

Original Research

Ultrasonography as diagnostic tool in rotator cuff injuries of shoulder

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ABSTRACT:

Aim: To evaluate diagnostic accuracy of ultrasonography as tool in rotator cuff injuries of shoulder. **Materials and method:** It included 50 patients between 15-65 years of age presenting with shoulder symptoms of pain and restriction of movements and excluded cases having fractures around shoulder. The patients were interviewed as per a set proforma which included their personal details and detailed history of symptoms. The cases were examined by a post graduate trainee and senior Orthopaedic Surgeon for final clinical diagnosis, based on specific tests of rotator cuff tear, such as Empty Can test and Neer's sign for Impingement and supraspinatus tear, Drop arm test for complete supraspinatus tear and Gerber's Lift off test for subscapularis tear. **Results:** 54% patients were farmer or labourer followed by 30% who were housewives. History of fall was noted only in 20% cases. Nearly 3/4th (76%, 38 cases) were right handed and right shoulder was involved in 80% (40 cases). Neer Impingement test was positive in 92% (46 cases), showing supraspinatus tendon involvement. Empty can test was positive in 36% (18 cases) showing complete or incomplete tear of supraspinatus tendon. Drop arm test was positive in 32% (16 cases) showing complete tear of supraspinatus tendon. Gerber's Lift Off test was found positive in 26% (13 cases) showing subscapularis tendon complete or incomplete tear. Based on these tests supraspinatus tendon was noted to have partial thickness tear in 24 cases and full thickness tear in 16 cases. Subscapularis tendon was partially torn in 13 cases along with partial tear of supraspinatus. One case had only subscapularis tendon involvement. **Conclusion:** Office-based shoulder ultrasound examination can be used in conjunction with the patient's clinical history and physical examination and provides important information regarding rotator cuff condition. Improved diagnostic accuracy with better clinical correlation can not only facilitate subsequent treatment planning but also lessen the overwhelmingly tight schedule of screening MRI for equivocal cases.

Keywords: rotator cuff injuries, ultrasonography, shoulder injury.

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INTRODUCTION:

The prevalence of this problem increases with age and it is estimated that by the age of 70 years more than 50% population will have a full or partial thickness of Rotator Cuff Tear though not always symptomatic.¹ Early diagnosis of this entity is important as untreated tears may enlarge, cause increased pain and lead to irreversible fatty degeneration and atrophy of shoulder muscles.^{2,3}

Various imaging techniques such as Ultrasonography, MRI, MR arthrography and CT arthrography can be used to detect Rotator Cuff Abnormality. These modalities identify the causal factors, involved tendons and its extension into muscles

which cannot be identified clinically.⁴ In view of high prevalence of Rotator Cuff injuries and its diagnostic difficulties on clinical examination and high cost and less availability of MRI, this study was done to find out the utility of Ultrasonography as a diagnostic tool in Rotator Cuff Injuries.

Magnetic resonance imaging (MRI) provides an anatomic picture, demonstrates the quality of rotator cuff muscles, and is very commonly used in clinical practice for detection of rotator cuff tears or shoulder stiffness. However, the cost of MRI examinations is far beyond that of an ultrasonography exam. Shoulder ultrasonography performed by a technician and interpreted by a radiologist with expertise has been

shown to be accurate in detecting full-thickness and partial-thickness tears of the rotator cuff.⁵ The sensitivity and specificity of ultrasonography for the diagnosis of symptomatic full thickness rotator cuff tear were reported to range from 91 to 100% and 85 to 86%, respectively.^{6,7} The technique also provides bilateral information without being affected by the presence of intra-osseous hardware, is better tolerated, and allows the patient to view real time information with immediate results. It is also less expensive than MRI. If the integrity of the rotator cuff is confirmed by shoulder ultrasonography, orthopedic surgeons and patients can be more confident of achieving successful results with non-operative treatment in patients with stiff shoulder without rotator cuff tear. Therefore, there will be no immediate indications to arrange MRI examinations for this group of patients. If patients with rotator cuff tears with or without shoulder stiffness are screened and diagnosed by shoulder ultrasonography at the orthopedic office, the subsequent surgical treatment can be carried on, avoiding progression of the rotator cuff tear because of the delay caused by a long wait time of MRI exams. However, in comparison with other modalities such as MRI, the use of ultrasonography for the diagnosis of rotator cuff disease in authors' hospital has achieved only limited acceptance among orthopedic doctors because of the uncertainty over the accuracy of this modality, which is not performed by the orthopedic surgeons themselves. We hypothesize that a well-trained orthopedic surgeon can utilize shoulder ultrasonography in conjunction with physical examinations, patient history, and a review of shoulder radiographs to accurately diagnose the rotator cuff pathology, thus allowing the provision of a so-called one-stop clinic, saving time and hospital visits, and potentially offering cost and time savings for patients who actually have rotator cuff tears. The waiting time of MRI exams should decrease once orthopedic surgeons start utilizing shoulder ultrasonography because patients who really have a rotator cuff tear will be notified as soon as they received ultrasonography screen. These patients could be arranged MRI exam with priority because they do have a rotator cuff tear.

