



Clinical midterm results of arthroscopic rotator cuff repair in patients older than 75 years

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Background: The effect of patient age on functional improvement after arthroscopic rotator cuff repair (ARCR) is still a matter of debate. The purpose of this study was to evaluate the clinical midterm results after ARCR in patients who were 75 years or older at the time of surgery.

Methods: A total of 31 shoulders in 30 patients older than 75 years at the time of surgery underwent ARCR for a degenerative full-thickness rotator cuff tear (RCT) between 2010 and 2016. Among those, 23 shoulders in 22 patients (74%) with a mean age at time of surgery of 77 ± 2 years (range, 75–82 years) were followed up after a mean of 7 ± 2 years (range, 3–9 years). Clinical assessment included the Western Ontario Rotator Cuff (WORC) index as well as patient satisfaction, the Subjective Shoulder Value (SSV), Simple Shoulder Test (SST), and the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) score.

Results: Overall, patient satisfaction was excellent, as everybody stated to be very satisfied with the surgery. Neither any complication nor revision surgery occurred during the study period. At final follow-up, the mean WORC index was $88\% \pm 15\%$. The mean SSV was comparable between the affected shoulder ($90\% \pm 15\%$) and the contralateral side ($87\% \pm 15\%$) ($P = .235$). The mean SST score was 10 ± 2 points and the mean ASES score was 89 ± 17 points.

Conclusion: ARCR for symptomatic RCTs without advanced muscle degeneration in patients older than 75 years at the time of surgery provided good clinical results and high patient satisfaction at midterm follow-up.

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

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Rotator cuff tears (RCTs) are primarily observed in the elderly, with rates lower than 10% in patients younger than 60 years and as high as 80% in those older than 80 years.¹⁸ Surgical treatment for symptomatic RCT is indicated if conservative management fails. During recent decades, rotator cuff repair (RCR) was reserved for younger patients, as intrinsic tissue degeneration along with comorbidities

were considered determinants of repair failures and negligible regain of shoulder function.^{19,27} Nevertheless, as older patients are becoming increasingly active with higher functional demands, treatment strategies have to be reconsidered. The current literature highlights comparable short-term improvements in shoulder function after surgical treatment when compared to a younger population.²⁷ However, concern exists regarding rotator cuff healing and deterioration over time.²

To date, there is a lack of mid- to long-term clinical results following arthroscopic RCR in the elderly. Thus, the purpose of this study was to evaluate postoperative shoulder

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function by assessing both subjective and objective measurements in patients older than 75 years at the time of surgery. We hypothesized that arthroscopic RCR provides good clinical results combined with a high patient satisfaction rate in the elderly at midterm follow-up.

Methods

Study population

In the first step, all patients ($n=1336$) who underwent arthroscopic RCR at a single center (Department for Shoulder and Elbow Surgery, Center for Musculoskeletal Surgery, Charité-Universitätsmedizin Berlin, Germany) for a degenerative full-thickness tear of the supraspinatus tendon with or without concomitant partial tears of the infraspinatus tendon or subscapularis (SSC) tendon between July 2010 and June 2016 were identified from our institutional shoulder database. We then included all patients older than 75 years at the time of surgery with a minimum follow-up of 3 years and prior unsuccessful nonoperative treatment consisting of physical therapy and analgesic medication for at least 3 months. The exclusion criteria were (1) previous surgeries on the affected shoulder, (2) preoperative pseudoparalysis, (3) fatty infiltration of rotator cuff muscles of grade 3 or higher according to Goutallier,¹⁰ and (4) if complete repair was not achieved. Furthermore, patients unable to give informed consent were excluded.

