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Original Article

Shoulder arthroscopy: comparison of preoperative and intraoperative evaluations

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Abstract

Introduction: Magnetic resonance imaging (MRI) is a commonly used radiological technique for diagnosing rotator cuff and shoulder pathologies. Orthopedists usually evaluate the MRI findings themselves.

Aim: This study aimed to assess the diagnostic consistency of MRI-written reports by radiologists in detecting impingement and rotator cuff damage in patients who undergo arthroscopic shoulder surgery.

Methods: We conducted a retrospective analysis of surgical notes and preoperative MRI reports of patients who underwent shoulder arthroscopy due to shoulder pathology between January 2019 and June 2022 at our clinic. Patients with evidence of impingement or rotator cuff tear on clinical examination were included. MRI reports were compared with intraoperative findings to determine the presence of shoulder impingement and rotator cuff tear.

Results: A total of 108 patients, 56 women and 52 men, with a mean age of 51 years, were included in the study. In surgical examinations of 37 patients in whom full-thickness rotator cuff tears were found on MRI reports, 27 had a full-thickness rotator cuff tear, and 10 had no rotator cuff tear requiring repair. In 27 of 51 patients who underwent rotator cuff tear repair, the full-thickness tear was reported on MRI, the partial tear was reported in 16, and the rotator cuff was intact in 8 cases. Impingement syndrome was reported in 73 of 90 patients who underwent total acromioplasty, and 34 of these patients also underwent rotator cuff repair.

Conclusion: This study shows that the consistency of shoulder MRI reports written by radiologists is limited. While MRI provides valuable preliminary insights, its limitations in diagnostic accuracy necessitate corroboration with comprehensive clinical examinations and intraoperative findings. It is more appropriate for orthopedists to examine and interpret MR images and to decide on surgery based on the history, examination, and imaging findings.

Keywords

arthroscopy, impingement, magnetic resonance imaging, rotator cuff tear, written reports

Introduction

Shoulder pain affects a significant proportion of the population, with estimates ranging from 7% to 20% in population studies.[1] Accurate diagnosis of shoulder pain is essential for appropriate and effective treatment. Magnetic resonance imaging (MRI) provides valuable information on rotator cuff imaging, including the detection of partial or full-thickness tears, acromion morphology, muscle atrophy extent, and fat infiltration. MRI is accepted as the best non-invasive method for evaluating shoulder pathologies.[2]

However, there is no consensus on the accuracy of physical examination tests for pathologies such as rotator cuff tears and shoulder impingement syndrome. Studies that

analyze the differences between observers in shoulder pathologies report that the evaluation results can vary.[3]

Currently, orthopedists in our country typically evaluate MRI images themselves. In this study, we aimed to evaluate the diagnostic reliability of MRI-written reports in detecting impingement syndrome and rotator cuff injury in patients undergoing arthroscopic shoulder surgery. Radiologists without access to detailed patient history and physical examination findings evaluated the shoulder MRI images.

Aim

This study aims to investigate whether this affects the accuracy of diagnosis. To our knowledge, there is no similar study in the extant literature, and this is the first study in which MRI reports are compared with arthroscopic findings.

Materials and methods

The present study includes patients who were evaluated for shoulder pathology in the orthopedics and traumatology clinic of a hospital and who underwent arthroscopic shoulder surgery. Patients who underwent surgery for reasons other than rotator cuff pathologies, those with missing data, and those who declined to participate were excluded from the study. Patients with signs of rotator cuff rupture or subacromial impingement on physical examination who underwent MRI and surgery within 6 months after MRI were included in this study.

Retrospective analysis was conducted on the age, sex, direction, surgical notes, and preoperative MRI reports of patients who underwent surgery in the clinic between January 2019 and June 2022. The same surgical team evaluated the patients preoperatively and determined the surgical indications during the specified dates. The same experienced surgical team performed all shoulder arthroscopy surgeries on these dates.

Preoperative MRIs taken in external centers were also included in the study because they were sufficient to make the surgical decision. The interpretation of MRI findings was evaluated, and tendons were categorized as intact, partial, or full-thickness tears. Cases noted as "near complete tear" were included in the complete tear group.

The preoperative MRI findings of the patients were recorded and compared with the intraoperative arthroscopic findings obtained within 6 months of the pre-operative period. The study did not include the pre-operative examination findings of the patients performed by the orthopedist who performed the surgery.

