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Arthroscopy VRS MRI Correlation in Shoulder Joint Pathology: Multicentric Study in Indian Population

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Abstract

Background: Both noninvasive magnetic resonance imaging (MRI) and invasive arthroscopy accomplished remarkable and impressive developments to evaluate shoulder joint [1]. These are achieved by the interaction of radiologists and arthroscopic shoulder surgeons who have shared their clinical experiences and provided feedback of mutual patients. However, the opinion of radiologists and surgeons regarding MR images of the shoulder still has undeniable inconsistencies to this date. Considering imaging modalities like MRI play a decisive role in planning the treatment protocols for patients, it is vital to know to what extent these operator-dependent imaging reports are valid, reliable and informative. Therefore, we studied the sensitivity, specificity, and positive and negative predictive values of MRI for diagnostic evaluation of shoulder disorders and compared the results with arthroscopy. *Materials and methods:* This is 6 months prospective study from August 2016 to January 2017. A total number of 62 subjects who underwent arthroscopic shoulder surgeries for various pathology were enrolled in the study. Pre-operative MRI was obtained with axial T1, axial T2 FAT SAT, sagittal T1, sagittal T2 FAT SAT and coronal T1 & T2 FAT SAT . Images were reported by a two expert radiologist from the radiology department of our institutions. The radiologist checked all the structures that could be evaluated in arthroscopy according to a checklist provided by the shoulder surgeon. They were biceps tendon, biceps labral complex, labrum, rotator interval, subscapularis tendon, ligaments, head and glenoid cartilages, sub-acromial bursa, supraspinatus and infraspinatus tendons. Patients underwent shoulder arthroscopy under general anesthesia within maximum four weeks. All previously mentioned structures were inspected and probed. With the same prepared checklist, pathologies were saved in detail for future comparison with the radiologist's MRI report. Then surgical intervention of found pathologies was done as needed. Finally, MRI findings (sensitivity, specificity, and positive and negative predictive values) were compared to arthroscopy findings. *Results:* Sensitivity of MRI proved to be highest for Hill-Sachs lesion size and location (94.2) and lowest for infraspinatus tendon (61.5). Highest specificity was in tears of biceps tendon (100.0) whereas it was lowest for Humeral head and Glenoid cartilage (81.4). MRI reports were shown to have the most positive predictive value for supraspinatus tendon tears (94.5), while it is lowest for infraspinatus tendon tears (80.0). The highest negative predictive value was found to be 96.08 which was recorded for biceps tendon pathologies (tendinosis and tear). However, detection of anterior labrum lesions possessed the lowest negative predictive value in MRI reports (70.0) *Conclusion:* MRI can be considered good noninvasive instigation for the assessment of supraspinatus tendon injuries and labral injuries, further research needed with large number patients.

Keywords: Shoulder; Arthroscopy; MRI.

Introduction

Both noninvasive magnetic resonance imaging (MRI)and invasive arthroscopy accomplished remarkable and impressive developments to evaluate shoulder joint [1]. These are achieved by the interaction of radiologists and arthroscopic shoulder surgeons who have shared their clinical experiences and provided feedback of mutual patients. However, the opinion of radiologists and surgeons regarding MR images of the shoulder still has undeniable inconsistencies to this date [2]. Diagnostic arthroscopy remains the gold standard in obtaining a definite diagnosis of shoulder joint pathologies [3]. Though patient history, clinical examination and MRI contributes for definitive diagnosis without patient undergoing surgery. Shoulder pathologic manifestations are investigated by the use of MRI,magnetic resonancearthrogram (MRA) and ultrasound (US) [4] Although MRI has been considered the most useful imaging study to assess the shoulder [5], it is still not fully clear whether any of the established imaging methods is superior to the others for different abnormalities [4].

Considering imaging modalities like MRI play a decisive role in planning the treatment protocols for patients, it is vital to know to what extent these operator-dependent imaging reports are valid, reliable and informative. Therefore, we studied the sensitivity, specificity, and positive and negative predictive values of MRI for diagnostic evaluation of shoulder disorders and compared the results with arthroscopy.

Materials and Methods

This is 6 months prospective study from August 2016to January 2017. A total number of 62 subjects whounderwent arthroscopic shoulder surgeries for various pathology were enrolled in thestudy. The written informed consent from the patients and institute ethical committee approval taken for thestudy.Patients with history of shoulder symptomssegregated and haematological and radiological investigations were requested if necessary, especially MRI. After confirming the diagnosis with clinical and investigations including MRI findings, treatment was initiated with suitable non-surgical modalities, such as drugs, physiotherapy and joint injection for an adequate period of time. In case of treatment failure, or in some patients with conditions necessitating early surgical intervention such as acute rotator cuff tearing, shoulder arthroscopy was performed. Patients with contradictory conditions for general anesthesia and surgery and those who showed acceptable responses to non-surgical treatments were excluded.

