Surgical and Patient Factors Associated with Baseplate Failure After Reverse Shoulder Arthroplasty: A Study by the ASES Complications of RSA Multicenter Research Group

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Abstract

Background:

Despite innovative design changes and improved methods of fixation, baseplate failure continues to be a clinical concern following Reverse Shoulder Arthroplasty (RSA). Presently, there is a lack of generalizable evidence to guide clinicians regarding the risk factors that contribute to baseplate failure, a complication that can result in poor clinical outcomes and revision procedures. The purpose of this multi-center study was to identify surgical, implant, and patient factors associated with baseplate failure following RSA.

Methods:

A retrospective, multicenter study was performed involving 15 institutions and 25 American Shoulder and Elbow Surgeons (ASES) members across the United States. Inclusion criteria consisted of patients who underwent RSA between June 2013 to May 2019 with a minimum follow up of 3-months. Study design parameters were defined through the Delphi method, requiring 75% agreement among surgeons for consensus. Univariate analysis was performed to compare baseline characteristics and surgical elements between patients with and without baseplate failure. Two appropriately fit multivariable logistic regressions were performed to identify patient characteristics and surgical elements independently associated with baseplate failure. Baseplate failure was defined as a gross shift of the baseplate component or hardware breakage, confirmed radiographically by X-ray or Computed Tomography (CT).

Results:

A total of 3,745 patients met the study's inclusion criteria. The median follow-up after surgery was 14 months (IQR = 10 – 25). For the entire cohort, the incidence of baseplate failure was 1.1% [n=43]. Subgroup analysis based on diagnosis revealed a failure rate of 1.3% for glenohumeral arthritis, 0.5% for rotator cuff disease and 6.8% for revision cases. Baseplate failure occurred at a median of 59 weeks (IQR = 35 – 122) after surgery, with only 11.6% (n = 5/43) associated with trauma. Radiographic analysis revealed gross shift of the baseplate component in 88.4% (n = 38/43) of failures. Hardware breakage was observed in 62.8% (n = 27/43 of cases. Univariate analysis revealed that baseplate failure was associated with prior ipsilateral shoulder surgery ($P < .001$), revision procedures ($P < .001$), glenoid-sided bone grafts ($P < .001$), and augmentation with a humeral spacer ($P = .003$). Factors independently predictive of baseplate failure, in order of decreasing effect, were revision arthroplasty (OR 10.00; $P < .001$), utilization of a bone graft (OR 4.91; $P < .001$) and total glenoid-sided lateral offset (OR 1.07; $P < .001$).

Conclusion

The strongest independent predictors of baseplate failure after RSA were revision surgery for failed arthroplasty and glenoid-sided bone grafting. Increased glenoid-sided lateral offset was also identified as a risk factor for failure. The majority of failures occurred without trauma, which may indicate that intrinsic factors play a larger role in baseplate failure. Hardware breakage was also common, highlighting potential areas for further improvement in implant design. These modifiable and non-modifiable risk factors of baseplate failure following RSA can be used to optimize preoperative patient counseling as well as surgeon decision-making at time of surgery.

Table I: Nonmodifiable Patient Characteristics

Parameters	*N*	No Baseplate Failure *N = 3702*	Baseplate Failure *N = 43*	P Value
Sex	*3745*			
Male		1517 (41.0%)	24 (55.8%)	0.070
Female		2185 (59.0%)	19 (44.2%)	
Age	*3745*	70.5 ± 8.5	68.0 ± 8.3	0.053
BMI (kg/m^2)	*3735*	30.2 ± 6.7	30.1 ± 5.5	0.915
Follow-up Duration (months)	*3745*	9.8, 14.0, 25.0	13.4, 24.0, 29.7	0.003*
ASA Comorbidity Score > 2	*3730*	1906 (51.7%)	24 (55.8%)	0.475
Comorbidities				
Immunosuppresants ϕ	*3159*	383 (12.3%)	6 (14.3%)	0.877
Osteoporosis	*3745*	503 (13.6%)	5 (11.6%)	0.881
Presence of IA	*3742*	367 (9.9%)	7 (16.3%)	0.260
Diabetes φ	*3743*	768 (20.8%)	7 (16.3%)	0.595
Smoking	*3499*			
Never		1808 (52.2%)	18 (47.4%)	
Former		1370 (39.6%)	17 (44.7%)	0.799
Current		283 (8.2%)	3 (7.9%)	
Prior Ipsilateral Shoulder Surgery	*3740*	1152 (31.2%)	27 (62.8%)	< 0.001*
Primary Diagnosis	*3745*			
GHOA		922 (24.9%)	12 (27.9%)	
CTA		1521 (41.1%)	7 (16.3%)	
MCT without GHOA		399 (10.8%)	2 (4.7%)	< 0.001*
Failed Arthroplasty (revision)		274 (7.4%)	20 (46.5%)	
Other		586 (15.8%)	2 (4.7%)	

* denotes statistical significance; *n (%)* represents count and frequency; $x \pm s$ represents mean and standard deviation; $Q1$, M, $Q3$ represents 1st quartile, median, and 3rd quartile; ϕ Immunosuppresants used within three months of surgery; φ Diabetes types I and II aggregated into one group for analysis; BMI, body mass index; ASA, American Society of Anesthesiologists; IA, inflammatory arthritis; GHOA, glenohumeral osteoarthritis; CTA, rotator cuff tear arthropathy; MCT, massive rotator cuff tear

Table IV: Predictors of Baseplate Failure

Covariates	OR	95% CI (2.5 - 97.5)	P Value
Regression A - Patient Characteristics			
Revision Arthroplasty	10.00	5.33 - 18.77	< 0.001*
Presence of IA	1.92	0.83 - 4.45	0.129
Presence of Osteoporosis	0.99	0.35 - 2.37	0.839
Age	0.99	0.96 - 1.02	0.547
Regression B - Surgical Factors			
Utilization of Bone Graft	4.91	2.32 - 10.37	< 0.001*
Total Glenoid-Sided LO	1.07	1.00 - 1.15	0.048*
On-growth Baseplate Surface (Ref: In-Growth)	1.09	0.53 - 2.25	0.817
Presence of Central Boss	0.93	0.46 - 1.89	0.851

* denotes statistical significance; OR, odds ratio; CI, confidence interval; IA, inflammatory arthritis; LO, lateral offset