Arthroscopic Decompression in the Management of Subacromial Impingement Syndrome

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Abstract

Background: Open acromioplasty has classically been described as a method of treatment for subacromial shoulder impingement syndrome. However, the arthroscopic method of management has also recently gained wide popularity.

Objective: The aim of this work was to present clinical outcome of arthroscopic decompression in the management of subacromial shoulder impingement syndrome.

Study Design: A case series.

Patients and Methods: The study involved 30 patients with stage II-III impingement; 18 females (60%) and 12 males (40%). Arthroscopic decompression was done from the bursal side (subacromial decompression). Among other exclusion criteria in this series; there were no cases with concomitant rotator cuff ruptures requiring repair.

Outcome Measures: The primary outcome measure was success of the procedure as judged by postoperative University of California at Los Angeles (ULCA) score on the last follow-up visit and Neer Criteria for "satisfaction". The secondary outcome was complications of the procedure.

Results: Average age at time of operation was 43.3 years. The mean follow-up was 25 months (range, 9-45). Outcome was satisfactory in 90%; 53.3% excellent and 36.7% good. Three patients had unsatisfactory results; 2 fair and one poor. No postoperative complications were found.

Conclusion: Results of arthroscopic subacromial decompression—though somewhat technically demanding—are gratifying when performed properly in selected patients. Hospitalization is brief with rapid return to daily activities and little risk of deltoid muscle complications.

Key Words: Shoulder arthroscopy – Subacromial decompression – Impingement syndrome – Acromioplasty.

Introduction

IN 1972, Neer [1] described "subacromial impingement syndrome" as a distinct clinical entity. He hypothesized that the rotator cuff is impinged upon by the anterior one third of the acromion, the coracoacromial ligament and the acromioclavicular joint, rather than by just the lateral aspect of the acromion. He also suggested that the portion of the rotator cuff that is impinged upon (the impingement zone) is centred on the insertion of the supraspinatus tendon to the greater tuberosity. Finally, he postulated that the formation of spurs in the substance of the coracoacromial ligament leads to chronic wear and to tears of the rotator cuff. Neer described three stages of impingement [2]. Stage-I impingement is characterized by oedema and haemorrhage of the bursa and cuff and is typically found in patients who are less than twenty-five years old. Stage-II impingement represents irreversible changes, such as fibrosis and tendonitis of the rotator cuff and is typically found in patients who are twenty-five to forty years old. Stage-III impingement is marked by more chronic changes, such as partial or complete tears of the rotator cuff and usually is seen in patients who are more than forty years old. Later on, impingement was divided into outlet and non-outlet lesions [3]. Outlet impingement occurs when the coracoacromial arch encroaches on the supraspinatus outlet, while non-outlet impingement may occur secondary to thickening or hypertrophy of the bursa or the rotator cuff tendons.

Neer [1] originally described the anterior acromioplasty, which includes debridement of the inflamed subacromial bursa, resection of the coracoacromial ligament and any spurs that are present, resection of the anteroinferior aspect of the acromion and resection of overhanging osteophytes from the acromioclavicular joint (ACJ) or of the entire joint if there is preoperative tenderness. This procedure has become an accepted method for the treatment of impingement and has been associated with a high percentage of satisfactory results [4-12].

However, excessive removal of acromial bone has been associated with complications and unsat-
isfactory clinical results [13-15]. Soon after, Ellman [16] described arthroscopic anterior acromioplasty as an alternative to open acromioplasty. In the last ten years, the arthroscopic procedure has produced results that are reported to be similar, if not superior, to those of the open procedure [12,16-22].

This is a case series to present the clinical outcome of arthroscopic subacromial decompression (ASD) in the management of subacromial shoulder impingement syndrome.

**Patients and Methods**

We performed a prospective study of 30 patients (30 shoulders) with Stage II-III shoulder impingement as classified by Neer [2] treated with arthroscopic subacromial decompression between September 2004 and September 2007. The follow-up continued till June 2008. The patients were followed-up for an average of 25 months (range, 9-45 months). All patients presented with anterosuperior shoulder pain, with or without other complaints including impingement symptoms.

Patients, who required a concomitant rotator cuff repair or those who had a history of previous shoulder surgery, associated glenohumeral pathology (e.g. SLAP tear, full-thickness rotator cuff tear, ACJ dislocation) or any other significant orthopaedic morbidity (e.g. reflex sympathetic dystrophy, congenital anomaly) were excluded from the study.

Operative intervention was resorted to after failure of at least 6 months of conservative measures including non-steroidal anti-inflammatory medications, rest, activity modification and rehabilitation program.

