International Journal of Research in Orthopaedics
Osman SM et al. Int J Res Orthop. 2024 Nov;10(6):1165-1169
http://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20243110

Original Research Article

Correlation between magnetic resonance imaging and arthroscopic findings in superior labral from anterior to posterior injuries of shoulder joint

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Received: 10 August 2024
Revised: 11 September 2024
Accepted: 18 September 2024

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ABSTRACT

Background: The aim of our study was to identify the accuracy of the magnetic resonance imaging (MRI) in detecting superior labral from anterior to posterior (SLAP) lesions when compared to arthroscopic findings, considering arthroscopy as the gold standard.
Methods: This is a retrospective study conducted between January 2015 to July 2021 that focuses on SLAP lesions to evaluate the accuracy of its magnetic resonance imaging (MRI) reporting. All patients who had shoulder arthroscopy were included, and their intra-operative pathology was recorded and compared to their pre-operative MRI reports. Accuracy was assessed by calculating the sensitivity and specificity of MRI in comparison to the standard shoulder arthroscopy.
Results: 60 patients were included in the study. In diagnosing SLAP lesions this study showed that MRI was 54% sensitivity, 67% specificity with 79% positive predictive value and 39% negative predictive value. Accuracy was found to be 55%.
Conclusions: In this study, the MRI did not detect SLAP lesions at a rate as high as arthroscopy, which is considered the gold standard. When performing arthroscopy, it is important to be diligent in detecting actual SLAP lesions that may not have been identified by traditional MRI scans.

Keywords: MRI, Shoulder arthroscopy, SLAP lesions

INTRODUCTION

With an estimated 16–26% prevalence, shoulder pain is thought to be the third most common reason for musculoskeletal consults.[1] Superior labral anterior to posterior (SLAP) lesions are a clinically recognised subset of diseases associated with complicated shoulder diseases. The term "SLAP lesion" was first used by Snyder in reference to the location and distinctive tear extension patterns of superior labral pathologies, which Andrews et al first documented in 1985.[2] The original 4-subtype classification of these lesions was created by Snyder et al.[3] The SLAP classification schemes were further divided by Morgan et al and Maffet et al to finally identify 10 distinct forms of SLAP tear patterns, including mixed SLAP and Bankart type injuries observed in particular associative patterns.[4,5]

Nowadays, a variety of imaging techniques, including nuclear medicine, sonography, fluoroscopy, conventional radiography, and magnetic resonance imaging (MRI), are utilised to assess pathologic diseases of the shoulder. MRI has completely changed how shoulder diseases are diagnosed. Additionally, MRI and MRI arthrography are thought to be the best imaging methods for SLAP lesions.

MRI is a recognised non-invasive, sensitive, accurate, and economical method for examining shoulder pathology.[6]

Nonetheless, the literature also reports equally incorrect and misleading outcomes. Torstensen et al, Green et al, and Jonas et al compared the accuracy of MRI and arthroscopy in their research found that MRI was not a reliable or accurate method for evaluating shoulder pathologic disorders, particularly in patients whose clinical picture was unclear.[7-9] One drawback of MRI is that some cochlear implants, ferromagnetic foreign substances (especially in the orbit), and cardiac pacemakers should not have their patients undergo it. Furthermore, some patients experience severe claustrophobia in MRI scanners with high field strengths.[10]

A growing number of diagnostic techniques are using magnetic resonance arthrography (MRA) to find SLAP lesions and shoulder pain.[11] MRA is the most effective visualisation technique for diagnosing these lesions, according to numerous studies in the literature.[12,13]

The current gold standard for identifying diseases of the shoulder is arthroscopy. A 20-power magnification offered by arthroscopy improves direct visualisation of the shoulder joint.[15] Even though arthroscopy is the gold standard of inquiry, it is not without its drawbacks. Because the arthroscopic inspection procedure itself modifies the joint's laxity, it might be challenging to assess the flaccidity of the capsule. Because the operation is invasive, there is a slight chance of problems like infection, harm to nearby structures (such the articular cartilage or musculocutaneous nerve), and fluid extravasations. The anaesthetic itself may also cause complications.[15]

Rationale

In our center MRI is used as fixed pre-operative tool for diagnosis of shoulder lesions including SLAP lesions, so this study was proposed to detect the accuracy of that and determine the best diagnostic tool in SLAP lesions.

