

**THE ROLE OF COMMUNITY DIAGNOSTIC
ULTRASOUND EXAMINATION IN THE
DIAGNOSIS OF FULL THICKNESS
ROTATOR CUFF TEARS**

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ABSTRACT

BACKGROUND Diagnostic Ultrasound examination has become the most commonly used investigation in Australia for diagnosing Rotator Cuff Tears. The authors felt that the results of such investigations were often inaccurate in their clinical practices

METHODS The diagnostic ultrasound findings in 336 cases were compared to arthrography, and in 225 cases findings at surgery

RESULTS A very poor accuracy rate of 0.38 was found for diagnostic ultrasound examination. The sensitivity was 0.24 and specificity was 0.61.

CONCLUSIONS The authors recommend extreme caution in the use of diagnostic ultrasound, as currently practiced in a general community setting, in diagnosing full thickness rotator cuff tears.

KEY WORDS rotator cuff, shoulder, ultrasound

INTRODUCTION

In planning treatment of rotator cuff disease, accurate diagnosis of whether a full thickness tear is present is important. This is especially so if surgical intervention is considered. History and clinical examination alone may not suffice and several imaging modalities are available to aid diagnosis. These include diagnostic ultrasonography, arthrography and magnetic resonance imaging. Ultrasonography has the theoretical advantages of being non invasive, relatively cheap and readily available in the general community.

Accuracy rates reported in the literature for diagnostic ultrasound diagnosis of full thickness cuff tears vary from 73% to 100% (1 - 10). This was not consistent with the impression gained by the senior authors (J.A.G. and D.H.S.) in clinical practice. Most of these studies were relatively small, only one reporting more than 125 cases (10). The cases studied generally came from units with particular interests in ultrasonography. Some studies compared ultrasonography to arthroscopy (2,3,4,5,6,7,,10) while other studies compared ultrasonography to arthrography (1,8,9). This study reviews a group of 336 patients who had both diagnostic ultrasound examination and arthrography, and compares the accuracy rate of the diagnostic ultrasound examination to that of arthrography and clinical examination, using findings at arthrography and surgery as the definitive.

MATERIALS AND METHODS

Three hundred and thirty six patients were included in this study. They presented to the one author (J.A.G.) between May 1996 and December 1997. The average age was 57 years (range 17 to 65 years) . One hundred and ninety four patients were males.

A full history was taken, examination performed, and plain radiographs were obtained. A provisional diagnosis was made of either a full thickness tear or impingement without a full thickness tear. Patients who had any other provisional diagnoses or had had previous surgery were excluded from the study. The following subgroups were included: (1) all patients assessed clinically as potentially requiring surgery (this included patients with significant loss of function and/or pain unresponsive to three months or more of non operative treatment), irrespective of the ultrasound findings and (2) all patients with positive diagnostic ultrasounds for full thickness cuff tears, who were under 50 years of age and would require surgery if the ultrasounds were proven correct (surgery is generally indicated in these patients because of the risk of tear extension). Older patients who clinically may have had rotator cuff tears but were assessed as not requiring surgery were also excluded, as these patients did not undergo arthrography which would not have altered the decision not to operate.

All patients in the study group presented with a diagnostic ultrasound examination ordered by their referring physician. The majority of patients were referred for consideration of surgical intervention. The ultrasounds were performed by one hundred and nine different radiologists. Twenty one radiologists had performed five

or more studies, including three radiologists who had performed ten or more. We recorded the radiologists report, specifically whether there was, or was not, a full thickness rotator cuff tear, and did not rely on our own interpretation of the films.

Ultrasonography of the shoulder is a dynamic investigation, and the surgeon is effectively reliant on the radiologist's assessment. Usually a 7.5 MHz linear array transducer is used and each patient is examined anteriorly, laterally and posterolaterally by both static and dynamic techniques. The shoulder structures are examined longitudinally and transversely. The radiologist's conclusion and not the criteria used to reach them, are the basis of this study.

All patients underwent single contrast arthrography. These were performed by three radiology practices. These procedures utilized 10mls of Isovue 200 mixed with 10mls 1% Xylocaine. Pre and post exercise films were taken. All arthrograms were interpreted by the consultant radiologist and by the same author (J.A.G.) who at the time of interpretation was blinded to the clinical and radiological findings. A diagnosis of a full thickness rotator cuff tear was made if contrast entered the subacromial space. In all cases the author's interpretation agreed with the radiologist's interpretation, as to whether or not there was a full thickness rotator cuff tear. Sixty seven percent of the patients in this study underwent surgery and in every case the arthrogram assessment regarding full thickness tear or otherwise was found to be correct. The indications for surgery were loss of function, severe pain and risk of tear extension.

