Research Article / Araştırma Makalesi
doi: 10.18678/dtfd.1718669

Duzce Med J, 2025;X(X):X-X
Düzce Tıp Fak Derg, 2025;X(X):X-X

Short-Term Outcomes of Reverse Shoulder Arthroplasty in Patients with Cuff Tear Arthropathy and Complex Proximal Humerus Fractures

Manşet Yırtığı Artropatisi ve Kompleks Proksimal Humerus Kırıkları Olan Hastalarda Ters Omuz Artroplastisinin Kısa Dönem Sonuçları

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ABSTRACT

Aim: This study aimed to evaluate the short-term clinical and functional outcomes of reverse shoulder arthroplasty (RSA) in patients with cuff tear arthropathy and complex proximal humeral fractures.

Material and Methods: A retrospective review was conducted on 15 patients who underwent RSA between January 2019 and July 2024 at a single tertiary center. Clinical evaluations were performed preoperatively and at 3 and 6 months postoperatively. Pain was assessed using the visual analog scale (VAS), and functional status was measured using the quick disabilities of the arm, shoulder and hand (Quick DASH) questionnaire. Shoulder range of motion (ROM) was recorded in abduction, flexion, and external rotation. Internal rotation was assessed by the vertebral level reached.

Results: The mean age was 74.3±6.8 years, and 80% (n=12) of the patients were female. Cuff tear arthropathy was the most common indication (86.7%, n=13). At 6 months postoperatively, the mean VAS score improved significantly from 7.9±1.2 to 2.3±1.1 ($p<0.001$), while the Quick DASH score decreased from 78.2±6.5 to 27.6±9.3 ($p<0.001$). Abduction and flexion increased from 68.4±17.3° and 71.2±16.1° to 115.6±21.2° and 105.7±18.5° postoperatively, respectively ($p<0.001$). No major complications were observed during follow-up.

Conclusion: RSA provides substantial short-term improvements in pain reduction, functional capacity, and ROM in a rare and complex patient group. These findings support its use as a reliable surgical option in carefully selected cases with irreparable rotator cuff pathology and complex fractures.

Keywords: Reverse shoulder arthroplasty; cuff tear arthropathy; proximal humerus fracture; range of motion; short-term outcomes.

ÖZ

Amaç: Bu çalışmanın amacı, manşet yırtığı artropatisi ve kompleks proksimal humerus kırıkları olan hastalarda ters omuz artroplastisinin (TOA) kısa dönem klinik ve fonksiyonel sonuçlarını değerlendirmektir.

Gereç ve Yöntemler: Ocak 2019 ile Temmuz 2024 tarihleri arasında üçüncü basamak bir tek merkezde TOA uygulanan 15 hastanın verileri geriye dönük olarak incelendi. Klinik değerlendirmeler ameliyat öncesinde ve ameliyat sonrası 3. ve 6. aylarda yapıldı. Ağrı, görsel analog skala (visual analog scale, VAS) ile değerlendirildi ve fonksiyonel durum quick disabilities of the arm, shoulder and hand (Quick DASH) anketi ile ölçüldü. Omuz eklem hareket açıklığı (range of motion, ROM) için abdüksiyon, fleksiyon ve dış rotasyon kaydedildi. İç rotasyon, ulaşılan vertebral seviyeye göre değerlendirildi.

Bulgular: Ortalama yaş 74,3±6,8 yıl olup, hastaların %80'i (n=12) kadındı. En sık endikasyon manşet yırtığı artropatisi idi (%86,7, n=13). Ameliyat sonrası 6. ayda ortalama VAS skoru 7,9±1,2'den 2,3±1,1'e anlamlı şekilde iyileşirken ($p<0,001$), Quick DASH skoru 78,2±6,5'ten 27,6±9,3'e geriledi ($p<0,001$). Ameliyat sonrası abdüksiyon ve fleksiyon 68,4±17,3° ve 71,2±16,1°'den sırasıyla 115,6±21,2° ve 105,7±18,5°'ye yükseldi ($p<0,001$). Takip sırasında herhangi bir majör komplikasyon gözlenmedi.

