Outcomes of Anatomic Total Shoulder Arthroplasty with Non-Augmented Glenoid Component for Walch B2 and B3 Glenoid Morphology

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INTRODUCTION: The optimal management of posterior glenoid bone loss in glenohumeral osteoarthritis with anatomic total shoulder arthroplasty (TSA) remains unknown, as the degree of bone loss and retroversion can vary across a wide spectrum in glenoids with Walch B2 and B3 morphology. The literature has supported the ability to correct mild to moderate pathology in B2 and B3 glenoids with standard, non-augmented polyethylene glenoid components, but little data has been reported on clinical outcomes in this specific patient population. The primary objectives of the current study were to evaluate the clinical and radiographic outcomes of utilizing standard, all-polyethylene, non-augmented anchor-peg glenoid (APG) components in anatomic TSA for patients with mild to moderate B2 or B3 glenoid morphology. A secondary objective was to identify preoperative clinical and radiographic variables that may be associated with poor outcomes.

METHODS: Between January 2010 and September 2019, we identified 79 shoulders with mild to moderate B2 or B3 glenoid morphology that underwent anatomic TSA with use of a non-augmented APG glenoid component having either a peripheral or central APG design. In each case, the surgeon had access to an augmented glenoid component but chose to use a standard component based upon the ability to template components within 10 degrees of native vault retroversion with less than 3mm of joint line medialization based on preoperative 3-dimensional computed tomography (3D-CT) scan. All patients had a minimum of 2 years of clinical and radiographic follow-up. The Penn Shoulder Score (PSS), glenoid anchor-peg osteolysis (grade 1 vs 2&3), and humeral head subluxation were the main outcome variables of interest. Statistical analysis was performed with a Students T-test and Chi square analysis for continuous and categorical variables, respectively.

RESULTS: Mean follow-up duration was 4.8 ± 2.6 years (range, 1.8 to 12.2); the mean patient age at surgery was 64.5 ± 6.6 years (range, 51.6 to 84.6); the mean preoperative retroversion was 12.6° ± 4.5° (range, 1.6° to 25.0°); the mean preoperative inclination was 4.0° ± 4.9° (-7.4° to 18.8°) ; the mean preoperative joint line medialization (mm) was -1.3 ± 1.8 (-5.5 to 3.7) (Table 1). Mean correction to achieve premorbid version was 7.2° ± 3.4° (range, -0.7° to 16.0°). Penn Shoulder Score (PSS) and humeral head subluxation were improved amongst all patients postoperatively (p<0.0001), with a mean PSS at latest follow-up of 89 ± 16.7 (23 to 100) (Figure 1). The cohort included 63/79 (80%) B2 glenoids and 16/79 (20%) B3 glenoids. There were four complications in the cohort (5.0%), three of which required reoperation: a washout for postoperative hematoma, open reduction and internal fixation of os acromiale for persistent pain, and revision to a reverse shoulder arthroplasty for posterior instability. The nonoperative complication was a traumatic posterior dislocation treated with closed reduction. Postoperative grade 1 anchor-peg osteolysis was present on latest radiographs in 8/79 (10.1%). Posterior humeral head subluxation was present on 9/77 (12%) patients with an available axillary lateral radiograph to review. On univariate analysis, Walch classification, preoperative glenoid retroversion, inclination, joint line medialization, and humeral head subluxation as measured on 3D-CT were not significantly associated with presence of grade 1 anchor-peg osteolysis at final radiographic follow-up (Table 1).

DISCUSSION AND CONCLUSION: The use of non-augmented polyethylene APG components in patients undergoing anatomic TSA with mild to moderate B2 and B3 glenoids results in significant improvements in patient reported outcome measures with low complication and reoperation rates. Anchor peg osteolysis was identified in 8/79 patients at mean follow-up of 4.8 years, and no patients were revised for glenoid component loosening or failure. Standard glenoid components can be utilized in anatomic TSA to address mild to moderate B2 and B3 glenoid deformity with satisfactory clinical and radiographic results. Further follow-up of this cohort is needed to better understand the implications of glenoid component anchor-peg osteolysis on loosening patterns and failure rate in the long-term.