Overall, 31 shoulders in 30 patients (2% of all eligible shoulders) fulfilled the inclusion and exclusion criteria. A total of 8 patients (8 shoulders) were lost to follow-up, as 6 patients died (not shoulder related) and for 2 patients (2 shoulders) the contact information was missing. A total of 23 shoulders (22 patients, 74%) were eligible for final follow-up evaluation after a mean period of 7 ± 2 years (range, 3-9 years). The mean age at time of surgery was 77 ± 2 years (range, 75-82 years), and 14 (64%) were male and 8 (36%) were female. A concomitant partial tear of the infraspinatus tendon was present in 7 (30%) shoulders. The anteroposterior tear size was determined according to Bateman,¹ with RCTs classified as small in 2 shoulders (9%), medium in 15 shoulders (65%), and large in 6 shoulders (26%). Furthermore, tendon retraction was graded using the Patte classification²²; 11 shoulders (48%) were graded as grade 1, 10 (43%) as grade 2, and 2 (9%) as grade 3. A concomitant tear of the SSC tendon was observed in 6 shoulders (26%), graded as type 1 in 2 shoulders and type 2 in 4 shoulders according to Lafosse.¹⁴ The dominant arm was affected in 16 (70%) shoulders, and a total of 5 patients (23%) underwent RCR on the contralateral side. The American Society of Anesthesiologists classification was used to preoperatively evaluate the patient's general health status.¹¹ Overall, 18 patients (82%) were graded as American Society of Anesthesiologists class 2 and 4 patients as class 3 (18%).

All arthroscopic surgeries were performed in the beach-chair position by 2 experienced shoulder surgeons. In all cases, an acromioplasty was performed. The extent of the RCT was determined intraoperatively under direct arthroscopic visualization from a posterolateral portal after débridement of degenerative tendon edges and bursal tissue. The tear size was then measured from anterior to posterior (Bateman classification¹) as well as from medial to lateral (Patte classification²²). Afterwards, a

tenodesis of the long head of the biceps tendon was performed in 7 (30%) shoulders and a tenotomy was done in 13 (57%) shoulders, whereas 3 (13%) patients received no procedure regarding the long head of the biceps tendon because of sufficient tendon quality and stability. In the next step, the SSC tendon was treated. If a partial tear (type 1) was observed, a débridement of both the tendon and the footprint was performed. In the case of a complete tear involving the upper part of the SSC tendon, vertical mattress sutures using a double-loaded suture anchor were accomplished. Based on the surgeon's preference, either a single-row repair (43%) using a modified Mason-Allen suture grasping technique or a double-row repair (57%) using a suture bridge fixation technique was performed to establish a watertight reconstruction of the posterosuperior RCT. A detailed description of the arthroscopic procedures can be found elsewhere.⁸

After surgery, the affected shoulder was placed into an abduction sling for 6 weeks, and passive exercises were immediately started. Active movement and strengthening exercises were permitted after 6 weeks.

Follow-up assessment

In 2019, a telephone consultation was performed to invite each patient to join final follow-up evaluation at our outpatient clinic. If the patient failed to appear personally, a questionnaire-based telephone interview was conducted to inquire patient satisfaction with surgery (1 = very satisfied, 2 = satisfied, 3 = rather satisfied, 4 = rather unsatisfied, 5 = unsatisfied) and if a revision surgery was performed at the affected shoulder, as well as to evaluate shoulder function in terms of the Western Ontario Rotator Cuff index, Simple Shoulder Value (SSV), Simple Shoulder Test, and American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES).^{9,13,16,29} Furthermore, a 10-point visual analog scale (0 = no pain, 10 = maximum pain) was used to rate the individual pain intensity. Further clinical assessment included active range of motion (abduction, flexion, external as well as internal rotation) of both the affected and nonaffected shoulder using a goniometer, which were then graded according to the Constant and Murley Score.³ In terms of written agreement, conventional radiographics (anteroposterior view and axial view) of both shoulders were obtained to evaluate osteoarthritic changes, which were further classified according to Samilson and Prieto.²⁴ If preoperative radiographs were available, the progression of secondary glenohumeral osteoarthritis from pre- to postoperative was assessed by using the Collective Instability Arthropathy²⁰ score.

Statistical analysis

Statistical analyses were performed with IBM SPSS Statistics 24.0 software (IBM, Armonk, NY, USA). A P value $<.05$ was considered significant. Descriptive statistics, including means, standard deviations, and minimum and maximum values of continuous variables, were calculated. The Wilcoxon test was used to compare both clinical and radiologic results between the affected and nonaffected shoulder as well as radiographics from pre- to postoperative. Either the Kruskal-Wallis test or the Mann-Whitney U test was used to compare clinical measures between subgroups. The Spearman rank correlation was performed in

order to correlate clinical results with radiologic findings at final follow-up.

