



MRI or Arthroscopy- Which is Better in Diagnosing Shoulder Pathology ?

¹Dr S. K. Saidapur, Professor, Department of Orthopaedics, KAHER's (KLE Academy of Higher Education and Research) Jawaharlal Nehru Medical College, Belagavi, Karnataka, India

²Dr Rohith. S. Mutt, Post Graduate, Department of Orthopaedics, KAHER's (KLE Academy of Higher Education and Research) Jawaharlal Nehru Medical College, Belagavi, Karnataka, India

³Dr Madhusudan Khompi, Assistant Professor, Department of Orthopaedics, KAHER's (KLE Academy of Higher Education and Research) Jawaharlal Nehru Medical College, Belagavi, Karnataka, India

⁴Dr Amit Patil, Post Graduate, Department of Orthopaedics, KAHER's (KLE Academy of Higher Education and Research) Jawaharlal Nehru Medical College, Belagavi, Karnataka, India

⁵Dr Ravi Jatti, Professor and HOD, Department of Orthopaedics, KAHER's (KLE Academy of Higher Education and Research) Jawaharlal Nehru Medical College, Belagavi, Karnataka, India

Corresponding Author: Dr Rohith. S. Mutt, Post Graduate, Department of Orthopaedics, KAHER's (KLE Academy of Higher Education and Research) Jawaharlal Nehru Medical College, Belagavi, Karnataka, India

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Abstract

Introduction: Common Musculo-skeletal problem arises from the shoulder joint after hip and spine, affecting daily activities and financial earning of the patient. MRI has commonly been used to Aid the diagnosis, provides superior detailing of ligamentous, cartilaginous, and labral structures but Several studies have shown that there is a discrepancy between MRI findings and the findings seen in Arthroscopy. This affects the preoperative planning and management as

certain pathologies might be missed on MRI which may or may not require surgical fixation.

Objectives: To compare the efficacy of MRI in diagnosis shoulder pathologies in comparison to arthroscopy, considering arthroscopy as the gold standard.

Materials and Methods: 61 patients with shoulder pain and restriction of shoulder movements were studied with MRI. If indicated, arthroscopy of the affected shoulder was done, and the same structures were inspected and compared to the preoperative MRI.

Results: Mean age of subjects was around 41-60, with a male predominance, showing correlation with diabetes mellitus. For rotator cuff sensitivity, specificity, PPV & NPV of 96.08%, 60.0%, 92.45% and 75% respectively. For SLAP tears sensitivity, specificity, PPV & NPV of 63.15%, 95.24%, 85.71% and 85.11% respectively. For Bankarts lesion sensitivity, specificity, PPV & NPV of 100.0%, 94.91%, 100.0% and 40.0% respectively also for Hill Sachs lesions sensitivity, specificity, PPV & NPV of 75.0%, 98.24%, 75.0% and 98.24% respectively.

Conclusion: For Rotator cuff tears, Bankarts lesion and Hill Sachs lesion MRI proves to be a accurate diagnostic tool on par with arthroscopy whereas for SLAP tears arthroscopy is still the gold standard.

Keywords: MRI technology, Surgical fixation, SLAP tear, Arthroscopy.

Introduction

The third most common Musculo skeletal problem arises from the shoulder joint with some studies showing the incidence of shoulder pain ranged from 7.7 to 62 per 1000 persons per year (median 37.8 per 1000 persons) per year(1), which include a spectrum of diseases such as rotator cuff injuries, SLAP tears, Bankart lesion, Hill Sachs lesion, shoulder instability etc. Since shoulder pathology can cause significant pain and discomfort thereby affecting daily activities and financial earning of the patient, it is important to deal with such cases with accurate diagnosis and treatment(2).

Therapeutic arthroscopy is considered the gold standard for diagnosis and management of shoulder pathology but since arthroscopy being a surgical procedure that requires hospitalization and anaesthesia thus has its own set of risks and complications.

Magnetic resonance imaging has been a revolution in diagnosis of shoulder pathology as it's a sensitive, accurate, cost-effective, and non-invasive tool in diagnosis of shoulder pathology(3).

Detailed clinical history and examination might aid in the diagnosis of the disease but studies have shown poor inter and intra observer reliability of such examinations (4,5).

Even with the improvement of the MRI technology and our knowledge about shoulder pathologies, studies have shown the discrepancy between the MRI findings and the arthroscopy findings. This affects the surgeon when planning for the management of a case as certain pathologies might be missed on MRI for which the patient may benefit from surgical fixation(6). Surgery is required for people who have a substantial or complete rotator-cuff-tear to restore the tendon to the bone.

