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Midterm outcomes of arthroscopic rotator cuff repair in patients aged 75 years and older

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Background: Full-thickness rotator cuff tears remain a significant cause of pain and dysfunction in the elderly. Substantial improvement in pain and functional outcomes with arthroscopic cuff repair is possible. Recent data has shown that patients older than 70-75 years still have clinical improvement with operative rotator cuff repair.

Materials and Methods: This is a retrospective study of patients aged ≥75 years undergoing arthroscopic rotator cuff repair at a minimum of 24 months after surgery. Outcome measurements included range of motion (ROM), visual analog scale (VAS) pain scores, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) scores, Single Assessment Numeric Evaluation (SANE) scores, and Short Form Health Survey (SF-12) scores. Reoperation and rates of conversion to reverse shoulder arthroplasty (RSA) were determined.

Results: Eighty-three patients were included with an average follow-up of 56.9 ± 25.9 months (range 24-127 months). Six (7.2%) patients had additional surgery, including 3 revision rotator cuff repairs for retear, 2 conversion to RSA, and 1 capsular release and loose anchor removal. There were statistically significant improvements in shoulder ROM, ASES, SANE, VAS, and SF-12 scores postoperatively.

Conclusion: Rotator cuff repair in select patients aged ≥75 years results in reliable improvements in pain and function. There was a low reoperation rate or conversion to RSA (7.2%) at midterm follow-up. This study indicates a role for rotator cuff repair in an elderly population and argues against the routine use of reverse arthroplasty for repairable rotator cuff tears in this population.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Rotator cuff tear; arthroscopic repair; elderly; shoulder surgery; outcomes; indications

Degenerative rotator cuff tears are common, especially with increasing age. The rate of asymptomatic full-thickness tears in individuals aged ≥70 years is 40%.[7] Arthroscopic cuff repair results in improved function and decreased pain. However, the rate of retear in those aged 60 years or older is high (31%-51%),[3,12] with most retears occurring 3-6 months after repair.[5] Several studies have associated failure of healing with poorer clinical

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results.[6,18] Despite lower healing rates in older patients (51%),[13] a recent study from the United Kingdom showed that patients with an average age of 78 years had outcomes similar to those in their younger peers, with significant improvements in functional outcome scores after arthroscopic repair.[17]

The average age in the United States continues to rise, and patients want to remain more active and functional.[15] The rates of reverse shoulder arthroplasty (RSA) continue to rise in the United States, and indications are continuing to expand.[9] Given concerns for rotator cuff retear in older patients, RSA is sometimes performed for large rotator cuff tears without arthritis in the elderly.[2] Given the implant cost and complication rates associated with RSA, it is important to understand the results and survival rates of alternative treatments such as arthroscopic cuff repair in elderly patients.[1,10]

The purpose of this study was to validate recent literature on successful results of rotator cuff repair in the elderly. The primary outcome of interest for this study was to determine survivorship of arthroscopic rotator cuff repair. Secondary outcomes included functional outcome scores, improvements in pain, and range of motion (ROM). We hypothesized improved clinical outcomes and low rates of conversion to RSA in patients aged 75 years and older undergoing arthroscopic rotator cuff repair.

Materials and methods

Patients were retrospectively identified through a database query of all patients who underwent rotator cuff repair at one institution by 8 fellowship-trained shoulder surgeons from January 2009 through November 2016. Patients with a full-thickness rotator cuff tear were identified by review of the operative report and/or clinic notes. Inclusion criteria consisted of patients aged 75 years and older, traumatic and atraumatic full-thickness rotator cuff tears repaired arthroscopically, and a minimum 2-year follow-up. Partial-thickness cuff tears, active infection, history of arthroplasty on the affected side, open cuff repair, irreparable tears, or those with glenohumeral arthritis were excluded.

