

Investigation of the Value of Different Field Strength MRI Scans for the Diagnosis of Rotator Cuff Injuries

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How to cite this paper: Li, X., Shi, W.D., Xu, F., Li, Q.S. and Xiao, X. (2022) Investigation of the Value of Different Field Strength MRI Scans for the Diagnosis of Rotator Cuff Injuries. *Open Journal of Radiology*, 12, 32-36.
<https://doi.org/10.4236/ojrad.2022.121004>

Received: February 16, 2022

Accepted: March 7, 2022

Published: March 10, 2022

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Abstract

Objective: A comparison of the difference between the two types of field MR scan in diagnosis of shoulder joint injury. **Method:** Randomly selected 153 patients with arthroscopic or open arthroplasty who had shoulder pain or dysfunction treated in our hospital from 2014 to 2017 were divided into 1.5 T group and 3.0 according to the field strength of MRI examination. Postoperative pathology was a gold standard. The sensitivity, specificity, consistency, and predictive value of two field-strength MRI examinations in the diagnosis of rotator cuff tears were calculated and compared. **Results:** The sensitivity, specificity, crude consistency, positive predictive value, and negative predictive value of the 1.5 T group were 68.75%, 82.35%, 73.47%, 88.00%, and 58.33%, respectively. The 3.0 T group was 72.22%, 89.47%, 78.18%, 92.86% and 62.96%, the differences between the above indicators were not statistically significant ($P > 0.05$). **Conclusion:** There was no difference in the authenticity and benefit index of rotator cuff injury diagnosed by 1.5 T and 3.0 T MRI.

Keywords

Shoulder Joint, Magnetic Resonance Imaging, Field Strength, Diagnostic Value

1. Introduction

With the increasing aging in China, shoulder joint pain has become a common and frequent clinical condition. Rotator cuff injuries account for about 17% to 41% of shoulder pain and are increasingly recognized and emphasized by clinicians [1]. The limitations of conventional X-rays and CT for soft tis-

sue lesions can no longer meet the needs of clinical diagnosis and treatment, so how to accurately diagnose the extent and degree of rotator cuff injury is an urgent problem. With the long-term clinical research, it is found that magnetic resonance imaging (MRI) has the characteristics of high soft tissue resolution, clear multi-directional and multi-level imaging, no ionizing radiation, and has the advantages of accurate location and characterization of lesions. It plays an important role in the diagnosis of rotator cuff injury. Williner has shown that the signal-to-noise ratio of 3.0 T MRI is twice that of 1.5 T, but 3.0 T can obtain higher quality images and more information [2] [3]. In this study, patients underwent arthroscopic or open repair and underwent 1.5 T and 3.0 T MRI to compare the clinical value of different field strengths of MRI in the diagnosis of rotator cuff injury, using the surgical diagnosis as the gold standard.

2. Materials and Methods

2.1. General Materials

The 153 patients with shoulder pain or dysfunction who underwent arthroscopic or open repair from 2014 to 2017 were randomly selected and divided into 1.5 T and 3.0 T groups. 1.5 T group included 67 males and 31 females; 17 had a history of trauma; 36 had arthroscopic surgery and 62 had open tendon-tendon and tendon-bone repair. 3.0 T group included 36 males and 19 females; 10 patients had a history of trauma; 20 patients had arthroscopic surgery and 55 patients had open tendon-tendon and tendon-bone repair surgery. The differences in baseline data between the two groups were not statistically significant ($P > 0.05$) and were comparable.

2.2. Equipment and Scanning Methods

Siemens Magnetom Avanto 1.5 T MRI scanner, Siemens Magnetom Verio 3.0 T MRI scanner. For conventional MR scanning, the patient was scanned in a supine position with the upper arm externally rotated (palm up), head first, and the shoulder joint as close to the midline of the bed as possible. The sequence included PDWI in transverse axis, FSTE T1WI (layer thickness 4 mm, spacing 0.4 mm), PDWI in oblique coronal position, FSTE T1WI (layer thickness 4 mm, spacing 0.4 mm), and PDWI in oblique sagittal position (layer thickness 4 mm, spacing 0.4 mm) for scanning. FOV): 180 × 180 mm.

