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Arthroscopic Subacromial Decompression: Results According to the Degree of Rotator Cuff Tear

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Summary: We evaluated the results of arthroscopic subacromial decompression according to the degree of rotator cuff tear in 71 patients, available for follow-up for at least 1 year (average 19 months). Of the patients with stage II disease, 82% were satisfied regardless of whether they had no rotator cuff tear (nine of 11) or had a partial tear (28 of 34) of the rotator cuff. Of patients with stage III disease (complete rotator cuff tear), 88% (23 of 26) were satisfied. An acceptable objective UCLA shoulder rating ≥28 points was seen in 82% (nine of 11) of the patients without a rotator cuff tear, 76% (26 of 34) with a partial tear, and 77% (20 of 26) with a complete tear. All four of the patients with complete tears <1 cm obtained excellent results. Three of the six failures were in patients with complete tears who had a narrowed acromial–humeral distance of <7 mm. The average UCLA pain score showed significant improvement from 2.8 (constant pain) to 8.6 (occasional pain) at 1–2 years postoperatively. The function, strength, and active forward flexion scores also increased at 1–2 years from their preoperative values. The overall patient satisfaction rate of 85% and the objective success rate of 77% are within the range of that seen with open rotator cuff repair. **Key Words:** Subacromial decompression—Rotator cuff—Shoulder.

The impingement syndrome of compression of the rotator cuff supraspinatus tendon against the anterior edge of the acromion, the coracoacromial ligament, and at times the acromioclavicular joint has been described by Neer (1). The three progressive stages are as follows: stage I, consisting of edema and hemmorhage, usually seen in patients under 25 years of age; stage II, consisting of fibrosis and tendonitis resulting from repeated episodes of mechanical irritation, noted in patients 25 to 40 years of age; and stage III, consisting of complete rotator cuff tears.

Stage I and most stage II lesions respond to a conservative program consisting of gentle exercise, nonsteroidal antiinflamatory medications, and occasional steroid injections. The stage II lesions, refractory to conservative treatment, can be managed by open decompression of the subacromial space. Stage III lesions are treated by rotator cuff repair and decompression of the subacromial space.

Rockwood (2) described 18 patients experiencing extensive rotator cuff tears for whom he felt that repair was inappropriate. He treated them exclusively with open subacromial decompression. All patients obtained relief of pain, and 15 out of 18 had an active range of motion, similar to their opposite shoulder. Rockwood concluded that "patients with chronic and severe degeneration of the rotator cuff can obtain releif of pain and a very functional shoulder if they have an adequate decompression, a good deltoid, even in the absence of an intact rotator cuff" (2).

Ellman (3,4) obtained an overall success rate of

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88% from arthroscopic subacromial decompression both in advanced stage II and selected cases of stage III impingement syndrome.

The purpose of this article is to evaluate the results of arthroscopic subacromial decompression according to the degree of rotator cuff tear.

ARTHROSCOPIC TECHNIQUE

The goals of surgery were to resect the subacromial bursa, to section the acromial attachment of the coracoacromial ligament (Figs. 1 and 2), and to perform the anterior acromioplasty by removing the anterior 0.7–1.0 cm of the acromion and thinning the inferior acromion an additional 1.5–2.0 cm posteriorly (Fig. 3). The anterior hook of the acromion was removed, changing a type III acromion to a type I acromion (5,6).

Surgery was performed in an outpatient setting with the patient under general anesthesia, and in the lateral position with the arm suspended in 45° of abduction and 15° of forward flexion. A 10-pound weight provided the suspension. The glenohumeral joint was inspected from a posterior portal. An anterior portal was used for tools, and an accessory anterior or superior portal provided inflow. Intraarticular surgery consisted of synovectomy, trimming labrum tears, shaving chondromalacia, and debriding loose fragments of rotator cuff tears. The subacromial space was then visualized using a posterior portal for a large inflow cannula, a posterolateral portal for the arthroscope, and an anterolateral portal for working tools. Initial visualization was often difficult and required adjustment of the inflow, the arthroscope, and the motorized tools. Many patients had an exhuberant villous subacromial bursa that required resection to visualize the undersurface of the acromion, the coracoacromial ligament, and the rotator cuff. The marginal outline of the acromion's undersurface was delineated us-

