

CLINICO-RADIOLOGICAL CORRELATION OF SHOULDER PAIN

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Abstract

Background - Shoulder pain is one of the commonest conditions encountered in our orthopedic department. Accurate diagnosis is a must before undertaking any treatment. Since clinical diagnosis cannot make an accurate diagnosis, radiological investigation is necessary to know the exact cause of shoulder pain. There are a wide range of invasive and non-invasive modalities that can be used to investigate these patients. Ultrasound examination is a highly specific and sensitive modality in comparison with MRI. High-resolution real-time USG has shown to be a cost-effective means of investigation of rotator cuff pathologies. With recent advances with USG, results of imaging of shoulder joint pathologies are as similar or in some cases more precise in the diagnosis than MRI.

Methods - Prospective analysis of 52 patients presenting with shoulder pain were included in our study. A pre-formed written consent is also taken. All patients underwent a thorough clinical examination, USG of the affected shoulder with comparison of the opposite side and MRI of the affected shoulder for comparison.

Results - Ultrasound is equivalent in detection of rotator cuff tears in comparison with MRI. MRI outscores ultrasound in detection of labral tears, cartilaginous lesions and subtle bony lesions. USG examination can be used as the first line of investigating a case of shoulder pain as it is inexpensive, real time and allows for comparison with the opposite side. MRI can be used as a confirmatory tool.

Keywords - Ultrasound; Magnetic Resonance Imaging; Rotator cuff

Introduction

Shoulder pain is one of the most common complaints encountered in orthopedic practice and often leads to considerable disability. There are various causes of a painful shoulder, but periarticular soft tissue lesions involving tendons and bursae are the most common and are often associated with chronic impingement of the rotator cuff on the anterolateral margin of the acromion. Even though a large number of clinical tests used for the diagnosis of painful shoulder are considered accurate in determining the location of the periarticular lesions, these entities may be difficult to differentiate by physical examination. Clinical diagnosis have low accuracy in comparison with arthroscopy. Patients presenting for imaging fall broadly into one of the following categories: Specific pain and restricted movements on abducting the arm and symptoms of instability [1].

High resolution ultrasound is noninvasive, less expensive and non-ionizing modality with good sensitivity in detecting both rotator cuff and non-rotator cuff disorder.³ It serves as a

complementary role to magnetic resonance imaging of the shoulder. The reported accuracy, sensitivity and specificity of high-resolution ultrasound in the detecting of any tear, whether partial or full thickness are all greater than 90%. High resolution ultrasound can also reveal the presence of other abnormalities that may mimic rotator cuff tear at clinical examination, including Tenosynovitis, Tendinosis, Calcific tendinosis, Subacromial-Subdeltoid bursitis, Greater tuberosity fracture etc [2].

Magnetic Resonance Imaging and Ultrasonography have replaced arthrography for evaluating the integrity of the rotator cuff. Magnetic Resonance arthrography is used for instability. MRI has become the “gold standard” for detecting both subtle and obvious internal derangement and assessing overall joint structure. MRI is reliable technique for the evaluation of rotator cuff tendons; previous low power magnet MRIs provided only a static evaluation of the shoulder joint and indirectly suggested the diagnosis of subacromial impingement. Whereas, recent super conductive magnets make it possible to do a dynamic evaluation of the shoulder joint to some extent. Over the last two decades musculoskeletal USG has established itself as a versatile imaging modality in the fields of radio-diagnosis, sports medicine and rheumatology. It has gained its rightful place in literature along with MRI. Cost effectiveness and ready availability are its biggest advantages in several clinical settings. The real time capability of ultrasound in conducting dynamic studies in areas like the shoulder is a very big asset. It helps to do quick comparison with the contra-lateral side, which is of great help in many difficult situations. It has its own limitations such as high operator dependency, long learning curve and problems of anisotropy. It has limited utility in evaluation of labral, rotator cuff interval, and in demonstrating subtle bony lesions [3].

