

## Research Article

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# Clinical, MRI and arthroscopic correlation in anterior and posterior shoulder instability

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## ABSTRACT

**Background:** The peculiar anatomy of shoulder puts the glenohumeral joint at a great risk of instability, which poses a challenge for management. Clinical examination is not always accurate. MRI and arthroscopy are hence used to aid the diagnosis. The study aimed to compare and correlate clinical and Magnetic Resonance Imaging (MRI) in cases of anterior and posterior shoulder instability against the arthroscopic confirmation of the diagnosis, which is considered gold standard.

**Methods:** A prospective study of 30 patients of shoulder instability (either anterior or posterior) was carried out, including both sexes and all age groups. The patients were first examined clinically, followed by 1.5 tesla MRI scan and finally arthroscopically. The findings of diagnostic arthroscopy were correlated with clinical & MRI findings. A definitive procedure to treat the pathology was then performed as per requirements. Sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of clinical and MRI findings was calculated to correlate with arthroscopic findings.

**Results:** Clinical diagnostic tests and MRI had a significant statistic correlation ( $P < 0.05$ ) with various lesions responsible for instability. Diagnostic accuracy of MRI was considerably higher in comparison to clinical examination for both anterior (90% vs. 86.67%) and posterior (96.67% vs. 93.33%) shoulder instability.

**Conclusion:** By obtaining correlation between clinical examination, MRI scan and arthroscopy for anterior and posterior shoulder instability, we conclude that MRI can give a better diagnosis of the pathology in comparison to clinical examination.

**Keywords:** Shoulder instability, Clinical examination, MRI

## INTRODUCTION

Instability of the shoulder joint is a frequently presenting problem. Its prevalence and management have been known since ancient times. Evidence of shoulder dislocations has been found in archaeological and paleopathological examinations of human shoulders several thousands of years old.<sup>1</sup> Early history of shoulder instability treatment and surgery is described in detail in a

book on recurrent shoulder instability by Moseley, in 1961.<sup>2</sup>

Inspite of the long historical knowledge, diagnosis and management of shoulder instability is still challenging for orthopaedicians. Though experienced clinicians can clinch the diagnosis from detailed history and clinical examination, it is not very accurate as some lesions do not produce the classical symptoms and signs. Hence

MRI and arthroscopy are used as highly valuable diagnostic tools.

MRI has allowed for direct visualization of many of the lesions related to instability, aiding in diagnosis as well as therapeutic planning and follow-up. Arthroscopy provides direct access to the joint and gives a clear view of the anatomy, in addition to serving as a therapeutic tool. It aids the diagnosis for those cases which cannot be assessed clinically or radiographically.

Review of the available literature suggests that there are a number of studies looking at two out of the three diagnostic tools (clinical examination, MRI scan, and arthroscopy). Therefore, our study was designed to identify correlation of all three methods. We aimed to obtain diagnostic accuracy of the three tools.

## METHODS

After obtaining due permission for the study and informed consent of the patients, 30 patients of shoulder instability (both anterior and posterior) were identified, including both sexes all age groups. They were reviewed clinically, then subjected to X-rays and MRI scanning, then followed by arthroscopy for diagnosis or treatment.

Clinical criteria included detail history, mechanism of injury, pain and its aggravating or relieving factors, joint line tenderness and special tests. Positive anterior apprehension, anterior drawer and Jobe's relocation tests were considered essential for diagnosis of anterior instability. Positive posterior load and shift test was considered diagnostic of posterior instability. Sulcus test was performed to rule out inferior instability.

Radiographs of the affected shoulder were taken to rule out any bony involvement like Bankart's or reverse Bankart's lesions; Hill Sach's or reverse Hill Sach's lesions. Routine anteroposterior and axillary lateral views were taken. Special views like anteroposterior view in internal rotation, west point view or Stryker notch view were also considered if needed.

Patients were then subjected to 1.5 tesla MRIs. They were studied and various pathologies of the glenoid, superior or inferior labrum or capsule were reported by competent radiologists, which were then reviewed by orthopaedic surgeons.

Later, after completing all routine investigations and obtaining pre-operative fitness, they were posted for diagnostic arthroscopy. In the lateral decubitus position, posterior, anterosuperior and anteroinferior arthroscopic portals for the shoulder were established. Diagnostic arthroscopy was then performed through posterior portal. Chondromalacia or traumatic lesions to articular surfaces of glenoid and humeral head were observed. Biceps and subscapularis tendons, glenoid labrum, capsule and

inferior-glenohumeral ligament were inspected for any fraying, tear or detachment.