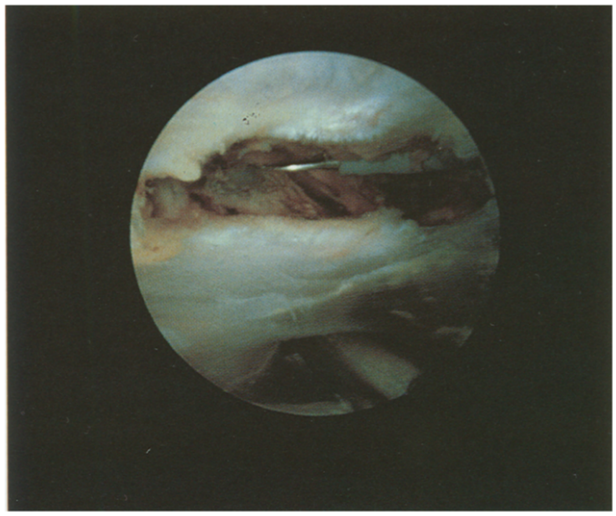

FIG. 2. The acromial attachment of the coracoacromial ligament has been separated from the overlying acromion. The deltoid muscle fibers are in the background (right shoulder).

FIG. 1. Electrosurgery hook knife cutting the acromial attachment of the coracoacromial ligament (right shoulder).

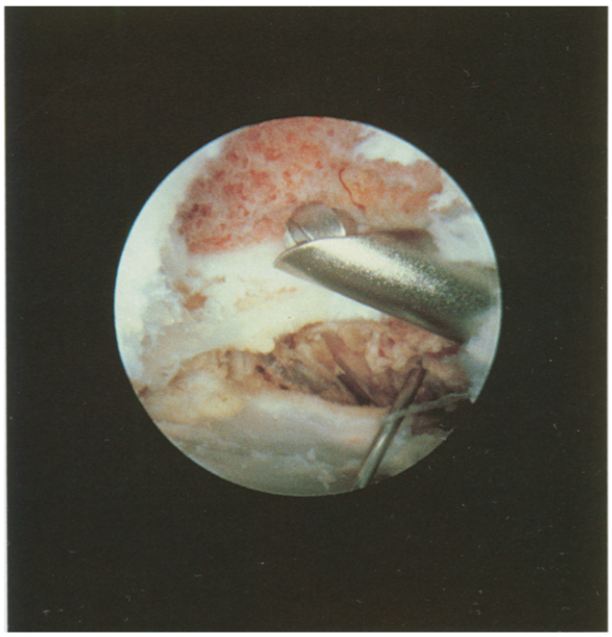

FIG. 3. Resection and thinning of the anterior acromion by the burr (right shoulder).

ing either a power shaver or a burr. The acromial attachment of the coracoacromial ligament was detached by using either electrocautery or a burr on the undersurface of the acromion. Next the burr was used to remove the anterior 0.7–1.0 cm of acromion and to thin the acromion for an additional 2.0 cm posteriorly. Finally, the undersurface of the acromioclavicular joint was examined to locate any spurs and to assure that the anteromedial corner of the acromion and the coracoacromial ligament attachment in this area was removed. Troublesome areas of bleeding were often encountered. Consequently, the use of electrocautery in a 1.5% glycine solution proved helpful. The superior surface of the rotator cuff was visualized, allowing the amount of clearance in the arch to be determined.

Postoperative rehabilitation encouraged immediate passive, active–assisted, and active exercises in forward flexion and external rotation. Most patients used a continuous passive motion machine for 6–8 h daily for the first postoperative week at home.

All cases were videotaped. The history and findings were recorded on a form developed by Tri-City Orthopaedic Surgery Medical Group (Fig. 4).

TRI-CITY ORTHOPAEDIC SURGERY MEDICAL GROUP, INC.

