



Functional outcome in chronic impingement syndrome by conservative open acromioplasty

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Abstract:

Background and objectives: The compression of supraspinatus tendon of the rotator cuff and the subacromial bursa by the anterior and inferior aspect of the acromion and by coracoacromial ligament, during overhead abduction of shoulder, leads to severe pain in the shoulder and gross restriction of overhead activities. Conservative Open acromioplasty is a simple procedure, using minimum instrumentation with small incision, simultaneously supraspinatus can be visualized and repaired. **Methods:** This is a retrospective and prospective study was conducted at Navodaya Medical College Hospital & Research Centre between 2012 to 2014. All Patients with chronic impingement syndrome, treated by Conservative Open acromioplasty as definitive modality of treatment, were followed up till regain of full function. A total of 60 patients included in study and were in age group of 20-63. **Results:** In current study, 60 patients were in the age group of 20-63. 10 patients (17%) had type 1 acromion, 26 patients (43%) had type 2 acromion, 24 patients (40%) had type 3 acromion. 3 patients (5%) were having AC joint arthrosis, in those patients lateral end of clavicle excision was done. 60 patient were followed up and results evaluated and graded, according to American Shoulder and Elbow surgeons scores In, 10 (17%) patients having type 1 acromion, 70 % had excellent results, 10% had good result and 20% had poor result. In, 26 (43%) Patients having type 2 acromion, 84.6% had excellent results, 11.5% had good results and 3.8% had poor results. In, 24 (40%) Patients having type 3 acromion, 80% had excellent results, 8.3% had good results, and 12.5% had poor results. In the current study 80% of our patients had excellent results, 10% had good results, 10 % had fair to poor results.. **Conclusion:** From this sample study, we consider that Conservative Open acromioplasty is an excellent treatment for chronic impingement syndrome.

Key words: Acromioplasty, coracoacromial ligament, Impingement syndrome, supraspinatus

Introduction

The compression of supraspinatus tendon of the rotator cuff and the subacromial bursa by the anterior and inferior aspect of the acromion and by coracoacromial ligament, during overhead abduction of shoulder, leads to severe pain in the shoulder and gross restriction of over head activities [1]. Various modalities of treatment have been described, like conservative management [2] (with physiotherapy, subacromial steroid injection) Total acromionectomy [3,4], lateral acromionectomy [5], Neer anterior acromioplasty [1], Modified Neer acromioplasty [6], conservative open acromioplasty [7,8], Arthroscopic subacromial decompression [9,10]. Anatomical variations of the acromion and the ability of these variations to produce impingement on the tendons and bursa between the acromion and the humeral head have long been recognized as a source of pain in the shoulder [3,4]. The height of the space between the acromion and the humeral head ranges from 1.0 to 1.5 centimeters [11]. However, interposed between these two osseous structures are the rotator cuff tendons, the long head of the biceps tendon, the bursa, the coracoacromial ligament. Any abnormality that disturbs the relationship of these subacromial structures may lead to impingement [12,13].

Impingement of the rotator cuff occurs when the cuff comes into contact with the anterior aspect of the acromion, rather than the lateral or posterior, during flexion of the arm. There is impingement on the subacromial bursa and the supraspinatus tendon of the rotator cuff between the anterior inferior corner of the acromion, the coracoacromial ligament and the greater tuberosity of the humerus [6]. A lot of daily activities require that the arm be used between the two planes of forward flexion and elevation in the plane of the scapula. This use repetitively traumatizes the supraspinatus tendon portion of the rotator cuff from impingement by the coracoacromial arch and the anterolateral edge of the acromion. The supraspinatus muscle-tendon unit is therefore the most vulnerable component of the rotator cuff mechanism. Impingement of the rotator cuff beneath the coracoacromial arch has been recognized as one of the causes of chronic disability of the shoulder [3,4]. Patients with impingement syndrome come with pain in the shoulder region, associated with weakness and stiffness of shoulder, restriction of over head activities and related house hold activities and reduced sport participation, which involving over head activities in basketball players, swimmers,

tennis players, badminton players, javelin throwers. 95% of lesions of the rotator cuff i.e. both partial and complete, were the end result of impingement by the anterior aspect of the acromion and therefore it is believed that an acromioplasty should be an integral part of a rotator cuff repair [6]. Armstrong [6] introduced the term supraspinatus syndrome and proposed that the condition should be treated with a total acromionectomy. But total acromionectomy failed to address the point of impingement. That led to the development of a two step acromioplasty, which consisted of first the removal of the anterior prominence of the acromion and second, the removal of the anterior inferior portion of the acromion. Nowadays, Arthroscopic acromioplasty has been tried. Results are well comparable with conservative open acromioplasty, but Arthroscopic decompression has a sharp learning curve, needs elaborate setup, technical expertise, as compared to conservative open acromioplasty which is cosmetically acceptable, simple procedure, minimal instrumentation, more over arthroscopic repair of rotator cuff is technically difficult. Conservative Open acromioplasty is a simple procedure, using minimum instrumentation with small incision, simultaneously supraspinatus can be visualized and repaired [8].