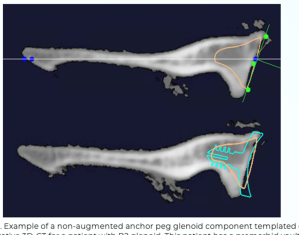

Figure 1. Example of a non-augmented anchor peg glenoid component templated on preoperative 3D-CT for a patient with B2 glenoid. This patient has a premorbid vault, retroversion of -11 degrees (orange) templated with a non-augmented anchor-peg glenoid (cyan).

Figure 1. Improvement in Penn Shoulder Score

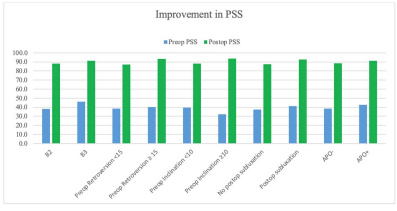

Table 1. Variables Associated with Anchor-Peg Osteolysis

	No Anchor-Peg Osteolysis (n=71)	Anchor-Peg Osteolysis (n=8)	P value
Age (yr)	64.7 ± 6.8 (51.6 to 84.6)	63 ± 5 (54 to 72)	0.437
Follow-up (yr)	4.5 ± 2.4 (1.8 to 10.9)	6.7 ± 2.9 (3.0 to 12.2)	0.069
Sex			0.670
Male	48 (68%)	6 (75%)	
Female	23 (32%)	2 (25%)	
Preop. 3D-CT measurements			
Glenoid version (°)	-12.7 ± 4.5 (-25.0 to -1.6)	-12.0 ± 4.7 (-19.6 to -5.3)	0.704
Glenoid inclination (°)	4.1 ± 4.9 (-7.4 to 18.8)	2.6 ± 4.6 (-4.9 to 9.3)	0.389
HGA-AP (%)	-3.0 ± 13.6 (-31.1 to 62.7)	-0.8 ± 10.4 (-10.0 to 21.3)	0.600
HSA-AP (%)	-13.4 ± 16.7 (-41.7 to 69.3)	-11.7 ± 9.7 (-23.0 to 4.4)	0.662
Joint-line medialization (mm)	-1.4 ± 1.8 (-5.5 to 3.7)	-0.7 ± 1.5 (-2.5 to 2.3)	0.240
Modified Walch classification			
B2	56 (79%)	7 (88%)	0.565
B3	15 (21%)	1 (12%)	
Preop. axillary radiograph (n=71)			
Humeral head subluxation	42 (66%)	5(71%)	0.758
Postop. axillary radiograph (n=77)			
Posterior head subluxation	9 (20%)	0 (0%)	0.269
Penn Shoulder Score			
Preop. (n=44)	38.6 ± 13.7 (6.2 to 63.3)	42.6 ± 11.9 (34.2 to 51.0)	0.714
Postop. (n=79)	88.5 ± 17.5 (23.0 to 100.0)	91.2 ± 7.9 (78.0 to 100.0)	0.448
Subgroup Analysis			
Preop. Retroversion <15° (n=57)	51 (89%)	6 (11%)	0.850
Preop. Retroversion ≥15° (n=22)	20 (91%)	2 (9%)	
Preop. Inclination <10° (n=70)	62 (89%)	8 (11%)	0.337
Preop. Inclination ≥10° (n=9)	9 (100%)	0 (0%)	
B2 (n=63)	56 (89%)	7 (11%)	0.565
B3 (n=16)	15 (94%)	1 (6%)	
PSS <80 (n=63)	56 (89%)	7 (11%)	0.565
PSS ≥80 (n=16)	15 (94%)	1 (6%)	

HGA, humeral head-glenoid alignment; HSA, humeral head-scapula alignment; AP, anteroposterior; SI, superoinferior; APO, anchor-peg osteolysis; PSS, Penn Shoulder Score. Values are given as mean and standard deviation with range in parentheses.