Results

Although 17 patients (18 shoulders) completed clinical evaluation at our institution, a total of 5 patients (5 shoulders) were available for a complete telephone interview. Overall, none among the study population had to undergo revision surgery, and no complication occurred. At final follow-up, 100% of the patients were very satisfied with the functional outcome.

The mean Western Ontario Rotator Cuff index of the affected shoulder was $88\% \pm 15\%$ (range, 49%-100%), the mean SSV $90\% \pm 15\%$ (range, 40%-100%), the mean Simple Shoulder Test score was 10 ± 2 points (range, 2-12 points), the mean ASES score 89 ± 17 points (range, 37-100 points), and the mean visual analog scale score 0.8 ± 2.3 points (range, 0-8 points). There was no significant difference with regard to both the SSV ($87\% \pm 15\%$; $P = .235$) and visual analog scale score (1.0 ± 2.0 points; $P = .634$) compared with the non-affected shoulder. The range of motion of both the affected shoulder and the contralateral side are summarized in Table I without any significant differences. Overall, tear size did not affect postoperative shoulder function (Table II). Furthermore, no significant differences regarding clinical outcome scores were found between single-row and double-row repairs (Table II).

In total, conventional radiographics were performed at final follow-up in 14 shoulders (61%). The Collective Instability Arthropathy score progressed significantly from a preoperative 0.4 ± 0.5 (range, 0-1) to the postoperative 1.2 ± 0.4 (range, 1-2) ($P < .05$). At final follow-up, there was no significant difference between the affected and nonaffected shoulder (mean Collective Instability Arthropathy score, 1.1 ± 0.6 ; range, 0-2) ($P = .414$) (Fig. 1). Although not statistically significant, a tendency of functional impairment with severity of secondary glenohumeral osteoarthritis was observed (Western Ontario Rotator Cuff index: $R = -0.195$, $P = .504$; SSV: $R = -0.230$, $P = .428$; Simple Shoulder Test score: $R = 0.555$, $P = .051$; ASES score: $R = -0.324$, $P = .259$).

Discussion

The main finding of this retrospective study was that arthroscopic RCR for the treatment of symptomatic RCTs in patients older than 75 years at the time of surgery provided good clinical midterm results. Furthermore, patient satisfaction at the time of final follow-up was excellent, and neither any complication nor revision surgery was observed during the study period. Nevertheless, a significant progression of secondary glenohumeral osteoarthritis occurred. Nevertheless, in our case series, no impact on functional

Table I Postoperative range of motion

Variable	Follow-up		P value
	Affected arm (n = 23)	Nonaffected arm (n = 23)	
Flexion (points)	10 ± 1	9 ± 2	.285
Abduction (points)	9 ± 2	9 ± 2	.680
Internal rotation (points)	8 ± 1	9 ± 2	.796
External rotation (points)	9 ± 2	9 ± 3	.317

Data are reported as mean \pm standard deviation (Constant score points).

Table II Clinical results at final follow-up

Variable	WORC, %	SSV, %	SST, points	ASES, points
Overall (n = 23)	88 ± 15	90 ± 15	10 ± 2	89 ± 17
Tear size ¹				
Small (n = 2)	99 ± 1	95 ± 7	11 ± 1	100 ± 0
Medium (n = 15)	88 ± 15	91 ± 16	10 ± 2	89 ± 15
Large (n = 6)	85 ± 16	88 ± 14	9 ± 4	86 ± 25
P value	.551	.947	.876	.627
Tear morphology				
SSP (n = 10)	86 ± 17	88 ± 17	10 ± 2	87 ± 17
SSP + ISP (n = 7)	92 ± 10	91 ± 15	9 ± 4	87 ± 25
SSP + SSC (n = 6)	89 ± 16	93 ± 8	10 ± 2	95 ± 5
P value	.761	.832	.683	.596
Fixation technique				
SR (n = 10)	92 ± 8	95 ± 5	10 ± 2	95 ± 4
DR (n = 13)	85 ± 18	87 ± 18	9 ± 2	85 ± 22
P value	.648	.446	.738	.446

SSP, supraspinatus tendon; ISP, infraspinatus tendon; SSC, subscapularis tendon; SR, single-row; DR, double-row; WORC, Western Ontario Rotator Cuff Index; SSV, Subjective Shoulder Value; SST, Simple Shoulder Test; ASES, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form.

