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ORIGINAL STUDY

Rotator cuff tears in patients younger than 50 years of age

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The purpose of this study was to investigate the characteristics of rotator cuff tears and the clinical outcome of rotator cuff repair in patients under 50 years of age. Sixty-eight patients (72 shoulders) aged < 50 years, who underwent repair of rotator cuff tears were evaluated. We analyzed the cause of injury, tear size, time from symptom onset to surgery, and rate that patients returned to previous jobs and sports. Postoperative results were assessed by pain, strength, range of motion, and UCLA scoring system. Most of the injuries were caused by an unambiguous traumatic event. The tear size generally was medium or large, while the time from symptom onset to surgery was shorter than that seen in a mixed population. The postoperative outcomes generally were good to excellent, and the rate that patients returned to previous jobs and sports was high. The findings suggest that a good outcome after early repair in younger patients with traumatic rotator cuff tears can be expected.

Keywords : rotator cuff tear ; RCT ; RCTs in younger patients.

INTRODUCTION

Rotator cuff tears are fairly common, and their prevalence increases with age (*2,4,5,6,7,9,20*). Numerous studies have reported satisfactory outcomes with regard to the treatment of rotator cuff tears in older patients, including the use of open, mini-open, and arthroscopic techniques (*8,15,16, 18,21*). However, limited information is available regarding the outcome of rotator cuff repair in younger patients (*1,10,12,13,19*).

To the best of our knowledge, degeneration is the predominant pathophysiology of rotator cuff tears in older patients, whereas younger patients often present with traumatic or sports-related injury (*10*). It is reasonable to assume that a younger patient with significant shoulder pain after an unambiguous traumatic event would seek medical help sooner than an older patient with insidious symptom onset. However, there are few reports in the literature that substantiate this hypothesis.

It is tempting to assume that younger patients possess better tendon quality, and, naturally, more tissue healing potential and more favourable outcome following rotator cuff repair. There is no consensus on this statement, however. In fact, Sperling *et al* (*19*) reported that as many as 45% of younger patients have an unsatisfactory long-term

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outcome. On the other hand, Ma *et al* (*13*) reported a more satisfactory outcome in patients younger than 40 years of age compared to that in older patients.

The purpose of this study was to investigate the characteristics of rotator cuff tears, and the clinical outcome following rotator cuff repair in patients under 50 years of age.

PATIENTS AND METHODS

Patients

Between January 2000 and January 2010, 94 patients (98 shoulders) younger than 50 years of age underwent mini-open repair of either incomplete or complete rotator cuff tears. A total of 82 patients (86 shoulders) with complete tears were enrolled in the study. Fourteen patients (17%) were lost to follow-up, and the remaining 68 patients (47 men, 21 women ; 72 shoulders) were evaluated. The patients' average age was 42.3 years (range : 26-49 years), and the average follow-up time was 71 months (range : 18-136 months). Forty-five (62.5%) dominant shoulders and 27(37.5%) non-dominant shoulders were affected. Patients' occupations and sports activities prior to injury were recorded : 13 patients (19.1%) were classified as labourers and 55 patients (60.9%) were classified as having sedentary jobs ; 11 patients participated in overhead athletics (e.g., tennis, ball sports, and swimming) with the affected shoulder.

An unambiguous traumatic event was noted in 53 cases (57 shoulders, or 79.2%), whereas symptomatic onset was insidious in 15 cases (15 shoulders or 20.8%). The mean time from symptom onset to surgery was 47 days (range : 26-73 days). Among the 15 cases with insidious onset, 11 patients were smokers, 2 patients had calcified deposits, 3 patients received prior steroid injection, and 4 patients were regularly involved in overhead activities.

Patients included in the study reported pain and dysfunction, and were diagnosed with full-thickness rotator cuff tears on magnetic resonance imaging (MRI) or sonogram. All MRI scans and sonograms were interpreted by the surgeon as well as a board-certified radiologist.

Operative Technique

All procedures were performed by the same surgeon with the patient in beach chair position under general anaesthesia.

A longitudinal skin incision was used over the anterior corner of the acromion, which extended distally for approximately 3-5 cm. The deltoid muscle was split. The size of the tear was evaluated and classified into 1 of 3 groups : group 1, small (< 1 cm) ; group 2, medium (1-3 cm) ; group 3, large/massive (> 3 cm).

Acromioplasty was performed in all shoulders. Then, the torn rotator cuff tendons were repaired as closely as possible to their normal anatomic footprint positions. Suture anchors (Arthrotek Collarless Harpoon ; Biomet, Inc., Warsaw, IN) were used to reattach the tendons to bone.