USG has its own limitations such as high operator dependency, long learning curve and problems of anisotropy. It has limited utility in evaluation of labral, rotator cuff interval lesions and in demonstrating subtle bony lesions. In our study of thirty patients with shoulder joint pain, with a clinical suspicion of rotator cuff injuries were subjected to USG and MRI of the shoulder joint. Our aim was to show that ultrasound examination was as effective to MRI, in the evaluation of shoulder pain, especially in cases of rotator cuff injuries [4].

Materials and Methods

Study place

The study was conducted among patients attending department of Radio diagnosis of Vydehi Institute of Medical Sciences and Research Centre (VIMS & RC).

Study Period

January 2020 to June 2021

Ethical approval

Institutional ethical committee approval was obtained prior to the initiation of the study

Study Population

All patients referred for ultrasound of shoulder to the department of radio diagnosis (in and out patient) of Vydehi Institute of Medical Sciences and Research Centre (VIMS & RC). A prospective study of 52 patients with shoulder pain was undertaken in the department of Radio-diagnosis.

Inclusion and exclusion criteria

Patients with history of pain in either shoulder joint, history of trauma (trivial), clinically suspected to have a rotator cuff injury (full thickness or partial thickness tears), biceps tendon injury, or calcific tendinitis were included in the study.

Clinically suspected cases of instability, known cases of Rheumatoid arthritis, previous surgery or prosthesis of shoulder and patients with pace makers, metal implants in their bodies, foreign bodies in their eyes and those having claustrophobia were excluded from the study [5].

Examinations done

These patients were initially clinically examined by the orthopedician and then radiologically evaluated. The radiological examinations that were undertaken are USG examination with comparison of the opposite shoulder and then a MRI of the affected shoulder. Ultrasound examination of the shoulder: The examination on the affected shoulder was carried out on a PHILIPS AFFINITI, with a high frequency linear transducer of 6-12 MHz. The rotator cuff tendons and muscles were examined in various positions, the ACJ and the posterior aspect of the joint was also examined. Dynamic examinations of the shoulder were also carried out. Comparison of the opposite shoulder was also done [6].

MRI of the affected shoulder- The MRI examination was performed on a 1.5 Tesla PHILIPS ACHIEVA, with a Flex C1 coil centered over the affected shoulder with the patient in supine position. Multiplanar images were obtained in the axial, oblique coronal and oblique sagittal planes.

Data analysis

The collected data was collected, coded, entered into Microsoft excel work sheet and exported to SPSS. Data was analysed using SPSS version 21. Data is presented as percentage in categories and then presented as tables and diagrams. Independent t test, and paired t-test were used for test of significance [7].

Results

A clinic-radiological correlation of 52 patients with shoulder joint pain was undertaken to study the correlation of USG finding with MRI findings. In present study majority were in the age group 41-50 (28.8%) followed by 21-30yrs (26.9%). In present study majority were males (63%) followed by females (36.5%). Majority of study population had duration of symptoms up to 1 month (44.2%) followed by 1-6 months (42.3%).

Majority had right shoulder involvement (69.2%). Study population was right hand dominant (100%). In present study major presenting complaint was h/o trauma (28.8%), followed by diabetes (21.2%). The results showed that majority had normal range of motion (59.61%). Restricted range of motion was in 40.39%. In present study majority were males (63%) followed by females (36.5%). In present study majority had right shoulder involvement (69.2%) and right hand dominant (100%).

In present study major presenting complaint was h/o trauma (28.8%), followed by diabetes (21.2%). In present study majority had normal range of motion (59.61%). Restricted range of motion was in 40.39%. Neer's test was negative in majority (67%) and was positive only in

32.7% of cases. Subscapularis muscle partial thickness tear was seen in 7.7% of cases and tendinosis in only one case. Supraspinatus muscle partial thickness tear was seen in 44.2% On USG. Calcifications were seen 3 cases of supraspinatus muscle, 2 cases of Infraspinatus muscle and in one case of subscapularis muscle on USG. Peribicipital tendon fluid was absent in majority (73%) and was seen in 26.9% of cases on USG. Subcoracoid bursitis was absent in all (100%) and Subacromial-subdeltoid bursitis was absent in majority (86.5%) i.e., present in only 13.5%. USG acromioclavicular joint hypertrophy was absent in majority (96.2%) and was seen only in 2 cases.