Sonuç: TOA, nadir ve karmaşık bir hasta grubunda ağrı azalması, fonksiyonel kapasite ve ROM açısından kısa vadeli önemli iyileşmeler sağlamaktadır. Bu bulgular, onarılamaz rotator manşet patolojisi ve karmaşık kırıkları olan, özenle seçilmiş vakalarda güvenilir bir cerrahi seçenek olarak kullanımını desteklemektedir.

Anahtar kelimeler: Ters omuz artroplastisi; manşet yırtığı artropatisi; proksimal humerus kırığı; eklem hareket açıklığı; kısa vadeli sonuçlar.

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Received / Geliş Tarihi : 12.06.2025
Accepted / Kabul Tarihi : 06.09.2025
Available Online /
Çevrimiçi Yayın Tarihi : 01.10.2025

INTRODUCTION

The shoulder joint, with its wide range of motion (ROM) and complex biomechanical structure, is highly susceptible to both traumatic and degenerative pathologies. Conditions such as rotator cuff insufficiency, complex proximal humeral fractures, advanced arthropathy, and failed shoulder arthroplasties often result in significant functional limitations and deterioration in quality of life. In these scenarios, anatomical total shoulder arthroplasty may be insufficient, necessitating alternative prosthetic approaches (1-4).

Reverse shoulder arthroplasty (RSA) is a non-anatomical prosthetic system designed to utilize the deltoid muscle as the primary motor unit. By altering glenohumeral biomechanics, RSA can provide joint stability and functional ROM even in the absence of a functional rotator cuff (5,6). Although RSA is increasingly recognized in orthopedic practice, it remains a relatively rare procedure, typically reserved for select clinical indications such as cuff tear arthropathy, complex fractures, tumor-related reconstructions, and revision arthroplasties (7). Consequently, clinical and functional data on this patient population remain limited.

While the literature has demonstrated the efficacy of RSA in reducing pain, improving function, and restoring mobility, the generalizability of these outcomes is constrained by variability in sample sizes, surgical indications, and follow-up durations across studies (8-10). Moreover, the sustainability of early functional gains and their impact on patient satisfaction remain areas of ongoing debate.

Globally, RSA accounts for approximately 10-15% of all shoulder arthroplasty procedures, while in Türkiye, this rate is even lower. Indications such as cuff tear arthropathy and complex proximal humeral fractures are considered relatively uncommon, and the surgical management of these cases is technically demanding. Advanced age, multiple comorbidities, and a history of previous surgeries further increase the complexity of this patient population. Therefore, patients undergoing RSA for these indications can be regarded as both “rare” and “challenging” within clinical practice (3,4,9).

The aim of this study was to evaluate the short-term clinical outcomes of RSA by comparing preoperative and postoperative 3- and 6-month pain levels, functional scores, and active ROM in a cohort of patients. These findings are expected to contribute valuable insight into the early efficacy of RSA in a rare but clinically relevant patient population.

MATERIAL AND METHODS

Study Design and Ethical Approval

This retrospective, single-center observational study was conducted at the orthopedic surgery department of a tertiary university hospital. Data were collected from the institutional electronic medical record system for patients who underwent RSA between January 2019 and July 2024. Ethical approval for the study was obtained from the Non-Interventional Clinical Research Ethics Committee of Düzce University (Approval No: 231 Date: 18.112024), and the study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants prior to surgery, and all personal data were anonymized and handled in compliance with national privacy regulations.

Patient Selection and Inclusion Criteria

A total of 21 patients were initially evaluated for eligibility. Inclusion criteria were: i) irreparable rotator cuff tear with glenohumeral arthropathy, ii) complex proximal humeral fracture with secondary degenerative changes, or iii) failure of a previous shoulder arthroplasty requiring revision with RSA. Patients were excluded if they had an active shoulder infection, underwent tumor-related resection, had incomplete follow-up (<6 months), or lacked sufficient clinical documentation. Six patients were excluded in total: four due to incomplete follow-up data, one due to active infection, and one due to insufficient documentation. Consequently, 15 patients were included in the final analysis. Baseline demographic and clinical characteristics, including age, sex, smoking status, surgical side, indication for RSA, comorbidities, and American Society of Anesthesiologists (ASA) classification (11), were extracted from the medical records.