Patient demographics including age, sex, and smoking status were recorded (Table I). Tendon involvement, tear size, chronicity of tear, repair construct (ie, single-row repair, transosseous equivalent double-row repair, or arthroscopic transosseous tunnel repair), and number of anchors used for repair were recorded. Rotator cuff tear size was assessed intraoperatively as described by Post et al,[11] measuring the tear in its longest diameter, with a small tear defined as <1 cm, medium tear as <3 cm, large tear as <5 cm, and a massive tear as ≥5 cm.– Tear chronicity was graded as "acute" if the tear occurred as a result of trauma and was repaired less than 12 weeks from injury in a patient with no prior cuff symptoms, "acute on chronic" if the tear occurred as a result of trauma in a patient with cuff-related symptoms prior to the traumatic event. The tear was considered "chronic" if there was either no history of trauma and the patient presented with cuff-related symptoms or a prior traumatic tear that was repaired more than 12 weeks from injury. All patients who underwent cuff repair for chronic tears had a trial of nonoperative management and failure of treatment prior to operative repair. Preoperative ROM measurements (within 6 months before surgery) and postoperative ROM measurements (mean 8.3 ± 22.2, range 3.7-156.4 months) were taken at the last clinic visit the patient was available and included active forward elevation, abduction, and external rotation measurements. All ROM measurements were collected and recorded by the treating surgeon, and a goniometer was not routinely used. Patients were contacted at a minimum of 2 years postoperatively to obtain visual analog scale (VAS) pain score (with 0 being no pain, and 100 being the worst pain imaginable), American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) score, Single Assessment Numeric Evaluation (SANE) score, and Short Form Health Survey physical (SF-12P) and mental (SF-12M) components. Reoperation rates and rates of conversion to RSA were also determined.

All patients included in the study had magnetic resonance imaging evidence combined with physical examination findings of a symptomatic, full-thickness rotator cuff tear. Single- or double-row repairs were used at the surgeon's discretion and were based on the characteristics of the tear. All patients were placed in an abduction sling postoperatively and sent to formal physical

Table I Patient demographics and tear characteristics (N = 110)

Variable	Mean ± SD (range) or n (%)
Age, yr	77 ± 2.6 (75-85)
Sex	
Male	57 (51.8)
Female	53 (48.2)
Follow-up, mo	56.9 ± 25.9 (24-127)
Smoking status	
Current	16 (14.6)
Former	20 (18.2)
Nonsmoker	74 (67.3)
Tear size	
Small/medium	60 (54.5)
Large	28 (25.5)
Massive	22 (22.0)
Tear chronicity	
Acute	34 (30.9)
Chronic	44 (40.0)
Acute on chronic	32 (29.1)
Anchors	3.3 ± 1.5 (1-8)
Repair construct	
Single-row	71 (64.5)
TOE	24 (21.8)
TO	12 (10.9)
Isolated subscapularis repair	3 (2.7)
Tendon involvement	
Supraspinatus	106 (96.4)
Infraspinatus	55 (50.0)
Subscapularis	42 (38.2)
Teres minor	9 (8.2)

TOE, transosseous equivalent repair; *TO*, arthroscopic transosseous repair; *SD*, standard deviation.

therapy or began a home exercise program between 4-6 weeks postoperatively per surgeon preference.

Summary statistics, including means and standard deviations, were calculated. The Shapiro-Wilk test was used to determine normality of data. The Mann-Whitney *U* test was used for comparison of means between unpaired groups with nonparametric data, and the Wilcoxon signed rank test was used for paired groups. Fisher exact test was used for categorical data, and linear regression was used to assess risk factors for revision. All statistics were performed using Stata software (StataCorp, College Station, TX, USA). Significance was set as $P < .05$.

Results

After application of inclusion and exclusion criteria, 110 patients were included. Of the 110 patients, 10 were deceased for reasons unrelated to their shoulder surgery at final outcomes evaluation. Of the remaining 100 patients, 83 patients were available and 17 were unreachable by telephone or e-mail. There were 40 males (48.2%) and 43 females (51.8%), with an average follow-up of 56.9 ± 25.9 months (range 24-127 months). Seventy-seven (77/83, 92.8%) patients were free of revision at final follow-up. Six patients (6/83, 7.2%) had undergone additional surgery. Three patients underwent revision rotator cuff repair for retear at a mean 7.5 months (range, 6-9 months) after the index operation. Two patients underwent RSA at 13.3 and 30.0 months after index rotator cuff repair. One patient underwent arthroscopic capsular release and removal of a loose anchor at 3.7 months after the index rotator cuff repair (Fig. 1).

