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Open Rotator Cuff Tear Repair Using Deltopectoral Approach

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ABSTRACT

Background: The goal of this study was to evaluate the outcome of the open repair of rotator cuff tears via the deltopectoral approach in patients unable to afford arthroscopic repair costs. **Methods:** We evaluated 80 consecutive patients who were treated for full-thickness rotator cuff tears by open repair through the deltopectoral approach. There were 48 men and 32 women at a mean age of 60.1 years (range, 35-80 years). Preoperative and postoperative clinical assessments were performed with the Constant score, American Shoulder and Elbow Surgeons (ASES) score, modified University of California Los Angeles (UCLA) score, and pain visual analog scale. **Results:** The mean follow-up period was 30.6 months (range, 18-48 months). At final follow-up visits, the ASES, Constant score, and modified UCLA score were found to have improved significantly from 33.56, 39.24, and 13.0 to 85.64, 81.46, and 32.2, respectively ($P < 0.01$). Pain, as measured on a visual analog scale, was improved significantly ($P < 0.01$). The mean time for recovering the full range of motion was 2.5 months. Postoperative pain at 48 hours and at 6 weeks was relatively low. There were no cases of intractable stiffness. **Conclusion:** The deltopectoral approach for open rotator cuff repair produced satisfactory results and reduces rate of shoulder stiffness and postoperative pain.

Key words: Rotator Cuff Tear, Deltopectoral, arthroscopic.

1. INTRODUCTION

The rotator cuff disease is known as one of the most common causes of chronic shoulder pain in adults, and its treatment is considered important because of the increased geriatric population and the advances made in medical diagnosis and treatment since the rotator cuff tear repair was first reported by Codman in 1911. The goal of the rotator cuff surgery is to relieve shoulder pain and to improve function (1-6). The repair of the rotator cuff tear has been carried out via open repair (6, 7), mini-open repair (8-11) and, more recently, arthroscopic repair (12-16). The arthroscopic technique is a less invasive approach and causes less injury to the deltoid muscle, which may prove advantageous for postoperative rehabilitation and outcome (14-17). In developing countries, the high price of instruments and devices sometimes prompts the use of the open technique. Previous-

ly, we employed the deltoid splitting technique for open rotator cuff repair, but the disadvantage of this approach lies in its severe postoperative pain and high rate of shoulder stiffness. Therefore, we decided to treat our new series of patients through the deltopectoral approach, in which the sparing of the deltoid muscle confers less potential risk of adhesion and probably less postoperative pain. The purpose of this study was to evaluate the outcome of open repair rotator cuff tears using the deltopectoral approach in a group of patients who could not afford the costs of arthroscopic surgery. We determined the effectiveness of this technique, severity of postoperative pain, and incidence of complications such as shoulder stiffness.

2. MATERIALS AND METHODS

This study was performed on patients referred to orthopedic clinic

of Imam Khomeini Hospital, Tehran, Iran during 2008-2012. All the patients had a physical examination and an imaging study—including magnetic resonance imaging (MRI), yielding results that were consistent with the rotator cuff tear. The patients were given a preoperative questionnaire, which comprised demographic information, history of the present illness, social history, detailed medical history, and surgical history. Of the 88 patients included in the study, 80 patients completed the follow-up period from 2008 to 2012. The average follow-up was 30.6 months (range, 18-48 months). Average age was 60.1 years (range, 35-80). The study population was comprised of 48 (60%) men and 32 (40%) women. Forty per cent of the patients were heavy laborers and 60% had sedentary work. The mean duration of symptoms before surgery was 27 months (14- 42 months). The rotator cuff tear types consisted of 26 (32.5%) cases of supraspinatus and subscapularis tear, 6 (7.5%) cases of isolated subscapularis tear, and 48 (60%) cases of supraspinatus tear only. In terms of size, there were 8 (10%) small, 18 (22.5%) medium, 21 (26.5%) large, and 33 (41.2%) massive rotator cuff tears. The inclusion criteria for the present study were inability of any patient to cover the costs of arthroscopy. The exclusion criteria were as follows:

- Infrapinatus tear considered not to be accessible via the deltopectoral approach;
- A partial-thickness or irreparable full-thickness tear,
- Labral pathology amenable to surgical repair,
- Degenerative arthritis of the glenohumeral joint,
- Symptomatic arthritis of the acromioclavicular joint,
- Rotator cuff arthropathy,
- Previous surgery in the same shoulder,
- Lack of compliance during the rehabilitation period; and
- Insufficient follow-up.