Shoulder Arthroscopic Surgery

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PRE-OP:
Indications:

History:
A-athletic injury I-other injury
J-job-related injury N-no injury

Stability:
O-normal
S-subluxation D-dislocation

Clicks:
Y-yes N-no

Impingement Test:
P-positive N-negative

Arthrogram:
P-positive
N-negative O-not done

Active Forward Flexion:
0 = 0-30° 3 = 90-120°
1 = 30-45° 4 = 120-150°
2 = 45-90° 5 = greater than 150°

Physical Findings:

Pain (UCLA):
1-constant, unbearable, strong meds. often
2-constant, but bearable, strong meds. occasionally
4-none or little at rest, occurs with light activities, salicylates often
5-with heavy or certain activities only, salicylates often
8-occasional and slight
10-no pain

Function (UCLA):
1-unable to use arm
2-very light activities only
4-light housework or most daily living activities
5-most housework, washing hair, putting on brassiere, shopping, driving
8-slight restriction only, able to work above shoulder level
10-normal activities

Strength of Forward Flexion (UCLA):
0-No Muscle Contraction
1-Muscle Contraction Only
2-Poor Strength
3-Fair Strength
4-Good Strength
5-Normal Strength

OPERATIVE FINDINGS:

Glenoid:
N-normal
1-1+ chondromalcia 3-3+ chondromalcia
2-2+ chondromalcia 4-4+ chondromalcia

Humerus:
N-normal
1-1+ chondromalcia 3-3+ chondromalcia
2-2+ chondromalcia 4-4+ chondromalcia

Hill-Sach:
Y-yes N-no

Synovia:
0-normal 2-mod. synovitis
1-mild synovitis 3-marked synovitis

Biceps:
0-normal
F-frayed A-absent

Rotator Cuff:
0-normal
1-slightly frayed 3-tear less than 1 cm.
2-mod. frayed, inner tear 4-tear more than 1 cm.

Labrum:
0-normal C-complete tear
P-prox. tear X-other tear
F-prox. flap tear A-absent

Loose Body:
O-normal Y-yes, #

Remarks:

TREATMENTS:

Glenoid Rx:
O-none
C-chondroplasty
A-abrade

Humerus Rx:
O-none
C-chondroplasty
A-abrade

Synovial Rx:
O-none
S-synovectomy A-lysis, adhesions

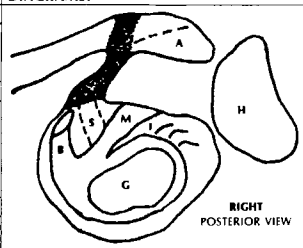
Biceps Rx:
O-none
D-debride

Rotator Cuff Rx:
O-none
D-debride

Labrum Rx:
O-none A-abrasion
P-partial excision S-staple
C-complete excision X-other

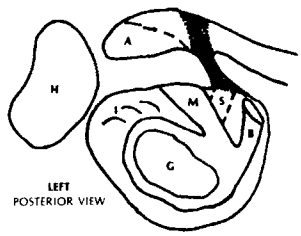
Other Rx:
O-none L-lavage
M-manipulation N-Neer Acromioplasty
B-bursectomy C-ext. calcium
X-other

DIAGRAMS:



RIGHT
POSTERIOR VIEW

A-Acromion undersurface
B-Biceps
G-Glenoid
H-Humeral Head
I-Inferior Glenohumeral Lig.
M-Middle Glenohumeral Lig.
S-Subscapularis Tendon



LEFT
POSTERIOR VIEW

FIG. 4. Tri-City Orthopaedic shoulder arthroscopy data collection form.

MATERIAL AND METHODS

Seventy-one patients (68% men and 32% women) with advanced stage II and stage III rotator cuff disease had an arthroscopic subacromial decompression. The follow-up period ranged from 12 to 36 months with an average follow-up time of 19 months. Patients ranged from 17 to 89 years of age (Fig. 5).

Indications for surgery were the following: pain for longer than 6 months; pain that did not improve with nonsteroidal antiinflammatory medications or steroid injections; pain that did not cease after an exercise program; and pain that interfered with either everyday activities, recreational activities, or sleep. Physical examination demonstrated impingement signs with forward flexion that could be relieved by injection of local anesthetic into the subacromial space.

The rotator cuff pathology was graded 0 to 4 as follows: no tear (grade 0); minor scuffing (grade 1); partial tears but not full thickness (grade 2); small full thickness <1 cm (grade 3); and large full thickness >1 cm (grade 4). The pathology was evaluated from the intraarticular and bursal side because a few grade-2 tears on the bursal side were grade 0 on the articular side. For publication purposes, the tears were rated as none (grade 0), partial (grade 1 and 2), or complete (grade 3 and 4). We define a subset of grade 4 that includes an acromial–humeral distance of <7 mm since this yields a poorer prognosis (7). The Neer stage II includes grades 0 to 2, and the Neer stage III includes grades 3 and 4.

