

A study to compare between USG and MRI in evaluation of rotator cuff injury in tertiary care hospital

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Abstract

Background: Objectives of our study was to Comparing the accuracy of Ultrasonography in shoulder joint pathologies by comparing its findings with those of Magnetic Resonance Imaging performed subsequently on the same patient to show that ultrasound examination was as effective to MRI, in the evaluation of shoulder pain, especially in cases of rotator cuff injuries. **Methodology:** A prospective study of sixty patients with shoulder pain was undertaken in the department of Radio-diagnosis during a period from August 2012 to August 2014. These patients were initially clinically examined by the orthopedician and then radiologically evaluated. The radiological examinations that were undertaken are an antero-posterior x-ray of the involved shoulder joint, followed by an USG examination with comparison of the opposite shoulder and then a MRI of the affected shoulder. **Conclusion:** Clinical examination of the shoulder joint does not provide adequate insight on the cause of shoulder pain. The commonest pathology causing shoulder pain is rotator cuff pathology, like partial or full thickness tears and the next common pathology is ACJ arthritis. US imaging can be considered almost equally effective as compared to MRI, in the evaluation of rotator cuff injuries. Though operator dependent, a well performed USG can effectively serve as a primary diagnostic method and screening of all painful shoulder joints because it is economic and fast and MRI should be used secondary because it provides more information about the extent of tendons and has lower risk of artefacts.

Key Words: Rotator cuff injury, Ultrasonography

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INTRODUCTION

Shoulder pain is one of the most common complaints encountered in orthopaedic practice and often leads to considerable disability. Even though a large amount 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.¹ Clinical diagnosis have low accuracy in comparison with arthroscopy.^{1,2} The lesions of the rotator cuff are common cause of shoulder pain and dysfunction. Cuff strain, Impingement syndrome, Rotator cuff tears make up a group of lesions that produce shoulder pain. It is clinically difficult to differentiate between these diagnoses and distinguish cuff problems from other conditions like Glenohumeral instability. Rotator cuff injury is a different spectrum, which is of the nature of chronic injury because of the intrinsic nature of the musculo-tendinous and osseotendinous part of the Rotator cuff and the anatomically narrow subacromial space. Hence, it is the commonest musculoskeletal ultrasound examination request. Improvement in the resolution of ultrasound machines, redefined technique and better understanding of the

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pathology have contributed to its high accuracy in the diagnosis of rotator cuff pathology. High resolution ultrasound is non invasive, 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 detection 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. Plain film radiography still being the basic initial investigation required for assessing bony trauma, osteoarthritis and most other arthropathies. They are often supplemented by other techniques for primarily soft tissue abnormalities, such as rotator cuff disease or masses. Magnetic Resonance Imaging and Ultrasonography have replaced arthrography for evaluating the integrity of the rotator cuff.⁴ Magnetic Resonance arthrography is used for instability.⁵ MRI has become the “gold standard” for detecting both subtle and obvious internal derangement and assessing overall joint structure.³ MRI is reliable technique for the evaluation of rotator cuff tendons; previous low power magnet MRI’s 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. Objectives of our study was to Comparing the accuracy of Ultrasonography in shoulder joint pathologies by comparing its findings with those of Magnetic Resonance Imaging performed subsequently on the same patient to show that ultrasound examination was as effective to MRI, in the evaluation of shoulder pain, especially in cases of rotator cuff injuries.

METHODOLOGY

A prospective study of sixty patients with shoulder pain was undertaken in the department of Radio-diagnosis during a period from August 2012 to August 2014.

INCLUSION CRITERIA

- Age >40 years,
- 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.

EXCLUSION CRITERIA

- Clinically suspected cases of instability.
- Known cases of Rheumatoid arthritis
- Previous surgery or prosthesis of shoulder.
- Patients with pace makers, metal implants in their bodies, foreign bodies in their eyes and those having claustrophobia.

These patients were initially clinically examined by the orthopedician and then radiologically evaluated. The radiological examinations that were undertaken are an antero-posterior x-ray of the involved shoulder joint, followed by an USG examination with comparison of the opposite shoulder and then a MRI of the affected shoulder.

Antero-posterior X-ray: Initially a plain Antero-posterior X-ray radiogram of the affected shoulder joint was done, using a WIPRO GE DX-525 150KVp 500mA or a ALLENGERS MARS65 150KVp 800mA X-ray. Findings such as cystic formation or erosions in the tuberosities, degenerative changes in the ACJ, humeral head and glenoid, calcifications in the region of the rotator cuff were documented.

Ultrasound examination of the shoulder: The examination on the affected shoulder was carried out on a GE VOLUSON 730 EXPERT SERIES, 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.

MRI of the affected shoulder: The MRI examination was performed on a 1.5 Tesla SIEMENS MAGNETUM AVANTO, 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.

STATISTICAL METHODS⁶

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale

between two or more groups. Diagnostic statistics viz. Sensitivity, Specificity, PPV, NPV and Accuracy have been computed to find the correlation of USG with MRI findings.

Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables etc.

RESULTS

Descriptive statistical analysis based on number and percentage is done. It reveals that 60% of the patients were between 40-50 years, 26.7% of patients were between 51-60 years and rest 13.3% of the patients were above 60 years of age. The overall mean age of patients studied is 49.77 (SD: 10.27 years). slight male

preponderance of 53.3% and 46.7% were females. It reveals that, 43.3% of patients had shoulder pain up to 1 month; another 43.3% of patients up to 1 – 6 months and 13.3% had pain from 6 – 12 months. Study shows 30% of patients with left shoulder involvement and rest 70% to have right sided shoulder pain. All patients (100%) in our study were right handed. It reveals that 16.67% of patients had a history of trauma and 30% of the patients were known diabetics. It also showed that 16.67% of patients had tenderness of physical examination. 43.3% of patients to have a normal range of motion, whereas restriction of motion of <30 and 30 - 45 degrees was seen in 16.7% of patients; and >45 degrees was seen in 23.3% of patients in our study. 43.3% of patients had a positive Neer’s test, where as 56.7% of patients had a negative Neer’s test in our study.

