



# International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2022; 8(2): 240-243  
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[www.orthopaper.com](http://www.orthopaper.com)  
Received: 08-01-2022  
Accepted: 17-02-2022

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## Correlation between MRI and diagnostic arthroscopy in shoulder injuries

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**DOI:** <https://doi.org/10.22271/ortho.2022.v8.i2d.3141>

### Abstract

**Background:** Shoulder injuries tend to present mainly as pain and often leads to considerable disability. It is essential that a diagnosis of the shoulder pathology is made and treatment started immediately to attain prompt recovery and avoid chronicity and complications.

The current gold standard diagnostic investigation is arthroscopy. MRI is a proven sensitive and accurate non-invasive tool for detecting internal derangement and assessing overall joint structures, but many studies have reported false positive and negative results.

The aim of the study is to compare the accuracy of the two Diagnostic Modalities, Arthroscopy and MRI, in bony and ligamentous structure injury of the shoulder joint.

**Methods:** Twenty one cases of the age group 18-60 years presenting with shoulder pain following injury were included in our study, where MRI was performed followed by Arthroscopy. The data were analyzed for sensitivity, specificity, positive predictive value and negative predictive value and the correlation between MRI and Arthroscopy is done with the help of these statistics.

**Results:** In the study highest sensitivity was found in full-thickness Supraspinatus tear, Bankart's lesion and Hill-Sachs lesion. The highest specificity and highest positive predictive value was found in Impingement syndrome, full thickness supraspinatus tear, Hill-Sachs lesion and Adhesive capsulitis. The highest negative predictive value was found in full-thickness supraspinatus tear, Bankart's lesion and Hill-Sachs lesion.

**Conclusion:** MRI is an accurate, practical, efficient, non-invasive diagnostic modality in shoulder injuries, specially in conditions like full- thickness supraspinatus tear, impingement syndrome, Hill-Sachs lesion and Bankart's lesion.

**Keywords:** Arthroscopy, MRI, Bankart's lesion, Hill-Sachs lesion, Impingement Syndrome, Full-Thickness Supraspinatus Tear

### Introduction

Shoulder injuries tend to present mainly as pain and is one of the most common complaints encountered in orthopaedic practice and often leads to considerable disability. Indeed, the self-reported prevalence of shoulder pain is estimated to be between 16% and 26% and each year in primary care about 1% of adults over the age of 45 years present with a new episode of shoulder pain; it is the third most common cause of musculoskeletal consultation in primary care<sup>[1]</sup>.

Due to the pivotal role the shoulder has in hand function, any disability or pain in the shoulder is likely to affect a person's ability to carry out daily activities. Thus, it is essential that in primary care good diagnosis of the principal shoulder pathology is made and treatment started immediately to attain prompt recovery and avoid chronicity and complications.

The diagnosis of shoulder pathologies rests on detailed clinical history, physical examination, special tests, imaging modalities (plain x-rays, USG shoulder, CT scan, MRI) and diagnostic shoulder arthroscopy.

MRI has become the gold standard for detecting both subtle and obvious internal derangement and assessing overall joint structures. MRI is an excellent modality because of its multiplanar capabilities. It is a reliable technique for the evaluation of the rotator cuff tendons and is the preferred imaging study with suspected impingement and rotator cuff injury. Although MRI remains an extremely useful imaging tool in identifying pathologic changes in the shoulder, there are several lesions that continue to provide diagnostic challenges that may have to be

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addressed by diagnostic shoulder arthroscopy.

Arthroscopy of the shoulder has developed rapidly and has become a major modality in the diagnosis and treatment of shoulder pathologies. Diagnostic arthroscopy is the only investigation that allows the Orthopaedic Surgeon to direct visualization of the shoulder joint [9]. It is considered by many as the best technique for diagnosing shoulder disorders [10] and subsequently creating a treatment plan. It allows the surgeon to identify all the structures of the glenohumeral joint such as the labrum, glenohumeral ligaments, humeral head, joint capsule and the undersurface of the rotator cuff [11]. With its 20 power magnification, it permits the detection of pathological features that may not be seen with the naked eye [12].