Descriptive statistics were used to express the results. All statistical analyses were performed using IBM SPSS 22.0 statistical software (IBM Corp., Armonk, NY, USA). Categorical variables are given as numbers and percentages, and continuous variables are given as averages.

Results

The study included a total of 108 patients, comprising 56 women (51.85%) and 52 men (48.15%), with a mean age of 51.1 years (range: 18–68). The detailed demographics are presented in **Table 1**.

Table 1. Patients' demographics

Parameters	Mean±SD	Min-max
Age	51.1±13.5	18–68
	Frequency (n)	**%**
Sex		
Male	56	51.8
Female	52	48.2
Total	108	100

min: minimum; max: maximum; SD: standard deviation; n: number

The comparison of MRI reports with intraoperative findings yielded significant observations regarding the diagnostic consistency for rotator cuff tears and impingement syndrome.

When the rotator cuff tears are examined: among 37 patients reported to have full-thickness rotator cuff tears on MRI, arthroscopy confirmed full-thickness tears in 27 cases (73%) and found no repairable tear in 10 cases (27%). For the 51 patients who underwent arthroscopic repair: (**1**) MRI identified full-thickness tears in 27 cases (52.94%), (**2**) MRI identified partial tears in 16 cases (31.37%), eight of which were managed surgically despite being reported as intact on imaging, (**3**) in eight cases (15.69%), MRI reported the rotator cuff as intact despite arthroscopic findings indicating the need for repair **(Table 2)**.

Table 2. Comparison of the MRI reports and intraoperative findings

Parameters		
MRI findings	**Arthroscopic repair n (%)**	
Tear	(–)	(+)
Full-thickness tears	10 (27%)	27 (73%)
Partial tears	17 (59%)	12 (41%)
Intact	20 (72%)	8 (28%)
Impingement		
Positive	0 (0%)	73 (100%)
Negative	16 (48%)	17 (52%)

n: number

When the impingement syndromes are examined: (**1**) Impingement syndrome was noted on MRI in 73 out of 90 patients who underwent total acromioplasty (81%), (**2**) of

these, 34 patients also required rotator cuff repair, (**3**) for the remaining 17 cases without MRI-reported impingement syndrome, all were found to require rotator cuff repair intraoperatively.

When the data were examined for statistical consistency: the sensitivity and specificity of MRI for detecting full-thickness tears and impingement syndrome varied significantly. MRI demonstrated limited diagnostic accuracy, as approximately 30% of full-thickness tear diagnoses on MRI were inconsistent with arthroscopic findings. Furthermore, a significant number of surgically treated patients with intact MRI findings highlighted the limitations of relying solely on radiological reports.

When the visual analysis of findings are examined: **Figs 1 and 2** illustrate representative cases where MRI findings were inconsistent with arthroscopic evaluations. These include misreported full-thickness tears and undetected stable supraspinatus tendons. Postoperative imaging demonstrated repaired tendon attachment sites, corroborating intraoperative assessments.

The results of the subgroup analyses were as follows: (**1**) sex-based observations: male patients showed a slightly higher prevalence of full-thickness tears on both MRI and arthroscopy. Female patients exhibited a higher frequency of MRI-reported partial tears. (**2**) Age correlation: patients aged 50 and above had a higher likelihood of full-thickness tears, consistent with age-related degenerative changes. Younger patients predominantly exhibited partial tears or intact tendons on MRI, with occasional discrepancies in surgical findings.

There were limitations in MRI interpretation: the variability in radiologists' interpretations, particularly for borderline cases such as near-complete tears, contributed to diagnostic inconsistencies. Additionally, differences in imaging quality and radiologist expertise likely influenced the variability in findings.