Surgical Technique

All procedures were performed by the same senior orthopedic surgeon using a standardized operative protocol. Patients were placed in the lateral decubitus position under general anesthesia. A deltopectoral approach was used in all cases. The subscapularis tendon was released at its insertion to gain access to the glenohumeral joint. Glenoid preparation included concentric reaming, followed by placement of a baseplate and glenosphere, with cement fixation used when bone quality was deemed inadequate. On the humeral side, canal preparation was performed in retroversion alignment, and a metaphyseal-fitting stem was implanted. The type and size of prosthesis components were selected intraoperatively based on trial reductions and soft tissue balance. All patients received the same RSA system (Next® Shoulder System, Next Shoulder Solutions, Ankara, Türkiye), ensuring uniformity in implant design across the cohort. Intraoperative fluoroscopy was used to confirm proper implant positioning and stability. The deltopectoral interval was closed in layers, and patients were placed in an abduction sling postoperatively (12). Postoperative rehabilitation followed a standardized protocol. All patients used an immobilization sling for 3 weeks. Passive ROM exercises were initiated in week 3, and active-assisted exercises were started at week 6 under the supervision of a physical therapist (13). Pre- and postoperative radiographs of a patient were shown in Figure 1.

Clinical and Functional Assessment

Clinical assessments were conducted at three different time points, preoperatively, and at 3 and 6 months postoperatively, with the measurements of pain intensity, functional outcomes, and ROM values. Pain intensity was

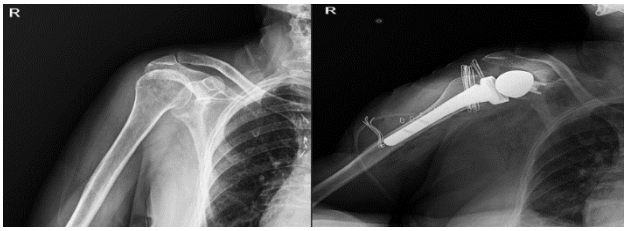

Figure 1. A sample pre- and postoperative radiographs of the right shoulder

assessed using the visual analog scale (VAS), ranging from 0-no pain to 10-worst possible pain (14). Functional outcome was measured using the quick disabilities of the arm, shoulder and hand (Quick DASH) questionnaire, a validated tool for upper extremity function (15). ROM was evaluated in four directions: active abduction, flexion, external rotation (with the arm at the side), and internal rotation (documented by the vertebral level reached with the thumb behind the back) (13).

All clinical measurements were performed by the same physiotherapist using a standard goniometer, and the same assessment protocol was used for all time points.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were reported as mean±standard deviation for continuous variables and as frequencies and percentages for categorical variables. The distribution of continuous variables was assessed using the Shapiro-Wilk test, supported by visual inspection of histograms and Q-Q plots. For normally distributed variables, preoperative and postoperative comparisons were performed using paired-sample t-tests. A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

A total of 15 patients who underwent RSA were included in the study. The mean age was 74.3±6.8 years, and the majority of the patients were female (80%, n=12). The right side was operated on in 66.7% (n=10) of cases, and the surgery involved the dominant extremity in 60% (n=9) of the patients. Five (33.3%) patients reported a history of smoking. The primary surgical indication was cuff tear arthropathy (86.7%, n=13), followed by complex proximal humeral fractures (13.3%, n=2). Three (20%) patients were ASA I, 9 (60%) patients were ASA II, and 3 (20%) patients were ASA III (Table 1).

Postoperative functional and pain outcomes showed a significant improvement over time (Table 2). The mean preoperative VAS score was 7.9±1.2, which significantly decreased to 4.1±1.4 at the 3rd postoperative month and further to 2.3±1.1 at the 6th month (p<0.001). Similarly, the Quick DASH score demonstrated a substantial functional gain, improving from a preoperative mean of 78.2±6.5 to 42.3±10.2 at the 3rd month, and reaching 27.6±9.3 at the 6th postoperative month (p<0.001).