Initial clinical evaluation included full examination; with a special emphasis on the specific tests for impingement as were previously described [23,24]. An injection of 10cc of 1% lidocaine and steroid in the subacromial space and/or the acromioclavicular joint ACJ, with consequent temporary relief helped to verify the source of pain.

Radiographs and MRI were routinely performed to exclude other coincidental pathologies and to exclude cases with rotator cuff tears.

Patients were evaluated according to the University of California at Los Angeles (UCLA) shoulder scoring scale [16] (Table 1). This was done preoperatively and at regular intervals during the follow-up period. Subjective pain and instability scores (each rated on a visual analogue scale of 1 to 10), patient satisfaction, and patient recommendation of the procedure (Yes or No for each), as well as any failures, were also collected.

Table (1): UCLA shoulder rating scale.

<table>
<thead>
<tr>
<th>Pain</th>
<th>Score</th>
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<tbody>
<tr>
<td>Present always and unbearable; strong medication frequently</td>
<td>1</td>
</tr>
<tr>
<td>Present always but bearable; strong medication occasionally</td>
<td>2</td>
</tr>
<tr>
<td>None or little at rest, present during light activities; salicylates frequently</td>
<td>4</td>
</tr>
<tr>
<td>Present during heavy or particular activities only; salicylates occasionally</td>
<td>6</td>
</tr>
<tr>
<td>Occasional and slight</td>
<td>8</td>
</tr>
<tr>
<td>None</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function:</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to use limb</td>
<td>1</td>
</tr>
<tr>
<td>Only light activities possible</td>
<td>2</td>
</tr>
<tr>
<td>Able to do light housework or most activities of daily living</td>
<td>4</td>
</tr>
<tr>
<td>Most housework and driving possible; able to dress and undress, including fastening brassiere</td>
<td>6</td>
</tr>
<tr>
<td>Slight restriction only; able to work above shoulder level</td>
<td>8</td>
</tr>
<tr>
<td>Normal activities</td>
<td>10</td>
</tr>
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<table>
<thead>
<tr>
<th>Active forward flexion:</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>~150°</td>
<td>5</td>
</tr>
<tr>
<td>120-150°</td>
<td>4</td>
</tr>
<tr>
<td>90-120°</td>
<td>3</td>
</tr>
<tr>
<td>45-90°</td>
<td>2</td>
</tr>
<tr>
<td>30-45°</td>
<td>1</td>
</tr>
<tr>
<td>&lt;30°</td>
<td>0</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Strength of forward flexion (manual muscle-testing):</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 5 (normal)</td>
<td>5</td>
</tr>
<tr>
<td>Grade 4 (good)</td>
<td>4</td>
</tr>
<tr>
<td>Grade 3 (fair)</td>
<td>3</td>
</tr>
<tr>
<td>Grade 2 (poor)</td>
<td>2</td>
</tr>
<tr>
<td>Grade 1 (muscle contraction)</td>
<td>1</td>
</tr>
<tr>
<td>Grade 0 (nothing)</td>
<td>0</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Satisfaction of the patient:</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied and better</td>
<td>5</td>
</tr>
<tr>
<td>Satisfied and worse</td>
<td>0</td>
</tr>
</tbody>
</table>

The primary outcome measure was success of the procedure as judged by postoperative ULCA score on the last follow-up visit and Neer Criteria for "satisfaction" [2]. The secondary outcome measure used was complication of the procedure.

According to UCLA scale, pain and function were rated as a 1-10 scale for each, with 1 being the worst score and 10 the best. Range of motion, strength and patient satisfaction were rated on a scale of 1-5, with a maximum total score of 35 points. The results were divided into excellent (34-35 points), good (28-33 points), fair (21-27 points) and poor (0-20 points). The criteria presented by Neer [2] were utilized to further subdivide the results further into "satisfactory" or "unsatisfactory" groups. According to this system, a patient with a satisfactory result was satisfied with the operation, had no significant pain, had full use of the shoulder.
with <20° loss of overhead extension and had at least 75% of normal strength. In the patient with an unsatisfactory result, these criteria were not met. It is believed that Neer's definition of satisfactory compromises the results that are graded by many authors as excellent or good, whereas his unsatisfactory rating would generally include results that are classified as fair or poor.

