

# THE VALUE OF ULTRASOUND SCANNING IN PREDICTING OUTCOME OF ROTATOR CUFF TENDONOPATHY

Ian Ryans, MB BCH MRCPG<sup>1\*</sup>, Roland McKane, MD FRCP<sup>1</sup>, Michael Hyland<sup>2</sup> and George Kernohan<sup>3</sup>.

<sup>1</sup>Rheumatology Department, The Ulster Hospital, Belfast, Northern Ireland, United Kingdom  
<sup>2</sup>Faculty of Life and Health Sciences, University of Ulster, Jordanstown, Northern Ireland, United Kingdom

## BACKGROUND

Recent developments in ultrasound technology including high-resolution ultrasound transducers have enabled detailed depiction of musculoskeletal structures. The use of ultrasonography has expanded in the diagnosis of musculoskeletal disorders. The sensitivity and specificity of ultrasonography of the rotator cuff tendons has been evaluated by comparison with findings at arthroscopy and open shoulder operations. It has been found to be a reliable method of assessing changes in the rotator cuff tendons. However, the technique has undergone relatively little other clinical evaluation, especially with regard to prognosis of the more common shoulder complaints.

## AIMS

To evaluate the predictors of outcome including diagnostic ultrasound scanning of the shoulder in rotator cuff disorders treated by corticosteroid injection and conventional physiotherapy

## METHOD

### Subjects for investigation

Subjects were recruited from general practice by the provision of a direct access shoulder assessment clinic. Following statistical advice a minimum of 50 subjects were required to achieve an acceptable degree of precision in the regression results. This is expressed by the associated p value for each calculation.

### Inclusion criteria

Adults with painful shoulder or upper arm on active abduction at the shoulder joint for duration of at least two weeks who consented to take part in the study were included.

### Exclusion criteria

1. Restriction in range of both passive external rotation and passive abduction in order to exclude the diagnosis of adhesive capsulitis of the shoulder.
2. Changes in keeping with osteoarthritis on shoulder X-ray
3. Clinical evidence of complete rotator cuff as treatment with corticosteroid injection would not be indicated in these subjects
4. Evidence of chronic inflammatory arthropathy
5. Significant cervical spine disease causing referred pain to the shoulder.
6. Weakness of the arm from cerebrovascular accident affecting movement of the painful shoulder.
7. Allergy to Tramadolone, Lidocaine or contraindication to injection
8. Significant trauma causing painful shoulder.

### Blinding procedures

The investigator making clinical diagnosis and follow up measurements was blinded to the results of ultrasound scan as was the physiotherapist performing the physiotherapy treatment.

### Ultrasound scan

An experienced consultant radiologist performed an ultrasound scan of both shoulders recording his findings blinded to the clinical diagnosis. Definitions of ultrasound findings are given at (Table 1).

Ultrasound Findings	Definition	Grouped Findings
Degenerative change at rotation	Increasing irregularity of the cortex at the site of the rotator cuff	Degenerative Change
Rotator Cuff	Areas of decreased echogenicity that are not seen to contract on active abduction	Change in Rotator Cuff
Partial tear	Partial thickness tear that does not completely divide the tendon	Tears
Full thickness tear	A complete tear that divides the tendon	
Fluid in subacromial space	Fluid lying deep to the acromion	Fluid
Fluid in subdeltoid space	A fluid collection anterior to the deltoid muscle	
Fluid in the coracoacromial bursa	A fluid collection between the coracoid and acromion	
Calcification	Contract between the greater tuberosity and acromion or coracoid	
Calcification	A bright white focus with shadowing	
Outcome	A value of 0 is no calcification with the outcome of a good result	

Table 1 Definitions and Grouping on Ultrasound Findings

## RESULTS

### Baseline characteristics

Sixty-nine patients were recruited to the study from 228 seen in the clinic over a 2-year period. The main reasons for exclusion were failure to consent to inclusion in the study, a diagnosis of adhesive capsulitis of the shoulder causing restriction in passive external rotation, significant cervical spine disease and evidence of complete rotator cuff tear.

The baseline characteristics are displayed in Table 2 and 3. The mean age of subjects was 54.3 years. There were a small majority of females (N=39, 57%). The right shoulder was more commonly affected (N=39, 57%), 9 subjects (13%) had bilateral involvement.

Table 2 - Baseline Characteristics, Age, Duration and Range of Movement (N=69)

Age	Minimum	Maximum	Mean	Std. Deviation
Number in	27	78	54.3	12.3
Active Abduction	4	416	46.4	67.5
Passive Abduction	32	160	109.2	37.6
Active External Rotation	80	160	157.9	23.8
Passive External Rotation	18	90	58.7	16.2
External Rotation	18	100	61.8	15.6

Table 3 - Hand Dominance, Trauma and Previous Treatment at Baseline (N=69)

Hand Dominance	Frequency	Percent
Right	6	13
Left	39	57
Minor Trauma	19	28
Previous Physio	22	32
Previous Injection	7	10

Table 4 Summary of Main Ultrasound Findings

Ultrasound finding	N	%	N	%
Degenerative change at rotation	25	36	36	52
Degenerative change Rotator Cuff	11	16		
Partial tear	13	19	54	78
Complete tear	3	4	18	26
Intra-articular tear	2	3		
Fluid in subacromial space	6	9	16	23
Fluid in subdeltoid space	10	14		
Impaction	13	19		
Calcification	22	32		
Calcification not defined	15	22		

## Ultrasound Findings

Findings at ultrasound are summarised in table 4. Numbers of findings in some specific ultrasound categories were small and were therefore grouped into larger categories. (Table 1).

Table 5 - Summary of findings on linear regression analysis at week 10 - significant associations highlighted

Dependent Variable	SDQ Week 3	Active Pain week 3	SDQ Week 10	Active Pain week 10	UAS Pain week 10	UAS Activity week 10	UAS Range week 10	UAS Rest week 10	UAS Total week 10	UAS Pain week 3	Active Pain week 3	UAS Pain week 3	Active Pain week 3	UAS Pain week 3	Active Pain week 3	UAS Pain week 3	Active Pain week 3	UAS Pain week 3	Active Pain week 3
SDQ Week 10	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
UAS Pain week 10	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
UAS Activity week 10	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
UAS Range week 10	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
UAS Total week 10	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

Table 5 summarises the significance levels of regression analyses carried out.

The table represents a large number (N = 70) of tests of significance. With such a number it is likely that 3 - 4 might produce significant findings by chance. For this reason it may be reasonable to raise the threshold of significance to 0.01. Thus SDQ at baseline and range of active abduction at baseline remain statistically significant.

Shoulder disability as measured by SDQ predicted outcome in 3 outcome measures. Restriction in range of movement as measured by active range of abduction predicted outcome in one outcome measure. Changes on ultrasound scanning did not predict outcome.

## CONCLUSIONS

This is the first study to explore ultrasonography as a predictor of outcome of rotator cuff tendon disorders treated with corticosteroid injection and physiotherapy.

No evidence was found to support the use of Ultrasonography to predict outcome in rotator cuff tendonopathy treated by corticosteroid injection and physiotherapy. Imaging techniques such as ultrasonography measure mainly anatomical change and may be unable to take into account the severity of a patient's disability.

Disability relating to the shoulder as measured by SDQ was a consistent predictor of outcome over multiple outcome variables in agreement with a previous study [2]. Range of active abduction also predicted outcome. It may be that measures of disability and active range of abduction are sensitive measures of severity of shoulder disorders or other physical or psychological factors predicting poor response to treatment.