Section: Radio Diagnosis

Original Research Article

CORRELATION OF USG & MRI FINDINGS IN PATIENTS PRESENTING WITH FROZEN SHOULDER

Monalisa Khatun[1], Sunit Kumar Jana[2], Santanu Biswas[3]

[1]*Senior Resident, Department of Radio diagnosis, Burdwan Medical College and Hospital, Baburbag, Purba Barddhaman, West Bengal, India*
[2]*Assistant Professor, Department of Radio Diagnosis, ICARE Institute of Medical Science and Research, Haldia, West Bengal, India*
[3]*Senior Resident (Medical Officer), Department of Radio Diagnosis, Kalna Sub-Division & Super Specialty Hospital, STKK Road, Kalna, Purba Barddhaman, West Bengal, India*

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Corresponding Author:
Dr. Monalisa Khatun,
Senior Resident, Department of Radio diagnosis, Burdwan Medical College and Hospital, Baburbag, Purba Barddhaman, West Bengal, India.
Email: monalisak135@gmail.com

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ABSTRACT

Background: Adhesive capsulitis, commonly known as frozen shoulder, is a painful and disabling condition characterized by progressive restriction of both active and passive movements of the glenohumeral joint. Imaging plays a vital role in confirming the diagnosis, assessing severity, and guiding treatment. Magnetic resonance imaging (MRI) is considered the gold standard, while high-resolution ultrasonography (USG) is emerging as a cost-effective and accessible alternative. The study aimed to evaluate the correlation between ultrasonography and MRI findings in patients presenting with frozen shoulder and to assess the diagnostic reliability of USG in detecting key structural abnormalities.

Materials and Methods: The present study was a descriptive Cross-sectional study. This Study was conducted from 1st January 2023 to 30th June 2024. Department of radio-diagnosis Burdwan medical college & hospital, burdwan, west Bengal. Study population 32.

Results: The majority of patients were aged 41–50 years (59.4%), with female predominance (62.5%). Thirteen patients (40.6%) were diabetic, and six (18.7%) had thyroid disorders. Clinically, decreased range of motion was the most common presenting feature (53.1%). MRI detected CHL thickening in 81.3% of patients, axillary recess involvement in 68.8%, and rotator interval abnormalities in 78.1%, whereas USG detected these findings in 68.8%, 53.1%, and 68.8% of patients, respectively, showing substantial correlation between the modalities.

Conclusion: USG demonstrates significant correlation with MRI in detecting structural changes in frozen shoulder and serves as a reliable, accessible, and cost-effective imaging modality, particularly in settings where MRI may not be feasible.

Keywords: Adhesive capsulitis, Frozen shoulder, Ultrasonography, MRI, Coracohumeral ligament, Axillary recess.

INTRODUCTION

Shoulder pain is the third most common musculoskeletal complaint in orthopedic clinics, with an increasing incidence. The shoulder has a wide range of motion but lacks stability, comprising two joints—the acromioclavicular (AC) and glenohumeral joints—formed by three bones: scapula, humerus, and clavicle. Common shoulder pathologies include tendon inflammation, tendon tears, joint instability, arthritis, and fractures. Being the most mobile and unconstrained joint, the shoulder is prone to injury of the rotator cuff muscles and other non-traumatic pathologies, particularly with advancing age, as soft tissues degenerate after 60 years.[1] Diagnosis of shoulder disorders relies primarily on clinical tests, which are helpful in identifying peri-articular soft tissue involvement but may not accurately locate the exact lesion in non-traumatic shoulder pain.[2] Adhesive capsulitis (frozen shoulder) is the most common non-traumatic shoulder pathology, characterized by progressive