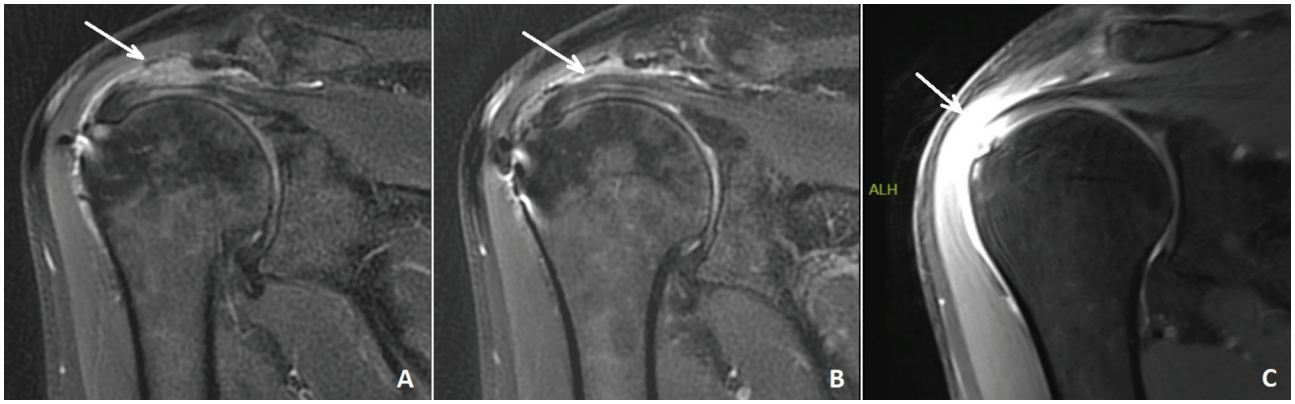

Figure 1. **A**) Coronal T2 MRI of a 55-year-old female patient interpreted as the presence of nearly complete rotator cuff rupture on the right shoulder (arrow: nearly complete rotator cuff rupture); **B**) Another coronal T2 section of the same patient, complete rupture of the supraspinatus was not detected in this patient's operation, rotator cuff repair was not performed (arrow: stable supraspinatus tendon); **C**) Coronal T2 MRI of a 49-year-old female patient interpreted by radiologists as the presence of distal full-thickness supraspinatus rupture. No rotator cuff rupture was detected in this patient (arrow: tendon attachment site cannot be distinguished).

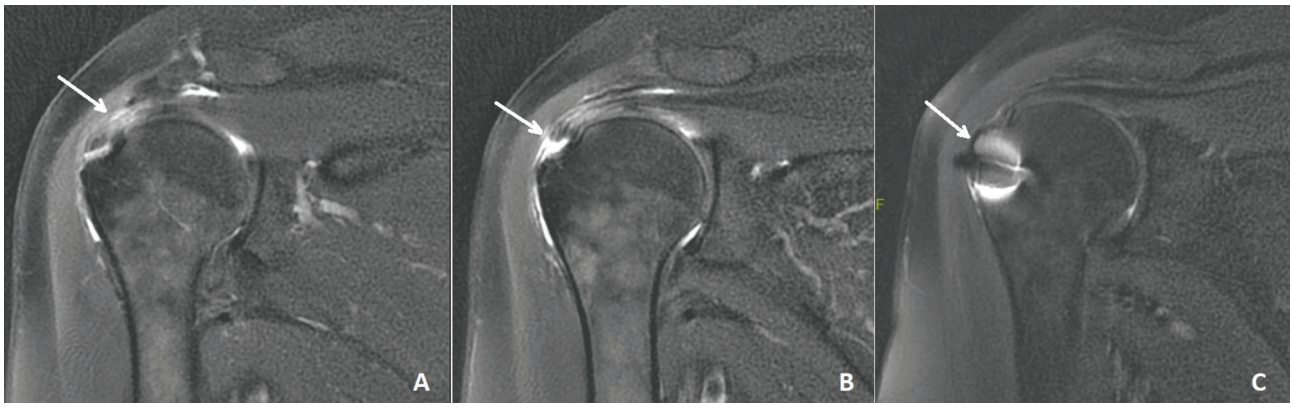

Figure 2. **A**) Coronal T2 MRI image of a 53-year-old male patient who was interpreted as the presence of supraspinatus and infraspinatus tendinitis in the right shoulder (arrow: tendon attachment site); **B**) another coronal T2 section of the same patient, a full-thickness tear was detected in this patient's operation, and it was repaired (arrow: tendon attachment site); **C**) postoperative 12th month MRI image (arrow: tendon attachment site of the repaired tendon).

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Discussion

Variable results have been reported in studies evaluating and comparing physical examination, MRI, and arthroscopy findings in the diagnosis of shoulder pathologies.[4] De Winter et al. reported that the results of physical examination tests differed among physiotherapists.[3] Norregaard et al. compared MRI findings and arthroscopy findings and found that the diagnostic accuracy of the examinations was low.[5] Silva et al., on the other hand, compared the examination findings with the MRI findings and found that the examination findings had low specificity.[6] In this study, the results of the comparison of the written results of the MRI images prepared by the radiologists with the surgical results are reported. As in many studies, arthroscopic surgical findings were accepted as a reference in this study.[7] It was planned to investigate whether the evaluation of MRI images by radiologists has a positive or negative effect on the accuracy of the diagnosis, with a brief preliminary diagnosis written only by the orthopedist, without knowing the detailed history and physical examination findings of the patient.