Study subacromial and subcoracoid impingement was present in 1 subject each. Subscapularis muscle partial thickness tear was seen in 7.7% of cases and Full thickness tear in 3.8% case. Supraspinatus muscle partial thickness tear was seen in 55.8% and tendinosis seen in 23.1% of cases. On USG only one case of Infraspinatus partial thickness was seen on USG. Peribicipital tendon fluid was present in majority (55.8%) of cases on MRI.

MRI Subacromial-subdeltoid bursitis was present in majority (51.9%), whereas subcoracoid bursitis was present in 38.5%. ACJ hypertrophy was seen in 38.5% of cases on MRI evaluation. MRI Type-1 acromian type were seen in majority (51.9%) followed by Type-II (38.5%) followed by Type-III (9.6%). MRI labral tears were seen in only 17.35 of cases. MRI there were single cases of axillary lymph node, calcific SST, joint edema, and thickened IGHL. USG showed high specificity in detecting Subscapularis tear (95.7%), and high sensitivity in detecting Supraspinatus (72.7%). In detecting Peribicipital Tendon fluid detection, USG showed high (95.7%) specificity but low sensitivity (44.8%). In detecting Subacromial-subdeltoid bursitis detection showed high (96%) specificity but low sensitivity (22.2 %). In detecting ACJ Hypertrophy detection showed high (100%) specificity but low sensitivity (10%).

	N	N %
SEX		
MALE	33	63.5%
FEMALE	19	36.5%
DURATION OF SYMPTOMS		
UP TO 1 MONTH	23	44.2%
1 TO 6 MONTHS	22	42.3%
6 TO 12 MONTHS	7	13.5%
AFFECTED SHOULDER		
RIGHT	36	69.2%
LEFT	16	30.8%
DOMINANT HAND		
RIGHT	52	100.0%
LEFT	0	0.0%
PRESENTING COMPLAINTS		
DIABETES	11	21.2%
H/O TRAUMA	15	28.8%
TENDERNESS	6	11.5%
RANGE OF MOTION		
NORMAL	31	59.6%
RESTRICTION	21	40.4%
<30 deg	5	9.6%

30-45 deg	5	9.6%
>45 deg	11	21.2%
NEER'S TEST		
NEGATIVE	35	67.3%
POSITIVE	17	32.7%
NEER'S TEST	N	N %
PERIBICIPITAL TENDON FLUID		
ABSENT	38	73.1%
PRESENT	14	26.9%
USG-BURSITIS		
SUBACROMIAL-SUBDELTOID BURSITIS		
ABSENT	45	86.5%
PRESENT	7	13.5%
SUBCORACOID BURSITIS		
ABSENT	52	100.0%
ACJ HYPERTROPHY - USG		
ABSENT	50	96.2%
PRESENT	2	3.8%
PERIBICIPITAL TENDON FLUID - MRI		
ABSENT	23	44.2%
PRESENT	29	55.8%
ACJ HYPERTROPHY - MRI		
ABSENT	32	61.5%
PRESENT	20	38.5%

Table 1 – Distribution of cases**Table 2 - Correlation of USG findings with MRI findings**

USG VS MRI(REFERENCE)		TP	FP	TN	FN
TEAR	1.Subscapularis	3	2	44	3
	2.Supraspinatus	32	4	4	12
	3.Infraspinatus	0	0	51	1
	4.Teres Minor	0	0	52	0
	5.Biceps Tendon	0	0	52	0
6.Peribicipital Tendon fluid		13	1	22	16
BURSITIS	7.Subacromial-subdeltoid bursitis	6	1	24	21
	8.Subcoracoid Bursitis	0	0	32	20
9. ACJ Hypertrophy		2	0	32	18

