

Early outcomes of reverse shoulder arthroplasty for degenerative shoulder conditions

Nikolay Cherkeзов^{1,2}✉, Nikolay Dimitrov^{1,2}

¹Medical University Sofia, Department of Orthopaedics and Traumatology, Sofia Bulgaria

²University Hospital of Orthopaedics” Prof.B. Boichev”, Sofia, Bulgaria

dr.n.cherkeзов@gmail.com

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Abstract- Background: Reverse shoulder arthroplasty (RSA) is widely used for the treatment of degenerative shoulder conditions, particularly in the presence of rotator cuff deficiency. This study aimed to evaluate short-term clinical and functional outcomes following RSA.

Methods: A prospective cohort study including 32 patients with cuff tear arthropathy or primary glenohumeral osteoarthritis was conducted. Patients were evaluated preoperatively and at a minimum of 12 months postoperatively using the Bulgarian versions of the Simple Shoulder Test (BSST) and the American Shoulder and Elbow Surgeons (BASES) score. Range of motion and complications were also assessed. Subgroup and correlation analyses were performed.

Results: Significant improvements were observed in both BSST and BASES scores (mean increase 56.4 and 56.7 points, respectively; $p < 0.001$). Range of motion improved significantly in all planes, particularly in forward flexion and abduction ($p < 0.01$). The complication rate was 15.6%, including aseptic loosening, infection, and component dissociation. No significant differences were found across subgroups, and no correlations were identified between demographic factors and outcomes.

Conclusion: RSA provides significant short-term improvements in pain, function, and shoulder mobility in patients with degenerative conditions, with consistent outcomes across patient subgroups. Further studies are required to evaluate long-term durability.

Keywords— reverse shoulder arthroplasty, degenerative shoulder conditions, patient-reported outcomes, range of motion

1. INTRODUCTION

Degenerative conditions of the shoulder joint involve a spectrum of disorders, including glenohumeral osteoarthritis (GHOA), rotator cuff tear arthropathy (RCTA) and degenerative rotator cuff disease that often coexist. They are mainly characterized by chronic pain, restricted range of motion, and progressive functional impairment of the

shoulder joint, rendering them clinically and socially significant. Epidemiological studies report a high prevalence of degenerative changes in the glenohumeral joint in patients presenting with shoulder pain¹.

GHOA is currently understood as a multifactorial condition, traditionally classified as primary or secondary, with contributions from systemic factors such as age, genetics, and obesity, as well as local mechanical influences including occupational load, prior trauma and altered joint biomechanics². In addition, secondary causes including inflammatory arthritis and avascular necrosis lead to disruption of cartilage integrity and articular congruency³.

Both physical and psychological aspects of quality of life are substantially affected by chronic pain and functional limitation. In younger individuals, these impairments restrict daily activities and work capacity, while in older patients they may compromise physical independence⁴.

The rotator cuff is a functional unit of four muscles that plays a crucial role in shoulder biomechanics, by providing dynamic stabilization of the glenohumeral joint, initiation and control of movement, as well as enabling internal and external rotation. Rotator cuff tears, reported as the most common pathological condition of the upper extremity in individuals over 50 years of age, represent a significant clinical challenge in an aging population⁵. In advanced stages, chronic cuff insufficiency may lead to cuff tear arthropathy, characterized by antero-superior migration of the humeral head and progressive degenerative changes within the joint⁶. Essentially, cuff tear arthropathy represents the combination of a massive rotator cuff tear and the subsequent development of glenohumeral osteoarthritis⁷.

Shoulder arthroplasty is the treatment of choice for advanced-stage degenerative shoulder disorders. In the presence of rotator cuff degeneration, reverse shoulder arthroplasty (RSA) is indicated, in which an inverted configuration is used, with a metallic sphere at the native glenoid and a polyethylene cup mounted on a humeral stem replacing the humeral head.⁸ Initially introduced for the management of massive irreparable rotator cuff tears, RSA directly addresses the altered shoulder joint kinematics⁹. Since its introduction in 1985, multiple design modifications and favorable clinical outcomes have led to an expansion of its indications, now including primary GHOA with an intact rotator cuff, revision procedures, and proximal humerus fractures¹⁰.

The aim of the present study is to evaluate the outcomes of reverse shoulder arthroplasty (RSA) in patients with degenerative shoulder conditions at a minimum follow-up of one year.

2. Materials and methods

For the purposes of the study, it was decided to use Bulgarian validated versions of two of the most commonly applied shoulder-specific outcome measures—the Simple Shoulder Test (SST) and the American Shoulder and Elbow Surgeons shoulder form (ASES)¹¹. A total of 32 patients with degenerative shoulder conditions treated with RSA were included in the study. All patients were managed and evaluated at the Clinic of Orthopaedics and Traumatology at University Hospital of Orthopaedics „Prof. B. Boichev”.