MATERIAL AND METHODS:

It included patients between 15-65 years of age presenting with shoulder symptoms of pain and restriction of movements and excluded cases having fractures around shoulder. Sample size was 50 patients.

The patients were interviewed as per a set proforma which included their personal details and detailed history of symptoms. The cases were examined by a post graduate trainee and senior Orthopaedic Surgeon for final clinical diagnosis, based on specific tests of rotator cuff tear, such as Empty Can test and Neer's sign for Impingement and supraspinatus tear, Drop arm test for complete supraspinatus tear and Gerber's Lift off test for subscapularis tear.

STATISTICS

Results for sensitivity, specificity, positive and negative predictive values are given twice, once by considering full-thickness tears as the positive finding, and once by considering both full and partial-thickness tears as the positive finding. The 95% confidence intervals (CI) were derived from the binominal distribution (www.swogstat.org/stat/public/binominal_conf.htm)

RESULTS:

54% (27) patients were farmer or labourer followed by 30% (15) who were housewives. History of fall was noted only in 20% cases. Nearly 3/4th (76%, 38 cases) were right handed and right shoulder was involved in 80% (40 cases). Neer Impingement test was positive in 92% (46 cases), showing supraspinatus tendon involvement. Empty can test was positive in 36% (18 cases) showing complete or incomplete tear of supraspinatus tendon. Drop arm test was positive in 32% (16 cases) showing complete tear of supraspinatus tendon. Gerber's Lift Off test was found positive in 26% (13 cases) showing subscapularis tendon complete or incomplete tear.

Based on these tests supraspinatus tendon was noted to have partial thickness tear in 24 cases and full thickness tear in 16 cases. Subscapularis tendon was partially torn in 13 cases along with partial tear of supraspinatus. One case had only subscapularis tendon involvement.

On Ultrasonography supraspinatus tendon was the most common tendon involved. Out of 8 patients having full thickness tear, 9 patients had tear of supraspinatus tendon and 1 patient had full thickness tear of subscapularis muscle. Partial thickness tear of supraspinatus tendon was noted in 28 cases. Partial thickness tear of subscapularis muscle was noted in 8 cases, most of which were associated with partial thickness tear of supraspinatus tendon also. 3 cases did not have any tear on Ultrasonography. Of these 3 cases, one had subacromial- subdeltoid bursitis and 1 had bicipital tendinitis.

Table 1: Correlation of Clinical and USG Finding of Rotator Cuff Injuries

Type of tear	On Clinical Examination	On Ultrasonography
Full Thickness tear of Supraspinatus tendon	16	7
Partial thickness tear of Supraspinatus with or without Subscapularis	24 (13 of these patients had partial tear of Subscapularis tendon)	28(13 of these cases Subscapularis tear also)
Only Subscapularis Tear (Full thickness)	1	1
Subacromial Bursitis	0	1
Bicipital Tendinitis	0	1

DISCUSSION:

The tendons are that of Supraspinatus, Infraspinatus, Teres Minor and Subscapularis. All these muscles arise from scapula and insert upon lesser and greater tuberosity of humerus.

Rotator Cuff tear may be traumatic or degenerative in etiology. Degenerative tear is more frequent and multifactorial. Tendon is weakened by extrinsic and intrinsic factors leading to gradual failure with or without superimposed trauma, resulting in full thickness tear.

Clinical tests have variable sensitivity and specificity and findings may overlap indicating multiple tendon involvement as well as bursitis or tendinitis. X- rays of shoulder do not show any specific finding except decrease in subacromial space or calcification at the insertion in cases of calcific tendinitis. Cortical irregularity of the greater tuberosity at attachment site of supraspinatus indirectly indicates the presence of a rotator cuff tear with a sensitivity of 90% and a negative predictive value of 96%.⁸ Based on this finding specific treatment cannot be offered.