Material and Methods

A retrospective and prospective study was conducted at Navodaya Medical College Hospital & Research Centre between 2012 to 2014. All Patients with chronic impingement syndrome, treated by Conservative Open acromioplasty as definitive modality of treatment, were followed up till regain of full function. A total of 60 patients included in study and were in age group of 20-63, 35 were males and 25 were females, 42 patients right side was affected. After getting admitted to the surgical ward, complete patient profile with thorough history, associated co-morbid illness was recorded. Complete physical examinations with special tests were recorded. Statistical analysis was done by SPSS 17.0 software and evaluated using independent sample t test. Pre-operative blood routine investigations, Radiograph Affected Shoulder Anterior –Posterior view, Chest X- ray, Additional X- ray if required. Magnetic resonance Imaging of shoulder in all cases helped in evaluating type of Acromion, Impingement syndrome, Rotator cuff tears. This would further help us in classifying type of acromion; confirm diagnosis and careful pre-operative planning.

Inclusion criteria

1. Clinically and radiologically established impingement syndrome where conservative treatment has failed for 3-4 month
2. Patients in age group 20-80 years
3. With Acromio-clavicular joint arthritis
4. Small and medium sized rotator cuff tears up to 3 cms

Exclusion criteria

1. Associated fractures around the shoulder.
2. Associated instability of the shoulder.
3. Associated SLAP tear.
4. Osteoarthritis of shoulder.
5. Large and complete rotator cuff tears.

Functional evaluation and scoring system:

American shoulder and Elbow surgeons Scoring system was used in current study. The final long term outcome was evaluated using (ASES). The scoring system assigns points for Pain, Function (work), Activities of daily living, sports. This scoring system takes following factors into consideration

- 1.Pain –is assessed by no pain or aggravated by unusual activities or complete disability
- 2.Function –able to do over head activities
- 3.Activities of daily living-it takes into consideration regarding various day to day activities like using back pocket, use hand to arm at shoulder level, comb hair, wash opposite underarm, sleep on affected shoulder.
- 4.Sports –return to same over head sports, decreased performance.

Table 1: Rating scale of the American Shoulder and Elbow Surgeons

1.PAIN	Points
None	(5)
Slight	(4)
After unusual Activities	(3)
Moderate	(2)
Marked	(1)
Complete disability	(0)
2.FUNCTION*	
Work*	
Sedentary	
labour(no overhead)	
labour(over head)	
3.Activities of daily living *	

Use back pocket	
Eat with utensil	
Use hand to arm at shoulder level	
Carry 4.5 to 6.8(10 to15lbs),arm at side	
Dress	
Pull	
Wash opposite underarm	
Comb hair	
Use arm over shoulder	
Reach behind back, fasten brassiere	
Sleep on shoulder	
Lift	
4. SPORTS	
Overhead sport-	(4)
Same non over head-	(3)
Same sport decreased performance	(2)
Different sports	(1)
No sports	(0)

*4=normal: 3= mild comprise: 2=difficult: 1=with aid: 0=unable

Scoring

- 14-17 excellent
- 10-13 good
- 6-9 fair
- <6 poor

Procedure:

Complete pre-op evaluation, with radiograph and magnetic resonance imaging. Patient in beach chair position, with a sand bag placed under medial border of the scapula, under general anaesthesia. Bony contour of the shoulder, including the lateral acromial border, coracoid and Acromioclavicular joint marked. Local infiltration of 10 ml of 1:500000 epinephrine is done to minimize bleeding. An incision starting from lateral to the anterior acromion towards the coracoid is done, subcutaneous dissection is done, the raphe between anterior and middle deltoid is identified and split, care is taken to prevent splitting of deltoid beyond 5 cm toward the anterior lateral acromion, to avoid axillary nerve injury. Deltoid is sometimes detached from the acromion with thicker flaps and in those situations; we make drill hole in to the acromion and fix with non absorbable sutures. This step helped us to mobilize patients early. Coraco acromial ligament is resected with electrocautery; this minimizes bleeding and hematoma formation, because acromial branch of the Coraco acromial artery is contained within ligament. Bursa is identified by its continuity with the acromial undersurface and its unilaminar appearance as opposed to the multilaminar

