Arthroscopic treatment for malunions of the proximal humeral greater tuberosity

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Abstract The purpose of this article was to report an arthroscopic treatment method for greater tuberosity malunion. Eight patients with malunion of the greater tuberosity were treated by arthroscopic acromioplasty, detachment of rotator cuff, tubero-plasty of the greater tuberosity and repair of the rotator cuff. On the basis of the UCLA rating scale, the overall score increased from 11.1 (range 9–14) to 30.2 (range 25–35) postoperatively, with one excellent result, six good results, and one poor result. All patients had less pain than preoperatively. Full activity level was achieved in two patients, five patients had only slight functional restriction, and one patient had mild limitation in activities of daily living. Seven patients returned to their previous occupations without restrictions. One patient did not return to work because of residual upper extremity weakness. We conclude that arthroscopic tubero-plasty is a good method for the treatment of greater tuberosity malunion.

Introduction

Malunion of the greater tuberosity is usually posterolateral. This displacement is due to the deforming forces of the rotator cuff. Displacement of the greater tuberosity more than 5 mm may lead to subacromial impingement and limitation of abduction and external rotation [2, 8, 9].

The deltoid force required for abduction [4] is significantly higher when the greater tuberosity is displaced more than 0.5 cm.

Previous surgical treatment of greater tuberosity malunions was osteotomy and reduction through an anterolateral approach, achieving fixation with screws, sutures or suture anchors [3, 5, 8].

Arthroscopic techniques have been used to treat a lesser tuberosity malunion [6] and a malunion of a head-splitting proximal humeral fracture [1], reshaping the humeral head to restore rotation.

Beredjikian et al. [3] reported using arthroscopic acromioplasty to address proximal greater tuberosity displacement.

We report a successful arthroscopic treatment method for greater tuberosity malunion.

Methods

Between June 2005 and August 2006, eight patients with malunion of the greater tuberosity were treated. There were four men and four women, with a mean age of 44.7 years (range 32–64 years). The greater tuberosity displacement was between 5 and 10 mm in all cases. The average time from the initial injury to the time that the patient was operated upon was nine months (range 7–12 months). All patients had pain, motion limitation and subacromial impingement signs. Radiographs (Fig. 1) and magnetic resonance (Fig. 2) were performed on all patients. Malunion of the greater tuberosity with posterolateral displacement between 5 and 10 mm was discovered in all cases.

An arthroscopic procedure was performed. Debridement of subacromial bursa and synovium, and acromioplasty were performed. The rotator cuff was detached from its insertion into the greater tuberosity with electrocautery

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Fig. 1 Preoperative radiograph showing a malunion of the greater tuberosity

(Fig. 3). The greater tuberosity was reshaped using a powered burr, removing the prominent bone and creating a smooth surface (Fig. 4). The rotator cuff was repaired using a double-row technique with two suture anchors (Fig. 5).

For the first four postoperative weeks patients wore a sling. During this time the patients were instructed to perform active elbow, wrist and hand motion and pendulum exercises. Shoulder passive-assisted range of motion was started at five weeks. Strengthening with isometric

Fig. 2 Preoperative magnetic resonance showing superior displacement of the greater tuberosity

Fig. 3 Detachment of the rotator cuff from its insertion into the greater tuberosity

exercises and active-assisted range of motion were initiated at six weeks. Use of weights and resistance exercises were avoided for at least three months. All patients were examined in the office postoperatively at one week, four weeks, eight weeks, three months, six months and at least 12 months postoperatively. At each follow-up visit, the pain, function and motion were recorded. Postoperative radiographs were obtained. Postoperative magnetic resonance was performed six months postoperatively to evaluate the rotator cuff. The UCLA scale was used to assess patients preoperatively and at final follow-up

Fig. 4 Reshaping of the greater tuberosity with a burr

Fig. 5 Arthroscopic view from a lateral viewing position with a double-row repair

(Table 1). The score was classified as excellent (34–35 points), good (29–33 points), or poor (less than 29 points).

Results

The mean follow-up was 18 months (range 12–24 months). Patient characteristics are showed in Table 2. There were no complications related to the surgical procedure.

Clinical results

According to the UCLA rating scale, the results were excellent in one case, good in six, and poor in one. The mean overall score increased from 11.1 (range 9–14) preoperatively to 30.2 (range 25–35) postoperatively.

Pain

All patients had less pain postoperatively. The pain rating improved from a mean of 2.5 (range 2–4) to 8.25 (range 6–10) at final follow-up.

Function

The mean preoperative score for function improved from 3 points (range 2–4) preoperatively to 8.25 points (range 6–10) postoperatively. Although a full activity level was achieved in two patients, five patients had only slight functional restriction, and one patient had mild limitation in activities of daily living. Seven patients returned to their

previous occupations without restrictions. One patient did not return to work because of residual upper extremity weakness.