Table 3- SENSITIVITY ANALYSIS OF USG VER MRI

USG VS MRI(REFERENCE)		SENSITIVITY	SPECIFICITY	PPV	NPV	ACCURACY
TEAR	1.Subscapularis	50.0%	95.7%	60.0%	60.0%	90.4%
	2.Supraspinatus	72.7%	50.0%	88.9%	25.0%	69.2%
	3.Infraspinatus	-	100.0%	-	98.1%	98.1%
	4.Teres Minor	-	100.0%	-	-	100.0%
	5.Biceps Tendon	-	100.0%	-	-	100.0%
6.Peribicipital Tendon fluid		44.8%	95.7%	92.9%	57.9%	67.3%
BURSITIS	7.Subacromial- subdeltoid bursitis	22.2%	96.0%	85.7%	53.3%	57.7%
	8.Subcoracoid Bursitis	-	100.0%	-	61.5%	61.5%
9. ACJ Hypertrophy		10.0%	100.0%	100.0%	64.0%	65.4%

Discussion

Shoulder disorders are one of the most common musculoskeletal presentation in general practice, and they can cause workers' compensation claims, inability to perform social activities, and substantial financial hardship for those affected and their families. Diagnostic radiological procedures such as ultrasonography (US), MRI, and MR arthrography (MRA) provide useful information that can help clinicians to establish the proper treatment plan for each patient [8].

This was a prospective study of 52 patients who presented with shoulder pain. A detailed history and clinical examination were done initially. An USG examination of the affected shoulder with comparison to the opposite side was done. These findings were correlated with MRI. In present study majority were in the age group 41-50 (28.8%), which is similar to a study done by Anil U Madurwar et al, where they had 49 years as the mean age of shoulder pain presentation. In present study 63% were males and this male predominance was consistent with Mitchell C et al study.

Right shoulder was the affected side in 36 (69.2%) of our cases, while the left side was affected in only 16 (30.8%) of our patients. This can be explained by complete right hand dominant study population in present study. Everyday activities such as brushing teeth or eating, writing, holding, driving etc will become difficult over period of time in right-handed people if the same side of shoulder is involved and eventually the seek medical help[9]. In present study major were presented with history of trauma (28.8%). History of diabetes was seen in 11 cases. Minor shoulder problems, such as sore muscles and aches and pains, are common.

On clinical examination tenderness was present in 6 (11.5%) of the patients. 31 patients (60%) had normal range of motion, whereas restricted range of motion was seen in 21

patients (40%). Neer's impingement sign is elicited when the patient's rotator cuff tendons are pinched under the coracoacromial arch. Pain with this maneuver is a sign of subacromial impingement. A positive Neer's Test was present in 17 patients (32.7%). Rotator cuff tendon disorders constitute the most common group of pathologies that affect the shoulder joints according to Neer CS et al.

Injury and degeneration are the 2 main causes of rotator cuff tears. An injury to the rotator cuff, such as a tear, may happen suddenly when falling on an outstretched hand. It may also develop over time due to repetitive activities. Rotator cuff tears can also happen due to the breakdown (degeneration) of the tissues, which may happen as part of the aging process. There were 6 cases of subscapularis tear according to MRI but only 3 cases were picked up by USG Correctly and 2 cases were falsely picked up by USG as subscapularistear [10].

There were 44 cases of Supraspinatus tear according to MRI and 32 cases were picked up by USG Correctly and 4 cases were falsely picked up by USG as Supraspinatus tear. In present study, USG showed high specificity in detecting Subscapularis tear (95.7%), and high sensitivity in detecting Supraspinatus (72.7%). Similar findings were seen in a study done.

Teefeyet also revealed overall accuracy of USG to be 87% in correct identification of partial as well as full- thickness tears which supports present study only in detecting subscapularis and supraspinatus tears. In detecting Peribicipital Tendon fluid detection showed high (95.7%) specificity but low sensitivity (44.8%). In detecting Subacromial-subdeltoid bursitis detection showed high (96%) specificity but low sensitivity (22.2%).