appearance of the rotator cuff. Bursa is resected, all adhesions released and subacromial space visualized. With an oscillating saw, the portion of acromion which is anterior to the anterior border of clavicle is excised; oscillating saw was used because it reduces the chance of an iatrogenic acromial fracture. Anterior and inferior portion of acromion is shaved, while protecting the rotator cuff by blunt Hohmann retractor. If severe degenerative arthrosis was found in AC joint. Then distal 1-1.5 cm of lateral clavicle was resected, leaving the superior acromioclavicular capsule intact. Rotator cuff was inspected for any small and medium sized tears and sutured side to side by absorbable sutures. Thorough irrigation of the wound done. Deltoid cuff is sutured from side to side, if necessary through drill holes into the acromion with non absorbable sutures. This is important because compromised deltoid function affects results of acromioplasty. Wound was irrigated with normal saline and wound closed in layers over a drain.

Postoperative protocol:

In all patients antibiotics prophylaxis was given at 6 hours pre-Operatively and standard intra-operative dose. Parenteral antibiotics And analgesics were given till 24 hours after surgery and then started orally. The arm was immobilized for 4 days in shoulder immobilizer. Wound inspection and drain removal was done on first post operative day, wound again inspected on fourth post-operative day. Sutures were removed, on eleventh post operative day. Pendulum exercises were started on 4th postoperative day, gentle range of movements started from 11th post operative day, Overhead abduction and internal rotation was started from 17th post operative day. Return to sports activity was avoided for 4 months.

Follow up evaluation:

Patients were followed at Orthopedic OPD every visit. Clinically patients were assessed. Any post-operative complications were detected and appropriate intervention was undertaken. Functional outcome of patient was assessed at the latest follow-up using standardized scale taking into account of pain, function, activities of daily living and sports. Results in each patient were graded as excellent, good, fair, or poor depending on ASES scoring system.

Results:

In current study, 60 patients were in the age group of 20-63, minimum age was 20 and maximum being 63. Mean age was 45.32±11.32. Out of 60

patients in current study, 35(59%) patients were males and 25(41%) patients were females. In the current study, 18 patients (30%) had diabetes mellitus, 6 Patients (10%) had hypertension, 12 patients (20%) had both diabetes mellitus and hypertension, 24 patients (40%) did not have any comorbid conditions. Right shoulder was affected in 42 patients (70%), left shoulder was affected in 18 patients (30%). In the current study, 10 patients (17%) had type 1 acromion, 26 patients (43%) had type 2 acromion, 24 patients (40%) had type 3 acromion. 3 patients (5%) were having AC joint arthrosis, in those patients lateral end of clavicle excision was done. Rotator cuff tears <3 cm were included in the study and repaired end to end by absorbable sutures. 12 patients (20%) had partial to medium sized rotator cuff tears. 1 patient (1.66%) developed Seroma, which was treated by debridement and antibiotics, eventually healed. 1 patient (1.66%) developed hematoma, leading to poor result, two patients (3.33%) developed pain and stiffness, leading to poor results in those patients. 60 patient were followed up and results evaluated and graded, according to American Shoulder and Elbow surgeons scores. In, 10 (17%) patients having type 1 acromion, 70 % had excellent results, 10% had good result and 20% had poor result. In, 26 (43%) Patients having type 2 acromion, 84.6% had excellent results, 11.5% had good results and 3.8% had poor results. In, 24 (40%) Patients having type 3 acromion, 80% had excellent results, 8.3% had good results, and 12.5% had poor results. The mean scores at the end of one month was 11.88±3.23.

The mean scores at the end of 6 month was 13.30±3.22 The mean scores at the end of 1 year was 14.68±3.61 No significant differences between the results at 1 month versus 1 year follow up was noted. Mean scores were similar between follow up visits. According to American Shoulder and Elbow Surgeons, patients having a score 14-17 were graded excellent, 10-13 were graded good, 6-9 were graded fair, <6 were graded as poor. In the current study 80% of our patients had excellent results, 10% had good results, 10 % had fair to poor results.