2.3. MRI Diagnosis

The films were reviewed and diagnosed by two or more attending physicians independently, and finally compared with the intraoperative diagnosis of the shoulder joint. The MRI diagnosis of a complete rotator cuff tear was based on the following accepted diagnostic criteria [4] [5] [6]: high signal through the entire supraspinatus tendon with or without tendon shortening on PDWI, high signal through the rotator cuff tendon on FS T1WI, and fluid signal in the subacromial

and subdeltoid bursae with abnormal rotator cuff tendon morphology. The patient was found to have abnormal rotator cuff tendon morphology.

2.4. Arthroscopic Surgery Diagnosis

The patients were operated by experienced orthopedic surgeons or above, and the MRI images were carefully compared with the 1.5 T or 3.0 T MRI images to determine whether the rotator cuff was damaged.

2.5. Statistical Analysis

Data analysis was performed using SPSS19.0.

3. Results

Table 1: In the 1.5 T group, 64 rotator cuff injuries were confirmed by surgery and 50 by MRI; in the 3.0 T group, 36 rotator cuff injuries were confirmed by surgery and 28 by MRI.

Table 2: Authenticity and benefit index value of MRI with different field strength in the diagnosis of rotator cuff injury. There was no significant difference in the authenticity and benefit index between the two field intensity MRI in the diagnosis of rotator cuff injury ($P > 0.05$).

4. Discussion

The rotator cuff is composed of supraspinatus, infraspinatus, subscapularis and teres minor tendons. It plays a major role in the movement of the shoulder joint

Table 1. Comparison between MRI examination and surgical diagnosis of different field intensities.

		Operation	MRI	Total
1.5 T	Positive	44	6	50
	Negative	20	28	48
	Total	64	34	98
3.0 T	Positive	26	2	28
	Negative	10	17	27
	Total	36	19	55

Table 2. Authenticity and benefit index values of MRI in the diagnosis of rotator cuff injury (%).

	Sensibility	Specificity	Uniformity	Positive predictive value	Negative predictive value
1.5 T	68.75	82.35	73.47	88.00	58.33
3.0 T	72.22	89.47	78.18	92.86	62.96
c^2	0.13	0.09	0.42	0.08	0.15

and maintains the stability of the shoulder joint. Rotator cuff injury can lead to shoulder pain and limited function. Except for a few cases of trauma, most of them are caused by peak impact syndrome [7]. Some of these tears can be repaired by shoulder arthroscopy, while complete tears need surgical treatment. If the diagnosis and treatment are not provided on time, it will lead to the upward displacement of the humeral head [8] and the pathological changes of the joint bone structure, so that the patient will be seriously injured.

With high spatial and tissue resolution, MRI can diagnose rotator cuff injury, which is recognized by more and more clinicians and patients. However, the quality of MRI with different field strengths is different, and the inspection cost of medium and high-end MRI scanner is expensive. At this stage, China is in the objective national conditions of developing countries, and there are restrictions on the unbalanced allocation of regional medical treatment. Some economically relatively backward areas can not pursue the actual situation of high-end equipment, and patients in such areas sometimes cannot afford high examination costs.

In order to make the clinical diagnosis of rotator cuff injury more accurate and reliable, based on the results of surgical diagnosis, this study compared and analyzed the clinical data of the value of two field intensity MRI in the diagnosis of rotator cuff injury. The selected evaluation indexes include sensitivity, specificity, positive predictive value and negative predictive value.

In conclusion, using surgical diagnostic results as the gold standard, no difference was found in the veracity and yield indexes of 1.5 T and 3.0 T MRI for the diagnosis of rotator cuff injury in the absence of shoulder arthrography, suggesting that there is no need to pursue high-end MRI equipment in economically underdeveloped areas and that 3.0 T MRI is unnecessary for patients with poor financial income with suspected rotator cuff injury to reduce the patient's burden of diagnosis and treatment. The burden of disease is reduced.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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