Subjective results (patient perception) were rated as satisfactory or unsatisfactory. A satisfactory result demonstrated significant improvement with either no pain or occasional pain and with improvement in functional level. Objective results were graded on the UCLA Shoulder Rating Scale (Table 1). Pain and function are each rated from 1 to 10, with 1 being the worst score and 10 being the best. Active range of motion, strength, and patient satisfaction were rated on a scale of 1–5. The maximum total score was 35 points. Results were rated as excellent (34–35 points), good (28–33 points), fair (21–27 points), and poor (0–20 points). An objective satisfactory result was a score ≥28 points (4).

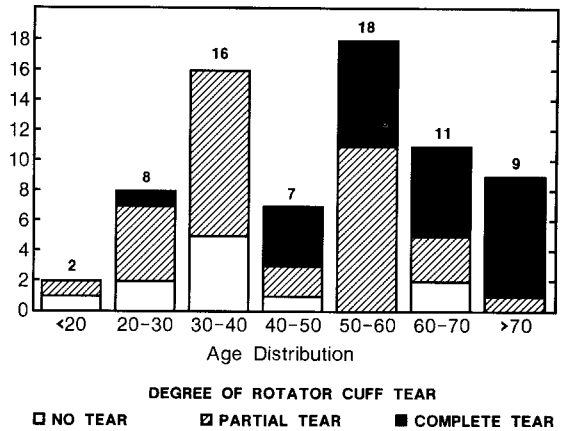


FIG. 5. Age distribution according to the degree of rotator cuff tear.

TABLE 1. *University of California at Los Angeles 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 brassiere	6
Slight restriction only; able to work above shoulder level	8
Normal activities	10
Active forward flexion	
>150°	5
120–150°	4
90–120°	3
45–90°	2
30–45°	1
<30°	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	0

Maximum Score = 35 points; Excellent = 34–35 points; good = 28–33 points; fair = 21–27 points; poor = 0–20 points
From ref. 4, with permission.

RESULTS

Injury history

Forty-four patients identified a history of injuries of which 22 were work related, 9 were athletic, and 13 were categorized as other. Twenty-seven patients were not injured.

Associated pathology

There were 36 patients with synovitis of the glenohumeral joint. Debridement of the glenoid labrum was completed in 20 patients, 17 patients received a debridement of a frayed biceps tendon, and a chondroplasty of the glenoid or humeral head was performed in 10 patients. One patient had an absent biceps tendon.

Associated surgery

Acromioclavicular joint arthroplasty was performed in three patients, and five others had a manipulation of their frozen shoulder. One patient had a biceps tendon tenodesis, and another had a removal of a labrum staple.

Pain scores

The average UCLA pain score indicated a significant level of improvement as follows: from 2.8 (constant pain) preoperatively to 6.5 (pain with activity) at 1 month postoperatively; increase to 8.3 (occasional pain) at 6 months postoperatively; additional increase to 8.5 at 12 months and to 8.8 at 24 months postoperatively (Fig. 6).

Function scores

The average function score changed from 3.2 (light work) preoperatively to 8.6 (slight restriction only; able to work above shoulder level) at 1–2 years postoperatively (Fig. 7).

Active forward flexion

The active forward flexion score changed from 3.4 (>120°) preoperatively to 4.5 (>150°) at 1–2 years after surgery (Fig. 7).

Strength of forward flexion scores

The average strength of forward flexion score changed from 3.4 (fair) preoperatively to 4.6 (good +) 1–2 years postoperatively (Fig. 7).

Patient satisfaction

Of all the patients, 85% (60 of 71) were satisfied with the results of their surgery (Table 2 and Fig. 8).

Of the patients with stage II disease, 82% (37 of 45) were satisfied. This included 9 of the 11 patients without a rotator cuff tear, and 28 of the 34 patients with a partial rotator cuff tear. Of patients with a complete rotator cuff tear (stage III), 88% (23 of 26) were satisfied (Fig. 8).

Objective scores

Objective results of excellent or good were obtained in 77% (55 of 71) of the patients (Table 2 and Fig. 9).

Satisfactory objective results (scores ≥28) were seen in 78% (35 of 45) of the patients with stage II pathology. This inlcuded 82% (9 of 11) of the patients without a rotator cuff tear, and 76% (26 of 34) of the patients with a partial rotator cuff tear. Of the patients with a complete rotator cuff tear, 77% (26 of 34) obtained a satisfactory score (Figs. 10 and 11). All four patients with small full-thickness tears <1 cm obtained excellent results.