Table 1: Correlation of USG findings with MRI findings –An Evaluation.

Findings	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
1.Subscapularis	50.00	92.86	33.33	96.30	90.00	0.051+
2.Supraspinatus	76.92	50.00	90.91	25.00	73.33	0.257
3.Infraspinatus	0.00	100.00	50.00	96.67	96.67	NS
4.Teres Minor	0.00	100.00	50.00	100.00	100.00	NS
5.Biceps Tendon	0.00	100.00	50.00	96.67	96.67	NS
6.Peribicipital Tendon Fluid	41.67	83.33	90.91	26.32	50.00	0.255
7.Subacromial-subdeltoid bursitis	26.09	85.71	85.71	26.09	40.00	0.519
8.Subcoracoid bursitis	0.00	100.00	50.00	46.67	46.67	NS

Correlation based on Diagnostic evaluation viz Sensitivity, Specificity, PPV, NPV and Accuracy of USG against MRI was performed and presented in Table 1. Our study reveals a 50% sensitivity, 92.6% specificity, a PPV of 33.33%, a 96.30% NPV, with an accuracy of 90.0% and significance of P = 0.051+, for pathologies of the subscapularis tendon. The supraspinatus tendon pathologies showed 76.92% sensitivity, 50.0% specificity, a PPV of 90.91%, a 25.00% NPV, with an accuracy of 73.33% and a significance of P = 0.257. For the infraspinatus and biceps tendon, both had 0% sensitivity, 100.0% specificity, a PPV of 50.0%, a NPV of 96.67%, with an accuracy of 96.67%, but no significance. For the teres minor, it had 0% sensitivity, 100.0% specificity, a PPV of 50.0%, a NPV of 100.0%, with an accuracy of 100.0%, but no significance. For peribicipital tendon fluid, the sensitivity was 41.67%, 83.33% specific, a PPV of 90.91%, a NPV of 26.32%, with an accuracy of 50% and significance of P = 0.255. Subacromial – subdeltoid bursitis showed, 26.09% sensitivity, 85.71% specificity, a PPV of 85.71%, a NPV of 26.09%, with an accuracy of 40.0% and significance of P = 0.519. In case of subcoracoid bursitis, it showed 0.0% sensitivity, a 100% specificity, a 50.0% PPV, a 46.67 NPV, with an accuracy of 46.67%, but no significance.

DISCUSSION

Rotator cuff pathologies were the commonest cause of painful shoulder in our study. The pathologies included partial, full thickness tears and tendinosis. Supraspinatus tendon was the commonest tendon to be involved in our study. Where in USG detected 44 patients and MRI detected 52 patients with supraspinatus tendon pathologies. This is in correspondence to the study by Zlatkin *et al* wherein they found that supraspinatus tendon involvement was present in around 80% of their cases.⁷ The USG criteria for detection of partial thickness tears were focal discontinuity of the tendon either at the bursal or articular margin. USG criteria for full thickness tears were recognized by complete absence of the tendon. The space over the humeral head is filled by the deltoid muscle and a thickened subacromial-subdeltoid bursa. Tendinosis was diagnosed by USG, in the form of thinning of the tendon and heterogeneous echotexture. MRI criteria for detection of partial thickness tears are characterized by a focal region of fiber discontinuity that is filled with fluid signal. Beside a focal tendon defect, additional findings included surface fraying or changes in tendon caliber, such as attenuation or thickening. MRI criteria for full thickness tears were characterized by tendon discontinuity. Tendon retraction was another sign

to detect full thickness tears. The presence of fluid in the subacromial- subdeltoid bursa, although not specific for a full-thickness tear, to be another indirect sign.⁸The pickup rate of subscapularis pathologies by USG was 10%, whereas the MRI pick up rate for subscapularis pathology was 6.7%. Supraspinatus pathologies the USG pick up rate was 73.3% and MRI pick up rate was 86.7%. Subscapularis tendon pathologies 50% sensitivity, 92.6% specificity, a PPV of 33.33%, a 96.30% NPV, with an accuracy of 90.0% and significance of $P = 0.051+$. The supraspinatus tendon pathologies showed 76.92% sensitivity, 50.0% specificity, a PPV of 90.91%, a 25.00% NPV, with an accuracy of 73.33% and a significance of $P = 0.257$. Subacromial – subdeltoid bursitis had a USG pickup rate of 23.3% and a MRI pickup rate of 76.7%. In our study SA - SD, 26.09% sensitivity, 85.71% specificity, a PPV of 85.71%, a NPV of 26.09%, with an accuracy of 40.0% and significance of $P = 0.519$. MRI, in particularly the SPAIR and STIR sequences are informative in detecting cuff tears. MRI is better in picking up labral and ligamentous pathologies, bony abnormalities and glenohumeral joint arthritis.

CONCLUSION

Clinical examination of the shoulder joint does not provide adequate insight on the cause of shoulder pain. The commonest pathology causing shoulder pain is rotator cuff pathology, like partial or full thickness tears and the next common pathology is ACJ arthritis. US imaging can be considered almost equally effective as compared to MRI, in the evaluation of rotator cuff injuries. Though operator dependent, a well performed

USG can effectively serve as a primary diagnostic method and screening of all painful shoulder joints because it is economic and fast and MRI should be used secondary because it provides more information about the extent of tendons and has lower risk of artefacts.

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