Ultrasonography of rotator cuff was started in 1977⁹ and has become wide spread due to increased portability, less cost and easy learning curve. With ultrasound, image acquisition and image interpretation are dependent on the skill of the interpreting physician. Low inter-observer variability has been demonstrated in rotator cuff evaluation.

Saraya S et al¹⁰ noted ultrasound sensitivity for tendinitis detection 85% with 86% NPV and 90% accuracy. For partial thickness tear he noted sensitivity and specificity of 88% and 89% respectively. For full thickness tear, he noted 100% sensitivity and 100% specificity.

Ultrasonography of the shoulder had been recently employed as a screening tool because it is simple, quick, affordable, and provides an immediate imaging method as an adjunct to clinical evaluation and a high rate in detection of full-thickness rotator cuff tears.¹¹

Yamamoto et al. performed ultrasound screening for rotator cuff tears in 683 residents of a Japanese mountain village and revealed that 283 shoulders in

211 individuals between 34 and 87 years of age had full-thickness rotator cuff tears.¹² Ultrasonography is cheaper and quicker than MRI and it is as accurate as MRI in the detection of rotator cuff tears.^{13,14} High-resolution ultrasonography is believed to have 100% sensitivity, 85% specificity, and 96% accuracy in detecting full-thickness rotator cuff tears.¹⁵ In a study of 61 patients, Brenneke and Morgan found that ultrasonography had a sensitivity of 95% and a specificity of 93% for the detection of full-thickness tears.¹⁶ Thus, ultrasonography may help to screen patients effectively prior to more advanced imaging methods in some cases.¹⁷ Shoulder ultrasonography is comparable with MRI in detecting the size of cuff tears. According to Iannotti et al., the sensitivity of ultrasonography for detecting the tear size in the anteroposterior dimension was 86% (95% confidence interval, 71–95%) and that of MRI was 93% (95% confidence interval, 81–99%). The sensitivity of ultrasonography for detecting the tear size in the medial-lateral dimension was 83% (95% confidence interval, 69–93%) and that of magnetic resonance imaging was 88% (95% confidence interval, 74–96%).¹⁸ In fact, shoulder ultrasonography may be better than MRI because of its capability to evaluate the cuff muscles globally from their insertions to their origins in real-time fashion since MRI is a static examination.¹⁹ Another advantage of shoulder ultrasonography is that it is office-based and can be performed at the time of the patient's clinical evaluation, so there is no need to schedule another appointment for the test, which is very convenient for the patient.¹⁸ It is also faster in comparison with MRI, with the average time per ultrasound examination being less than 10 min when performed by experienced examiners.²⁰ Patients with shoulder pain prefer ultrasound over MRI, and they are more willing to repeat an ultrasound examination according to Middleton et al.²¹ Chauhan NS et al²² found high resolution ultrasound equivalent to MRI in diagnosis of Rotator cuff tear. He noted a sensitivity of 86.7 % and specificity of 100% for full thickness tears and sensitivity of 89.7%

and specificity of 98.8% for partial thickness tears. He also found comparable diagnostic accuracy of USG and MRI and recommended the use of ultrasonography as the first line investigation for diagnosis of rotator cuff tear.

Singh A et al²³ evaluated shoulder pain patients with USG and MRI. His majority of patients were in the age group of 56-65 years, similar to our study. There was male preponderance (56%) as seen in our study. Out of 50 patients subjected to investigations, he noted complete thickness tear in 25 (50%) patients and partial thickness tear in 15 (30%) patients, tendinosis in 18% and no abnormality in 2% patients. MRI detected 28 complete and 12 partial thickness tears in his study. It was concluded that USG of shoulder shows promising results in the diagnosis of Rotator Cuff tears and in differentiating partial from complete tears.

Singh AP et al²⁴ noted rotator cuff tears either partial or full thickness in 70% of his 60 cases on USG. MRI showed rotator cuff tear in 81.67% of the cases.

CONCLUSIONS:

Office-based shoulder ultrasound examination can be used in conjunction with the patient's clinical history and physical examination and provides important information regarding rotator cuff condition. It reduces wait time from first outpatient visit to final surgery and MRI to final surgery and in patients with rotator cuff tears. Higher positive detection rates regarding rotator cuff tears were found among patients who received shoulder MRI exam. Improved diagnostic accuracy with better clinical correlation can not only facilitate subsequent treatment planning but also lessen the overwhelmingly tight schedule of screening MRI for equivocal cases.

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