Minimal fraying (< 10%) of the long head of the biceps tendon was noted in 5 patients, but no significant pathologic changes, such as tendon subluxation, dislocation, partial tearing, or synovitis changes, were found. Concomitant debridement of the fraying was performed in all 5 patients.

Following surgery, a gradually progressive rehabilitation protocol was followed. During the first 4 weeks after the operation, passive range of motion pendulum exercises were advised with arm sling support. Active assisted forward flexion, external rotation, and abduction range of motion exercises were allowed during the next 4 weeks. Active range of motion was emphasized at the 8-week postoperative follow-up visit. All patients underwent a sonogram at least 1 year after operation.

Grading of Pain, Strength, and Range of Motion

Preoperatively and postoperatively, all patients were evaluated with regard to pain, range of motion, and strength. Pain was evaluated in terms of activities of daily living, and was scored by the visual analog scale (VAS). Strength was evaluated with manual testing of resisted scaption (arm elevation strength in the plane of the scapula at 90° abduction) and resisted external rotation, and was scored on a standard 0-5 scale, in which 5 = normal, 4 = good, 3 = fair, 2 = poor, and 0 = complete paralysis. Range of motion was measured in terms of forward flexion and external rotation, with the arm adducted at the side.

Postoperative function was assessed by means of the University of California-Los Angeles (UCLA) shoulder scoring system : excellent = 34-35, good = 28-33, fair = 21-27, and poor = 0-20.

RESULTS

Of the 72 shoulders, 45 (62.5%) had an excellent outcome, 24 (33.3%) had good, 2 (2.8%) had fair, and 1 (1.4%) had a poor outcome.

Table I. — Correlation between tear size and UCLA scores

Group	Excellent (34-35)	Good (28-33)	Fair (21-27)	Poor (0-20)	Total	Mean UCLA score
1	7	6	0	0	13	31.8
2	18	11	1	0	30	33.2
3	20	7	1	1	29	32.4
Total	45	24	2	1	72	32.6

There were 13 shoulders in group 1, 30 in group 2, and 29 in group 3. The mean postoperative UCLA score across all groups was 32.6 ; group 1 (small tears) had a score of 31.8, group 2 (medium tears) had a score of 33.2, and group 3 (large/massive tears) had a score of 32.4. The differences between these groups was not statistically significant ($P = 0.45$) (Table I).

No patient required revision surgery due to re-tear of the rotator cuff, and there were no infections or significant neurovascular complications.

All patients underwent a sonogram at least 1 year after the operation ; none of which showed evidence of a significant re-tear of the rotator cuff, and most of whom went on to satisfactory outcomes.

Patients who attributed their symptoms to a single traumatic event, such as a fall, and whose shoulders had been asymptomatic prior to the event, represented 79.2% of the total cases. These patients had statistically similar postoperative UCLA scores as those who had an insidious onset of symptoms (57 shoulders ; mean postoperative UCLA score, 32.8 vs 15 shoulders ; mean postoperative UCLA score, 33.3 ; $P = 0.32$).

Among the 15 cases with insidious onset of symptoms, 10 were classified into group 1, 3 into group 2, and 2 into group 3. Fraying of the torn rotator cuff and the undersurface of the coracoacromial ligament was more common in these cases, compared with the cases with traumatic event.

All but 3 patients (65 of 68 ; 95.6%) returned to their previous occupations and sports activities by the last follow-up. Of the 3 patients, 2 were labourers who underwent a traumatic nonathletic event, and 1 had a sedentary job who sustained a sports injury (tennis). The 2 labourers changed their occupations due to fear of re-injury, while the sedentary worker quit his sport due to pain during overhead activity.

The average preoperative pain score was 6 (range, 5-8). Postoperatively, the score decreased significantly to 2.4 overall ($P = < 0.001$). Within the 3 groups, pain also improved significantly postoperatively.

The mean preoperative muscle strength was 3.9 (range, 2-5) in resisted scaption, and 4.0 (range, 3-5) in resisted external rotation. Postoperatively, these scores did not improve significantly overall. In resisted scaption, mean overall strength improved to 4.4 ($P = 0.113$), and, in resisted external rotation, mean overall strength improved to 4.5 ($P = 0.089$). Within the 3 groups, only group 1's strength improved significantly postoperatively in resisted scaption (preoperative, 3.9 vs postoperative, 4.6 ; $P = 0.047$).