Of the 77 patients with final follow-up who were free of revision surgery, there were significant improvements in ROM and functional outcome scores. Forward elevation improved an average of 36° (104° to 140°, $P < .0001$), abduction improved an average of 19° (69° to 88°, $P = .0003$), and external rotation improved an average of 7° (34° to 41°, $P = .016$) (Fig. 2). ASES scores improved an average of 41.0 points (45.5 to 86.5, $P < .0001$), SANE scores improved an average of 48.1 (35.6 to 83.7, $P < .0001$), and VAS of pain decreased an average of 43.8 (52.5 to 8.7, $P < .0001$). The SF-12M score improved an average of 3.4 points (51.1 to 54.5, $P = .019$), and the SF-12P score improved an average of 2.7 points (41.6 to 44.3, $P = .0006$) (Fig. 3). There was no association between revision surgery and size of cuff tear ($P = .15$). When small and medium tears were grouped and compared to large and massive tears, there were no statistically significant postoperative differences for ASES (88.9 vs. 82.9, $P = .12$), SANE (86.3 vs. 81.1, $P = .19$), VAS (8.7 vs. 7.0, $P = .62$), SF-12P (44.5 vs. 43.4, $P = .65$), or SF-12M (54.2 vs. 54.8, $P = .79$) scores between tear sizes respectively. On regression analysis, there was no statistical association between reoperation and age, sex, smoking status, tear chronicity, involved tendon (subscapularis, supraspinatus, infraspinatus, teres minor), or number of tendons torn.

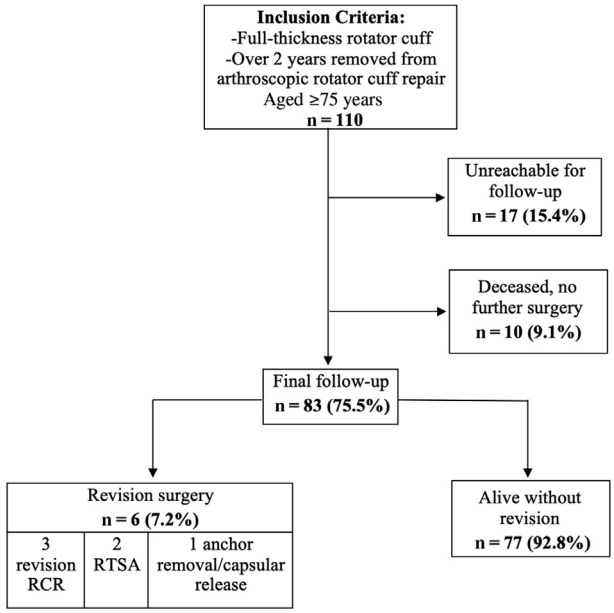

Figure 1 Flowchart of patient inclusion and follow-up. *RCR*, rotator cuff repair; *RSA*, reverse shoulder arthroplasty.

Thirty patients (38.5%) had preoperative pseudoparesis (defined as inability to actively forward elevate past 90°), which improved to 7 (9.5%) patients with pseudoparesis postoperatively (76.7% improved) ($P = .005$). Preoperative pseudoparesis trended toward a statistically lower postoperative ASES score (81.6 vs. 90.2, $P = .06$) and had a statistically significant lower postoperative SANE score (78.8 vs. 88.5, $P = .048$), but had no statistically significant association with postoperative VAS or SF-12 scores. There was also no association between preoperative pseudoparesis and revision surgery.

Discussion

Patients aged ≥75 years with repairable, full-thickness rotator cuff tears can still have a significant clinical benefit from arthroscopic rotator cuff repair. Our study showed significant improvements in ROM, pain, and functional outcome scores at an average follow-up of 5 years. The findings of this study are in line with recent reports of operative repair of rotator cuff tears in the elderly.