2.1. Surgical Technique

After the administration of an interscalene block and induction of general anesthesia, all the patients were placed into the beach-chair position. A 5-cm skin incision was made in the line of the anterior axillary skin crease and the deltopectoral interval was exposed. The coracoacromial ligament was cut routinely, except in cases with massive chronic anterosuperior tears that repair were not considered satisfactory. Two Hohmann retractors were thereafter placed: one above the humeral head (below the acromion) and the other laterally. Internal rotation of the shoulder exposed the posterior part of the cuff (with the exception of the most distal part). Scar tissue releases were subsequently performed, and the bursa was debrided. The greater tuberosity was prepared with a high-speed burr. The footprint having been prepared, the torn tendon was repaired by the modified Mason-Allen stitches using transosseous suture. In the cases with type III acromions or when rotator cuff impinged with the acromion intraoperatively, acromioplasty was performed anteriorly and laterally with a high-speed burr. In this method, acromioplasty is slightly more difficult than the deltoid splitting approach insofar as a retractor must be placed over the humeral head to completely expose

the underneath of the acromion. For postoperative pain control, Acetaminophen and a cyclooxygenase-2 selective inhibitor were administered orally until the second postoperative day. From postoperative days 3 to 5, a tablet containing a combination of 25 mg of Tramadol and 325 mg of Acetaminophen was prescribed, along with a cyclooxygenase-2 inhibitor. For additional postoperative pain control beyond that provided by the authors' regular regimen, intramuscular Diclofenac was added if required.

2.2. Postoperative Management

All the patients had an abduction pillow for the first 4 to 6 weeks. Pendulum exercises were performed immediately postoperatively; Passive exercises were performed under supervision of a physiotherapist. Exercises were then advanced to active motion was permitted at the 6th postoperative week. The patients were examined preoperatively and postoperatively using subjective and objective outcome measures. Evaluations were performed with the Constant score, American Shoulder

Category	Points
Pain	
Present all of the time and unbearable, strong medication frequently	1
Present all of the time 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	
Only light activities possible	
Able to do light housework or most activities of daily living	1
Most housework, Shopping, and driving possible; able to do hair and dress and undress, including fastening brassiere	2
Slight restrictions only, able to work above shoulder lever	4
Normal activities	6
Active forward flexion	
>150	8
120-150	4
90-120	3
45-90	2
30-45	1
<30	0
Strength of resisted external rotation	
(Manual testing)	
Grade5 (normal)	5
Grade4 (good)	4
Grade3(fair)	3
Grade2(poor)	2
Grade1 (muscle contraction)	1
Grade0(nothing)	0
Satisfaction of the patient	
Satisfied and better	5
Not satisfied and worse	0
NOTE. UCLA rating results: Poor <21, Fair 22-27, Good 28-33, Excellent 34-35	

Table 1. Modified UCLA Scoring system

and Elbow Surgeons (ASES) score, modified University of California Los Angeles (UCLA) score, and pain visual analog scale by an independent observer (shoulder physiotherapist) (Table 1). The patients rated their pain using a visual analog scale (VAS) - ranging from 0 (no pain) to 10 (unbearable pain) - preoperatively, during the first 48 hours postoperatively, and at 6 weeks and 6 months postoperatively.

3. RESULTS

Eighty patients were included in this study. The mean VAS score in the immediate postoperative pain (at 48 hours) was 6.10 ± 1.87 and the mean VAS score at the 6 weeks was 4.35 ± 1.02 . The mean time for recovering full passive range of motion was 3.5 months. The mean follow-up period was 30.6 months (range, 18-48 months). Two (2.5%) patients with diabetes mellitus developed stiffness, which necessitated 6 months of physiotherapy. There was no permanent stiffness. The mean ASES score improved from 33.56 ± 14.31 preoperatively to 85.64 ± 10.54 postoperatively (At the final follow up) ($P < .01$), and the mean Constant score improved from $39.24 \pm$

	Preoperative	Postoperative	Statistical Measure	P value
Constant score	39.24 ± 18.61	81.46 ± 11.67	Paired t test	($P < .01$)
ASES score	33.56 ± 14.31	85.64 ± 10.54	Paired t test	($P < .01$)
UCLA score	13.0 ± 2.1	32.2 ± 4.1	Paired t test	($P < .01$)

Table 2. Comparisons of Clinical Scores before and after Operation (At the final follow up). * Po 1 = Postoperative, during first 48 hours, Po 2 = Postoperative, at 6 weeks, Po 3 = Postoperative, at 6 months