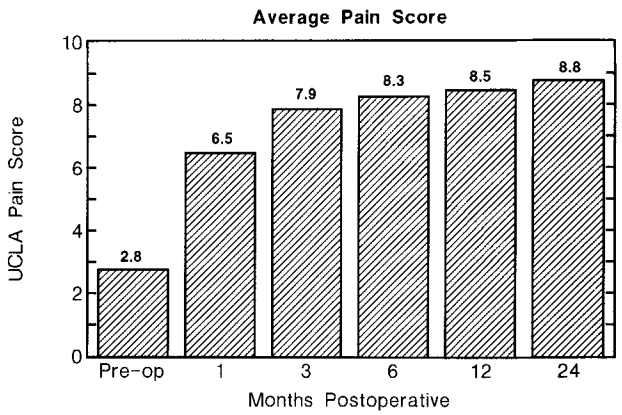


FIG. 6. Average pain score according to the postoperative month.

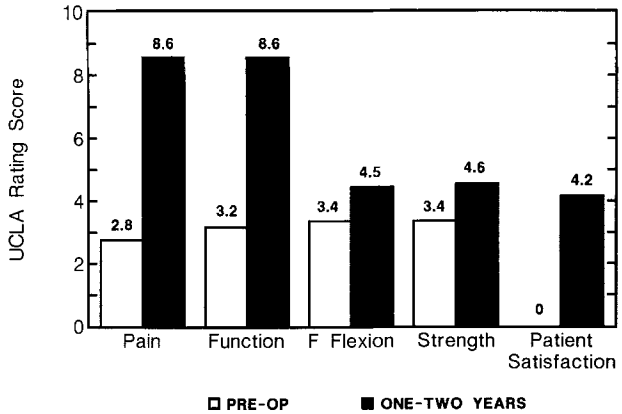


FIG. 7. UCLA shoulder ratings preoperatively and at final 1–2-year follow-up.

TABLE 2. *Results of subacromial decompression for rotator cuff tear*

	Patient satisfaction			Objective rating			
	n	Yes	No	E	G	F	P
Stage II pathology							
Rotator cuff tear (Grade 0)	11	9	2	4	5	1	1
Slightly frayed cuff (Grade 1)	13	10	3	5	4	4	0
Moderately frayed cuff (Grade 2)	21	18	3	11	6	2	2
Stage II subtotal	45	37	8	20	15	7	3
Stage III pathology							
Complete tear <1 cm (Grade 3)	4	4	0	4	0	0	0
Complete tear >1 cm (normal acromial–humeral distance) (Grade 4A)	16	14	2	4	9	3	0
Massive tear (decreased acromial–humeral distance) (Grade 4B)	6	5	1	1	2	2	1
Stage III subtotal	26	23	3	9	11	5	1
Total	71	60	11	29	26	12	4

E = Excellent (34–35 points); G = good (28–33 points); F = fair (21–27 points); P = poor (0–20 points).

Of 16 patients with tears >1 cm and a normal acromial–humeral distance, 13 experienced a satisfactory result (28–35 points). However, only 4 of these 16 have excellent results (Fig. 11).

Of the six patients with massive tears associated with narrowing of the acromial–humeral distance, five are satisfied but only three had a satisfactory score (Fig. 11).

Patients with complete tears had lower preoperative scores regarding pain, function, strength, and active forward flexion than those with none or partial tears. However these same patients obtained similar scores at 1 and 2 years postoperatively (Figs. 12 and 13).

Unsatisfactory results

Eleven patients were not satisfied with their results. Eight of these had stage II disease, and five of the eight had worker's compensation or legal claims. One had a debridement of her rheumatoid shoulder with recurrence of pain during overhead activity at 2 years postoperatively.

Three patients with stage III disease were not satisfied. One patient had severe rotator cuff arthropathy, another, who is a truck driver, refused open repair of his tear, and the third, a 57-year-old woman, has pain with overhead activity.

Five additional patients had objective scores <28. However, they were satisfied with the results of their surgery. This includes three patients with massive tears of the rotator cuff.

Complications

One case was abandoned during the study period because of inadequate visualization of the subacromial space. Two patients developed a reflex sympathetic dystrophy. There were no infections or transient paresthesias.