Full-thickness rupture was reported in only half of the patients who underwent arthroscopic full-thickness rotator cuff rupture repair. In addition, approximately 70% of the cases in which the presence of a full-thickness tear was reported had a full-thickness tear on arthroscopic examination. These findings indicate that the consistency of written MRI results prepared by radiologists in this case series is low. However, in the cases in this study, the surgical decision was made and surgery was performed after the orthopedists' history, examination, and MRI evaluations.[2-4] Therefore, these data cannot determine the sensitivity and specificity of radiology reports because this study did not include cases of non-surgical shoulder pathologies. In addition, this study is a retrospective review, and the results of orthopedists interpreting images are not available; therefore, the results of comparing orthopedists' interpretations and MRI reports are not available.

In current clinical practice, almost all orthopedists examine MRI findings themselves. This study shows that it would not be correct to make a decision based only on an MRI report prepared by radiologists. It also emphasizes that orthopedists' ability to interpret MRI may contribute to a proper diagnosis.[2-4] The orthopedist has the chance to evaluate MRI images with an eye with a detailed history and clinical findings of the patient and has the chance to increase his/her experience by combining all this information with arthroscopy findings.

Data from physical examination of the shoulder have been extensively reported in dozens of studies to date. However, statistical analyses are often neglected in these studies, and the power of evidence is often insufficient. Current meta-analyses report that shoulder examination alone is generally insufficient to confirm or rule out pathology. The accuracy of physical tests increases with the combination of multiple test findings. Combining the history and examination findings also increases the accuracy of diagnosis. One of the reasons that complicates studies is that physical examinations depend on subjective results. The test results depend on patients reporting pain with certain movements. Another issue is that most tests are not specific to a single pathology. Similar pathological findings may occur for many reasons. And another issue is that pathologies such as rotator cuff rupture can sometimes be completely asymptomatic. Although magnetic resonance imaging and arthroscopy are accepted as the gold standard in diagnosis, difficulties in interpreting the findings continue.[8-10]

Another important issue in examining shoulder radiographs and MRIs is not to focus only on the tear or impingement but to consider other possible pathologies. Sometimes the cause of pain or other symptoms may be benign or malignant tumors located in the humerus, scapula, or clavicle.[11,12] In this study, patients who were found to have tumors in their radiological examinations were excluded from the study.

It has been reported that there is a slight difference in the accuracy of diagnosis between general radiologists and musculoskeletal radiologists in the evaluation of rotator cuff pathologies. Studies have reported that the use of high-field-strength MRI systems in detecting rotator cuff rupture improves diagnostic accuracy. The advantage of MRI over ultrasound is that it is less operator dependent. It has been reported that the education level of the radiologist and the number of imaging evaluations per year are important in increasing diagnostic accuracy. This may indicate that the evaluation of all radiological images by orthopedists will increase their experience and the accuracy of diagnosis.[13-15]

This study had some limitations. Although the same experienced team performed all arthroscopy procedures, almost all MRI reports were prepared by different institutions and clinicians. Therefore, differences in knowledge and experience among radiologists may affect the results. This situation also had several advantages. It has become a type of multicenter data study, not limited to the knowledge and experience of a single radiologist, but containing the data of many centers. The other issue is the decision on the surgical method for partial tears. If a tear reported by the radiologist as a partial tear is quite large, repair may be required, whereas a small partial tear can be followed. More detailed descriptions of partial tears in reports may improve the results. Another issue is that the learning curve of shoulder arthroscopy is long. Surgeons may not be able to detect the existing tear on arthroscopy. This can lead to interpretations that MRI images have false positive findings.

The study results suggest that relying solely on MRI reports for the diagnosis of rotator cuff tears and impingement may not be sufficient for accurate arthroscopic surgical decision making. In this study, a significant number of patients with full-thickness rotator cuff tears on MRI did not require repair during surgery. Similarly, some patients who underwent rotator cuff repair did not show a full-thickness tear on MRI. Impingement syndrome was also found in some patients without being detected on MRI.