Range of motion

The mean active forward flexion of the shoulder increased from 93.75° (2.75 points) preoperatively to 148.75° (4.37 points) postoperatively. There was a mean increase at latest follow-up evaluation of 20.65° (range 10–30°) in external rotation, 6.8° (range 0–10°) in internal rotation and 52.5° (range 40–80°) in abduction (Table 3).

Table 1 UCLA scoring system

Function/reaction measured	Points
Pain	
Present all of the time and unbearable; strong medication used frequently	1
Present all of the time but bearable; strong medication used occasionally	2
None or little at rest, present during light activities; salicylates used frequently	4
Present during heavy or particular activities only; salicylates used occasionally	6
Occasional and slight	8
None	10
Function	
Unable to use limb	1
Only light activities possible	2
Able to do light housework or most activities of daily living	4
Most housework, shopping, and driving possible; able to fix hair and dress and undress, including fastening brassiere	6
Slight restriction only; able to work above shoulder level	8
Normal activities	10
Active forward flexion	
150 degrees or more	5
120–150 degrees	4
90–120 degrees	3
45–90 degrees	2
30–45 degrees	1
Less than 30 degrees	0
Strength of forward flexion (manual muscle testing)	
Grade 5 (normal)	5
Grade 4 (good)	4
Grade 3 (fair)	3
Grade 2 (poor)	2
Grade 1 (muscle contraction)	1
Grade 0 (nothing)	0
Satisfaction of the patient	
Satisfied and better	5
Not satisfied and worse	0

Table 2 Patient characteristics pre- and postoperative

Patient	Gender	Age (y)	Pain		Function		Strength of forward flexion		Satisfaction		UCLA score	
			Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	Female	42	2	6	2	6	2	4	0	5	9	25
2	Male	48	2	8	2	8	3	4	0	5	10	29
3	Female	64	4	10	4	8	4	5	0	5	14	33
4	Female	58	2	8	4	8	2	4	0	5	11	29
5	Male	32	4	10	4	10	3	5	0	5	14	35
6	Female	40	2	8	2	8	3	5	0	5	9	30
7	Male	36	2	8	2	10	3	4	0	5	10	32
8	Male	38	2	8	4	8	3	4	0	5	12	29

Strength of forward flexion

All patients had improved strength at the latest follow-up evaluation. The strength improved from 2.875 points (range 2–4) preoperatively to 4.375 points postoperatively (range 4–5).

Patient satisfaction

The mean score of patient satisfaction increased from 0 points preoperatively to 5 points postoperatively.

Radiographic results

Postoperative radiographs showed a smooth congruent surface of the greater tuberosity. Postoperative magnetic resonance showed the integrity of the rotator cuff in all cases.

Discussion

Arthroscopy has been used to treat a case of lesser tuberosity malunion [6] and a case of malunion of a proximal humeral fracture with impaction of the articular humeral surface [1].

The proximal humeral head was reshaped using a bur to eliminate the bone block and restore rotation. Beredjiklian et al. [3] treated two greater tuberosity malunions with arthroscopic acromioplasty. They had a satisfactory result. Arthroscopic greater tuberosity tubero-plasty has been successfully used to treat massive rotator cuff tears [7].

We thought that a greater tuberosity tubero-plasty in addition to an acromioplasty could improve the result of the treatment of greater tuberosity malunions. In order to perform the tubero-plasty we needed to detach the rotator cuff. We had certain concerns about the possibility of rotator cuff repair failure, but the use of a double-row fixation technique gave us a good outcome. We believe that the results of this small series of patients encourages the use of this arthroscopic technique for the treatment of greater tuberosity malunions. We think that this method is more appropriate for small or multi-fragmented greater tuberosity fractures. If the fragment is big, it is better to perform an open reduction, osteotomy of the fragment and fixation with screws.

If severe limitation of movement is observed preoperatively, a capsulotomy should be performed. We did not perform capsulotomy because in our cases the maximum limitation of external rotation was 30° and we noticed in the clinical examination prior to the surgery that there was

Table 3 Range of motion pre- and postoperatively

Patient	Active flexion	Forward	External rotation		Internal rotation		Abduction	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	3 (100°)	4 (140°)	60	85	80	90	100	140
2	3 (100°)	4 (140°)	60	90	80	90	100	140
3	2 (80°)	5 (170°)	70	85	90	90	80	160
4	3 (100°)	4 (140°)	60	85	80	90	90	130
5	3 (100°)	5 (160°)	70	90	80	90	90	150
6	2 (80°)	4 (140°)	70	90	90	90	80	410
7	3 (95°)	5 (160°)	70	80	90	90	90	150
8	3 (95°)	4 (140°)	70	90	90	95	90	130

limited rotation caused by the displaced tuberosity, but we think that if a greater stiffness is observed, a capsulotomy would be essential to achieve a good result.

Conclusion

We conclude that arthroscopic tuberooplasty is a good method for the treatment of greater tuberosity malunion.

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