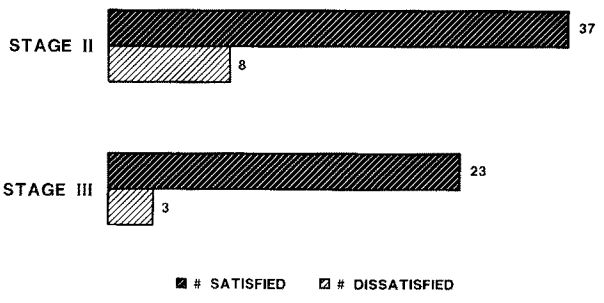


FIG. 8. Patient satisfaction for Stage II or Stage III disease.

FIG. 9. Objective UCLA shoulder rating scale for stage II, stage III (<1 cm complete tear), and stage IV (>1 cm complete tear).

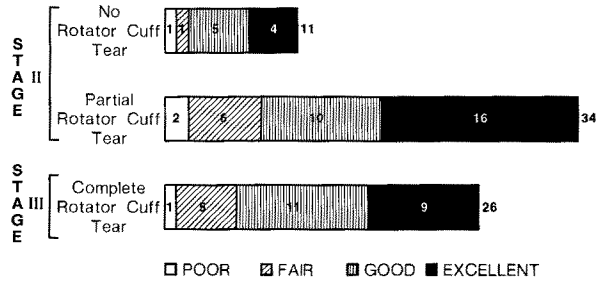


FIG. 10. UCLA Objective Satisfactory Rating according to the degree of rotator cuff tear.

DISCUSSION

Technique

The surgical technique demands advanced arthroscopic skills. Initial exposure of the subacromial space requires resection of the bursa to locate the rotator cuff, the coracoacromial ligament, and the acromion. Troublesome bleeding can be controlled by electrocautery. The final resection is evaluated to ensure adequate rotator cuff clearance.

Since the deltoid muscle is not detached, the advantage of arthroscopic subacromial decompression is immediate, active mobilization of the arm. Most decompression procedures are performed on an outpatient basis. The exact intraarticular pathology can be readily defined and treated.

Stage II Pathology

The patient satisfaction rate of 82% and the objective success rate of 78% for stage II disease are similar to the arthroscopic results of Ellman (3–4) and Paulos et al. (8). These data also compare with the open surgical results of Hawkins and Abrams (9), Post and Cohen (10), Neer (1), Cofield and Azevado (11), Tibone et al. (12,13), Neviaser et al. (14), Ha'eri and Wiley (15), and Penny and Welsh (16).

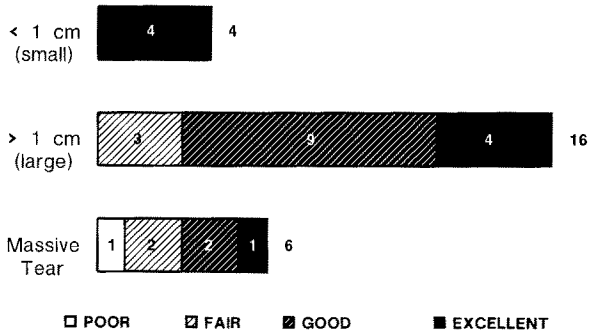


FIG. 11. UCLA shoulder rating scale for complete rotator cuff tears: <1 cm; >1 cm with a normal acromial–humeral distance; and massive tears.

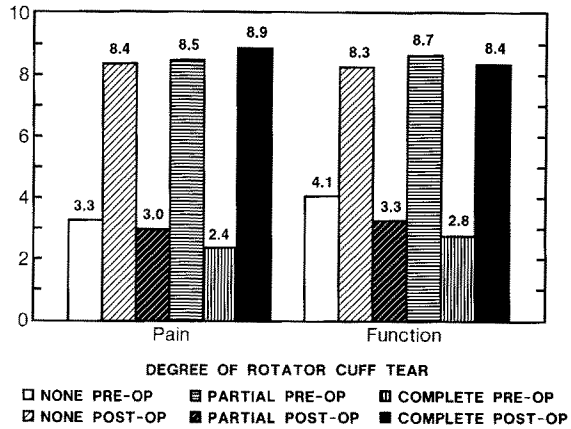


FIG. 12. UCLA preoperative and final 1–2-year follow-up ratings for pain, and function versus the degree of rotator cuff tear.