**Surgical technique:**

General anaesthesia was administered. The patient was placed in the modified beach-chair position. The acromion, the coracoid process and the coracoacromial ligament were drawn, making it possible to mark the site of the three principal portals (Fig. 1). The portal sites were injected with 1% lidocaine with epinephrine to reduce skin bleeding. Standard arthroscopic portals were used: Posterior portal: Located 1 cm distal to the posterior angle of the acromion on the level of the "soft point" between infraspinatus and teres minor; Posterior-lateral portal: Placed 1 cm lateral to the posterior angle of the acromion and Anterior-lateral portal: Lies over a line that prolongs the anterior edge of the clavicle and acromion, 2 cm distal to the acromial lateral border. A routine diagnostic arthroscopy was made in the glenohumeral joint after which, subacromial decompression was then performed based on the physical findings of impingement in the preoperative evaluation and the intraoperative findings that were recognized in the subacromial space (e.g., prominent downward placed acromion, inflamed subacromial bursa, inferior ACJ osteophytes). The subacromial decompression included a partial bursectomy and an anteroinferior acromioplasty and a routine resection of the coracoacromial ligament. Underhanging osteophytes on the inferior clavicle and/or the ACJ, were also removed, when discovered. Regardless, some subacromial soft tissues and bursal tissue must be cleared before the ACJ can be clearly visualized (Fig. 2). Localization of the ACJ was facilitated by the immediate preoperative placement of a 22-gauge needle into the joint from above. An electrosurgical blade was used to cut the coracoacromial ligament away from the lateral acromial border to the acromioclavicular joint, allowing visualization of the deltoid fibers. Electrocautery was primarily used to expose the undersurface of the acromion. The acromion is exposed posteriorly to the level of the posterior aspect of the clavicle. Branches of the acromial branch of the coracoacromial artery are coagulated just anterior to the edge of the acromion as necessary. A 5-mm Burr is used to resect bone from the anterior inferior surface of the acromion, smoothing and shaping it back to the posterior border of the clavicle. The amount of bone resection can be estimated on preoperative radiographs or MRI (Fig. 3). The acromioplasty is complete when it is felt that the acromion is smooth and flat, and that an adequate space has been created between the acromion and superior surface of the rotator cuff. This may also be done by comparing the depth of the acromion groove, which is created with the burr initially, with the height of the sleeve of the burr. In addition the "precision acromioplasty" advocated by Sampson et al. [25] was modified and could also be used to evaluate the amount of resected acromion. In this technique, the burr is placed in the posterior portal with the arthroscope in the lateral portal. The manner of bone resection is similar to the cutting block technique used in total knee systems. The posterior aspect of the undersurface of the acromion serves as the cutting block to guide the resection anteriorly by using sweeping motions from lateral to medial while maintaining the angle of the burr.

In some of the cases, it was determined that the undersurface of the acromion was not the true offending factor causing impingement, but rather inferiorly directed osteophytes from the undersurface of the ACJ. In these cases, those osteophytes were removed solely without any procedure performed on the acromion. Likewise, in cases in which the ACJ was thought to be the causative factor and was documented to have arthritis evident on the preoperative radiograph, the ACJ was resected arthroscopically from the bursal side (Fig. 4) in the manner similar to that described by Gartsman [26].

**Postoperative rehabilitation program:**

Patients were usually discharged home on the day of surgery. Instructions are given to wear a sling for 1 week, mostly for comfort. Pendulum exercises are instituted within the first 24 hours, and gentle range of motion activities with an overhead pulley are done during the first week. The patients are seen at one week after the surgery and usually sent to physical therapy with instructions to progress to pulley exercises over the next week. Recreational sports begin when the athlete obtains a painless full range of motion and good strength, usually at 8 to 12 weeks (Fig. 5-a,b,c).

**Statistical methods:**

All statistical calculations were done using SPSS version 15 (SPSS Inc., Chicago, IL, USA). Data were statistically described in terms of range, mean and frequencies. Comparison of the pre and postoperative scores was done by the Wilcoxon signed ranks test. \(p\)-value less than 0.05 was considered significant.
Arthroscopic Decompression in the Management of Subacromial Impingement

Fig. (1): Patient positioning and surface marking.

Fig. (2): Bursal resection with overlying bony resection.

Fig. (3): MRI showing impingement of acromion on supraspinatus tendon.

Fig. (4): X-ray showing ACJ resection.

Fig. (5-a,b,c): Immediate postoperative range of motion.
Results

The age of the studied group ranged from 37 to 53 years with a mean of 44.9 years. They were 18 females (60%) and 12 males (40%). All cases were unilateral; 17 (56.6%) of the right shoulder and 13 (43.3%) of the left. The dominant hand was involved in 20 cases (66.6%). Only four male patients (13.3%) were involved in regular high level sports. The mean duration of symptoms was 12.2 months (range 6 to 30 months). The preoperative UCLA score ranged from 7 to 24 with an average of 16.3.