limitation of active and passive glenohumeral joint movement, often accompanied by severe pain.[3] Although diagnosed clinically, imaging modalities such as ultrasonography (USG), magnetic resonance imaging (MRI), and arthrography can confirm the diagnosis and detect associated rotator cuff and intra-articular pathologies.[4,5] Imaging results guide management decisions, whether operative or conservative.[6] Musculoskeletal ultrasound (MSKUS) is particularly useful for detecting synovitis, joint effusions, and septic fluid for potential aspiration. Expert recommendations identify shoulder, along with hand/wrist, elbow, hip, knee, and ankle/foot, as key areas for musculoskeletal ultrasound application.[7] Both USG and MRI have advantages and limitations; they can be complementary in evaluating shoulder pathology. Selection of the most accurate, cost-effective, and least invasive modality depends on accessibility and feasibility.[8] USG can also guide intra- and peri-articular procedures in adhesive capsulitis.[9] Classic imaging findings of adhesive capsulitis include thickening and high T2 signal of the axillary pouch joint capsule/inferior glenohumeral ligaments, coracohumeral ligament thickening, and scarring in the subcoracoid region, as well as changes in the rotator interval.[10,11] In this study, a coracohumeral ligament (CHL) thickness ≥2 mm will be considered diagnostic for frozen shoulder to reduce underdiagnosis. Rotator interval and axillary recess changes will be assessed using echogenicity on USG and signal intensity on MRI for simplicity. MRI, a non-invasive and increasingly used modality, can detect even minute intra- and extra-articular soft tissue changes, while USG offers a widely available, safe, and cost-effective alternative.[12] Historically, arthrography has been the gold standard, revealing reduced joint volume (usually 5–7 mL) and contraction of the subscapular and axillary recesses. This study aims to compare clinical findings with USG and MRI in patients with frozen shoulder and to evaluate the utility of USG as an initial diagnostic tool correlating with MRI findings.

MATERIALS AND METHODS

Study design: A Descriptive Cross-sectional study.

Place of study: Department of radio-diagnosis Burdwan medical college & hospital, burdwan, west Bengal

Period of study: From 1st January 2023 to 30th June 2024.

Study Population: Department of Radio diagnosis, Burdwan medical college & Hospital, in collaboration with Department of Orthopedics, Burdwan medical college & Hospital.

Sample size: The sample size 32 patients.

Inclusion Criteria

All clinically diagnosed cases of Frozen Shoulder of any age & sex who were willing to give informed consent.

Exclusion Criteria

- Patients unfit for USG & MRI examination.
- Patients having history of any trauma.
- Known cases of NEOPLASIA- hampering shoulder function.
- Patients unwilling to give consent.

Study Variable

USG findings –

- Thickening of CHL (>/= 2mm).
- Altered Echogenicity in Rotator Interval.
- Altered Echogenicity in Axillary Recess.

MRI findings-

- Thickening of CHL (>/= 2mm)
- Altered Signal Intensity in Rotator Interval.
- Altered Signal Intensity in Axillary Recess.

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

RESULTS

Table 1: Distribution of the study participants according to Age (n=32)

Age groups (in years)	Frequency	Percent
≤ 30	1	3.1
31 - 40	8	25
41 - 50	19	59.4
>50	4	12.5
Total	32	100

Table 2: Distribution of the study participants according to sex (n=32)

Sex	Frequency	Percent
Female	20	62.5
Male	12	37.5
Total	32	100

Table 3: Distribution of the study participants according to diabetic history (n=32)

Diabetes	Frequency	Percent
No	19	59.4
Yes	13	40.6
Total	32	100

Table 4: Distribution of the study participants according to thyroid disorder (n=32)

Thyroid disorder	Frequency	Percent
No	26	81.3
Yes	6	18.7
Total	32	100

Table 5: Distribution of the study participants according to symptoms (n=32)

Symptoms	Frequency	Percent
Pain	15	46.9
Decreased range of movement	17	53.1
Total	32	100

Table 6: Comparison of MRI and Ultrasonography (USG) Findings in Patients with Frozen Shoulder

		MRI	USG
CHL thickening	<2 mm	6 (18.7%)	10 (31.2%)
	≥2mm	26 (81.3%)	22 (68.8%)
	Total	32 (100.0%)	32 (100.0%)
Axillary recess	Present	22 (68.8%)	17 (53.1%)
	Not present	10 (31.2%)	15 (46.9%)
	Total	32 (100.0%)	32 (100.0%)
Rotator interval	Present	25 (78.1%)	22 (68.8%)
	Not present	7 (21.9%)	10 (31.2%)
	Total	32 (100.0%)	32 (100.0%)