Inclusion criteria were age ≥ 18 years, a diagnosis of cuff tear arthropathy or primary glenohumeral osteoarthritis confirmed by imaging (radiography, CT, or MRI), failure of conservative treatment for at least 6 months, treatment with RSA, ability to complete Bulgarian-language questionnaires, and provision of informed consent. Exclusion criteria were fractures of the shoulder girdle or humerus, comorbidities significantly affecting quality of life (e.g., stroke, active infection, paralysis) and cognitive impairment.

A prospective cohort study was conducted in which patients were evaluated preoperatively and at a minimum of 12 months following RSA using the validated BSST and BASES questionnaires. Range of motion and postoperative local complications were also assessed.

Patients were further analyzed according to demographic and clinical variables, including age, sex, ASA score, body mass index (BMI), smoking status, prior shoulder surgery, humeral stem fixation (cemented vs. cementless), and humeral cup design (inlay vs. onlay).

3. RESULTS

The study cohort comprised 32 patients, including 10 men (31.3%) and 22 women (68.8%). The mean age was 64.15 ± 5.55 years (range, 56–74 years). The largest subgroup among men was aged 50–59 years ($n = 6$), while among women the majority were aged 60–69 years ($n = 13$). The minimum follow-up duration was 12 months, with a mean follow-up of 14.6 months (range, 12–17 months). The main demographic, clinical, and surgical characteristics of the study cohort are presented in Table 1.

Index	Value		
Patients, n	32		
Age (years), mean $\pm$ SD (range)	64.15 ± 5.55 (56 – 74)		
Sex, n (%)	Male:	10	(31.3)
	Female:	22	(68.8)
BMI (kg/m^2), mean $\pm$ SD	30.05 ± 5.03		
ASA class, n (%)	ASA II:	7	(21.9)
	ASA III:	20	(62.5)
	ASA IV:	5	(15.6)
Prior shoulder surgery, n (%)	Yes:	5	(15.6)
	No:	27	(84.4%)
Smoking, n (%)	Active:	15	(46.9)
	Non-smoker:	17	(53.1)
Fixation of humeral stem, n (%)	Cemented:	27	(84.4)
	Cementless:	5	(15.6)
Humeral cup- inlay/onlay, n (%)	Inlay:	15	(46.9)
	Onlay:	17	(53.1)

Table 1. Demographic, clinical, and surgical characteristics of the study cohort

The results of patient assessments using the BASES and BSST questionnaires preoperatively and at minimum of 12 months following reverse shoulder arthroplasty are presented in Table 2.

Time point	BSST		BASES		95% CI	<i>p</i> -value
	$\bar{X}$	$\pm$ SD	$\bar{X}$	$\pm$ SD		
Preoperative	13.45	$\pm$ 9.94	14.76	$\pm$ 7.51	95% CI 43.71–69.12	<i>p</i> < 0.001
Min. 12 months	69.86	$\pm$ 22.46	71.45	$\pm$ 17.60	95% CI 46.08–67.31	<i>p</i> < 0.001

Table 2. Comparison of patient-reported outcomes (BSST and BASES) preoperatively and at minimum 12 months following reverse shoulder arthroplasty.

A statistically significant improvement was observed in both BASES and BSST scores at 12 months postoperatively compared to preoperative values (Table 2). BSST improved by 56.41 points, 95% CI 43.71–69.12, *p* < 0.001, and BASES improved by 56.70 points, 95% CI 46.08–67.31, *p* < 0.001. Patients demonstrated marked functional improvement, accompanied by a reduction in pain and enhanced shoulder-related quality of life. The increase in mean scores reflects substantial clinical benefit following RSA, indicating improved functional capacity and patient-reported outcomes.

Clinical functional parameters related to range of motion were assessed preoperatively and at a minimum of 12 months following RSA, and the results are presented in Table 3.

Parameter	Preoperative		Min. 12 months		95% CI	<i>p</i> -value
	$\bar{X}$	SD	$\bar{X}$	SD		
Forward flexion	46.46	$\pm$ 29.67°	136.0	$\pm$ 26.55°	95% CI 64.52–114.56	<i>p</i> < 0.001
Abduction	41.38	$\pm$ 29.19°	118.38	$\pm$ 31.49°	95% CI 50.00–104.00	<i>p</i> < 0.001
External rotation	10.92	$\pm$ 7.68°	24.38	$\pm$ 10.91°	95% CI 15.37–41.87	<i>p</i> = 0.0005
Internal rotation	20.23	$\pm$ 11.90°	48.85	$\pm$ 14.74°	95% CI 5.85–21.07	<i>p</i> = 0.0005

Table 3. Comparison of shoulder range of motion preoperatively and at minimum 12 months following reverse shoulder arthroplasty.