Although MRI is an important imaging tool as mentioned above, arthroscopy remains the reference standard in diagnosing shoulder pathologies against which alternative diagnostic modality should be compared. This study seeks to compare to what extent MRI findings are accurate, with arthroscopic findings, as the “gold standard” in shoulder pathologies.

### Materials and Methods

Twenty-one cases of shoulder pathology attending the dept of Orthopaedics in Gauhati Medical College and Hospital, Guwahati during a 12-month period from 01/06/2019 to 31/05/2020 was included in our prospective study and

informed consent was obtained. The patients were then subjected to shoulder arthroscopy after necessary investigations and fitness.

The data obtained in our study were analysed in the forms of table, charts and diagrams. With the help of this statistical parameters, the sensitivity, specificity, positive predictive value and negative predictive value are calculated for each of the diagnoses. Correlation between MRI and Arthroscopy is done with the help of these statistics for each of the diagnoses.

### Results

In our study, MRI was found to have the highest sensitivity in full-thickness Supraspinatus tear (100%), Bankart's lesion (100%) and Hill-Sachs lesion (100%) and the lowest sensitivity was in SLAP lesion (40%). The specificity was found to be highest in Impingement syndrome (100%), full thickness supraspinatus tear (100%), Hill-Sachs lesion (100%) and Adhesive capsulitis (100%). While the highest positive predictive value was found in Impingement syndrome (100%), full thickness Supraspinatus tear (100%), Hill-Sachs lesion (100%) and Adhesive capsulitis (100%) and the lowest positive predictive value was found in partial thickness subscapularis tear (60%). The negative predictive value was found to be highest in full-thickness supraspinatus tear (100%), Bankart's lesion (100%) and Hill-Sachs lesion (100%).

**Table 1:** Statistical measures of MRI correlation with Arthroscopy of various shoulder problems

Shoulder pathology	Sensitivity	Specificity	Positive predictive value(ppv)	Negative predictive value(npv)	P value
Impingement syndrome	83.35%	100%	100%	93.75%	<0.0003
Partialtear supraspinatus	90.91%	90.00%	90.91%	90.00%	<0.0003
Fullthickness tear supraspinatus	100%	100%	100%	100%	<0.0008
Partialthickness subscapularis tear	75.00%	88.24%	60.00%	93.75%	<0.03
Bankart's lesion	100%	84.62%	80.00%	100%	<0.0002
Hill-sachs lesion	100%	100%	100%	100%	<0.0001
Slap lesions	40.00%	93.75%	66.67%	83.33%	<0.128
Adhesive capsulitis	75%	100%	100%	94.44%	<0.003

### Discussion

Nowadays MRI has become the gold standard for detecting both subtle and obvious internal derangement and assessing overall joint structures of the shoulder. In this study, we tried to evaluate the MRI reports and compare these with arthroscopic findings. We can derive several conclusions from our study, which is summarized.

#### Impingement syndrome

In a study by A M Malhi, R Khan [27], a sensitivity of 0.84, positive predictive value (PPV) of 0.83, a specificity of 0.76, negative predictive value (NPV) of 0.78 was found for MRI correlation of impingement syndrome with arthroscopy. In a study by Lannotti *et al.* [5], the sensitivity of 93% and specificity of 87% were found. For sensitivity, we have comparable results, but for specificity, PPV, NPV, our results are higher than the mentioned study. This may be due to the fact that our study had a small sample size as compared to the previous study.