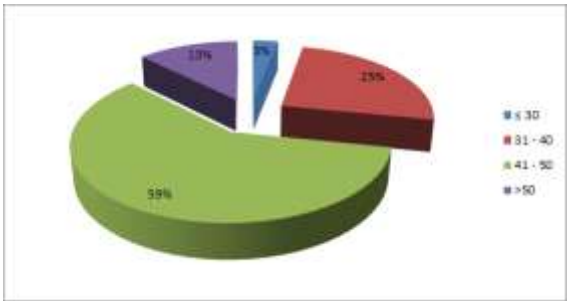

Figure 1: Distribution of the study participants according to Age (n=32)

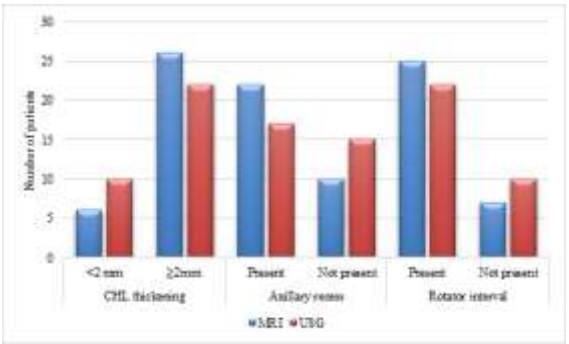

Figure 2: Comparison of MRI and Ultrasonography (USG) Findings in Patients with Frozen Shoulder

In the present study, the majority of patients (19 out of 32; 59.4%) belonged to the 41–50 years age group, indicating that frozen shoulder is most prevalent in middle-aged individuals. This was followed by 8 patients (25%) in the 31–40 years age group and 4 patients (12.5%) aged above 50 years. Only 1 patient (3.1%) was aged 30 years or below. [Table 1]

In this study, out of 32 patients, 20 (62.5%) were females and 12 (37.5%) were males. This indicates a female predominance in the occurrence of frozen shoulder. The findings are consistent with previous literature reporting a higher incidence of adhesive capsulitis among females, particularly in the middle-aged group. The female-to-male ratio in the present study is approximately 1.7: 1, suggesting that females are more commonly affected than males in this condition. [Table 2] In this study, out of 32 patients, 13 patients (40.6%) were diabetic, while 19 patients (59.4%) were non-diabetic. [Table 3]

In the present study, 6 out of 32 patients (18.7%) had a thyroid disorder, while 26 patients (81.3%) had no thyroid abnormalities. This shows that about one-fifth of frozen shoulder patients had associated thyroid dysfunction, particularly hypothyroidism. These findings suggest that thyroid disorders increase the risk of developing frozen shoulder, likely due to connective tissue and collagen metabolism changes. [Table 4]

In this study, the most common presenting symptom was decreased range of movement, observed in 17 patients (53.1%), followed by pain in 15 patients (46.9%). This indicates that while shoulder pain is a frequent initial complaint, restriction of movement is the predominant feature in patients presenting with frozen shoulder. These findings are consistent with the typical clinical presentation of adhesive capsulitis, where stiffness gradually becomes more prominent as the disease progresses. [Table 5]

Coracohumeral Ligament (CHL) Thickening: MRI showed CHL thickening ≥2 mm in 26 patients (81.3%), while 6 patients (18.7%) had <2 mm

thickening, On USG, 22 patients (68.8%) had CHL thickening ≥2 mm and 10 patients (31.2%) had <2 mm. This indicates that MRI detected slightly more cases of CHL thickening than USG. Axillary Recess Involvement: MRI revealed axillary recess involvement in 22 patients (68.8%), whereas 10 patients (31.2%) showed no involvement, USG detected axillary recess changes in 17 patients (53.1%), with 15 patients (46.9%) showing no involvement. This shows that MRI was more sensitive in identifying axillary recess abnormalities.Rotator Interval Changes: MRI demonstrated rotator interval abnormalities in 25 patients (78.1%), with 7 patients (21.9%) showing no changes, USG detected rotator interval involvement in 22 patients (68.8%), while 10 patients (31.2%) showed no abnormality. [Table 6]

DISCUSSION

The present study was a descriptive Cross-sectional study. This Study was conducted from 1st January 2023 to 30th June 2024. Department of radio-diagnosis Burdwan medical college & hospital, burdwan, west Bengal. Study population 32.