No cases of subcoracoid bursitis were detected on USG while MRI detected it in 20 of cases. Thus, MRI is a better modality than USG in picking up SA-SD bursitis, this is similar to a study by Shrestha et al. In detecting ACJ Hypertrophy detection showed high (100%) specificity but low sensitivity (10%).out of 20 cases (by MRI) only 2 were correctly detected by USG [11].

Smith TO et al did a meta-analysis study where Ultrasonography had good sensitivity and specificity for the assessment of partial thickness (sensitivity 0.84; specificity 0.89), and full-thickness rotator cuff tears (sensitivity 0.96; specificity 0.93) which supports present study. Ultrasound accurately diagnosed simply the presence or absence of a tear in 74% of patients of shoulder pain in a recent study done by Day M et al. which supports present study. In detecting soft tissue changes in arthritic AC joints MRI was better than ultrasound in a study done by Park J et al, which is again supporting present study where it showed only 10% sensitivity in detecting ACJ hypertrophy[12].

Reference:

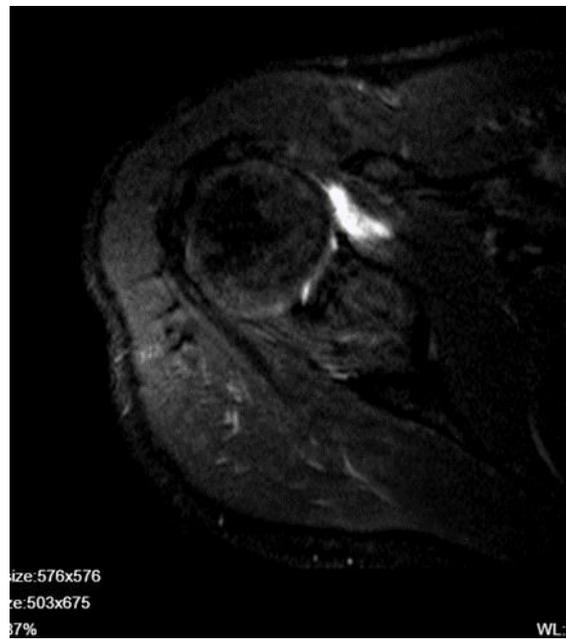
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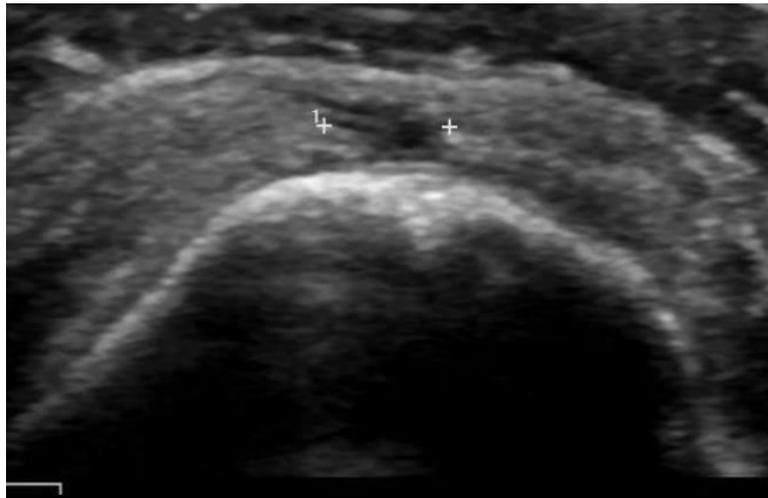
Supplementary data



Case 1 - T2W sagittal image showing altered signal intensity in subscapularis tendon



Case 2 - T2W axial image showing altered signal intensity in supraspinatus tendon at musculotendinous junction.



Case 3 - USG shows hypo echogenicity within the supraspinatus muscle



Case 4 - T2W sagittal images showing hyper signal intensity in supraspinatus and subscapularis tendons.