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ORIGINAL STUDY

Outcome of open rotator cuff repair. An analysis of risk factors

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The aim of this study was to evaluate the long-term functional outcome of full thickness rotator cuff tears treated by open repair and acromioplasty and to determine various factors affecting the outcome.

This is a prospective clinical study on 42 patients who underwent full thickness rotator-cuff repair by a single surgeon between 2000 and 2003.

The mean follow-up was 26 months. In patients with massive rotator cuff tear (n = 15), increase in the mean postoperative Constant score was significantly less compared to patients with small and moderate tears ($p < 0.01$). In patients older than sixty years, the improvement in postoperative Constant score was significantly less compared to the rest of the patients ($p < 0.001$). However, the postoperative Constant score significantly improved from the preoperative score in all patient groups ($p < 0.0001$). There was a significant negative correlation with size of cuff tear, age of the patient and Constant-Murley score ($p < 0.05$). Body mass index, smoking, gender, and the duration of symptoms did not have a significant effect on either Constant-Murley score or visual analogue score.

We conclude that older patients and those with massive rotator cuff tear could benefit from surgical intervention, although not as much as younger patients and those with small/moderate size cuff tears.

Key words : shoulder ; rotator cuff ; repair ; risk factors.

INTRODUCTION

Rotator cuff pathology is a common problem in old age. The incidence of rotator cuff tear increases with age *(5, 13)*. The aetiology of rotator cuff tear is multifactorial and it has been mainly attributed to chronic attritional changes from impingement *(10)*. Rotator cuff injury can occur in younger patients and the cause is usually trauma. The patients with rotator cuff tear may have mild shoulder pain with slight loss of function or may even be asymptomatic *(12)*. In some patients the symptoms can be severe progressive shoulder pain, and frequently associated with night pain and severe disability in elevating the arm *(11)*. This is especially true in case of severe rotator cuff tear.

Operative management of rotator cuff tear is usually required in patients with symptoms refractory to a conservative rehabilitation program. This is complicated by the fact that most of these patients are elderly and have many associated medical problems. The selection of operative treatment is also controversial. The operative debridement of rotator cuff tendons with acromioplasty, especially in massive irreparable rotator cuff tear in elderly

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frail patients, has shown promising results *(4, 16)*. However there are few surgeons who recommend open repair of rotator cuff tendons with acromioplasty even in massive rotator cuff tears *(6, 8, 15)*.
In light of all these controversies, we carried out this study to evaluate the results of open repair of full thickness rotator cuff tear with acromioplasty and to analyse various factors associated with a good final outcome.

PATIENTS AND METHODS

This is a prospective analysis of 42 consecutive patients who underwent open repair of the rotator cuff with subacromial decompression between 2000 and 2003. A consultant orthopaedic surgeon with special interest in shoulder surgery performed all the operations. The hospital physiotherapist assessed all the patients pre-operatively using the Constant-Murley scoring system *(3)*. The first author reviewed all the patients independently in a separate follow-up clinic. Forty patients, including one bilateral rotator cuff repair, were seen in the clinic, the remaining two patients could not be contacted. The Constant – Murley scoring system was used for clinical evaluation of the patients. A visual analogue score was used to chart the pain. Informed consent was obtained from all the patients. The second author reviewed the case notes and operation notes independently.

There were 30 males and 10 females. The average age at the time of operation was 64 years (range : 22 to 82). The decision to operate was based on the patient's symptoms, clinical findings and response to conservative treatment. The average follow-up period was 26 months (range : 12 to 50). The involved side was right in 25 patients and left in 15 patients. The operation side was the dominant arm in 38 (92.6%) patients. Sixteen (39%) patients recalled a traumatic event before the onset of symptoms, of which the trauma was severe in two patients in the form of a road traffic accident. The average time interval between operative surgery and onset of symptoms was 56.4 months (range : 6 to 180).