Data are reported as mean \pm standard deviation.

outcome scores was found. To our knowledge, this is the first study investigating functional midterm results in the elderly after arthroscopic RCR.

Although short-term clinical results after arthroscopic RCR in patients older than 70 years have been proven to be very good, concerns exist regarding its midterm effectiveness. It is generally accepted that surgical repair is preferable to decompression without repair in patients with high functional demand, regardless of patient age.⁶ Therefore, watertight RCR in the elderly should be considered if conservative management fails. A number of studies have

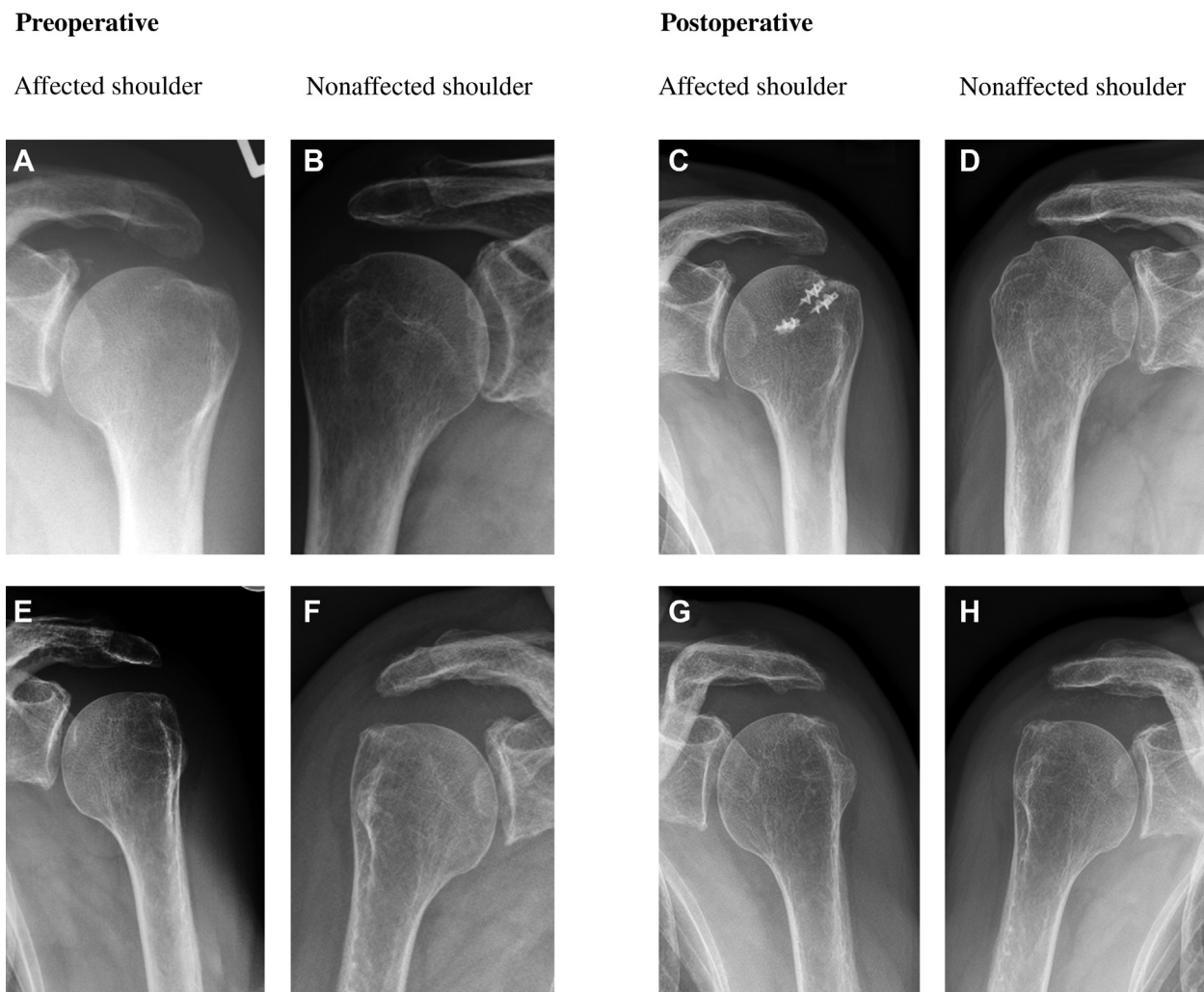


Figure 1 Pre- and postoperative (8-year follow-up) radiographs of both the affected shoulder and the contralateral side. Top row: (A, B) A 77-year-old male patient who underwent arthroscopic rotator cuff repair (ARCR) for an anterosuperior tear of the left shoulder in 2011. After 6 months, an arthroscopic débridement with tenotomy of the long head of the biceps tendon was performed on his right shoulder because of an irreparable massive rotator cuff tear. (C, D) At final follow-up, radiographs show a mild progression of secondary glenohumeral osteoarthritis at the left shoulder, whereas superior migration of the humeral head was observed at the right side, indicating a cuff tear arthropathy. The Simple Shoulder Value was 90% for the left shoulder and 50% for the right side. Bottom row: (E, F) An 81-year-old female patient who underwent ARCR for a tear of the supraspinatus tendon in the left shoulder in 2010. No surgery was performed on the contralateral side. (G, H) No progression in glenohumeral osteoarthritis was seen in both shoulders, and the SSV was reported as 90% for both sides.

demonstrated both good to excellent clinical results and a high patient satisfaction in the short-term follow-up.^{26,28} Furthermore, complete healing in the short-term follow-up can be achieved with regularity,^{5,6,23} with failure rates comparable to those in younger patients.¹⁷

Regarding patient age at time of surgery, we chose a very demanding study population with a mean patient age of 77 years. In all patients, conservative treatment had failed and surgical treatment was subsequently indicated to prevent further tear progression. Beyond patient age, increasing tear size and muscle degeneration in particular impair the opportunity to achieve complete repair and good

rotator cuff healing rates.^{12,25,31} Thus, in older patients too, preoperative workup and patient selection are key to ensuring patients have a better chance achieving good clinical results. A recent study by Padaki et al²¹ underlined the importance of preoperative optimization of pulmonary and urinary care, showing how perioperative complications in patients older than 65 years are twice as common as those found in younger patients. The majority of our study cohort was preoperatively in good health and physically active.