Retear after rotator cuff repair is common; however, the association between retear and functional outcomes lacks clarity.[5,6,13] Higher rates of retear (31%-51%) have been described in patients >60 years old.[3,12] Five patients (6.0%) had a symptomatic retear requiring revision cuff repair or RSA in our study. When small and medium tears were grouped and compared to large and massive tears as a group, there were no significant differences in measured outcome scores. This finding highlights overall clinical improvement regardless of tear size. Although prior studies have demonstrated poorer results in the absence of

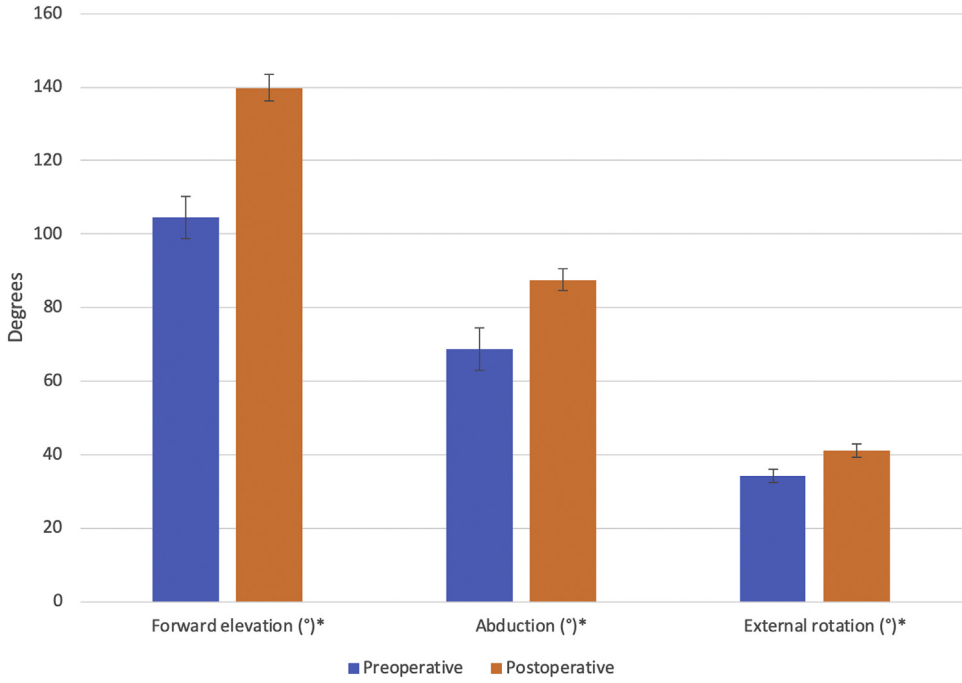

Figure 2 Range of motion outcomes. * Statistically significant difference ($P < .05$).