The surgical technique was similar in all cases. All patients had arthroscopy of the shoulder to assess the pathology. The technique includes an anterior shoulder incision with a deltoid split approach elevating the fascia and periosteum off the acromion and clavicle. Division of the coracoacromial ligament, anterior-inferior acromioplasty and excision of the lateral end of the clavicle were performed in all patients. The rotator cuff was repaired and secured to the bone in 36 (85%) patients. A subscapularis flap was required in 3 patients and the closure was incomplete in 2 patients. Re-attachment of deltoid to bone was performed with ethibond sutures in all cases. All patients received a uniform rehabilitation programme after surgery.
At surgery all patients had full thickness rotator cuff tear. The size of tear before mobilisation of tendons was assessed using the Cofield and Lanzer classification system *(2)*. This showed that 5 (12%) patients had small tear (< 1 cm), 9 (21.9%) patients had moderate tear (1-3 cm), 12 (29.2%) patients had large tear (3-5 cm) and 15 (36.4%) patients had massive tear (> 5 cm).

Data were entered into Excel spreadsheet (Microsoft) and statistical analysis was performed using SPSS 12 software. The difference in the pre and post-operative Constant score and visual analogue score were analysed using paired Student t-test. The association between continuous variables and outcome was analysed using the Pearson correlation coefficient. The association between categorical variables and outcome was analysed using the ANOVA test.

RESULTS

The overall mean Constant-Murley score improved significantly from a pre-operative value of 21.3 (range : 0 to 63) to a post-operative value of 66.1 (range : 16 to 98) ($p < 0.001$, paired Student t-test). The visual analogue score for pain improved significantly from a pre-operative value of 7.7 to 2.1 ($p < 0.0001$, paired Student t-test). We had 23 (56%) patients with post-operative Constant score more than 65 and we rated them as excellent or good. A poor result was found in 6 (14%) patients who had a Constant score of less than 50 (fig 1).

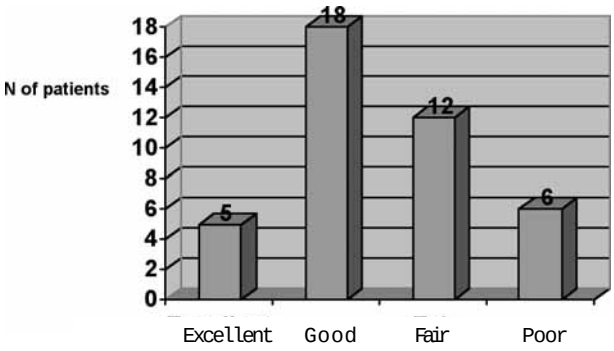

Fig. 1. — The results of treatment based on Constant score. On the X-axis is the number of patients. Excellent (91-100), Good (65-90), Fair (50-64), Poor (0-49).

We divided the patients into two groups. The patients with massive tear (size > 5 cm) were compared (n = 15) with those with tear size less than or equal to 5 cm (n = 26). In patients with massive rotator cuff tear, the mean postoperative Constant-Murley score was 57 (range : 16 to 80) compared to a score of 72 (range : 43 to 91) in the rest (fig. 2). Although the results in patients with tear size more than 5 cm was inferior when compared to patients with tear size less than 5 cm, it showed a statistically significant increase from the mean pre-operative score of 20.3 (range : 0 to 39) ($p < 0.001$, t-test).

We also divided the patients by age to see whether any difference existed. We compared those above 60 years (n = 26) with those below 60 years (n = 15). The mean post-operative Constant score in patients with age above 60 years at surgery was 61 (range : 16 to 85) compared to 76 (range : 55 to 98) for the rest of the patients. This also showed a

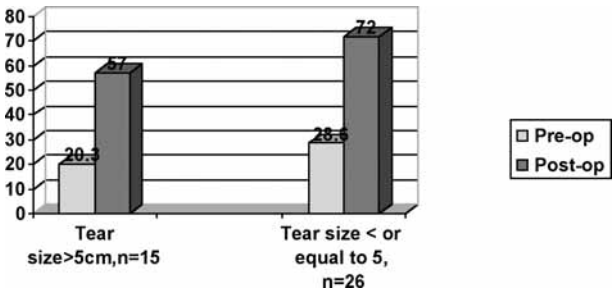

Fig. 2. — Pre- and post-operative mean Constant score in patients with massive rotator cuff tear and the rest of the patients. Y-axis = constant score (0-100).