A statistically significant improvement in range of motion was observed in all planes following RSA (all *p* < 0.01). Mean forward flexion increased from 46.46 $\pm$ 29.67° preoperatively to 136.0 $\pm$ 26.55° postoperatively, while abduction improved from 41.38 $\pm$ 29.19° to 118.38 $\pm$ 31.49°. External rotation increased from 10.92 $\pm$ 7.68° to 24.38 $\pm$ 10.91°, and internal rotation from 20.23 $\pm$ 11.90° to 48.85 $\pm$ 14.74°. The greatest gains

were observed in forward flexion and abduction, whereas external rotation demonstrated more limited improvement, consistent with the known biomechanical constraints of RSA. Overall, these findings indicate substantial restoration of functional shoulder mobility.

Postoperative local complications were observed in 4 patients. These included one case of aseptic loosening of a cemented humeral stem, one case of periprosthetic infection, and two cases of dissociation of the humeral cup from the stem. No statistically significant differences in BSST or BASES improvement were observed according to sex, smoking status, prior surgery, humeral stem fixation, or humeral cup design (all $p > 0.05$).

No significant correlations were observed between age, BMI, or ASA score and postoperative improvement in BSST or BASES (all $p > 0.05$).

4. DISCUSSION

Reverse shoulder arthroplasty resulted in significant short-term improvements in patient-reported outcomes and range of motion, with notable gains in BSST, BASES, forward flexion, and abduction.

The functional improvement observed in the present cohort is comparable to previously reported outcomes. In a large systematic review, RSA was associated with mean improvements of approximately 56° in forward flexion, 50° in abduction, and 14° in external rotation, along with clinically significant improvements in patient-reported outcome measures.¹² Similar improvements in ASES scores and active elevation have also been described in clinical series with short-term follow-up¹³. In line with these reports, our study demonstrated substantial gains in forward flexion and abduction, with more modest improvements in external rotation. This pattern is well described in the literature and is attributed to the biomechanical design of RSA, which enhances deltoid efficiency while not fully restoring the function of the posterior rotator cuff¹⁴. Restoration of active elevation is a key advantage of RSA, particularly in patients with rotator cuff deficiency. Previous studies have shown that RSA reliably improves forward elevation and reverses pseudoparalysis in the majority of patients¹⁵. The substantial improvements in forward flexion observed in the present cohort likely reflect similar biomechanical mechanisms, including deltoid recruitment and altered joint kinematics.

The complication rate in the present study was 15.6%, including aseptic loosening, infection, and component dissociation. Although higher than the approximately 9.4% reported in large meta-analyses¹², this rate remains within the range described in the literature, where complication rates vary depending on patient characteristics, surgical technique, and implant design. Mid- to long-term studies report complication rates up to 15–20%, with infection rates of 1–4% and revision rates below 5%¹⁶.

No significant differences in outcome improvement were observed across the analyzed subgroups, and no meaningful correlations were identified between demographic factors and postoperative outcomes. Although limited by sample size, these findings suggest that RSA may provide consistent short-term benefits across a range of patient and surgical variables.

While the present study demonstrates favorable short-term outcomes, the durability of these improvements over time remains an important consideration. Long-term data suggest that the functional benefits of RSA are largely maintained. In a systematic review with follow-up extending up to 20 years, significant improvements in clinical scores and overhead function were observed, with no evidence of deterioration in outcomes between 5 and 20 years postoperatively. Similarly, active forward elevation and abduction remained stable over time, whereas external rotation showed minimal long-term improvement, reflecting persistent biomechanical limitations of the procedure¹⁴. These findings support the notion that the early improvements observed in the present study are likely to be sustained in the long term, although continued follow-up is required to confirm implant longevity and functional durability.

This study has several limitations, including the relatively small sample size, which limits subgroup analysis, and the short follow-up period. Additionally, the single-center design may limit generalizability. Nevertheless, the prospective design and use of validated, culturally adapted outcome measures represent important strengths.

5. CONCLUSION

Reverse shoulder arthroplasty provides significant short-term improvements in pain, function, and range of motion in patients with degenerative shoulder conditions. Substantial gains in patient-reported outcomes and forward elevation were observed at a minimum follow-up of one year, confirming the effectiveness of the procedure in restoring functional shoulder mobility. Despite a moderate complication rate, outcomes were consistent across patient subgroups, suggesting reliable clinical benefit. Further studies with larger cohorts and longer follow-up are required to evaluate long-term durability and implant survival.

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Authors

Dr. Nikolay Cherkezov is a member of Bulgarian Orthopaedic and Trauma Association. He is an assistant professor and a PhD candidate at the Department of Orthopaedics and Traumatology, Medical University of Sofia, Sofia, Bulgaria. He is a resident at University Hospital of Orthopaedics “Prof. B. Boichev”.

Dr. Nikolay Dimitrov is a member of Bulgarian Orthopaedic and Trauma Association. He is an orthopaedic surgeon at University Hospital of Orthopaedics “Prof. B. Boichev” and Head of “Bone pathology and general orthopaedics Clinic”. He is also a Professor at the Department of Orthopaedics and Traumatology, Medical University of Sofia, Sofia, Bulgaria.