Orthopedists may benefit from having strong MRI inter-

pretation skills and using detailed examinations along with MRI findings to make surgical decisions. Treatment options for partial cuff tears and impingement syndrome should be based on a combination of clinical findings, MRI findings, and the surgeon's experience and perspective.

To better understand this issue, larger multicenter studies are needed. These studies will provide more data on the consistency of MRI reports in the diagnosis of rotator cuff tears and impingement and may lead to improved arthroscopic surgical decision-making.

Conclusions

All these results underscore the importance of combining MRI evaluations with clinical assessments and surgical expertise. While MRI provides valuable preliminary insights, its limitations in diagnostic accuracy necessitate corroboration with comprehensive clinical examinations and intraoperative findings. This study shows that the consistency of shoulder MRI reports written by radiologists is limited. It is more appropriate for orthopedists to examine and interpret MR images and to decide on surgery based on the history, examination, and imaging findings.

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Competing interests

The authors have declared that no competing interests exist.

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References

1. Bjelle A. Epidemiology of shoulder problems. Bailliere's clinical rheumatology. 1989; 3(3):437–51. doi: 10.1016/s0950-3579(89)80003-2
2. Iannotti JP, Zlatkin MB, Esterhai JL, et al. Magnetic resonance imaging of the shoulder. Sensitivity, specificity, and predictive value. J Bone Joint Surg Am 1991; 73:17–29.
3. De Winter AF, Jans MP, Scholten RJ, et al. Diagnostic classification of shoulder disorders: interobserver agreement and determinants of disagreement. Ann Rheum Dis 1999; 58:272–7. doi: 10.1136/ard.58.5.272
4. Yıldırım C, Muratoğlu OG, Muslu DC, et al. [Comparison of clinical examination, magnetic resonance imaging and arthroscopy findings in rotator cuff tears]. Med Bull Haseki 2019; 57:414–20 [Turkish]. doi: 10.4274/haseki.galenos.2019.5521
5. Nørregaard J, Krogsgaard MR, Lorenzen T, et al. Diagnosing patients with longstanding shoulder joint pain. Ann Rheum Dis 2002; 61:646–50. doi: 10.1136/ard.61.7.646
6. Silva L, Andréu JL, Muñoz P, et al. Accuracy of physical examination in subacromial impingement syndrome. Rheumatology 2008; 47:679–83. doi: 10.1093/rheumatology/ken101
7. Leroux JL, Thomas E, Bonnel F, et al. Diagnostic value of clinical tests for shoulder impingement syndrome. Rev Rhum (Engl Ed) 1995; 62:423–8.
8. O'Kane JW, Toresdahl BG. The evidenced-based shoulder evaluation. Curr Sports Med Rep 2014; 13:307–13. doi: 10.1249/JSR.0000000000000090
9. Hegedus EJ, Goode AP, Cook CE, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests. Br J Sports Med 2012; 46:964–78. doi: 10.1136/bjsports-2012-091066
10. Lenza M, Buchbinder R, Takwoingi Y, et al. Magnetic resonance imaging, magnetic resonance arthrography and ultrasonography for assessing rotator cuff tears in people with shoulder pain for whom surgery is being considered. Cochrane Database Syst Rev 2013; 9:009020. doi: 10.1002/14651858.CD009020.pub2
11. Öztürk R, Arıkan ŞM, Toğral G, et al. Malignant tumors of the shoulder girdle: Surgical and functional outcomes. J Orthop Surg (Hong Kong) 2019; 27:2309499019838355. doi: 10.1177/2309499019838355
12. Öztürk R, Bulut EK, Ateş ÖF, et al. A simple bone cyst of the acromion: case report. Rev Bras Ortop (Sao Paulo) 2021; 56:263–7. doi: 10.1055/s-0040-1715516
13. Smith TO, Daniell H, Geere JA, et al. The diagnostic accuracy of MRI for the detection of partial- and full-thickness rotator cuff tears in adults. Magn Reson Imaging 2012; 30:336–46. doi: 10.1016/j.mri.2011.12.008
14. Lambert A, Loffroy R, Guiu B, et al. Rotator cuff tears: value of 3.0T MRI. J Radiol 2009; 90:583–8. doi: 10.1016/s0221- 0363(09)74024-7
15. Wright T, Yoon C, Schmit BP. Shoulder MRI refinements: differentiation of rotator cuff tear from artifacts and tendonosis, and reassessment of normal findings. Semin Ultrasound CT MR 2001; 22:383–95. doi: 10.1016/s0887-2171(01)90028-9