The average preoperative forward flexion was 166° (range, 159°-171°), while the average preoperative external rotation was 63° (range, 59°-66°). Overall and within each group, these scores did not improve significantly postoperatively ($P = 0.16$). Overall, forward flexion improved to 169° postoperatively ($P = 0.059$), and external rotation improved to 65° postoperatively ($P = 0$ .124) (Table II).

DISCUSSION

Rotator cuff tears are a well-known cause of shoulder pain and disability. Symptomatic full-thickness rotator cuff tears tend to be found in older patients and are uncommon in younger patients. Cadaveric investigations have demonstrated a high percentage of pathologic changes and cuff tears, especially with advanced age (*3,12,20*). Nobuhara *et*

Table II. — Results in terms of pain, strength and range of motion

		Pre-op	Post-op	p value
Pain (VAS)	Group 1	5.4	1.5	0.008*
	Group 2	6.4	2.4	0.000*
	Group 3	5.9	3.0	0.000*
	Total	6.0	2.4	0.000*
Strength (Resisted Scaption)	Group 1	3.9	4.6	0.047*
	Group 2	4.0	4.5	0.067
	Group 3	3.8	4.3	0.171
	Total	3.9	4.4	0.113
Strength (Resisted External Rotation)	Group 1	4.2	4.6	0.434
	Group 2	4.1	4.5	0.172
	Group 3	3.9	4.5	0.083
	Total	4.0	4.5	0.089
Range of motion (Forward Flexion)	Group 1	169°	173°	.216
	Group 2	166°	168°	.406
	Group 3	164°	167°	.059
	Total	166°	169°	.059
Range of motion (External Rotation)	Group 1	64°	67°	.168
	Group 2	63°	65°	.071
	Group 3	63°	65°	.253
	Total	63°	65°	.124

*$p < 0.05$.

al (*17*) documented that rotator cuff tears in patients under 45 years of age accounted for only 12.3% of their study population. In our institution, between January 2000 and January 2010, the overall number of patients who underwent surgical repair of a torn rotator cuff, performed by a single surgeon, was 817, and only 94 (11.5%) of these patients were younger than 50 years of age.

The aetiology of full-thickness rotator cuff tears in younger, higher-demand patients appears to be trauma with a single unambiguous event (*13*). Similarly, most of the tears in this series were trauma-related, with 57 patients experiencing an unambiguous traumatic event (79.2%).

Marx *et al* (*14*) reviewed 86 published papers and reported that the most frequent duration of non-operative treatment before surgery was a minimum of 3 months. Comparatively, in our series, the time from symptom onset to surgery was remarkably shorter, with an average of 47 days (range : 26-73 days). We speculate that the difference is related to the high incidence of injury by unambiguous events in younger patients, rather than chronic symptoms in an older population.

In recent studies, satisfactory outcomes of rotator cuff repair have been documented in mixed populations, both by means of arthroscopic and open techniques (*1,8,16,21*). Satisfactory outcomes have also been documented in younger patients (*1,13*). The results of the current study, with an overall mean postoperative UCLA score of 32.6, are similarly good.

In our study, all but 3 patients (65 of 68 ; 95.6%) returned to their previous occupations or sports activities by the last follow-up. Of the 3 patients, only one quit his previous sport due to residual postoperative pain. The others changed their occupations due to psychological fear of rotator cuff re-injury. The high rate of returning to pre-injury occupation was similar to other studies : Burns *et al* (*1*) and Krishnan *et al* (*11*) reported that 91.9% and 90% of patients, respectively, returned to their previous level of activity and employment. The patients in their studies were part of a younger population.

Our study found no significant overall post-operative improvement in strength, though the subjective measurement used in our study can imply

bias and unreliability. Sperling *et al* (*19*) found 10 in 29 patients to have normal strength after open repair, and Burns *et al* (*1*) reported that strength improved significantly postoperatively after arthroscopic repair. Further accurate studies with objective measurement are necessary.

There was no significant difference in terms of postoperative range of motion, including both forward flexion and external rotation. We found that the younger patients in this study had almost normal range of motion preoperatively, even with rotator cuff tears.

In contrast to cuff reconstruction with a graft, the advantages of repair surgery include shorter operation time and smaller incision. Good tendon quality and plasticity were found intra-operatively in this study, and the residual tears were limited even in the large or massive tears after surgical repair.

In conclusion, our data demonstrate that rotator cuff tears in patients younger than 50 years of age are usually caused by an unambiguous traumatic event. The tear size generally was medium or large, while the time from symptom onset to surgery was shorter than that seen in a mixed population. In general, the postoperative outcomes were good to excellent, and most patients returned to previous jobs and sports. Our findings suggest that early surgery in younger patients with (usually traumatic) rotator cuff tears yields a good outcome.

