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TITLE: Comparison of Reverse Shoulder Arthroplasty For Fracture Sequelae With vs. Without Tuberosity Osteotomy

INTRODUCTION: The utilization and indications for reverse shoulder arthroplasty (RSA) continue to increase. Reverse shoulder arthroplasty has become the most common arthroplasty technique for the treatment of proximal humerus fractures in both the acute and chronic setting. Many factors and variables regarding the use of RSA for the treatment of proximal humerus fracture have been studied including early versus late RSA, cemented versus cementless humeral components, and standard versus fracture specific stems. However, there is little evidence comparing patients who required a tuberosity osteotomy to those that did not. The purpose of this study was to compare the clinical outcomes and complications of patients who underwent RSA for late fracture sequalae requiring tuberosity osteotomy to those that did not require a tuberosity osteotomy.

METHODS: A retrospective review of our institutional shoulder arthroplasty database was performed to identify all patients who underwent RSA for late fracture sequelae. Inclusion criteria was any patient who underwent RSA for late fracture sequelae that was at least two years postoperatively from their procedure. Exclusion criteria were patients who underwent RSA for an acute fracture and patients who lacked adequate preoperative radiographs. Preoperative radiographs were utilized to classify fracture deformities according to the classification previously described by Boileau et al.[1] Patients were divided into two groups, those requiring tuberosity osteotomy and those that did not during their RSA procedure. Data collected included demographic variables, mechanism of injury, any previous shoulder surgeries, Boileau fracture classification, postoperative range of motion (ROM), complications, and reoperations. The latest postoperative radiographs were evaluated for tuberosity healing, tuberosity resorption, humeral loosening, and scapular notching.

RESULTS: We identified 37 patients who underwent RSA for late fracture sequalae, 12 patients did not require tuberosity osteotomy and 25 patients required tuberosity osteotomy during their RSA procedure. There were no differences in age, sex, or BMI between the two cohorts ($p>0.05$). There were no differences in time from injury to RSA, mechanism of injury, or number of previous surgeries between the two cohorts ($p>0.05$, Table I). There were significant differences in fracture deformities between the cohorts with the no tuberosity osteotomy cohort having a higher proportion of Boileau type I fracture deformities and the tuberosity osteotomy cohort having a higher proportion of Boileau type III and IV fracture deformities ($p<0.001$, Table I). At final follow-up, the no tuberosity osteotomy cohort had greater forward elevation (135.9 ± 42.7 vs. 98.8 ± 33.9, $p=0.004$) and external rotation (34.5 ± 12.8 vs. 24.2 ± 16.5, $p=0.044$) than the tuberosity osteotomy cohort respectively. There were no significant differences in complications or reoperations between the cohorts ($p>0.05$). At final radiographic follow-up, the no tuberosity osteotomy cohort had a greater rate of tuberosity healing (100.0% vs. 72.0%, $p=0.042$) than the tuberosity osteotomy cohort. The tuberosity osteotomy cohort had a higher rate of tuberosity resorption (32.0% vs. 0.0%, $p=0.027$) than the no tuberosity osteotomy cohort.

DISCUSSION and CONCLUSION: Reverse shoulder arthroplasty has become the predominate shoulder arthroplasty performed for proximal humerus fracture sequelae and it remains a challenging procedure. This study demonstrates that surgeons should try to maintain the tuberosities in their malunited position if possible because it can lead to improved range of motion and decrease rates of tuberosity resorption. However, this remains dependent on the severity of the fracture deformity and needs to be balanced with the ability to properly orient the arthroplasty stem and avoiding impingement that could place patients at greater risk for instability.

REFERENCE:

[1]Boileau P, Trojani C, Walch G, Krishnan SG, Romeo A, Sinnerton R. Shoulder arthroplasty for the treatment of the sequelae of fractures of the proximal humerus. J. Shoulder Elb. Surg. Am. Shoulder Elb. Surg. Al. 2001 Aug;10(4):299–308. doi:10.1067/mse.2001.115985

FIGURES AND TABLES:

Table I. Injury Details and Fracture Classification

		No Tuberosity Osteotomy (n=12)	Tuberosity Osteotomy (n=25)	p-value
Time From Injury to Surgery (Months, Mean ± SD)		19.4 ± 35.0	30.3 ± 78.6	0.326
Mechanism of Injury (No, %)	Mechanical Fall	11 (91.7%)	22 (88.0%)	0.578
	Fall From Height	0	1 (4.0%)	
	MVC	1 (8.3%)	0	
	Assault	0	1 (4.0%)	
	Seizure	0	1 (4.0%)	
Surgery Prior to Arthroplasty (No., %)		6 (50.0%)	13 (52.0%)	0.909
Number of Previous Surgeries (Mean ± SD)		0.58 ± 0.67	0.64 ± 0.7	0.408
Type of Previous Surgery (No, %)	ORIF	6 (50.0%)	9 (36.0%)	0.509
	IMN	0 (0.0%)	3 (12.0%)	
	RCR	0 (0.0%)	1 (4.0%)	
Boileau Classification (No, %)	I	11 (91.7%)	1 (4.0%)	**<0.001**
	II	1 (8.3%)	1 (4.0%)	
	III	0 (0.0%)	11 44.0%)	
	IV	0 (0.0%)	12 (48.0%)	

MVC = motor vehicle crash; *ORIF* = open reduction internal fixation; *IMN* = intramedullary nail; *RCR* = rotator cuff repair