Discussion:

The results were evaluated in detail and compared them with well established studies mentioned in literature. Current study revealed the average age of patients with Impingement syndrome as 45.31 yrs (Range 20-63) which is comparable to P Hyovonen et al [14] and H.D.Skoff [8]. Youngest

patient was 20 years and oldest was 63 years. Two patients were athletes, one was basket ball player, other was tennis player, at the end of 6 months both were able to go back to sporting activities. Current study had 59% males and 41% women, comparable with Charles Neer et al [1]. In current study males were more commonly affected than females. Predominant male preponderance seen in all studies. The right shoulder was affected in 70% of the patients and the left shoulder in 30%. Dominant right shoulder was commonly involved was seen in all studies. Current study had 17 % patients with Type 1 Acromion, 43% patients with Type 2 Acromion and 40% patients with Type 3 Acromion, which is comparable with Bigliani et al [14].

In the current study 20 % of patients had partial tears of rotator cuff tears, which was intra-operatively sutured, end to end by non absorbable sutures, thus preventing complete tears and reducing morbidity. Toivonen et al [15] confirmed the hypothesis previously reported by Morrison and Bigliani that there is an association between type 3 Acromion and rotator cuff tears. Current study is comparable with rotator cuff tear incidence with Charles Neer et al [1] Current study had some patients with complete degenerative rotator cuff tears >4 cms, which were repaired, but were not included in the study. In the current study 5% (3 patients) had severe Acromioclavicular joint arthrosis which was confirmed by pre-op radiographs and Magnetic Resonance Imaging. AC joint Excisional arthroplasty i.e. lateral end clavicle excision was done, which did not impair the final outcomes. The clavicle was resected, leaving the superior acromioclavicular capsule intact, to make deltoid repair easier. The clavicular cut was not beyond 1.5 cm to avoid violating Coraco-clavicular ligaments and making the distal clavicle unstable. Thorling et al [16], Daluga and Dobozi et al [17], Stuart et al [18] in their studies stated that, excision of lateral end of clavicle did not impair the results.

Incidence of lateral end clavicle excision is comparable with C A Rock wood and Fr Lyons et al [6]. Results of current study is comparable with studies like Post and Cohen et al [19], Sachs, stone and Divine et al [20], Rockwood and Lyons et al [6]. In the current study after evaluating all patients, about 90% patients i.e. 54 patients at the end of 6 months were able to do normal routine day to day activities like combing, doing kitchen work like picking boxes from over head cupboard, other activities which were restricted before surgery. At the end of study patients were happy with the

outcome, high in confidence. Both sportsman involved in the study were able to return to sporting activities. In our study, 6 patients had fair to poor results. 2 patients had uncontrolled diabetes, who developed peri-arthritis and stiffness in the joint postoperatively, thus contributing to poor results. 2 patients had severe pain and stiffness of the shoulder, as they could not comply with our physiotherapy protocol due to reflex sympathetic dystrophy. 1 patient had developed a Seroma; another patient had hematoma formation, both leading to delayed mobilization, eventually having a poor result. The rate of complications after open acromioplasty is predictably quite low. Reported complications like acromial fracture, persistent pain, postoperative glenohumeral stiffness, prolonged rehabilitation, delayed return to work, weakness, superficial or deep wound infection, detachment of the deltoid and its dysfunction.

McShane et al [7], in a study of twenty-nine patients who had an acromioplasty for the treatment of impingement syndrome, reported a high percentage of complications (including acromial fracture and prolonged convalescence) after procedures involving detachment of the deltoid. Most of the problems were related to technical errors. In the current study, deltoid was split in between anterior and middle fibers so this helped in faster recovery and early mobilization, in about 3 patients detachment of deltoid was done and sutured to the acromion by drill holes, in those patients rehabilitation was prolonged, but no effect on results was found. Ogilvie-Harris et al [21] evaluated sixty-seven shoulders in sixty-five patients, who had had persistent pain for more than two years after an open anterior acromioplasty. All patients had a thorough examination to determine the reason for failure. Arthroscopy revealed that the original diagnosis had been incorrect in 40 per cent of cases and technical errors during surgery were seen in 42 per cent of cases, In the current study correct diagnosis was made by various clinical signs and further diagnosis confirmed by failed conservative management and Magnetic Resonance Imaging of the affected shoulder. Flustad et al [22] and Matsen et al [23] have documented technical inadequacy in failed Acromioplasties. Adequate bone must be removed to alleviate outlet stenosis. Inadequate bone removal seems to occur more often in arthroscopic rather than open Acromioplasty. In current study, adequate bone was removed and visualized intra-operatively; outlet stenosis was visualized and checked by full range of motion of shoulder intra-operatively.

