Risk Factors of Acromial and Scapular Spine Stress Fractures Differ by Indication: A Study of the American Shoulder and Elbow Surgeons Complications After Reverse Shoulder Arthroplasty Multi-Center Research Group

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INTRODUCTION: Both patient and implant related variables have been implicated in the incidence of acromial (ASF) and scapular spine fractures (SSF) following reverse shoulder arthroplasty (RSA). Previous literature offers limited insight into the influence of varying indications including primary glenohumeral arthritis with intact rotator cuff (GHOA), rotator cuff arthropathy (CTA), and massive irreparable rotator cuff tear (MCT) on ASF and SSF. The purpose of this study was to determine patient factors predictive of cumulative ASF/SSF risk for varying preoperative diagnosis and rotator cuff status.

METHODS: A retrospective, multicenter study was performed across fifteen institutions comprising 21 members of the American Shoulder and Elbow Surgeons (ASES). Patients undergoing RSA between January 2013 and June 2019 with preoperative diagnoses of GHOA, RCA and MCT were included in this study. Inclusion criteria, definitions and inclusion of patient factors in a multivariate model to predict cumulative risk of ASF/SSF were determined through an iterative Delphi process, requiring ≥75% agreement amongst contributors to be included in the methodology. Only ASF/SSF confirmed by clinical and radiographic correlation were included for analysis.

RESULTS: Our study cohort included 4,565 patients with preoperative diagnoses of GHOA (n = 1,637) or RCA/MCT (n = 3,124) with mean follow-up of 19.5 months (range 4.5-34.4). The incidence of cumulative stress fracture was 4.3% (n=196). The incidence of stress fracture in the GHOA cohort was 2.1% (n=34/1603) compared to 5.5% (n=162/2962) (p<0.001) in the RCA/MCT cohort. In the RCA/MCT cohort, 22.2% (n = 36) of the fractures were caused by trauma, compared to 17.6% (n = 6) of the fractures in the GHOA group (p=0.675). Presence of inflammatory arthritis (OR 2.90 95% CI 1.08-7.78; p=0.035) was the sole predictive factor of stress fractures in GHOA (Table I), compared with inflammatory arthritis (OR 1.86 95% CI 1.19-2.89; p=0.016), female sex (OR 1.81 95% CI 1.20-2.72); p=0.007), and osteoporosis (OR 1.56 95% CI 1.02-2.37; p=0.003) in the RCA/MCT cohort (Table II). There were no significant differences of all demographic variables between diagnosis cohorts on fracture rates.

DISCUSSION AND CONCLUSION: The findings of this large, multicenter cohort indicate that patients with a preoperative diagnosis of GHOA have a different risk profile for ASF/SSF stress fractures after RSA than patients with RCA/MCT. Though rotator cuff integrity is protective against ASF/SSF, approximately 1/50 patients receiving RSA with primary GHOA will have this complication, primarily influenced by a concomitant diagnosis of inflammatory arthropathy. Understanding risk profiles of patients undergoing RSA by varying diagnosis is important in counseling, expectation management, and treatment by surgeons.

Table I: Predictors of Stress Fractures in OA

Factor	OR (95% CI)	P-Value
Age	1.04 (0.99 - 1.09)	0.113
Female Sex	2.06 (0.91 - 4.67)	0.084
Presence of Osteoporosis	1.89 (0.79 - 4.52)	0.153
Presence of Inflammatory Arthritis	2.90 (1.08 - 7.78)	0.035*

*Represents statistical significance with alpha-risk set at 0.05

Table II: Predictors of Stress Fractures in RCA/MCT

Factor	OR (95% CI)	P-Value
Age	1.01 (0.99 - 1.03)	0.258
Female Sex	1.81 (1.20 - 2.72)	0.007*
Presence of Osteoporosis	1.56 (1.02 - 2.37)	0.003*
Presence of Inflammatory Arthritis	1.86 (1.19 - 2.89)	0.016*

*Represents statistical significance with alpha-risk set at 0.05