ARTHROSCOPICALLY-ASSISTED ROTATOR-CUFF REPAIR

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We reviewed 44 patients with 44 full-thickness rotator-cuff tears at an average of 4.2 years after arthroscopically-assisted repair. There were 25 women and 19 men aged between 35 and 76 years (average 58); 35% of the shoulders had other intra-articular lesions.

Most of the patients (85%) had been discharged from hospital immediately after the operation. The result was rated good or excellent in 84%, 88% of the patients were satisfied, and 64% of the athletes returned to their previous sports. The size of the tear was a determining factor in the outcome.

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Recent improvement in shoulder arthroscopy has enabled us to appreciate better the spectrum of rotator-cuff injuries and to treat these lesions by less invasive techniques. The early results of arthroscopically-assisted rotator-cuff repair were promising (Levy, Uribe and Delaney 1990; Warner, Altchek and Warren 1991). Levy et al (1990) reported 80% good or excellent results in 25 patients followed for at least one year, and Warner et al (1991) reported 13 good or excellent results in 17 patients followed for two years with 11 of 12 athletes returning to their previous sports.

We now present our experience of 44 arthroscopically-assisted rotator-cuff repairs.

PATIENTS AND METHODS

Between January 1987 and January 1991, 48 patients had 52 arthroscopically-assisted repairs for chronic full-thickness rotator-cuff tears. We were able to evaluate 44 of these patients (44 repairs) at a minimum of two years after operation. There were 25 women and 19 men. Their average age was 58 years (35 to 76). The dominant arm was involved in 29 patients.

The indications for surgery were persistent pain and/or functional disability which did not improve after six months of conservative treatment. In all of them full-

thickness rotator-cuff tears had been shown by pre-operative arthrography. All the operations were performed at the UCLA affiliated medical centres or the Hughston Orthopaedic Clinic.

Operative technique. A standard shoulder arthroscopy is performed with the patient in the lateral position. The whole glenohumeral joint is inspected and concomitant lesions are dealt with. The extent of the rotator-cuff tear is graded as less than 1 cm, 1 to 3 cm, 3 to 5 cm, or > 5 cm. The edges of the tear are debrided, the arthroscope is passed into the subacromial bursa and the coracoacromial ligament is divided. Next, a burr is used to make a bony trough on the greater tuberosity. Three or four size 0 polydioxanone sutures (Ethicon, Somerville, New Jersey) are placed in the proximal edge of the torn tendon using an arthroscopic suture passer (Concept, Linvatec Corp, Largo, Florida) via the anterolateral portal (Fig. 1).

Fig. 1

Arthroscopic placement of sutures at the proximal edge of the torn cuff to facilitate mobilisation.

The arm is then placed by the patient's side and the repair is completed through a small transverse incision which incorporates the anterolateral portal. The deltoid muscle is split for 2 to 4 cm longitudinally through the cleft created by the anterolateral portal. The split must not extend more than 5 cm from the acromion to avoid injury to the axillary nerve. The torn edge of the cuff can now be seen and is pulled laterally by tension on the sutures.

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Once the cuff can be brought to the bony trough without too much tension, four bone holes are made with a towel clip. Three non-absorbable mattress sutures are passed through the torn cuff which is pulled into the bony trough, and the sutures are tied through the bone holes (Fig. 2).

Postoperatively, the shoulder is immobilised in a 45° abduction splint for three weeks, followed by a sling for three weeks. Rehabilitation is started on the first day and passive range-of-motion exercises are used for the first three weeks, followed by actively-assisted exercises during the fourth week. At six weeks resistance exercises are started, progressing to unrestricted activities at three to four months.

Data analysis. The average follow-up was 4.2 years (2.5 to 6.1). Function was evaluated using the UCLA shoulder rating scale (Ellman, Hanker and Bayer 1986) (Table I). Pain and function were rated on a scale of 1 to 10 points, 1 being the worst result. The overall result was graded as follows: excellent, 34 to 35 points; good, 29 to 33; and poor, less than 29. Active range of motion and muscle strength in forward flexion, abduction, and external rotation were also measured by the same physiotherapist both pre- and postoperatively.

We compared the patients' preoperative and postoperative scores for all of these measurements. Correlations between the size of the tear repaired, the functional outcome and the ability to return to the previous sport were made. A non-parametric (Kruskal-Wallis) test was used for these comparisons. A *p* value of < 0.05 was considered significant.

RESULTS

UCLA shoulder rating. All patients improved after surgery. The average pre- and postoperative scores were 10.5 and 32.7 respectively (*p* = 0.001). Overall, 82% of the patients achieved excellent or good results and 88% were satisfied. The mean postoperative scores improved for each of the subcategories of pain, range of motion, function, and strength (*p* < 0.05). The more specific ranges of motion and strengths measured also improved consistently: forward flexion from 110° to 157°; abduction from 100° to 155°; and external rotation from 37° to 50° (*p* < 0.05). The average gain in external rotation was 18° (7 to 38), in forward flexion 45° (25 to 55), and in abduction, 40° (20 to 50). All patients improved at least one grade on manual strength testing. The average preoperative and postoperative strength gradings were: external rotation, 3.3 and 4.3; forward flexion, 3.4 and 4.5; abduction, 3.2 and 4.5.