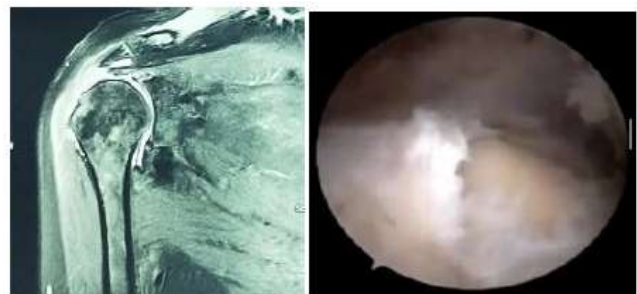


Figure 1: MRI showing complete tear of supraspinatus which was later confirmed on arthroscopy

Few studies have been done in India regarding the diagnosis of shoulder pathologies but with ever changing MRI technologies, this study was done to identify the short comings of MRI when compared to arthroscopy in the Indian setup and help us take necessary steps in order to improve patient care(7).



Figure 2: MRI showing SLAP tear, later confirmed on arthroscopy.



Figure 3: MRI showing Hill Sachs lesion, later confirmed on arthroscopy

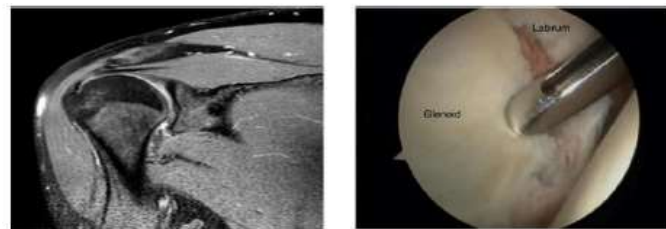


Figure 4: MRI showing Bankarts lesion, later confirmed on arthroscopy

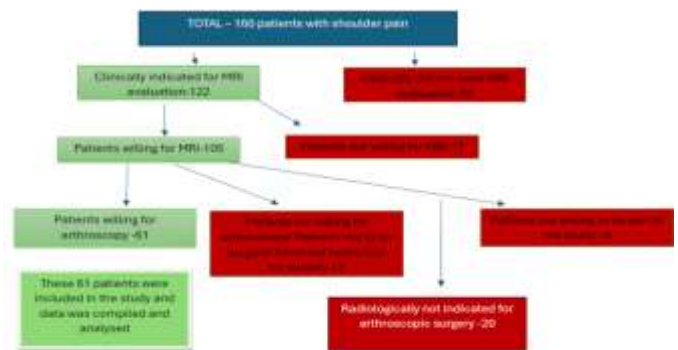
Material and Methods

This cross-sectional study was done from March 2022 to February 2023 in a tertiary care hospital. 61 patients, between 18-80 years of age, presenting to the orthopaedic outpatient department with shoulder pain or instability or with clinical signs of impingement or tear were examined in detail and necessary investigations including MRI were performed. Then the patients were informed regarding the study and informed written consent was taken from the willing participants. If both clinically and radiologically indicated, patient was counselled for arthroscopic intervention. Patients willing for arthroscopic intervention, further fitness and

investigations were performed and consent for surgery was taken. Intraoperative findings were noted. The data of all Investigations and Intraoperative findings were documented, compiled, and analysed. MRI diagnosis was placed into one of the four categories after arthroscopic evaluation (Considering arthroscopy as the gold standard): True positive (TP): MRI diagnosis of tear, confirmed on arthroscopic evaluation. True negative (TN): MRI diagnosis of no tear was confirmed on arthroscopy. False positive (FP): MRI showed a tear, but arthroscopy was negative. False negative (FN): If MRI images were negative but arthroscopy showed a tear.

A total of 160 patients were screened for the study:

Chart 1:



Results:

Table 1:

Rotator cuff tears	SS	SP	PPV	NPV
Present Study	0.96	0.60	0.92	0.75
Bhatnagar A et al	0.91	1.0	1.0	0.63
Zubair Younis et al	0.92	0.81	0.88	0.87
Naqvi GA et al	0.91	0.84	0.92	0.84
Muthami KM et al	0.46	0.88	0.71	0.72
Zubair Younis et al	0.92	0.81	0.88	0.87

Table 2:

SLAP Tear	SS	SP	PPV	NPV
Present study	0.63	0.95	0.85	0.85
Bhatnagar A et al	0.15	0.96	0.67	0.69
Momenzadeh OR et al	0.74	0.8	0.78	0.76
Iqbal HU et al	0.95	0.85	0.84	0.96
Zubair Younis et al	0.28	0.94	0.5	0.86