ROM also improved significantly. The mean shoulder abduction increased from 68.4±17.3° preoperatively to 115.6±21.2° at 6 months postoperatively (p<0.001). Similarly, mean flexion improved from 71.2±16.1° to 105.7±18.5° (p<0.001). Among patients with available data, external rotation improved from a mean of 15.6±8.2° to 35.4±12.1° at 6 months (p=0.002). Internal rotation showed a functional gain from the sacral level to approximately L1 level, though it was not statistically quantified (Table 3).

Table 1. Demographic and clinical characteristics of the patients (n=15)

Age (years), mean±SD	74.3±6.8
Gender, n (%)	
Female	12 (80.0)
Male	3 (20.0)
Smoking history, n (%)	5 (33.3)
Operated side, n (%)	
Right	10 (66.7)
Left	5 (33.3)
Surgery on dominant side, n (%)	9 (60.0%)
Indication for surgery, n (%)	
Cuff tear arthropathy	13 (86.7)
Complex fracture	2 (13.3)
ASA Classification, n (%)	
I	3 (20.0)
II	9 (60.0)
III	3 (20.0)

SD: standard deviation, ASA: American Society of Anesthesiologists

DISCUSSION

In this study, the short-term clinical and functional outcomes of RSA in a cohort of 15 patients with cuff tear arthropathy and complex proximal humeral fractures were evaluated. The findings revealed a significant reduction in pain levels, improvements in functional status as measured by the Quick DASH score, and meaningful gains in shoulder ROM over the first six postoperative months. These results support existing evidence that RSA is an effective surgical strategy in cases where conventional anatomic arthroplasty is either contraindicated or predictably insufficient (5,16,17).

The present study focused on a relatively uncommon and clinically demanding patient population. RSA accounts for approximately 10-15% of all shoulder arthroplasties worldwide, and the proportion is even lower in Türkiye. Most of the patients in this study were elderly with multiple comorbidities, advanced cuff tear arthropathy, or complex proximal humeral fractures, all of which increase

Table 3. Changes in shoulder ROM from preoperative to postoperative 6th month

ROM Parameter	Preoperative	Postoperative 6th month	p
Abduction (°)	68.4±17.3	115.6±21.2	**<0.001**
Flexion (°)	71.2±16.1	105.7±18.5	**<0.001**
External rotation (°)	15.6±8.2	35.4±12.1	**0.002**
Internal rotation*	Sacral	L1 vertebral	—

ROM: range of motion, *: internal rotation was recorded as the vertebral level reached with the thumb behind the back

Table 2. Comparison of VAS and Quick DASH scores over time

	Preoperative	Postoperative 3rd month	Postoperative 6th month	p*
VAS, mean±SD	7.9±1.2	4.1±1.4	2.3±1.1	**<0.001**
Quick DASH, mean±SD	78.2±6.5	42.3±10.2	27.6±9.3	**<0.001**

VAS: visual analog scale, DASH: disabilities of the arm, shoulder and hand, SD: standard deviation, *: p-value of paired t-test compared preoperative and postoperative 6th month

surgical complexity. These factors justify the description of this cohort as both 'rare' and 'challenging' in the clinical setting (3,4,9).

RSA offers a mechanical advantage by converting the shoulder joint into a semi-constrained articulation that relies on the deltoid muscle for active motion, thereby compensating for irreparable rotator cuff dysfunction. Numerous studies have demonstrated its efficacy in restoring function and alleviating pain in such patients (7,18,19). In the present study, the Quick DASH score decreased by approximately 65% at the six-month mark, which is consistent with findings by Bacle et al. (20), who noted that functional improvements typically plateau after the first six months postoperatively.

Pain relief was also notable. The mean VAS score dropped from 7.9 preoperatively to 2.3 at six months, confirming RSA's effectiveness in pain management. These outcomes are in line with reports by Boileau et al. (21) and Zumstein et al. (22), who highlighted early and sustained analgesic effects following RSA.