Pre-operative MRI was obtained at our institution with Siemens Healthineers India machine of 1.5 Tesla magnet.axial T1, axial T2 FAT SAT, sagittal T1, sagittal T2 FAT SAT and coronal T1 & T2 FAT SAT with a wide range of MRI indices noted. Images were reported by a two expert radiologist from the radiology department of our institution. The radiologist checked all the structures that could be evaluated in arthroscopy according to a checklist provided by theshoulder surgeon. They were bíceps tendon, biceps labral complex, labrum, rotator interval, subscapularis tendon, ligaments, head and glenoid cartilages, sub-acromial bursa, supraspinatus and infraspinatus tendons. Patients underwent shoulder arthroscopy under general anesthesia within maximum four weeks after reviewing the MRI findings in the lateral decubitus position after applying a special shoulder traction device, with standard posterior and mid-glenoid portals and a 30 degree arthroscopic lens. All previously mentioned structures were inspected and probed. With the same prepared checklist, pathologies were saved in detail for future comparison with the radiologist's MRI report. Then surgical intervention of found pathologies was done as needed. Finally, MRI findings (sensitivity, specificity, and positive and negative predictive values) were compared to arthroscopy findings.

Results

This study was done on 62 patients with shoulder joint disorders who required shoulder arthroscopy in their clinical course of management. After definite diagnosisthrough arthroscopy, MRI reports were assessed and the four statistical measures of performance of the MRI test (sensitivity, specificity, and positive and negative predictive values) were calculated for biceps tendon, labrum, subscapularis tendon, rotator interval and synovitis, supraspinatus tendon, infraspinatus tendon, glenoid and humeral head cartilage and subacromial bursa. Sensitivity of MRI proved to be highest for Hill-Sachs lesion size and location (94.2) and lowest for infraspinatus tendon (61.5). Highest specificity was in tears of biceps tendon (100.0) whereas it was lowest for Humeral head and Glenoid cartilage (81.4). MRI reports were shown to have the most positive predictive value for supraspinatus tendon tears

(94.5), while it is lowest for infraspinatus tendon tears (80.0). The highest negative predictive value was found to be 96.08 which was recorded forbiceps tendon pathologies (tendinosis and tear). However, detection of anterior labrum lesions possessed the lowest negative predictive value in MRI reports (70.0). In general, specificity of MRI had the highest values, compared to the other three characteristics of this diagnostic test and specifically for five out of eight evaluated areas where it is more than 90. All calculated data are shown in (Table 1).

Table 1: Showing sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of different variables

Structures	Arthroscopy	MRI	Sensitivity	Specificity	PPV	NPV
Biceps labrum complex	33	28	75.76	89.66	89.29	76.47
Biceps tendon	13	11	84.62	100	100	96.08
Labrum	38	32	76.32	87.5	90.63	70
Subscapularis tendon	7	8	77.78	98.11	87.5	96.3
Rotator interval & Synovium	12	9	66.67	98	88.89	92.45
Supra-spinatous tendon	39	37	89.74	91.3	94.59	84
Infra-spinatous tendon	13	8	61.54	95.92	80	90.38
Humeral head & Glenoid Cartilage	33	38	94.29	81.48	86.84	91.67
total number of patients 62						

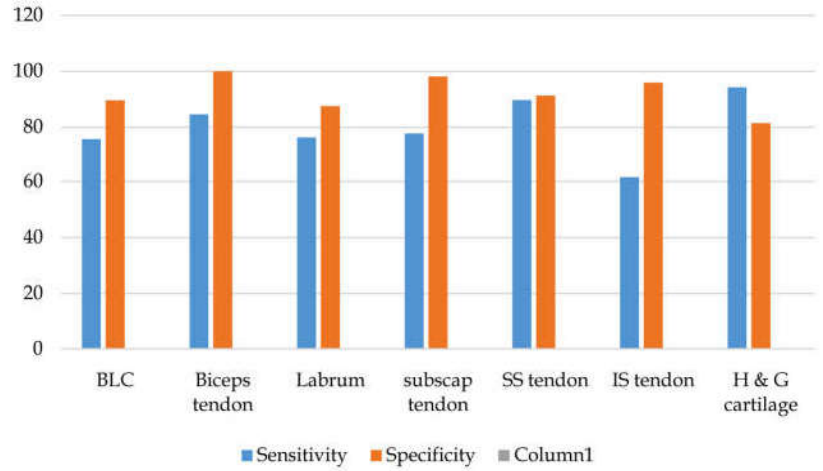

Chart 1: Comparison of sensitivity and specificity of different variables (BLC- Biceps labrum complex, subscap- subscapular, SS- supra scapular, IS- infra scapular, H&G- Humeral and Glenoid cartilage)

Discussion

MRI has achieved wide acceptance as an imaging technique for evaluation of soft tissue and bony pathologies of the shoulder joint. This was initially due to the sensitivity and specificity of MRI for detection of rotator cuff pathologies. MRI is extremely sensitive to alterations in the bone marrow and fluid in joint space that may represent pathology occult to plain radiography and bone scintigraphy of shoulder. MRI is a practical, well accepted and accurate non-invasive imaging technique in patients presenting with shoulder pain and is imaging modality of choice when clinical examination is suspect of shoulder disease and plain radiographs are normal or equivocal. In this study we were interested in evaluating the reports of shoulder MRIs, submitted by radiologists in our center. We asked the radiologist of this study, to precisely inspect the shoulder MRI's of the 62 patients for all the structures predetermined in our checklist. Several interesting conclusions were made upon which the results of our study are based. Rotator interval and infraspinatus tendon pathologies have the highest chance to be missed by the reader, and reports of subscapularis tendon tears and humeral head pathologies are false with a greater probability, as

they have the lowest PPV. On the other hand, supraspinatus tendon tears had the greatest PPV, which means their diagnosis in MRI can be reliable and definitive. Furthermore, sensitivity and specificity of detection of this lesion in MRI were both near 90%.