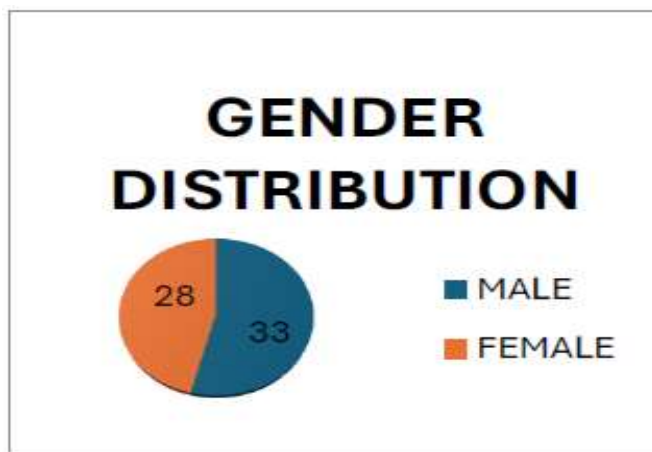
Table 3:

Bankart's lesion	SS	SP	PPV	NPV
Present study	1.0	0.94	1.0	0.40
Joshi UP and Puri S	0.91	0.86	0.96	0.75
Bhatnagar A et al	0.8	1.0	1.0	0.89
Momenzadeh OR et al	0.5	0.84	0.77	0.60
Zubair Younis et al	0.88	0.94	0.8	0.96

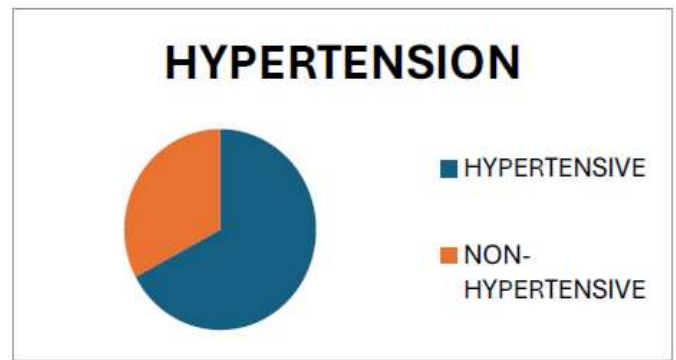
Table 4:

Hill Sachs	SS	SP	PPV	NPV
Present study	0.75	0.98	0.75	0.98
Bhatnagar	0.8	1	1	0.89
OR Momenzadeh	0.5	0.84	0.77	0.60

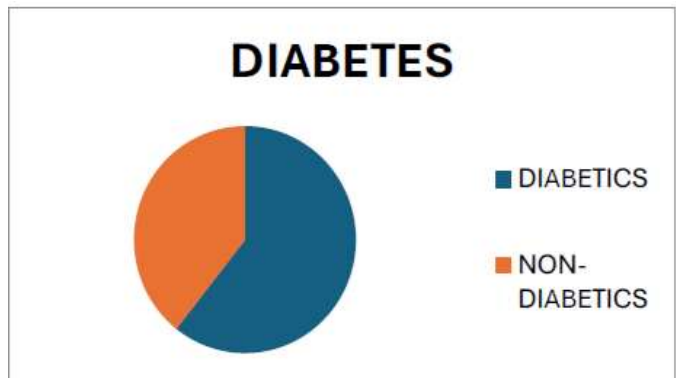
*SS-sensitivity, SP-specificity PPV-positive predictive value NPV-negative predictive value



Graph 1: Gender distribution.



Graph 2: study consisted of 41 (67.21%) hypertensive subjects



Graph 3: study consisted of 37 (60.66%) diabetes mellitus subjects

Discussion

The effectiveness of MRI for the diagnosis of shoulder disease is dependent on the nature of the pathological abnormality. There is a controversy regarding the accuracy of MRI in detection of shoulder pathology (8), Being a non-invasive test for diagnosis of the pathology, the role of MRI is progressively increasing to identify the patients who may benefit from the Arthroscopic procedure or the patients who may recover with conservative treatment.

We found majority of patients are from the ages between 41-60, trailed by 61-80 years and then of 21-40 years age group. This is in agreement with study by Bhatnagar et al(7) where “they found 82% of the patients to be aged above 40 years of age with 56.41% of them in the age group of 40-60 years”. Muthami KM et al.(9), found

“majority of patients to be aged between 45 and 49 (24%) years and between 60 to 64 years (21%)”.

