The value of ultrasound scanning in predicting outcome of rotator cuff tendonopathy

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

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BACKGROUND

Recent developments in ultrasound technology including high-resolution ultrasound transducers have enabled detailed depiction of superficial musculoskeletal structures. The use of ultrasonography has expanded in the diagnosis of musculoskeletal disorders. The sensitivity and specificity of ultrasound 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 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 diagnosis of 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 Triamcinolone, 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 insertion	Increasing irregularity of the cortex at the insertion of a tendon	Degenerative Change	Change in Rotator Cuff
Degenerative change Rotator Cuff	Areas of decreased echogenicity that are visible in two planes but do not appear to contain fluid		
Partial tear	A defect in the tendon that does not completely divide the tendon	Tears	
Complete tear	A defect in the tendon, which completely separates the tendon into two parts		
Intrasubstance tear	A defect in the tendon that does not extend to the surface of the tendon		
Fluid in sub-deltoid bursa	Fluid lying deep in the acromion or deltoid muscle	Fluid	
Fluid long head of biceps	A fluid collection adjacent to the biceps tendon arising from within the joint space		
Impingement	Contact between the greater tuberosity and acromion on abduction		
Calcification	A hyperechoic focus with distal shadowing		
Osteochondral defect	A break in the articular cortex with the development of a small subchondral cyst		

Table 1 Definitions and Grouping on Ultrasound Findings

INJECTION TECHNIQUE

All subjects were injected with Triamcinolone 20mg and Lidocaine 2% 5mls by a lateral approach to the subacromial space.

PHYSIOTHERAPY

All subjects were referred for physiotherapy where they receive standard physiotherapy treatment for rotator cuff problems until the therapist was satisfied that the treatment was complete. Range of movement exercises and a rotator cuff strengthening rehabilitation programme including muscle balance techniques were used. Electrotherapy modalities were used as indicated.

OUTCOME MEASURES.

Main outcome measures were recorded at 10 weeks. Short form 36 general health assessment was administered at baseline and 10 weeks. Functional assessments were performed by administration of 22 point shoulder disability questionnaire (SDQ) validated by Croft et al [1], measurement of active and passive range of movement in abduction, visual analogue scales of pain at rest and pain with movement were recorded at baseline and 10 weeks.

STATISTICAL ANALYSIS

Linear regression analysis was used to assess relationship between dependent variables and baseline clinical and ultrasound findings. Independent variables at baseline used as predictors of outcome were SDQ, age, neck pain, range of active abduction, duration of symptoms, visual analogue scale for pain at rest, visual analogue scale for pain with activity calcification on USS, degenerative change on USS, tendon tears on USS and presence of fluid on USS. Dependent variables used as outcome measures were SDQ, sf36 bodily pain score, sf36 role limitation physical score, active abduction, passive abduction, visual analogue scales for pain with activity and pain at rest assessed at week 10.

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)

	Minimum	Maximum	Mean	Std. Deviation
Age	27	78	54.3	12.3
Duration in weeks	4	416	46.4	67.5
Active Abduction	32	180	109.2	37.8
Passive Abduction	80	180	157.9	23.8
Active External Rotation	18	90	58.7	15.2
Passive External Rotation	18	100	61.8	15.6

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

	Frequency	Percent
Bilateral	9	13
Dominant	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	%	N	%
Degenerative change at insertion	25	36	36	52		
Degenerative change Rotator Cuff	11	16				
					54	78
Partial tear	13	19				
Complete tear	3	4	18	26		
Intrasubstance tear	2	3				
Fluid in subdeltoid bursa	6	9	16	23		
Fluid long head of biceps	10	14				
Impaction	13	18				
Calcification	22	32				
Osteochondral defect	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

	Independent Variables									
Dependent Variables	SDQ week 0	Active Abduction week 0	VAS Rest Pain Week 0	VAS Pain With Activity Week 0	Duration of Symptoms	Neck Pain	Calcification on USS	Rotator cuff tears on USS	Degenerative change in Rotator cuff on USS	Fluid on USS
SDQ Week 10	p<0.001	p=0.005	NS	NS	NS	NS	NS	NS	NS	NS
sf36 bodily pain week 10	p<0.001	NS	NS	NS	NS	NS	NS	NS	NS	NS
sf36 role limitation physical week 10	p<0.001	p<0.05	NS	NS	NS	NS	NS	NS	NS	NS
Active Abduction week 10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Passive Abduction week 10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
VAS Activity week 10	p<0.05	p<0.05	NS	NS	p<0.05	NS	NS	NS	p<0.05	NS
VAS Rest week 10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

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.

References
1. Croft, P. et al. Measurement of shoulder related disability: results of a validation study. Ann Rheum Dis. 1994; 53: p. 525-8.
2. MacDermid, G.J., I.M. Hunt, and A.J. Sinnar, Predictors of chronic shoulder pain: a population based prospect... Scott Journal of Rheumatology, 1998; 28(3): p. 161-5.