A definitive procedure to treat the diagnosed pathology was then planned and performed as required. Post-operative management included antibiotics, analgesics, anti-inflammatory and other supportive drugs. Suitable physiotherapy was also given. Patient was followed up regularly at 2 weeks intervals for 3 months.

Record of clinical, MRI, and arthroscopic findings were kept and compared. Arthroscopic findings were regarded as the gold standard. A statistical correlation was then calculated.

## RESULTS

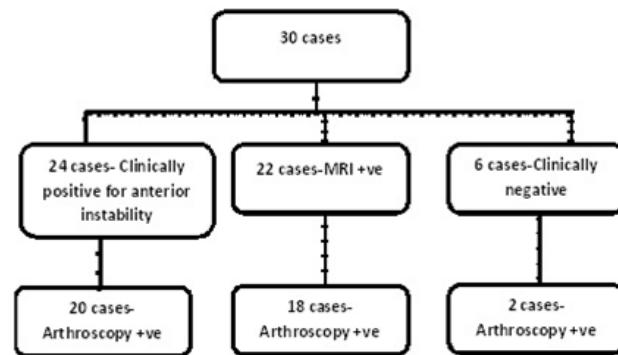
Of the 30 cases of shoulder instability, majority were in the age group of 20-30 years (66.6%) with average age being 28.13 years. 21 were males (70%). Fall on an outstretched hand was the commonest mode of injury (53.55%).

**Table 1: Diagnostic values of clinical tests.**

	Anterior instability	Posterior instability
Sensitivity %	85.71	100
Specificity %	100	92.86
Accuracy %	86.67	93.33
PPV %	100	50
NPV %	33.33	100

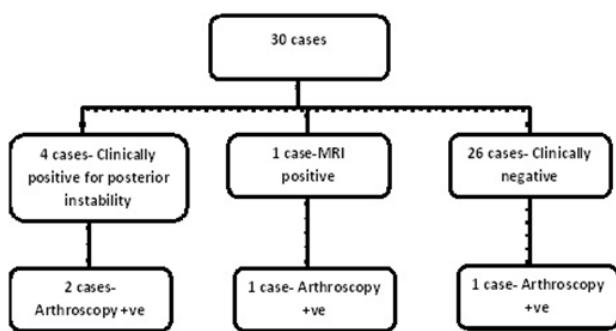
**Table 2: Diagnostic values of MRI.**

	Anterior instability	Posterior instability
Sensitivity	91.30	50
Specificity	85.71	93.33
Accuracy	90.0	96.67
PPV	95.45	100
NPV	75.0	96.55



**Figure 1: Anterior instability case distribution.**

There were 24 cases where clinical diagnosis of anterior instability was suspected (Figure 1). Out of these 24 cases there were 18 cases where both MRI and arthroscopy were positive in confirming the diagnosis (75%). Arthroscopy was positive in 20 cases (83.3%). From a total of 22 cases where MRI scan showed anterior instability, 18 cases confirmed with positive arthroscopic evidence (81.8%). MRI had better sensitivity (91.30% vs. 85.71%) but low specificity (85.71% vs. 100%) in comparison to clinical examination in diagnosis for anterior instability. Similarly +ve predictive values (95.45% vs. 100%) were low and -ve predictive values (75% vs. 33.33%) were found to be higher in MRI scan than clinical examination for diagnosis for these injuries. Diagnostic accuracy of MRI was considerably higher in comparison to clinical examination (90% vs. 86.67%) as depicted in Tables 1 and 2.



**Figure 2: Posterior instability case distribution.**

There were 4 cases where clinical diagnosis of posterior instability was suspected (Figure 2). Out of these 4 cases there was 1 case where both MRI and arthroscopy were positive in confirming the diagnosis (25%). Arthroscopy was positive in 2 cases (50%). 1 case where MRI scan showed posterior instability, was confirmed with positive arthroscopic evidence (100%). Clinical examination had better sensitivity (100% vs. 50%) but low specificity (92.86% vs. 93.33%) in comparison to MRI in diagnosis for posterior instability. Similarly +ve predictive values (50% vs. 100%) were low and -ve predictive values (100% vs. 96.55%) were found to be higher in clinical examination than MRI scan for diagnosis for these injuries. Diagnostic accuracy of MRI was higher in comparison to clinical examination (96.67% vs. 93.33%) as depicted in Tables 1 and 2.