#### Partial-thickness supraspinatus tear

Loeffler *et al.* [30] and other similar studies [16, 28] demonstrated the efficacy of MRI with sensitivities and specificities ranging from 85% to 100% for partial-thickness supraspinatus tears. These studies found a positive predictive value of 100% for the detection of rotator cuff pathology. In a systemic study by

Smith *et al.* [21] and other similar studies [14], assessing the diagnostic test accuracy of magnetic resonance imaging (MRI) in the detection of partial- thickness rotator cuff tears in the adult population, the pooled sensitivity values ranged from 44% to 98% and specificity values ranged from 90% to 95%. In our study, we found a sensitivity of 90.91%, specificity of 90.0%, positive predictive value (PPV) of 90.91% and negative predictive value (NPV) of 90.0%, for partial thickness supraspinatus tear, which is comparable to the previous mentioned studies.

#### Full-thickness supraspinatus tear

In a study by Traugher *et al.* [16] and other similar studies [5, 28, 30] studying the MRI and arthroscopic correlation of supraspinatus tears, MRI sensitivity ranged from 95% to 100%. In 2003, a systematic review by Dinnes *et al.* [14] and other similar studies [21], assessing the diagnostic test accuracy of magnetic resonance imaging (MRI) in the detection of full-thickness supraspinatus tears in the adult population, found that the pooled sensitivity ranged from 89% to 95% and pooled specificity ranged from 93% to 97%. These results are comparable to our study for full-thickness tear with MRI sensitivity and specificity of 100%.

#### Partial tear subscapularis tear

Kim *et al.* [29] reported that 19% of subscapularis tears were

found during arthroscopic procedures of 314 consecutive shoulders. In our study we also found 19% of partial subscapularis tendon tears by arthroscopy which is similar.

In a retrospective study comparing magnetic resonance imaging and arthroscopic findings by Guido *et al.* [20], MRI sensitivity and specificity were respectively 25% and 98% for subscapularis tendon tears. Gyftopoulos *et al.* [22], in a similar study found a sensitivity of 80%, a positive predictive value of 51% and a negative predictive value of 98% for a partial subscapularis tear. In our study, we found a sensitivity of 75%, specificity of 88.24% and positive predictive value of 60% and a negative predictive value of 93%, which is comparable to the previously mentioned literatures.

#### Shoulder instability

In 2010 Hayes ML, Collins MS *et al.* [19]. Studied consecutive patients who underwent diagnostic MRI and shoulder arthroscopy for instability from 1997 to 2006 and found that the sensitivity of MRI in detecting Bankart's lesion was 98.4% and specificity was 95.2%. For Hill- the Sachs lesion,

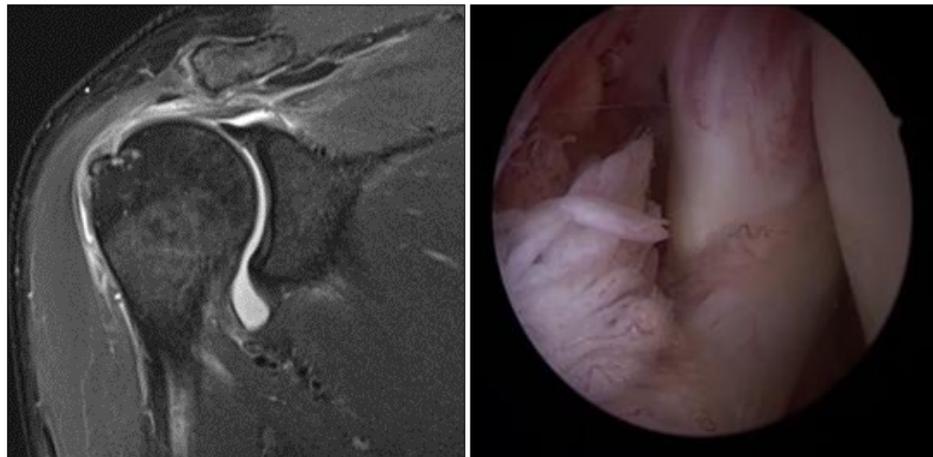
sensitivity of MRI was 96.3% and specificity was 90.6%. Momenzadeh *et al.* in a similar study found a sensitivity of MRI for Hill-Sachs lesion to be 91%. In our study, we found sensitivity and specificity of 100% and 84.62% respectively for Bankart's lesion. For the Hill Sachs lesion, we found sensitivity and specificity of 100%. Our study results are comparable with the previously mentioned literatures.