REFERENCES

1. **Burns JP, Snyder SJ.** Arthroscopic rotator cuff repair in patients younger than fifty years of age. *J Shoulder Elbow Surg* 2008 ; 17 : 90-96.
2. **Codman EA, Akerson IB.** The pathology associated with rupture of the supraspinatus tendon. *Ann Surg* 1931 ; 93 : 348-359.
3. **Cotton RE, Rideout DF.** Tears of the humeral rotator cuff. *J Bone Joint Surg* 1964 ; 46-B : 314-328.
4. **DePalma AF, Callery G, Bennett GA.** Variational anatomy in degenerative lesions of the shoulder joint. *Instr Course Lect* 1949 ; 6 : 255-281.
5. **DePalma AF, White JB, Callery G.** Degenerative lesions of the shoulder joint at various age groups which are compatible with good function. *Instr Course Lect* 1950 ; 7 : 168-180.
6. **Fukuda H, Hamada K, Yamanaka K.** Pathology and pathogenesis of bursalside rotator cuff tears viewed from en bloc histologic sections. *Clin Orthop Relat Res* 1990 ; 254 : 75-80.
7. **Fukuda H, Mikasa M, Yamanaka K.** Incomplete thickness rotator cuff tears diagnosed by subacromial bursography. *Clin Orthop Relat Res* 1987 ; 223 : 51-58.
8. **Gartsman GM, Khan M, Hammerman SM.** Arthroscopic repair of full-thickness tears of the rotator cuff. *J Bone Joint Surg* 1998 ; 80-A : 832-840.
9. **Grant JCB, Smith GC.** Age incidence of rupture of the supraspinatus tendon. *Anat Rec* 1948 ; 100 : 666.
10. **Hawkins RJ, Morin WD, Bonetti PM.** Surgical treatment of full-thickness rotator cuff tears in patients 40 years of age or younger. *J Shoulder Elbow Surg* 1999 ; 8 : 259-265.
11. **Krishnan SG, Harkins DC, Schiffern SC, Pennington SD, Burkhead WZ.** Arthroscopic repair of full-thickness tears of the rotator cuff in patients younger than 40 years. *Arthroscopy* 2008 ; 24 : 324-328.
12. **Liu SH, Baker CL.** Arthroscopically assisted rotator cuff repair : correlation of functional results with integrity of the cuff. *J Arthroscopy* 1994 ; 10 : 54-60.
13. **Ma HL, Wu JJ, Lin CFJ, Lo WH.** [Surgical treatment of full thickness rotator cuff tears in patients younger than 40 years.] (in Chinese). *Zhonghua Yi Xue Za Zhi (Taipei)* 2000 ; 63 : 452-458.
14. **Marx RG, Koulouvaris P, Chu SK, Levy BA.** Indications for surgery in clinical outcome studies of rotator cuff repair *Clin Orthop Relat Res* 2009 ; 467 : 450-456.
15. **Millar NL, Wu X, Tantau R, Silverstone E, Murrell GA.** Open versus two forms of arthroscopic rotator cuff repair. *Clin Orthop Relat Res* 2009 ; 467 : 966-978.
16. **Murray TF, Lajtai G, Mileski RM, Snyder SJ.** Arthroscopic repair of medium to large full-thickness rotator cuff tears : Outcome at 2- to 6-year follow-up. *J Shoulder Elbow Surg* 2002 ; 11 : 19-24.
17. **Nobuhara K.** *The Shoulder : Its Function and Clinical Aspects*. World Scientific Pub Co Inc, 2003, p 204.
18. **Papadopoulos P, Karataglis D, Boutsiadis A *et al.*** Functional outcome and structural integrity following mini-open repair of large and massive rotator cuff tears : a 3-5 year follow-up study. *J Shoulder Elbow Surg* 2011 ; 20 : 131-137.
19. **Sperling JW, Cofield RH, Schleck C.** Rotator cuff repair in patients fifty years of age and younger. *J Bone Joint Surg* 2004 ; 86-A : 2212-2215.
20. **Yamamoto A, Takagishi K, Osawa T *et al.*** Prevalence and risk factors of a rotator cuff tear in the general population. *J Shoulder Elbow Surg* 2009 ; 19 : 116-120.
21. **Zumstein MA, Jost B, Hempel J, Hodler J, Gerber C.** The clinical and structural long-term results of open repair of massive tears of the rotator cuff. *J Bone Joint Surg* 2008 ; 90-A : 2423-2431.