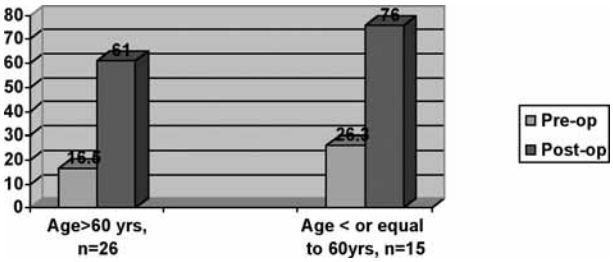

Fig. 3. — Pre- and postoperative mean Constant score in patients with age above 60 years and the rest of the patients. Y-axis=Constant score (0-100).

statistically significant increase from the mean pre-operative score of 16.5 (range : 0 to 48) and 26.3 (range : 7 to 63) respectively ($p < 0.0001$, t-test) **(**fig. 3).

In patients with massive rotator cuff tear, 13 out of 15 were in the age group above 60 years. In patients above 60 years, 13 out of 26 had massive rotator cuff tear. This suggests that the older the age, the more likely it is to have massive tear.

The overall result of surgical treatment as measured by Constant-Murley score was correlated to the size of tear (ANOVA, $p = 0.03$) and also to the age of the patient at surgery (ANOVA, $p = 0.04$). The other factors analysed were continuous variables like, gender, body mass index (BMI), smoking habits and duration of symptoms before the operation. In this series no statistical correlation was found between the above factors and Constant's score ($p > 0.05$).

The anatomic location of tear is as illustrated in table I. There was involvement of all three rotator cuff tendons in 11 (26.8%) patients. There was no immediate post-operative complication. One patient had re-rupture of the tendon within 3 months and she underwent a re-exploration and

Table I. — Anatomical location of rotator cuff tear demonstrated intra-operatively

Location	Number (percentage)
Supraspinatus	14 (34.1%)
Supraspinatus and infraspinatus	15 (36.6%)
Subscapularis	1 (0.2%)
Supraspinatus, infraspinatus and subscapularis	11 (26.8%)

repair. One patient lost his abduction after the operation, from a pre-operative value of 60° to a post-operative value of 30°. He had a massive tear of 8 cm involving all three tendons. Another patient who had a very poor postoperative score of 16 was an 80-year-old gentleman, he also had an 8-cm massive tear involving all three tendons.

The overall patient satisfaction was assessed by asking the patients whether they were satisfied with the surgery and would be ready to undergo this procedure on their opposite shoulder if the same pathology occurred ; all except one patient answered positively (97.6%).

DISCUSSION

The operative management of rotator cuff tear is becoming more and more popular. The increasing life expectancy has led to more elderly patients presenting to orthopaedic surgeons with degenerative rotator cuff problems. The poor vascularity, degeneration and friable nature of rotator cuff tendons in elderly predisposes to tear following trivial trauma. The delayed presentation leads to further retraction of the tendon edges. Older patients are prone to have more severe tendon degeneration hence a bigger size of rotator cuff tear. This is a challenge to any shoulder surgeon.

The result of rotator cuff repair is dependent on multiple factors. The size of the tear *(1)* and the age *(1, 5)* of the patient have been considered to be major negative factor. The management of massive tears in elderly patients has been a controversy. Various authors have described favourable results after debridement of the rotator cuff with subacromial decompression either done open or arthroscopically *(4, 16)*. The comparisons of repair versus debridement have been favourable to repair *(8, 9)*. The long-term results of debridement have been reported unsatisfactory *(8, 9)*. The reason for the better success rate of repair is thought to be due to preservation of continuity and tension in the rotator cuff tendons and hence the biomechanics of glenohumeral joint *(15)*. Lam *et al* *(6)* have suggested a good functional outcome and pain relief after open repair in massive full thickness rotator cuff tear in the elderly.

We could not statistically demonstrate the influence of other independent variables like gender, smoking, duration of symptoms and BMI on the outcome of rotator cuff repair in this study. Although some studies have shown increased risk of rotator cuff related problems in patients with high BMI *(14)* and poor results after rotator cuff repair in smokers *(7)*, our study did not show such effect on surgical repair. A large multi-centre study may be helpful to throw light on this issue.

We feel that although the age and size of tear are significant negative factors, the overall patient satisfaction and pain relief from the procedure together with functional improvement makes open repair of rotator cuff tendon a valuable option in elderly patients. Our study also suggests that age and size of tear go together, hence their negative impact on the result of the repair has an additive effect. The pain relief, especially the relief from night pain and the ability to perform normal day-to-day activities should be the realistic goal in performing this open repair in elderly patients.

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