Men made up 54.10% of the individuals in our study, while women made up the rest 45.90% of the subjects. A study of the literature regarding the same demonstrates that men are clearly more likely than women to get shoulder injuries, regardless of the region, ethnicity, or cultural norms. There are several causes for the higher incidence and prevalence of shoulder injuries in male patients, including their employment, increased physical workload, exposure to more outdoor activities, and traffic accidents.(7)

Majority of the subjects had hypertension and were also found to be diabetics. The study consisted of 37 (60.66%) diabetes mellitus subjects and 41 (67.21%) hypertensive subjects. Diabetes is known to be a high-risk factor for most of the diseases or conditions as it not only worsens the shoulder injury but also delays wound healing with higher susceptibility to infections and complications, all of which increase the healing time

The study by Kirkley et al (10) delved into the correlation between MRI findings and arthroscopic observations across various shoulder disorders in primary anterior dislocation of shoulder joint. Their analysis revealed differing levels of correlation for different conditions: fair correlation for rotator cuff tears and joint capsule lesions, moderate correlation for superior labral lesions, high sensitivity for Hill-Sachs lesions, and a perfect correlation for Bankart lesions which is in similar vein when compared to our study. Whereas 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 (11)

The findings from Lenza et al's systematic study highlight the strengths and limitations of MRI in diagnosing rotator cuff tears (figure:1). The study indicates that MRI performs well in identifying full-thickness tears but may not be as effective in detecting partial-thickness tears, suggesting a discrepancy in sensitivity between the two types of tears. This information is valuable for clinicians to consider when utilizing MRI as a diagnostic tool for rotator cuff injuries, as it underscores the need for additional diagnostic modalities or clinical assessments to accurately detect partial-thickness tears (12).

The reasons for undiagnosed lesions can be attributed to mechanical limitations of detecting under surface tears especially delaminating tears and unique oblique orientation of the supraspinatus tendon to the imaging plane. Sometimes there are MRI over-diagnosis of rotator cuff tendinitis which is most commonly seen due to magic angle phenomenon or presence of interstitial tears which cannot be detected by arthroscopy.

Meanwhile for SLAP lesions (figure: 2), arthroscopy was found to be more efficacious in diagnosing slap tear lesions in comparison to MRI. There is probably due to some anatomical factors such as the curvature of the glenoid, and the version of glenoid while studying MRI images.

Joshua M pollster et al (13), attributed the low sensitivity of MRI when detecting the Bankart's lesion to two main factors - wide variation in the type and position of a Bankarts lesion (figure: 4) and the Close proximity and abutment of labrum to capsule and cortical bone which have same signal intensity makes it difficult to distinguish them from one another.

Kirkley et al. & Hodler J et al (10,14). MRI showed it was excellent at detecting Hill-Sachs lesion (figure: 3).

Our study also proved that the capabilities of MRI as a diagnostic modality are on par with the arthroscopy.

This indicates the importance of considering the specific diagnostic strengths and limitations of MRI when evaluating shoulder conditions, particularly in cases where accurate diagnosis is crucial for determining treatment approaches.

The latest technological advancements have helped boost the diagnostic accuracy of MRI. We found that MRI was capable in diagnosing the most common shoulder injuries when compared to arthroscopy which remains the undisputed gold standard diagnostic modality.

The most common injuries in our study were rotator cuff injuries which were efficaciously detected by MRI (on par with arthroscopy) with good sensitivity and specificity.

For SLAP tears Arthroscopy is still the superior diagnostic tool than MRI, whereas for both Hill Sachs and Bankarts lesions, MRI is on par with arthroscopy.

The advantages of MRI, such as being non-invasive, 3D viewing, storage and transfer of image along with its capability to overcome the shortcomings of arthroscopy have favored its increasing use. However, the lack of access, expensiveness, and the availability of the physician to interpret the image have been some of the major setbacks in using it as the primary diagnostic modality.

There is a dearth shortage in terms of data in terms of usage of MRI as a primary diagnostic modality. Therefore, we recommend using MRI as an adjuvant diagnostic modality to arthroscopy to attain a definitive diagnosis reducing/eliminating any chances of missing any shoulder injury.

There are a few limitations in our study such as that only the patients suitable for surgery were part of the study. Arthroscopy being considered as reference standard is also a potential source of bias. Also the operating surgeons were aware of the patients MRI findings preoperatively. This may affect the verification bias, but it would be unethical to blind the operating team preoperatively as it would affect the planning for the surgery. In our study, we had a limited sample size which might not reflect the true burden of the disease. There is a need for large multi-centric studies to confirm the findings of our study.

In conclusion, MRI can be used as a definitive diagnostic tool when rotator cuff injuries, Bankarts lesion or Hill Sachs lesions are suspected but when it comes to diagnose SLAP lesion, MRI is much inferior to the gold standard arthroscopy. Therefore diagnostic arthroscopic assessment remains the gold standard for the detection of intra-articular shoulder pathology.

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