The overall results were satisfactory in 90% (27 cases) while 10% (3 cases) were unsatisfactory. Of the satisfactory group, 53.3% were rated excellent (16 cases) and 36.6% were rated good (11 cases). The unsatisfactory group comprised 2 cases with fair results and one patient with poor results.

The average preoperative pain score was 4.6 (pain during activities; salicylates required frequently). Postoperatively, the average pain score was significantly higher ($p<0.001$). It reached 8.9 (occasional and slight discomfort). Preoperative functional score was 5.0 (restricted to light work but capable of performing most ADL). Postoperatively, it reached 8.9 ($p<0.001$), indicating an ability to work above shoulder level with occasional slight restriction. Average range of motion (ROM) and forward flexion improved by $22^\circ$.

No major complications were noted during or after the procedure. We observed a single case of superficial skin infection which resolved spontaneously on appropriate antibiotic therapy and repeated dressings. In addition there were two cases of moderate haematoma which also likewise resolved. There were no cases of transient parasthesia, nerve injuries or otherwise.

Discussion

Historically, various authors have noted abnormal contact between the coracoacromial arch and the rotator cuff tendons [1-3,27-31], but the exact aetiology was not clearly understood. Armstrong [27] and Diamond [29] also noted the role of the acromion as a cause of symptoms in the shoulder and suggested acromionectomy as a solution. McLaughlin and Asherman [4] developed the lateral acromionectomy to relieve impingement on the rotator cuff. However, this procedure does not involve removal of the anterior portion of the acromion, which is responsible for impingement and it necessitates detachment of a substantial portion of the deltoid origin. The disappointing results of complete acromionectomy and lateral acromionectomy led Neer to focus on the undersurface of the acromion as the offending area. Although outlet impingement is originally described as usually involving the anterior acromion initially and then later progressing to the AC joint, in some individuals, degenerative changes of the AC joint may result in osteophyte formation and impingement in the absence of anterior acromial impingement [32]. Similarly, Petersson and Gentz [33] demonstrated that inferiorly directed AC joint osteophytes are significantly associated with supraspinatus tendon ruptures even in the absence of anterior acromial osteophytes. Ellman [16] published the first large series with ASD patients; 88% (average age, 50 years) had satisfactory results. Esch et al. [34] reported 82% satisfactory results in stage II impingement patients with and without partial rotator cuff tears. In addition, they had 88% satisfactory results in the patients with stage III full-thickness rotator cuff tears. Hawkins et al. [35] reported 46% satisfactory results with ASD, while they had a concurrent series of open acromioplasty patients with 87% satisfactory results. Gartsman [36] had 95% satisfactory results in his group without partial tears and 83% satisfactory results in his group with partial tears. Although all our patients had no tears of the rotator cuff, our results compare favorably with previous reports; 90% of patients were deemed satisfactory, compared to 81 to 100% in other studies [34-39].

The ideal extent of acromial resection is unknown, but dimensions (depth by length) of 0.9x2.0 cm and 1x1cm have been recommended [2]. All of our patients had conversion of acromial morphology from types 3 and 2 to type 1.

The efficiency of arthroscopy in the treatment of the impingement syndrome could result from the resection of the thickened bursal tissues. Soifer et al. [39] showed rich neural innervations of the subacromial space, especially of the subacromial bursa. Impulses transmitted by free nerve ends may be responsible for the pain associated with the impingement syndrome and rotator cuff pathology, consequently, explaining the relief of pain after arthroscopic debridement. We are aware that subacromial arthroscopic resection provides space for the shoulder components and increases the capacity of the subacromial space. Subacromial bursectomy could also be a determining element in this surgery. Only a randomized prospective study on isolated resection of the bursa in these impingement syndromes, will eventually confirm this hypothesis.
Although our study involves a small number of cases, it provides information on outcomes expected from surgery, which compared favorably with those described in previous reports of arthroscopic subacromial decompression. Further studies are also needed to measure the extent of bone resection, more accurately using computed tomographic scans.

The possible benefits from ASD may include; smaller and more cosmetic scars with early mobility (deltoid attachment maintained) and frequently an earlier return to normal activity. The disadvantage of ASD, when compared with an open decompression, is the technically demanding nature of ASD as demonstrated in this report. The procedure requires a steep learning curve for the surgeon. The setup and positioning are more intricate and time consuming. More expensive equipment is needed for ASD than for an open decompression.

Conclusion:

Arthroscopic subacromial decompression—though somewhat technically demanding—is gratifying when performed properly in selected patients. Hospitalization is brief with rapid return to daily activities and little risk of deltoid muscle complications.

References