Biceps-Labrum Complex and Biceps Tendon

Acordning to Tuckman GA [6] complete biceps tendon rupture not only occurs in the extra-articular part in the biceps grove, but also possibly in the intra-articular part, it is essential to pay attention to MRI in order not to miss intra-articular ruptures .fluid around the long head of the biceps is abnormal only if it completely surrounds the tendon in the absence of joint effusion [7]. Biceps tendon dislocation could be detected in MRI easily, but usually it is accompanied by subscapularis tendon and/or coraco-humeral ligament rupture. Hence, in this way if we are suspicious of these tendon and ligament ruptures, kinematic shoulder MRI in full external rotation position would be more helpful [8]. MR arthrography has higher sensitivity and specificity than non-contrast MRI in detection of SLAP lesion, but it is not accurate in the differentiation of complete and partial biceps-labral detachment; and limb traction during the MRI procedure improves this differentiation [9].

Labral Pathologies in Anterior Instability

Study shows MRI sensitivity and specificity for labrum pathologies of degeneration, tear and erosion were reported at 90.6% and 68.8% and MR arthrography in diagnosis of labrum pathologies is better than conventional MRI. Labral defect, frying and detachment are diagnosed more accurately with dye infiltration [10]. In a study by Cvitanic et al showed axial MR arthrography in the ABER position has had the most sensitivity and specificity in detection of labrum pathologies [11].

Humeral Head and Glenoid Cartilage

Sensitivity and specificity of MRI in detecting glenohumeral cartilage lesions were 43% and 91% for humeral and 53% and 93% for glenoid lesions [12]. Although the authors considered MRI overall a good tool, they mentioned reduced accuracy in low-grade lesions. Also MRI being reader-dependent is disadvantageous to this modality .

Rotator Cuff Tendons

Correlation between MRI and arthroscopy to diagnosis rotator cuff tear in a study by Frei et al., showed a sensitivity of 0.92 and specificity of 1.0, with the authors claiming MRI to be one of the most effective ways for rotator cuff tear diagnosis [13]. A systematic study by Lenza et al., which reviewed correlation of rotator cuff tears in MRI and arthroscopy, suggested that MRI has good diagnostic accuracy for identification of full-thickness tears. However, it has a poor sensitivity regarding partial-thickness tears [5].

Symptomatic partial rotator cuff tears were evaluated by Vlychou in patients with impingement syndrome of the shoulder through MRI, before arthroscopic or mini-open surgical interventions. MRI imaging had a sensitivity of 97.7%, a specificity of 63.6% and PPV of 91.7% [14]. In a study by Robertson et al., MRI inter-observer and intra-observer reliability for rotator cuff full thickness tears had an accuracy of about 90%, but they did not obtain this result in partial thickness tears [15]. MR arthrography increases the ability of MRI to detect rotator cuff tears particularly on articular side partial thickness tears, although this is not the case for MRI in detecting full thickness tears and bursal-side partial thickness tears [9]. Kirkley et al. analyzed correlation of MRI and arthroscopy for multiple disorders [16].

Correlations were fair for rotator cuff tear and joint capsule lesions, moderate for superior labral lesions, sensitive for Hill-Sachs lesions and perfect for Bankart lesions. The authors concluded that MRI can be considered a valuable tool for Bankart and Hill-Sachs lesions associated with primary traumatic anterior dislocations; however, it has limited efficiency to detect other pathologic lesions. In a double-blind study comparing MRI and arthroscopy results with patients with shoulder pain, MRI proved to be highly accurate in diagnosing full-thickness supraspinatus tears, yet had a poor correlation for biceps tendon. The overall conclusion of the authors, was that MRI was a useful tool in the identification of shoulder pathology [12]. In general, it is clear that MRI findings are highly dependent on readers' subjective assessments and reports vary in different clinical conditions and settings.

Subscapularis Tendon

Diagnosed subscapularis tendon tears using radialslice MRI with arthroscopy was assessed in radial, transverse and oblique sagittal images by Furukawa et al. Sensitivities and specifies were 94.7% and 82.4%, 57.9% and 100% and finally 60.5% and 100% for radial, transverse and oblique sagittal images, respectively [17].

Conclusion

MRI can be considered good noninvasive instigation for the assessment of supraspinatus tendon injuries and labral injuries, further research needed with large number patients.

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