Minimum incision as described by Neer which prevented postoperative morbidity, Splitting the deltoid in between anterior and middle fibers and limiting the distal split to within 5 cms helped in easy apposition, post-operative early mobilization, avoiding axillary nerve injury, thus preventing deltoid dysfunction, which is the main cause of poor results. Subacromial bursa can be mistaken for the rotator cuff, but differentiation can be made by the fact that the bursa is unilaminar whereas the rotator cuff is multilaminar. Release of adhesions between the bursa and the rotator cuff was important, as it reduces post-op pain and increases overhead activity.

The Coraco-acromial ligament was cut using a cautery, which prevented hematoma formation, which contributes to poor results. However, one of our patients developed a hematoma and had poor results. Saw was used instead of the osteotome to excise and shave the anteroinferior part of acromion, which prevented iatrogenic acromion fracture. While excising the acromion the rotator cuff was protected by blunt Hohmann retractor by depressing the humeral head and rotator cuff. Partial and small cuff tears were sutured side to side, thus preventing complete tears. Suturing of deltoid back to the acromion by drill holes was the important step in the operation, which aided in early mobilization and good outcome functionally. In our study, we fixed the deltoid to the acromion by non –absorbable sutures in 3 patients and good outcome was seen in these patients. AC joint arthroplasty in patients in severe AC joint arthrosis was done i.e. excision of 1-1.5 cm of clavicle and leaving behind the superior capsule helped in reducing the pain post-operatively. Simple incision, easy operative technique, minimum instrumentation. Results of conservative open Acromioplasty are comparable with Arthroscopic subacromial decompression as evidenced in a study by Mc Shane et al [7] and H.D.Skoff et al [8]. Direct visualization of subacromial space and adequate excision and shaving of the impinging part of the acromion helps in reducing the chances of revision surgery. Simultaneous visualization of rotator cuff, small to moderate tears, can be repaired in a single stage procedure. Conservative open Acromioplasty addresses extrinsic as well as intrinsic problem of Impingement syndrome, mainly reducing mechanical Impingement, reducing the chances of progression to a complete rotator cuff tear. Based on the current study, Conservative open acromioplasty is an easy surgical procedure, Using minimal instrumentation,

having minimal complications and good functional outcome.

Summary:

Impingement on the tendinous portion of the rotator cuff by the Coraco-acromial ligament and the anterior and the anterior third of the acromion is responsible for a characteristic syndrome of disability of the shoulder. A characteristic proliferative spur and ridge has been noted on the anterior lip and undersurface of the anterior process of the acromion and this area may also show erosion and eburnation. The treatment of the impingement is to remove the anterior edge and undersurface of the anterior part of the acromion with the attached Coraco-acromial ligament. Hypertrophic lipping at the Acromio-clavicular joint may impinge on the supraspinatus tendon when the arm is in abduction and if the lip is prominent, this joint should be resected. These are the principles of anterior acromioplasty. Conservative open acromioplasty offers better pain relief, especially in patients with mechanical impingement, while it provides better exposure for repairing tears of the supraspinatus and prevent further, impingement and wear at the critical area, without loss of deltoid power.

Conclusion:

Conservative Open acromioplasty is - a simple procedure. Small incision and minimal instrumentation, very convenient. Minimal complications and inexpensive. Cosmetically acceptable with very satisfactory functional results .Type II and Type III Acromion are associated with complete and partial tears of rotator cuff. Associated pathology can also be addressed - rotator cuff tear and AC joint Arthritis. Conservative open acromioplasty is a Valid and valuable option for treatment of chronic rotator cuff impingement.

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Figure 1: Pre-operative MRI showing partial tears of supraspinatus



Figure 2: Pre-operative MRI showing impingement syndrome and type ii acromion

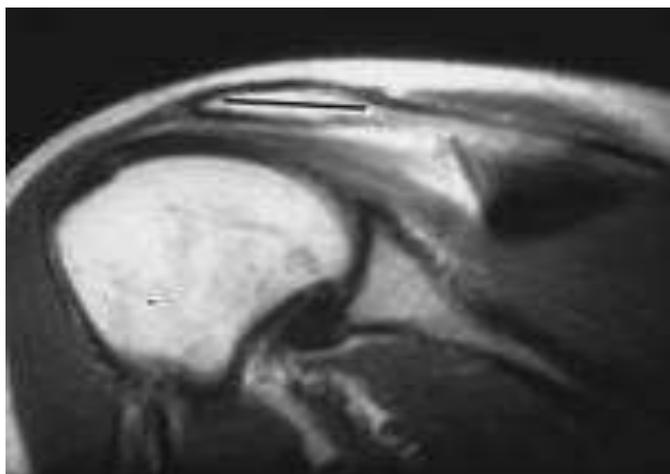


Figure 3: Pre-operative MRI showing impingement syndrome and type III acromion.