In the present study, the majority of patients (19 out of 32; 59.4%) belonged to the 41–50 years age group, indicating that frozen shoulder is most prevalent in middle-aged individuals. This was followed by 8 patients (25%) in the 31–40 years age group and 4 patients (12.5%) aged above 50 years. Only 1 patient (3.1%) was aged 30 years or below. Similar study by Albert F et al,[4] (2023) and Kim SH et al,[6] (2021) reported the highest prevalence of adhesive capsulitis in middle-aged adults.

In this study, out of 32 patients, 20 (62.5%) were females and 12 (37.5%) were males. This indicates a female predominance in the occurrence of frozen shoulder. The findings are consistent with previous literature reporting a higher incidence of adhesive capsulitis among females, particularly in the middle-aged group. The female-to-male ratio in the present study is approximately 1.7:1, suggesting that females are more commonly affected than males in this condition. Similar study by Zreik NH et al,[11] (2016) and Le HV et al,[17] (2017) reported female predominance in frozen shoulder.

In this study, out of 32 patients, 13 patients (40.6%) were diabetic, while 19 patients (59.4%) were non-diabeti. This supports prior studies showing a strong association between diabetes mellitus and adhesive capsulitis. Similar study by Rizk M et al,[14] (2019) and Neviaser R et al,[16] (2015) reported higher prevalence of frozen shoulder among diabetic patients.

In the present study, 6 out of 32 patients (18.7%) had a thyroid disorder, while 26 patients (81.3%) had no thyroid abnormalities. This shows that about one-fifth of frozen shoulder patients had associated thyroid dysfunction, particularly hypothyroidism. These findings suggest that thyroid disorders increase the risk of developing frozen shoulder, likely due to connective tissue and collagen metabolism changes. Similar study by Tighe R et al,[15] (2017) and Le HV et al,[17] (2017) reported thyroid dysfunction as a risk factor for adhesive capsulitis.

In this study, the most common presenting symptom was decreased range of movement, observed in 17 patients (53.1%), followed by pain in 15 patients (46.9%). This indicates that while shoulder pain is a frequent initial complaint, restriction of movement is the predominant feature in patients presenting with frozen shoulder. These findings are consistent with the typical clinical presentation of adhesive capsulitis, where stiffness gradually becomes more prominent as the disease progresses. Similar study by Hand GC et al,[12] (2007) and Neviaser R et al,[16] (2015) reported decreased range of motion as the most frequent presenting symptom.

Coracohumeral Ligament (CHL) Thickening: MRI showed CHL thickening ≥2 mm in 26 patients (81.3%), while 6 patients (18.7%) had <2 mm thickening. On USG, 22 patients (68.8%) had CHL thickening ≥2 mm and 10 patients (31.2%) had <2 mm. This indicates that MRI detected slightly more cases of CHL thickening than USG. Axillary Recess Involvement: MRI revealed axillary recess involvement in 22 patients (68.8%), whereas 10 patients (31.2%) showed no involvement. USG detected axillary recess changes in 17 patients (53.1%), with 15 patients (46.9%) showing no involvement. This shows that MRI was more sensitive in identifying axillary recess abnormalities. Rotator Interval Changes: MRI demonstrated rotator interval abnormalities in 25 patients (78.1%), with 7 patients (21.9%) showing no changes. USG detected rotator interval involvement in 22 patients (68.8%), while 10 patients (31.2%) showed no abnormality. Similar study by Rilshad AK et al,[1] (2022), Kulkarni PS et al,[2] (2022), and Connell DA et al,[20] (2019) found comparable correlation between MRI and USG for CHL, axillary recess, and rotator interval changes.

CONCLUSION

In this study of 32 patients with frozen shoulder, the condition was most prevalent in middle-aged adults, particularly females, with diabetes and thyroid disorders being common comorbidities. Clinically, decreased range of motion was the predominant presenting feature. MRI detected slightly more cases of coracohumeral ligament thickening, axillary recess involvement, and rotator interval abnormalities compared to ultrasonography, highlighting its higher sensitivity. However, USG demonstrated substantial correlation with MRI findings and effectively identified key structural changes, supporting its role as a reliable, cost-effective, and accessible imaging modality for the diagnosis and assessment of adhesive capsulitis, especially in settings where MRI may not be readily available.

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