#### Slap lesion

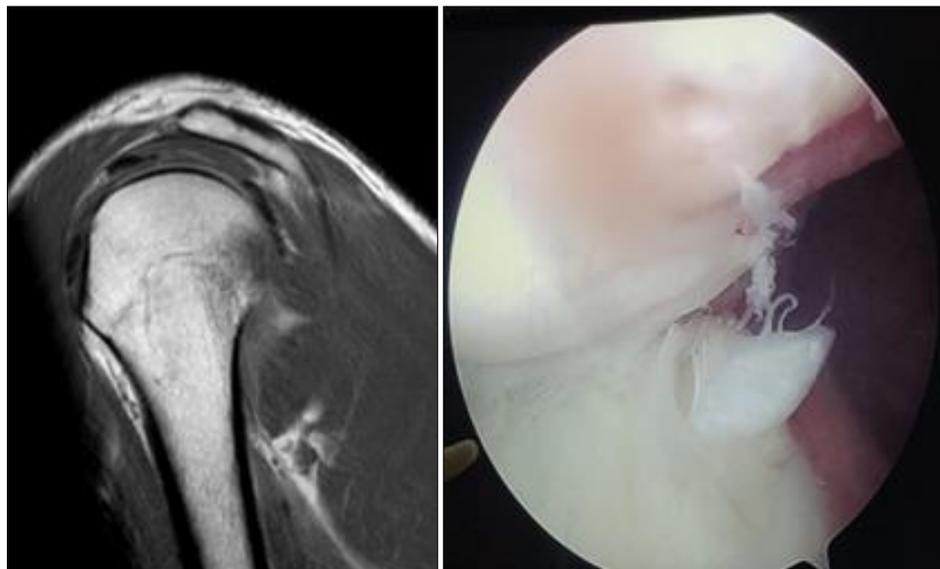
In 1991, Legan JM *et al.* [15], in a series of 88 patients, the sensitivity of superior labral tears was 75%. In 2008, Kautzner *et al.* [18], found MRI sensitivity of 43% and specificity of 96% for SLAP lesions. We found comparable results of 40% sensitivity and 93.75% specificity in our study.

#### Adhesive capsulitis

A study by Jung *et al.* [17], found sensitivity and specificity of 79% and 100%, respectively of MRI for adhesive capsulitis. In our study, we found a sensitivity of 75% and specificity of 100% of MRI, which is comparable.



**Fig 1:** Full-thickness supraspinatus tear



**Fig 2:** Bankart's Lesion

#### Conclusion

MRI is a practical, well accepted and accurate non-invasive imaging technique in patients presenting with shoulder pain and is the imaging modality of choice when the clinical examination is suspect of a shoulder injury and plain radiographs are normal or equivocal. On reviewing previous literatures, we found comparable results, however, the

limitation of our study was the small sample size.

By analyzing the results of this study, we conclude that Magnetic Resonance Imaging is an accurate, practical, efficient, non-invasive, acceptable diagnostic modality in shoulder injuries especially in conditions like full-thickness supraspinatus tear, impingement syndrome, Hill-Sachs lesion and Bankart's lesion.

However, for SLAP lesions we could not find a statistically significant correlation between MRI and arthroscopy. For partial tear subscapularis tendon, MRI and arthroscopy correlation was of suggestive significance. Hence, a larger study is recommended for a conclusion to be made.

Continued interaction and collaboration between a Radiologist and Shoulder arthroscopic surgeon may lead to a better understanding of the pathologies and may help in defining required modifications and innovations in MRI technique for improved accuracy of MRI in diagnosing shoulder pathologies.

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