METHODS

Study design

This is a single-center, level III retrospective cohort study.

Setting

Khoula hospital is a public health service level-1 referral center, the hospital electronic medical records (EMR) system was reviewed, and data collected for the period from January 2015 to July 2021.

Participants

All patients who had shoulder arthroscopy were included.

Data collected was age, gender, affected side, MRI result and arthroscopic findings. Operation notes and shoulder MRI images reviewed for patient included. We have excluded patients who did not have a pre-operative MRI report. All those patients were assessed clinically during their outpatient visit by the senior author (AEM) who is fellowship trained in shoulder arthroscopy and when intraarticular pathology was suspected, shoulder MRI was requested.

The MR pictures were acquired with a standard 1.5 Tesla (T) MRI unit and it was reported by the same senior radiologist. All surgeries were performed by the senior author (AEM) under general anesthesia in the beach-chair position.

After review of surgery notes and pre-operative shoulder MRIs reports, MRI's sensitivity and specificity in comparison to shoulder arthroscopy were computed, and accuracy was assessed using the following criteria - true positive (TP): positive SLAP lesion on MRI, positive SLAP lesion on arthroscopy, true negative (TN): negative SLAP lesion on MRI, negative SLAP lesion on arthroscopy, false positive (FP): positive SLAP lesion on MRI, negative SLAP lesion on arthroscopy, and false negative (FN): negative SLAP lesion on MRI, positive SLAP lesion on arthroscopy.

Statistical methods

IBM statistical package for the social sciences (SPSS) was used to analyse the study's data. Given that shoulder arthroscopy is recognised as the gold standard, the two diagnostic techniques' compliance was evaluated. Calculations were made on the MRI's sensitivity, specificity, positive, and negative predictive values for the diagnosis of SLAP lesions. The Fleiss kappa test was used to determine the reliability of agreement between MRI and arthroscopy in the identification of SLAP lesions; a result of $p<0.05$ was considered statistically significant.

RESULTS

66 patients were identified using our inclusion criteria. Six (9%) patients were excluded from the study as they did not have an MRI report. The 60 patients comprised 14 (23.3%) females and 46 (76.7%) males with a mean age of 41.5 years (range: 20-63 years).

Table 1: Results.

Parameters	Value (%)
Sensitivity	54
Specificity	67
Positive predictive value	79
Negative predictive value	39

The right shoulder was affected in 37 patients (61.7%) and the left shoulder in 23 (38.3%). The pre-operative diagnoses based on MRI findings were rotator cuff syndrome (n=14), impingement syndrome (n=8), calcific tendonitis (n=1), Bankart lesion (n=14), isolated SLAP lesion (n=15), degenerative changes (n=1) and normal

report (n=7). The SLAP type classifications detected on arthroscopic examination were 18 (30%) normal, 29 (48.3%) type 2, 3 (5%) type 3, zero (0%) type 4, and 10 (16.7%) type 5 lesion.

In 23 (38.3%) of 60 patients, SLAP lesions were detected on both MRI and arthroscopy. In 12 (20%) of 60 patients, SLAP lesions were undetected on both MRI and arthroscopy. 19 (31.7) patients had SLAP lesions on arthroscopy which were not detected by MRI. 6 (10%) patients had SLAP lesions on MRI that were not detected by arthroscopy. In the diagnosis of SLAP lesions in this study, MRI showed 54% sensitivity, 67% specificity, 79% positive predictive value (PPV) and 39% negative predictive value (NPV), accuracy was found to be 55%.