Delay from time of diagnostic ultrasound to time of arthrogram averaged 47 days (range 1 day to 120 days). There was no history in any patient of trauma between the two investigations.

The diagnostic ultrasound reports were compared with the arthrography findings and clinical examination.

RESULTS

There were 155 false negatives (where the arthrograms and in many cases surgery revealed full thickness tears while the diagnostic ultrasounds were negative)(Tables 1 and 3). Ninety seven percent of those patients were in fact diagnosed clinically as having full thickness tears.

There were also 51 false positive readings (using arthrography as the definitive diagnostic modality)(Tables 1 and 3). In these cases unnecessary surgery might have been undertaken if the patient had not undergone arthrography. In these patients the clinical diagnoses were correct in 94% of cases (based on arthrography findings).

Full thickness tears were however diagnosed CLINICALLY incorrectly in 47 cases out of 242, or in 19% of cases.

The Accuracy of diagnostic ultrasound examination was 0.38 (Table 2), the Sensitivity was 0.24 and Specificity 0.61. This study showed the investigation had a Positive Predictive Value of 0.49 and a Negative Predictive Value of 0.34.

DISCUSSION

Clinical reports to date (1 - 10) suggests that diagnostic ultrasound examination is very accurate and sensitive in the diagnosis of full thickness rotator cuff tears.

This study indicates that in the clinical setting in which the study was conducted, diagnostic ultrasound was often inaccurate . The authors recognize that the study assumes arthrography was definitive and this is recognized as a theoretical weakness in the study. In the 67% of this group of patients who underwent surgery, however, the arthrogram was found to be correct in all cases. This certainly supports the use of arthrography as the definitive examination in the accurate diagnosis of rotator cuff tears. Other studies in the literature have relied also on this (1,8).

The study confirmed an accuracy rate of 0.38, a sensitivity of 0.24, and a specificity of 0.61. For preoperative ultrasound the positive predictive value was 0.49 while the negative predictive value was 0.34.

A large number of radiologists were represented in this study. We are unaware of their experience with shoulder ultrasound. The literature stresses the importance of the equipment used and the experience of the operator (5,6,). The purpose of the study is not to determine the potential reliability of diagnostic ultrasound examination in a specialized unit but to assess its role in the general Australian community.

Data from the Health Insurance Commission (11) indicates that there were 72,854 services for shoulder ultrasound in 10 months from July 2000 to April 2001 (benefits paid \$6,152,301) and 152,742 services from July 2001 to April 2002 (benefits paid

\$12,904,124). This was a growth rate of 109.75% in one year . These figures do not include Workers Compensation or Third Party investigations.

These results suggest that a large amount of money is being spent on an investigation which, at least in the diagnosis of full thickness rotator cuff tears, is unacceptably unreliable.

Discussion of diagnostic ultrasound's role in the diagnosis of other shoulder conditions including subacromial impingement is beyond the scope of this study.

In conclusion these results indicate that diagnostic ultrasound examination, is not a reliable tool for the diagnosis of full thickness tears of the rotator cuff. The authors caution against the use of shoulder diagnostic ultrasound examination to diagnose or exclude full thickness rotator cuff tears, at least in the general community.

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TABLE 1**SUMMARY OF RESULTS FOR FULL THICKNESS ROTATOR CUFF TEARS**

ULTRASOUND	ARTHROGRAM	NUMBER	CLINICAL DIAGNOSIS
Correct Result			
Positive	positive	44	r.c. tear
Positive	positive	5	impingement
Negative	negative	44	r.c. tear
Negative	negative	37	impingement
Incorrect Result			
Positive	negative	3	r.c. tear
Positive	negative	48	impingement
Negative	positive	151	r.c. tear
Negative	positive	4	impingement
TOTAL		336	

TABLE 2**SUMMARY OF RESULTS OF ULTRASOUND EXAMINATION**

TRUE POSITIVES	(T.P.)	49	
TRUE NEGATIVES	(T.N.)	81	
FALSE POSITIVES	(F.P.)	51	
FALSE NEGATIVES	(F.N.)	155	
ACCURACY	(TN+TP/ TOTAL)		0.38
SENSITIVITY	(TP/TP+FN)		0.24
SPECIFICITY	(TN/TN+FP)		0.61
POSITIVE PREDICTIVE VALUE	(TP/TP+FP)	0.49	
NEGATIVE PREDICTIVE VALUE	(TN/TN+FN)	0.34	

TABLE 3

	ARTHROGRAM POSITIVE	ARTHROGRAM NEGATIVE
ULTRASOUND POSITIVE	49	51 incorrect result
ULTRASOUND NEGATIVE	155 incorrect result	81