	Preoperative	Po 1	Po 2	Po 3
PVAS	6.15 ± 2.33	6.10 ± 1.87	4.35 ± 1.02	1.21 ± 1.05

Table 3. Comparisons of PVAS before and after Operation (At the final follow up)

18.61 preoperatively to 81.46 ± 11.67 postoperatively (At the final follow up) ($P < .01$). Follow-up evaluation using the UCLA scores showed that 89% of the patients had good and excellent postoperative scores, with 44 (55%) excellent, 27(34%) good, 7 (9%) fair, and 2 (2%) poor results. Overall, the mean UCLA score rose significantly from 13.0 ± 2.1 preoperatively to 32.2 ± 4.1 postoperatively ($P < .01$) (Table 2). Pain, as measured on the VAS, was improved from 6.15 ± 2.33 preoperatively to 1.21 ± 1.05 postoperatively (at 6 months) ($P < .01$) (Table 3).

Complications

No intraoperative complications were noted. No neurologic compromise was detected in any patient. None of the patients who showed unsatisfactory outcomes on the UCLA scale chose to undergo repeat surgery.

4. DISCUSSION

The most important goals of the rotator cuff surgery are to protect the deltoid, provide adequate subacromial decompression, confer adequate tendon mobilization, and secure the repair of the rotator cuff. These goals can all be achieved via the deltopectoral approach; this modality is easy to perform technically and easy to teach and requires no special equipment. This study is not

reported hitherto. Despite the improvement in surgical techniques and arthroscopic instruments, the cost of arthroscopic shoulder surgery is still high and not affordable by all patients in underdeveloped countries. Therefore, open rotator cuff repair still has a significant place in these situations. Published series of open rotator cuff repair of full-thickness tears have reported good results in 71% to 92% of patients—improving pain, function, and strength (4-12). One disadvantage of the traditional open and mini-open repair is that they may result in shoulder stiffness after surgery, with the incidence ranging between 11% and 20% (1, 4, 16). In our study, however, postoperative shoulder stiffness was reported by 2.5% the patients, both of whom had diabetic mellitus. Also, there were no cases of intractable stiffness. Another disadvantage of the traditional open and mini-open repair is postoperative pain resulting from the detachment of the deltoid from the acromion. Although rare, damage to the deltoid origin remains a problem with open rotator cuff repair by deltoid splitting technique. Deltoid pull-off has no good surgical solution and results in permanent weakness to the shoulder. This can be avoided by using

techniques that do not require the deltoid origin to be taken down. The traditional open rotator cuff repair can also be more painful than the deltopectoral approach. In the immediate postoperative period, pain can adversely affect rehabilitation of the joint. This fact combined with the potential risk of subdeltoid adhesions can result in postsurgical stiffness. Our method appears to confer successful outcomes because of the preservation of the deltoid muscle attachment via the deltopectoral approach. Indeed, the immediate postoperative pain was relatively low in our series of patients. In addition,

isolated subscapularis tears are better repaired through the deltopectoral approach. Liu and Baker (17) repaired 35 full-thickness rotator cuff defects with arthroscopic assistance and a deltoid splitting incision with 85% good and excellent results and 92% patient satisfaction. In a second study by the same authors, no difference in results was reported between open and arthroscopically assisted rotator cuff repairs (12). Outcome studies of the open repair of the rotator cuff display an 88% to 90% success rate (18-20). It has been reported that the preservation of the deltoid muscle attachment is critical to success, and separation of the deltoid insertion from the acromion results in significant deficits in motion and strength (18, 22, 23). Pain in this study was lower than that reported in the study of Cho et al. (24). The deltopectoral approach has its own drawbacks, first and foremost among them are insufficient exposure for posterolateral rotator cuff tears and difficulty for performing acromioplasty.

5. CONCLUSION

At final follow-up visits in the present study, the ASES, Constant score, and UCLA score were found to have improved significantly. Our results indicate that this approach might be a more reliable alternative to most ar-

thoroscopic rotator cuff repairs. It is worthy of note that our objective was simply to assess the clinical results of and patient satisfaction with the use of the deltopectoral approach, and we did not seek to evaluate repair integrity.

Authors' contributions

All authors have read and approved the content of the manuscript. The authors are liable for its content and for having participated in writing and reviewing the text, as well as approving the final version to be submitted. Likewise, we accept the introduction of changes to the content, if necessary subsequent to review, and of changes to the style of the manuscript by the journal's editorial staff.

CONFLICT OF INTEREST: NONE DECLARED.

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