Table 2: Comparison between the literature and this study.

Authors	No. of patients	Specificity	Sensitivity	PPV	NPV	Accuracy
Philips et al	77	4-22	83-91	63-70	11-53	85
Yıldız et al	132	40	71	80	29	64
Gunay et al	52	77	31	80	27	42
Connell et al	102	89	98	96	94	96
Conolly et al	144	94	38	90	51	61
Our study	60	67	54	79	39	55

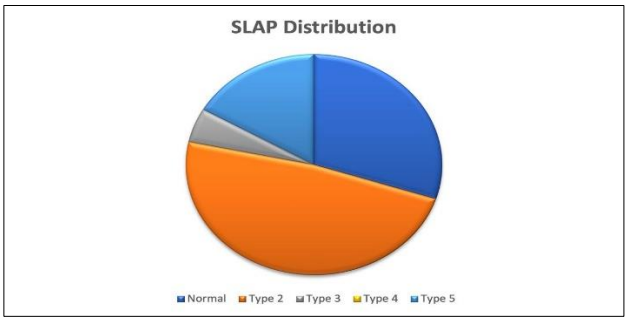

Figure 1: The distribution of the SLAP tear in the study.

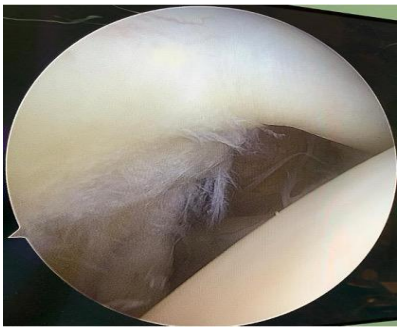

Figure 2: Arthroscopic view of type 2 SLAP injury.

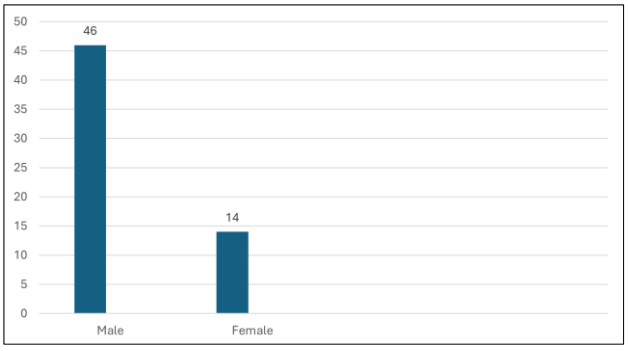

Figure 3: Male to female ratio.

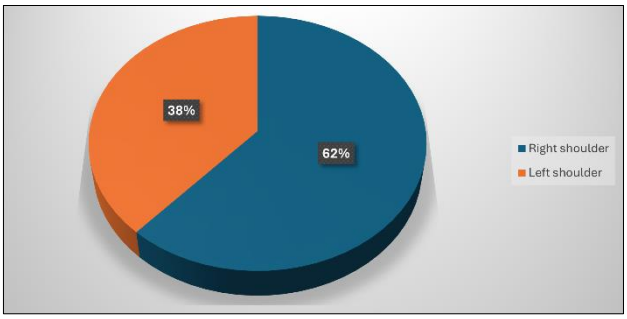

Figure 4: Affected side.

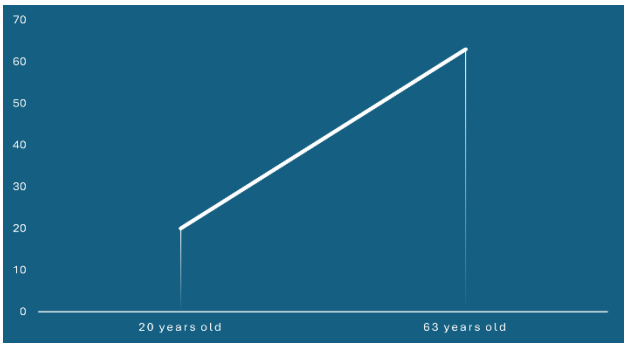

Figure 5: Age.