Shoulder mobility, particularly in abduction and flexion, showed substantial postoperative improvement, reaching mean values of 115° and 105°, respectively, by the sixth month. These levels of motion are generally sufficient for basic daily activities, especially in elderly patients with reduced physical demand (23). External rotation also improved significantly, although internal rotation, measured by vertebral level, was not suitable for statistical analysis. Limitations in external rotation gains may be related to variations in subscapularis integrity and the biomechanics of prosthesis design (24,25). When outcomes were analyzed by indication, patients with cuff tear arthropathy demonstrated consistent improvements in pain and functional scores, while those with complex proximal humeral fractures also benefited from significant pain relief. However, ROM assessment in the fracture subgroup was more limited, reflecting the inherent difficulties of postoperative rehabilitation in these cases.

Although RSA is a technically demanding procedure, complication rates in the current series were low. No major complications such as dislocation, infection, or periprosthetic fracture were observed during the six-month follow-up. This contrasts with published complication rates ranging from 10% to 25% in broader cohorts (10,26-28). We attribute our favorable safety profile to careful patient selection, standardized surgical technique, and adherence to a structured postoperative rehabilitation protocol. Nonetheless, some complications, particularly mechanical loosening or scapular notching, may manifest later and thus necessitate longer-term surveillance. Technical challenges were also encountered, including poor bone quality, glenoid medialization, and the need to balance soft tissues in elderly patients. Such intraoperative considerations highlight the demanding nature of RSA in this context, and careful surgical planning was critical to achieving stable fixation and satisfactory postoperative outcomes.

Importantly, the majority of our patients were classified as ASA II-III, indicating a population with considerable anesthetic and perioperative risk. Despite this, significant improvements in pain, function, and mobility were achieved, supporting the feasibility of RSA even in medically fragile patients when perioperative care and rehabilitation are optimized.

This study has several limitations. First, the sample size was relatively small (n=15), which may limit the generalizability of the findings and precluded a formal power analysis. Second, the retrospective design is subject to selection and reporting biases, despite standardized data collection. Third, although outcomes were presented separately for cuff tear arthropathy and fracture subgroups, the low number of fracture patients restricted the strength of subgroup comparisons. Fourth, the follow-up period was restricted to six months, preventing assessment of long-term prosthesis survival, durability of functional gains, radiographic changes such as scapular notching, and late-onset complications. Fifth, ROM evaluation was incomplete in some fracture patients due to postoperative restrictions, which may have led to underestimation of true functional recovery. Sixth, internal rotation was assessed qualitatively using vertebral level, which may lack sensitivity and limit comparative analysis. Additionally, no standardized patient-reported satisfaction scale (e.g., Likert-type global rating) was employed. Finally, all surgeries were performed at a single center by a single surgical team, which may enhance procedural consistency but limit external validity.

CONCLUSION

This study adds to the growing body of evidence supporting RSA as a reliable treatment option for complex shoulder conditions, particularly in cases of cuff tear arthropathy and proximal humeral fractures. Despite the study's limitations, including a small sample size, short-term follow-up, and single-center design, findings suggest that RSA can provide significant pain reduction, functional improvement, and restoration of shoulder mobility within a relatively short postoperative period. These early outcomes are especially relevant for elderly patients with limited functional reserve.

Future studies involving larger, multicenter cohorts with long-term follow-up are needed to better define the durability of outcomes and identify factors that influence complication rates, implant longevity, and patient-reported satisfaction. Comparative analyses of prosthetic designs, surgical techniques, and postoperative rehabilitation protocols will also be essential for optimizing patient care in this growing field of shoulder arthroplasty.

Ethics Committee Approval: The study was approved by the Non-Interventional Health Research Ethics Committee of Düzce University (18.11.2024, 231).

Conflict of Interest: None declared by the authors.

Financial Disclosure: None declared by the authors.

Acknowledgments: None declared by the authors.

Author Contributions: Idea/Concept: ZOK; Design: ZOK; Data Collection/Processing: ZOK; Analysis/Interpretation: ZOK; Literature Review: ZOK; Drafting/Writing: ZOK; Critical Review: ZOK.

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