. Friedman M V., Hillen TJ, Holland D V., Essenberg JM, Demertzis JL. Impact of shoulder sonography on clinical decision making. In: Journal of Ultrasound in Medicine. Wiley Blackwell; 2017. p. 1365–71.
10. Mitchell C, Adebajo A, Hay E, Carr A. Shoulder pain: diagnosis and management in primary care. BMJ [Internet]. 2005 Nov 12;331(7525):1124–8. Available from: https://www.bmj.com/lookup/doi/10.1136/bmj.331.7525.1124
11. Griesser MJ, Harris JD, Campbell JE, Jones GL. Adhesive capsulitis of the shoulder: a systematic review of the effectiveness of intra-articular corticosteroid injections. J Bone Joint Surg Am
    [Internet]. 2011 Sep 21 [cited 2024 Oct 29];93 18(18):1727–33. Available from: https://doi.org/10.2106/JBJS.J.01275
12. Walmsley S, Osmotherly PG, Rivett DA. Clinical Identifiers for Early-Stage Primary/Idiopathic
    Adhesive Capsulitis: Are We Seeing the Real Picture? Phys Ther [Internet]. 2014 [cited 2024 Oct 29];94(7):968–76. Available from: https://doi.org/10.2522/ptj.20130398
13. Lee YJ. Evaluation of Shoulder Pain in Outpatient Clinic. Korean Journal of Family Practice [Internet]. 2021 Oct 20 [cited 2024 Oct 29];11(5):324–30. Available from: https://www.kjfp.or.kr/journal/view.html?doi=10.21215/kjfp.2021.11.5.324
14. Greenberg DL. Evaluation and Treatment of Shoulder Pain. Medical Clinics of North America. 2014 May 1;98(3):487–504.
15. Oh JH, Park MS, Rhee SM. Treatment Strategy for Irreparable Rotator Cuff Tears. Clin Orthop Surg [Internet]. 2018 Jun 1 [cited 2024 Oct 29];10(2):119. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5964259/
16. Iannotti JP. Accuracy of Office-Based Ultrasonography of the Shoulder for the Diagnosis of Rotator Cuff Tears. The Journal of Bone and Joint Surgery (American). 2005 Jun 1;87(6):1305.
17. Papatheodorou A, Ellinas P, Takis F, Tsanis A, Maris I, Batakis N. US of the Shoulder: Rotator Cuff and Non–Rotator Cuff Disorders. RadioGraphics. 2006 Jan;26(1):e23–e23.
18. Martinoli C, Bianchi S, Prato N, Pugliese F, Zamorani MP, Valle M, et al. US of the Shoulder: Non– Rotator Cuff Disorders. RadioGraphics. 2003 Mar;23(2):381–401.
19. Teefey SA, Rubin DA, Middleton WD, Hildebolt CF, Leibold RA, Yamaguchi K. Detection and quantification of rotator cuff tears. Comparison of ultrasonographic, magnetic resonance imaging, and arthroscopic findings in seventy-one consecutive cases. J Bone Joint Surg Am. 2004
    Apr;86(4):708–16.
20. Vlychou M, Dailiana Z, Fotiadou A, Papanagiotou M, Fezoulidis IV, Malizos K. Symptomatic partial rotator cuff tears: Diagnostic performance of ultrasound and magnetic resonance imaging with surgical correlation. Acta radiol. 2009 Feb 1;50(1):101–5.
21. Churchill SR, Fehringer E V., Dubinsky TJ, Matsen FA. Rotator Cuff Ultrasonography: Diagnostic Capabilities. Journal of the American Academy of Orthopaedic Surgeons. 2004 Jan;12(1):6–11.
22. Lucas J, van Doorn P, Hegedus E, Lewis J, van der Windt D. A systematic review of the global prevalence and incidence of shoulder pain. BMC Musculoskelet Disord [Internet]. 2022 Dec 1 [cited 2024 Oct 29];23(1):1073. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9730650/
23. Hodgetts CJ, Leboeuf-Yde C, Beynon A, Walker BF. Shoulder pain prevalence by age and within occupational groups: a systematic review. Arch Physiother [Internet]. 2021 Nov 4 [cited 2024 Oct 29];11(1). Available from: https://journals.aboutscience.eu/index.php/aop/article/view/2835
24. Khosravi F, Amiri Z, Masouleh NA, Kashfi P, Panjizadeh F, Hajilo Z, et al. Shoulder pain prevalence and risk factors in middle-aged women: A cross-sectional study. J Bodyw Mov Ther. 2019 Oct 1;23(4):752–7.
25. Hodgetts CJ, Jacques A, Daffin L, Learmonth YC. Testing the association between shoulder pain prevalence and occupational, physical activity, and mental health factors in two generations of Australian adults. Chiropr Man Therap [Internet]. 2023 Dec 1 [cited 2024 Oct 29];31(1):1–10. Available from: https://chiromt.biomedcentral.com/articles/10.1186/s12998-023-00520-1