DISCUSSION

MRI is regarded as one of the gold standard techniques for assessing shoulder joint soft tissue and bone disorders. The purpose of this study was to assess the shoulder MRI results that our center's radiologists had submitted.

Our center is a public health level-1 referral center. It is considered routine to request MRI as part of the diagnostic process of shoulder problems in our hospital.

Together with our radiology department, we carried out this study to assess the radiologist's supplied shoulder MRI results and compare them with arthroscopy findings.

Our goal was to enhance the accuracy of the reports and build stronger relationships with the radiologists. To be more precise, SLAP lesions was the sole variable on which we concentrated our research.

Using standard MRI to detect SLAP lesions is thought to be challenging. The investigation conducted by Monu et al indicated that the external rotation position and the coronal oblique view were useful in identifying SLAP lesions.[16]

According to Tuckman et al's study, pre-operative MRI demonstrated an overall sensitivity of 66%, specificity of 77%, PPV of 24%, and NPV of 95% when used as a diagnostic technique for SLAP lesions in patients undergoing arthroscopy.[17]

Since all of these values were lower than those reported in earlier research, it was determined that because of its high NPV percentage, MRI cannot be regarded as an accurate diagnostic technique in and of itself, with the exception of a lesion exclusion rate that is appropriate for SLAP lesions.

Conventional MRI showed 43% sensitivity and 96% specificity for SLAP lesions, according to the findings of a related investigation.[18] When it comes to identifying SLAP lesions, MR arthrography is more sensitive and specific than non-contrast MRI. However, it is not as accurate in differentiating between total and partial biceps-labral separation; limb traction during the MRI technique helps with this differentiation.[19] Jee et al reported sensitivity of 92% and specificity of 82% with MR arthrography compared to arthroscopy.[20]

Conolly et al compared musculoskeletal fellowship-trained radiologists to radiologists who didn't undergo same training and found that they possessed substantially more sensitivity in correctly identifying the lesion.[21] Furthermore, they discovered that non-contrast MRI was an unreliable diagnostic method for type-II SLAP lesions in a community setting, with low sensitivity and high specificity in the detection of these lesions.

According to Phillips et al's study, SLAP tears are frequently misdiagnosed based on MRI evaluation because of the high sensitivity and low specificity of MRI.[22] As a result, the researchers came to the conclusion that conventional MRI is an unsuitable test for accurately evaluating the biceps labral complex for the presence of a SLAP tear. When SLAP lesions were detected on conventional MRI, Connell et al reported a sensitivity of 98% and a specificity of 89.5%, having 79% athletes in its community, the Connell study may not have produced reliable results.[23] Furthermore, Yilitz et al in his study suggested that MRI was a good diagnostic tool for SLAP lesions but its use for the classification is limited.[24]

Results in this study are more suggestive of the low accuracy (55%) of MRI and care must be considered when suspecting a SLAP lesion.

Limitations

Limitation in this study include being retrospective study, relatively small sample number, majority of participant underwent conventional MRI, a dedicated study comparing MRA to arthroscopy might yield different results.

CONCLUSION

While the majority of shoulder diseases can be identified primarily from the history and clinical examination, further imaging is necessary to identify SLAP abnormalities. According to the results of the current investigation, gold standard arthroscopy had a higher percentage rate of SLAP lesion detection on MRI. When using arthroscopy, caution should be exercised to identify true SLAP lesions that are not visible on traditional MRI. To completely understand this problem, bigger series of clinical trials are required, involving both MRI and MR arthrography in comparison to arthroscopy.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Osman SM, Galal S, Hegazy MH, Alkindi N, Almandhari A. Correlation between magnetic resonance imaging and arthroscopic findings in superior labral from anterior to posterior injuries of shoulder joint. Int J Res Orthop 2024;10:1165-9.