Our overall success rate is better than that of Ogilvie–Harris and Wiley (17) and Cofield (18), who performed arthroscopic rotator cuff debridements without a subacromial decompression. In addition, our data are similar to the report of Andrews et al. (19) on arthroscopic debridement of partial rotator cuff tears.

Stage III Pathology

Patients with complete rotator cuff tears have an overall patient satisfaction rate of 88% and an objective satisfactory rating of 77%. Our results are comparable to the open rotator cuff repair results of Ellman et al. (7), Gore et al. (20), Watson (21), Cofield (22–24), Post et al. (25), Vastamaki (26), Hawkins et al. (27), Neviaser and Neviaser (14,28), Bassett and Cofield (29), Solonen and Vastamaki (30), Wolfgang (31,32), Samilson and Binder (33), Packer et al. (34), Ha'eri and Wiley (35), and Earn-

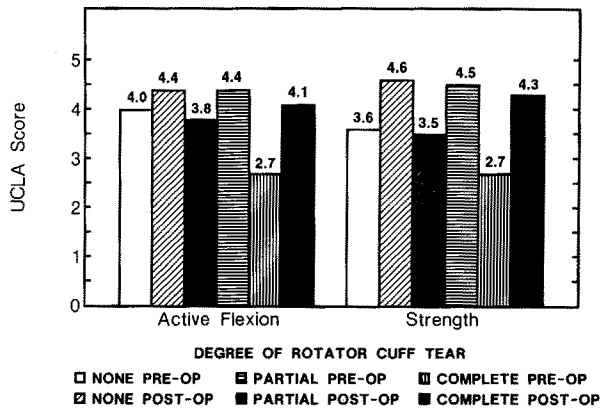


FIG. 13. UCLA preoperative and final 1–2-year follow-up ratings for active flexion, and strength versus the degree of rotator cuff tear.

shaw et al. (36). The relief of pain, especially night pain, is gratifying. Most patients improved functionally because of the associated pain relief.

All four patients with small full-thickness tears of <1 cm have an excellent result. Only 4 of the 13 patients with large tears and a normal acromial–humeral distance obtained an excellent result. These results are better than those of Ellman (4) who had no excellent results from arthroscopic subacromial decompression of complete tears.

We feel that arthroscopic debridement and decompression of large tears remain controversial. Patients enjoy the pain relief and immediate use of their arms. The long-term results of weakness and possible extension of the tear are unknown.

Current Treatment Plan

Our current approach to patients with signs and symptoms of impingement that do not improve with conservative treatment is to recommend arthroscopy. A preoperative arthrogram or sonogram may be useful for patient education, but is not clinically necessary. A bone scan is frequently ordered to determine acromioclavicular joint pathology, especially in younger patients who lift weights. The rotator cuff can be viewed from both the articular and the bursal sides. Partial rotator cuff tears are debrided with motorized tools, and a subacromial decompression is performed. In active patients younger than 50-years-old, complete tears are also debrided along with subacromial decompression, with the additional option of open repair through a small deltoid splitting incision. If repaired, patients must understand that there is a postoperative protection period of 6 weeks, when it is necessary to avoid aggressive active exercises. However, they may begin passive exercises immediately after open repair. If the patient is unwilling to undergo this procedure, then the open repair may be deferred until a later date.

Patients with narrowing of the acromial–humeral distance are informed of the limited goals of subacromial decompression.

CONCLUSION

Debridement of the shoulder joint, rotator cuff, and subacromial bursa, along with sectioning of the coracoacromial ligament and anterior inferior acromioplasty, can be performed under arthroscopic monitoring without detachment of the deltoid muscle. Most patients experience rapid relief in pain over 1–3 months postoperatively with an accompanying improvement in function, strength, and motion.

The overall patient satisfaction rate of 85% and the objective success rate of 77% were within the range of that seen with open rotator cuff surgery.

The results in patients with stage II disease were not related to whether or not there was a tear, a slightly frayed cuff, or a moderately frayed cuff.

Results in patients with stage III disease were related to tear size. Patients with complete tears <1 cm obtained an excellent result. Patients with larger complete tears and a normal acromial–humeral distance were satisfied, but only 4 of these 16 patients were rated excellent. Those with a massive tear and an acromial–humeral distance <7 mm were improved by their pain relief.

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