## DISCUSSION

Shoulder dislocations, account for 50% dislocations in the human body. The first reported dislocation is mentioned in mankind's oldest book, the Edwin Smith Papyrus (3000-2500 BCE).<sup>3</sup>

Shoulder instability occurs when the structures surrounding the shoulder joint fail to tightly contain the humeral head within the glenoid socket. The common causes are trauma leading to dislocation, overuse as in

athletes, or atraumatic conditions like connective tissue disorders leading to joint laxity. The glenohumeral joint has a unique and complex anatomy which predisposes it to instability. It has a high degree of mobility, with both static and dynamic factors maintaining its stability.<sup>4,5</sup> The static factors include the bony configurations of the glenoid and the humerus, the glenoid labrum, the joint capsule, and the glenohumeral ligaments. The dynamic factors include the muscles of the rotator cuff and, to a lesser degree, the long head of the biceps and the deltoid muscle.

According to Pollock and Flatow<sup>6</sup>, shoulder instability can be classified based on timing (acute, primary or recurrent, chronic), degree (subluxation, dislocation or occult), direction (anterior, posterior, inferior or combinations), etiology (traumatic, atraumatic or acquired), volition (voluntary or involuntary including positional, muscular or psychological).

Majority of the patients present with traumatic anterior instability and 95% of shoulder dislocations are of the anterior type.<sup>7</sup> Posterior instability is rare and difficult to diagnose as it often overlaps with multidirectional instability. Various injuries are associated with glenohumeral instability involving bones, labro-ligamentous components, or the rotator cuff which MRI can identify easily.

In 1925, Pilz reported the first detailed radiographic examination of recurrent shoulder dislocation. He stated that routine radiographs were of little help in diagnosis.<sup>8</sup>

In 1956, Rowe analysed 500 shoulder dislocations and stated that 96% were traumatic in origin and only 4% were atraumatic.<sup>9</sup>

In 1994, Michael R Green and Kevin P. Christensen conducted a double blinded study comparing MRI findings with those noted in surgery for 33 patients with possible anterior dislocations. Of the 28 surgically confirmed labral lesions, 21 were detected by MRI.<sup>10</sup>

In 1996, Stephen H Liu et al. studied 54 patients with shoulder pain secondary to anterior instability or glenoid labral tears refractory to 6 months of conservative management. The ability to predict the presence of glenoid labral tear by physical examination was compared with that of MRI and confirmed arthroscopically. They concluded that physical examination was more accurate in predicting glenoid labral tears than MRI.<sup>11</sup>

In 2002, Tzannes A, Murrell G presented a paper on Clinical Examination of the unstable shoulder and studied diagnostic values of various tests for shoulder instability. They had sensitivity and specificity of 50 and 100 for anterior instability and 14 and 100 for posterior instability.<sup>12</sup>

In 2010, Hayes ML, Collins MS et al. studied consecutive patients who underwent diagnostic MRI and shoulder arthroscopy for instability from 1997 to 2006. They concluded that MRI demonstrates a high sensitivity & specificity for diagnosis of articular cartilage injuries in patients with glenohumeral instability.<sup>13</sup>

Our study of 30 patients of shoulder instability revealed that MRI has better sensitivity and diagnostic accuracy, in comparison to clinical examination, for both anterior and posterior shoulder instability.

We endeavoured to present a correlation between clinical and MRI findings of anterior and posterior instability, comparing them with arthroscopic findings, which were considered gold standard. This was aimed at making the diagnosis of shoulder pathologies easier and more reliable for the examiners. Retrospective analysis of the findings and collaboration of 4 orthopaedic surgeons and 2 radiologists were the shortcomings of the study. No controversies were raised by the study.

For a precise physical examination, a thorough anatomical knowledge and a great deal of experience are needed. Identification and interpretation of shoulder pathologies clinically and using MRI scan can be difficult. It can be observer dependent as well as dependent upon the sensitivity of the scanner.

## CONCLUSION

By obtaining correlation between clinical examination, MRI scan and arthroscopy for anterior and posterior shoulder instability, we conclude that MRI can give a better diagnosis of the pathology in comparison to clinical examination. Carefully performed clinical examination is not always accurate to reach a diagnosis. MRI technique is non-invasive and combines soft tissue contrast with tomographic possibilities without the use of ionizing radiation. It can visualise both superficial and deep structures and can delineate bone, cartilage, ligaments with high precision. It also helps in classification and pre-operative assessment of the pathology.

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**Ethical approval:** Not required

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