

Adoption of Reverse Total Shoulder Arthroplasty for Surgical Treatment of Proximal Humerus Fractures Differs by Patient Race

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BACKGROUND: Reverse total shoulder arthroplasty (rTSA) has gained popularity for the operative treatment of proximal humerus fractures (PHF). Several studies have investigated disparities in utilization of rTSA for glenohumeral arthritis and rotator cuff arthropathy, but less is known regarding rTSA utilization for PHF. The purpose of this study was to compare racial differences in surgical management of PHF between open reduction and internal fixation (ORIF), hemiarthroplasty, and rTSA. Our hypothesis was that non-white patients would be less likely to undergo rTSA.

METHODS: The National Surgical Quality Improvement Program (NSQIP) database was queried for CPT codes corresponding to ORIF, rTSA, and hemiarthroplasty between 2006 and 2020. Only surgeries with a confirmed PHF International Classification of Diseases 9th or 10th edition diagnosis code were included. Race, ethnicity, age, sex, body mass index (BMI), and American Society of Anesthesiologists (ASA) class were recorded. Chi squared tests were performed to assess relationships between patient factors and operative intervention. Factors significant at the 0.10 level in univariable analyses were included in a multivariable multinomial model to predict operative intervention. Odds ratios were calculated as odds of receiving a particular treatment compared to ORIF. Due to small sample sizes (<5% of study population), race was categorized as white and non-white in the multivariable model.

RESULTS: 7,827 patients underwent surgical treatment for a PHF, including 548 (7%) undergoing hemiarthroplasty, 5,232 (67%) undergoing ORIF, and 2,047 (26%) undergoing rTSA. 27% of White patients with PHF underwent rTSA compared to 21% of Black patients, 16% of Asian patients, and 14% of Native American and Alaskan Native patients (p < 0.001, Figure 2). Utilization of rTSA for PHF increased from 0% in 2006 to 34% in 2020 (Figure 3). Age (p<0.001), sex (p<0.001), BMI (p<0.001), and ASA class (p<0.001) were also significantly associated with type of surgical intervention in univariable models and were included in the multivariable model (Table 1). In the multivariable analysis, Utilization of rTSA increased over time (OR 1.2 per year since 2006, p < 0.001) and hemiarthroplasty decreased over time (OR 0.86 per year since 2006, p < 0.001). Non-white patients had significantly lower odds of receiving rTSA versus ORIF (OR 0.75, 95%CI 0.58-0.97), as did male patients (OR 0.77, 95% CI 0.66-0.88, Table 2). Patients over 65 (OR 3.86, 95% CI 3.39-4.38), higher ASA classifications (ASA2: OR 3.24, 95% CI 1.86-5.66, ASA3: OR 4.77, 95% CI 2.74-8.32, ASA4: OR 5.25, 95% CI 2.89-9.54), and who were overweight (OR 1.33, 95% CI 1.14-1.55) or obese (OR 1.52, 95% CI 1.32-1.75) had higher odds of undergoing rTSA versus ORIF. Race and sex were not associated with utilization of hemiarthroplasty. Higher ASA classification and higher BMI were also associated with increased utilization of hemiarthroplasty.

DISCUSSION: As utilization of rTSA increases, understanding disparities in surgical treatment of PHF is crucial for improving outcomes and equitable access to an emerging orthopaedic technology. Our analysis of 7,827 patients suggests non-white patients are less likely to receive rTSA compared to white patients, even after controlling for other patient factors. Although our study is limited by reliance on database coding and a relatively small number of non-white patients, the relative over-representation of academic centers in this database suggests our results may underestimate true racial disparities in treatment of PHF.

SIGNIFICANCE/CLINICAL RELEVANCE: While certain patient factors such as age, BMI, and comorbidities are known to have a direct impact on outcomes and should be predictive of surgical intervention, patient race should not dictate treatment.

Table 1. Cohort Demographics by Operative Intervention

	Total 7827	Hemi 548 (7%)	ORIF 5232 (67%)	rTSA 2047 (26%)	P
Race					< 0.001
Native American/Alaskan	35	5 (14%)	25 (71%)	5 (14%)	
Asian	193	15 (8%)	148 (77%)	30 (16%)	
Black	277	15 (5%)	205 (74%)	57 (21%)	
White	7322	513 (7%)	4854 (66%)	1955 (27%)	
Age					< 0.001
Over 65	4967	433 (9%)	2750 (55%)	1784 (36%)	
Under 65	4177	243 (6%)	3425 (82%)	509 (12%)	
Sex					< 0.001
Female	6843	524 (8%)	4448 (65%)	1871 (27%)	
Male	2300	151 (7%)	1727 (75%)	422 (18%)	
BMI					< 0.001
Normal	2509	154 (6%)	1833 (73%)	522 (21%)	
Obese	3747	294 (8%)	2383 (64%)	1070 (29%)	
Overweight	2593	192 (7%)	1743 (67%)	658 (25%)	
ASA Class					< 0.001
1-No Disturb	426	14 (3%)	393 (92%)	19 (4%)	
2-Mild Disturb	3732	216 (6%)	2778 (74%)	738 (20%)	
3-Severe Disturb	4495	402 (9%)	2720 (61%)	1373 (31%)	
4-Life Threat	480	42 (9%)	277 (58%)	161 (34%)	
Hispanic Ethnicity					0.84
No	7081	494 (7%)	4732 (67%)	1855 (26%)	
Yes	659	44 (7%)	436 (66%)	179 (27%)	

Table 2. Multivariable Multinomial Model to Predict Operative Intervention

	Hemi	P	rTSA	P
Race				
White	Reference			
Not White	1.07 (0.73-1.55)	0.74	0.75 (0.58-0.97)	0.03
Age				
< 65	Reference			
>65	1.65 (1.36-2.01)	< 0.001	3.86 (3.39-4.38)	< 0.001
Year				
2006	0.86 (0.83-0.88)	< 0.001	1.2 (1.17-1.22)	< 0.001
ASA Class				
1-No Disturb	Reference			
2-Mild Disturb	1.53 (0.81-2.88)	0.19	3.24 (1.86-5.66)	< 0.001
3-Severe Disturb	2.46 (1.31-4.62)	0.01	4.77 (2.74-8.32)	< 0.001
4-Life Threat	2.04 (0.98-4.27)	0.06	5.25 (2.89-9.54)	< 0.001
BMI				
Normal	Reference			
Overweight	1.46 (1.13-1.88)	< 0.001	1.33 (1.14-1.55)	< 0.001
Obese	1.56 (1.23-1.97)	< 0.001	1.52 (1.32-1.75)	< 0.001
Sex				
Female	Reference			
Male	0.89 (0.71-1.1)	0.28	0.77 (0.66-0.88)	< 0.001
Ethnicity				
Non-Hispanic				
Hispanic	1 (0.71-1.42)	0.98	0.94 (0.76-1.17)	0.58

Figure 1. Surgical Interventions by Race and Year