Shoulder function was found to be very good, and patient satisfaction was very high at midterm follow-up.

Those findings are in accordance with Levy et al,¹⁵ who found satisfying midterm results in patients with a mean age beyond 60 years. A study by Yel et al³⁰ highlighted good clinical results in patients older than 65 years 9 years after open RCR. A prospective study by Dezaly et al⁴ comparing the treatment of repairable supraspinatus tendon tears with both isolated acromioplasty and biceps tenotomy in a population older than 60 years found that tendon repair yields significantly better functional outcome, especially in patients with ultrasonography-confirmed tendon healing. We might summarize that the elderly also ultimately benefit from arthroscopic RCR in terms of sustained functional improvement, pain relief, and satisfaction.

Unfortunately, we did not evaluate tendon integrity at final follow-up. This was mainly based on the patient's noncompliance with further time-consuming diagnostics. In spite of that, conventional radiographics were used to assess the development and progression of secondary glenohumeral osteoarthritis, which was recently found to be a major long-term issue after RCR. Flurin et al⁷ found that, among other factors, patient age and initial tear size were significantly associated with the severity of osteoarthritic changes at long-term follow-up. A further key determinant was tendon integrity, as repair failures increased the risk for progressive secondary osteoarthritis. In our study population, a significant increase from the pre- to postoperative state was found. The severity of osteoarthritis deteriorated by 1 stage in 79%. Nevertheless, this progression might rather be the natural course in that period of one's life than secondary to a persistent rotator cuff lesion, as similar progression was detected for the nonaffected shoulder. Further studies are necessary to specify this crucial long-term issue. A further limitation of the presented study has to be mentioned. The retrospective design was at fault for the lack of preoperative data, including shoulder function, objective and subjective scores, as well as tear-specific characteristics like fatty infiltration of the rotator cuff.

Finally, people grow older and an increasing functional demand in the elderly is observed, both overcoming the stigmatized perception of the surgeon in this population, and thus, it is of importance to not merely focus on chronological age but rather engage in individualized therapeutic approaches.

Conclusion

Arthroscopic RCR provided excellent subjective clinical midterm results in the elderly. Furthermore, patient satisfaction was very high, and neither any complication nor revision surgery was observed during the follow-up period.

Disclaimer

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