Size of tear and functional outcome. Overall, there was a good or excellent functional outcome in 84% (37/44) of patients. This was seen in all those (8/8) who had small tears, in 15 of the 17 with moderate tears, in 12 of the 15 with large tears, and in two of the five with massive tears. No significant differences were observed between the small, moderate, and large tears. Significant differences

Fig. 2

Three mattress sutures are passed through the torn cuff and tied through four bone tunnels.

Table I. UCLA shoulder rating scale

	Score*
Pain	
Present always and unbearable; strong medication frequently	1
Present always, but bearable; strong medication occasionally	2
None or little at rest, present during light activities; salicylates frequently	4
Present during heavy or particular activities only; salicylates 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 do hair and to dress and undress, including fastening bra	6
Slight restriction only; able to work above shoulder level	8
Normal activities	10
Active forward flexion	
> 150°	5
120° to 150°	4
90° to 120°	3
45° to 90°	2
30° to 45°	1
< 30°	0
Strength of forward flexion (manual muscle testing)	
Grade 5 (normal)	5
4 (good)	4
3 (fair)	3
2 (poor)	2
1 (muscle contraction)	1
0 (nothing)	0
Satisfaction of the patient	
Satisfied and better	5
Satisfied and worse	0

* maximum score 35 points

were observed between these tears and the massive tear group ($p < 0.05$).

Size of tear and return to sports. Overall, 64% (14/22) of the patients returned to their previous sports. Sports were resumed by 80% (4/5) of those with small tears, 78% (7/9) of those with moderate tears, 50% (3/6) of those with large tears, and by none (0/2) of those with massive tears. Comparing the different sports, five of the seven swimmers, six of the ten golfers, and three of the five tennis-players returned to their sport.

Duration of hospital stay. All the patients stayed in hospital less than 48 hours after operation, 37 of them staying less than 24 hours. Of the seven patients who stayed longer than 24 hours, two had nausea and fever, two needed strong analgesics, and three lived far away. They were all discharged by the third day after surgery.

Associated pathology. Overall, 15 patients had intra-articular pathology, seven had labral tears, five had a tear of the biceps tendon, two had synovitis, and one had loose bodies.

Complications. Three complications were encountered. Two patients with massive tears had postoperative frozen shoulder syndrome. In one this resolved after prolonged physical therapy and the other required manipulation under anaesthesia. One patient had a superficial wound infection which resolved with local treatment. Two patients developed impingement syndrome, one from acromioclavicular degeneration two to five years after surgery, and one from bony spurs four years after surgery. Both patients had had small tears repaired, and no rotator-cuff tear was seen during subsequent arthroscopic acromioclavicular resection. No patient had a symptomatic rerupture.

DISCUSSION

The surgical management of full-thickness rotator-cuff tears continues to be controversial. Most authors have reported good results from open repair and acromioplasty (Neviaser, Neviaser and Neviaser 1978; Cofield 1985; Hawkins, Misamore and Hobeika 1985; Ellman, Hanker and Bayer 1986; Rockwood and Burkhead 1988; Cofield, Hoffmeyer and Lanzer 1990) and some have had equally good results with arthroscopic debridement and subacromial decompression, without repairing the cuff (Burkhart 1990; Cofield et al 1990; Levy, Gardner and Lemak 1991; Ogilvie-Harris and Demazière 1993).

Recent advances in shoulder arthroscopy have

improved the methods of evaluation and management of rotator-cuff disease, especially in stage-II and stage-III impingement lesions and many authors have reported good results from arthroscopic subacromial decompression and debridement of partial tears (Post and Cohen 1985; Gartsman 1990; Ellman and Kay 1991; Snyder et al 1991; Ellman, Kay and Wirth 1993). There have, however, been few studies of arthroscopically-assisted rotator-cuff repair. The technique of Levy et al (1990) involved either arthroscopically-placed sutures or a minimal deltoid-splitting technique. All their patients with small or moderate tears and 71% of those with large or massive tears had a good outcome. Warner et al (1991) reported good or excellent results in 13 of their 17 patients; eight of the nine tennis-players and all the three golfers returned to their previous sports but no correlation between the size of the tear and the functional outcome was mentioned.

Our study showed that 82% of the patients had good or excellent results and that 88% of the patients were satisfied. The size of the tear seemed to be a determining factor in the functional outcome; the small and moderate tears did better than the large and massive tears. The patients' satisfaction, however, did not seem to relate to the size of the tear repaired; those with small, moderate, and large tears were equally satisfied.

In this series 22 of the 44 patients were recreational athletes, including seven swimmers, ten golfers, and five tennis-players. Fourteen were able to return to their sports (five of seven swimmers, six of ten golfers, and three of five tennis-players). Again, the size of the tear repaired was a determining factor. Open rotator-cuff repair is known to have reliable results and to allow most athletes to return to their sports. Returning to overhead throwing or racquet sports, however, is less certain (Ellman et al 1986; Tibone et al 1986) and it remains to be seen whether arthroscopically-assisted rotator-cuff repair can be more effective. The technique has several potential advantages: 1) it is easier to evaluate and treat coexisting glenohumeral lesions; 2) the attachment of the deltoid muscle is preserved; 3) rehabilitation is more rapid and hospital stay is diminished because there is less soft-tissue damage; and 4) the cosmetic result is better than after open repair.

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