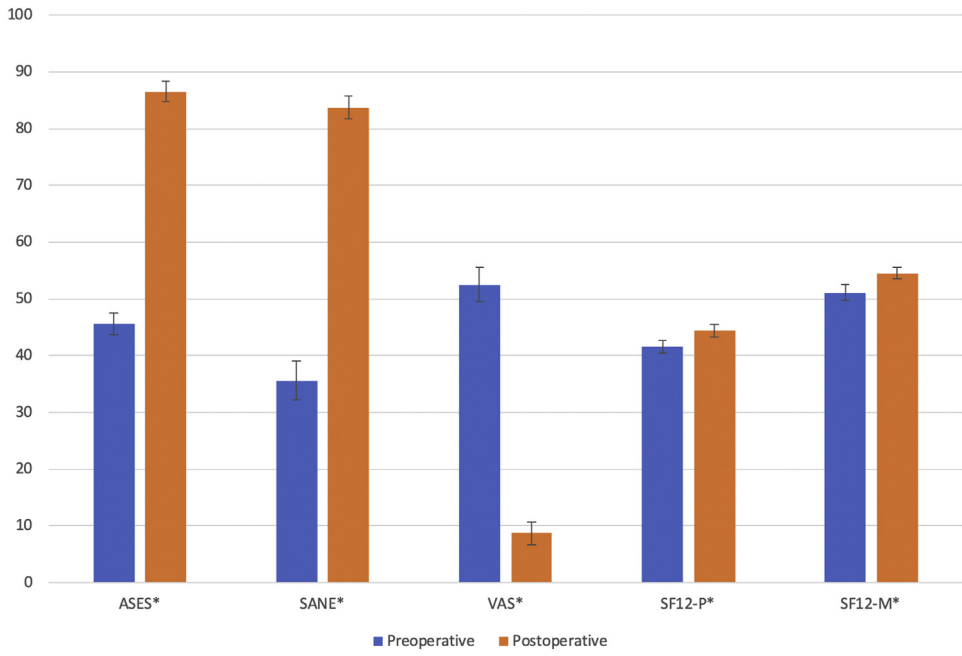

Figure 3 Functional outcomes data. *ASES*, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; *SANE*, single assessment numeric evaluation; *VAS*, visual analog scale; *SF12-P*, Short Form Health Survey Physical Evaluation; *SF12-M*, Short Form Health Survey Mental Evaluation. * Statistically significant difference ($P < .05$).

structural healing,[6,8] our results do not demonstrate measurable differences in outcomes based on tear size.

The rates of RSA for the treatment of rotator cuff tear arthropathy continue to rise, likely due to excellent outcomes in these patients. However, RSA is not without significant surgical risks, including acromial stress fracture, infection, continued pain, polyethylene wear, and aseptic implant loosening.[10] Our cohort consisted of only 2 (2.4%) conversions to RSA, both of which had preoperative massive cuff tears involving 3 tendons. Therefore, we

recommend caution against performing RSA in the setting of a repairable cuff tear in an elderly patient when arthroscopic cuff repair has shown satisfactory healing rates and outcomes.

In line with prior literature, we report substantial improvements in ROM, pain relief, and functional outcomes after rotator cuff repair in patients aged ≥75 years. Witney-Lagen et al[17] compared operative repair of rotator cuff tears in a cohort with an average age of 78 years to their younger counterparts with an average age of 59 years. The authors found significant functional and pain improvements in both groups. Another study by Gwark et al[4] found similar outcomes for arthroscopic cuff repair in the elderly compared with young healthy patients. The authors found a mean improvement in forward elevation of 43°, abduction of 40°, and external rotation of 11°, as well as in VAS score of 2.1 at rest and 5.0 with activity. There were also significant improvements in Constant scores in their cohort of 53 patients aged >70 years.

The definition of pseudoparalysis has been recently debated. According to one systematic review, the definition of pseudoparalysis is most frequently reported in the literature as the inability to actively forward elevate the arm past 90° with retained passive elevation.[14] However, this is actually correctly defined as pseudoparesis, as we have used in the present article. We defined pseudoparesis in the present study as the inability to actively forward elevate the arm past 90° with retained passive elevation. We had a significant improvement in pseudoparesis in our cohort: 30 (38.5%) patients preoperatively to 7 (9.5%) patients postoperatively. This was associated with a significantly lower postoperative SANE score, and a lower ASES score that trended toward significance but was not associated with an increased risk for revision surgery. None of the 7 patients with postoperative pseudoparesis went on to have revision surgery during our study period; however, there is a potential that these patients may require surgery in the future. Although patients with preoperative pseudoparesis had a lower postoperative ASES score, the mean was 81.4, which has been shown in prior studies to indicate a successful outcome.[8] The lack of improvement in the SANE score could be due to the patients' overall perception of their function after surgery.[16]

This study has limitations. The retrospective nature creates a selection bias in which patients with poor tendon quality, rotator cuff atrophy, and medical comorbidities that may preclude healing were excluded. As we do not have complete follow-up on all patients, there is a potential to bias failure rates after surgery. Magnetic resonance imaging was also not available for review to determine rotator cuff integrity and fatty degeneration. Although patients showed good clinical improvement, there is a potential that a number of them did not have healing of the repair yet remained asymptomatic. Outcomes were also not compared to a control group, and patients were instead compared to their preoperative functional status.

Conclusion

Rotator cuff repair in patients aged 75 years and older results in significant improvements in pain, ROM, and functional outcome scores. In our cohort, there was a low rate of reoperation or conversion to arthroplasty (7.2%) at 5-year follow-up. Although there are expanding indications for RSA, successful outcomes and low reoperation rates can be achieved with operative repair of rotator cuff tears in elderly patients without glenohumeral arthrosis.

Disclaimer

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