

## Shoulder Hemiarthroplasty in Underweight Patients: A Cause for Pause?

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**INTRODUCTION:** Shoulder arthroplasty is a popular option for alleviating upper extremity pathologies including osteoarthritis, proximal humerus fractures, and rotator cuff-tear arthropathies.<sup>1</sup> The three main types of glenohumeral replacements include hemiarthroplasty, an anatomic total shoulder replacement (TSA), and a reverse total shoulder replacement (rTSA). Hemiarthroplasties have the inherent advantage over TSA and rTSA by not requiring a glenoid socket implant, which has historically been the most common piece of arthroplasty failure.<sup>2</sup> While many studies have investigated the negative impact elevated BMI can have on outcomes following arthroplasties, few have investigated the potential impact of being underweight. Therefore, the purpose of this study is to compare postoperative outcomes of shoulder hemiarthroplasties stratified by BMI, with a particular focus on those with BMIs <18.5.

**METHODS:** Patients between 2012-2022 were identified as having undergone hemiarthroplasty by the associated CPT code from the NSQIP database (23470). Post-operative complications including bleeding, and readmission were assessed for HA. One-way ANOVA and logistic regression analyses controlling for age, sex, race, Hispanic or non-Hispanic status, ASA class, history of chronic obstructive pulmonary disease, and history of diabetes were performed using R software.<sup>3</sup>

**RESULTS SECTION:** A total of 3247 were included in the analysis with 47 having a BMI <18.5 (Underweight), 609 with a BMI of 18.5-24.9 (Normal Weight), 988 with a BMI of 25-29.9 (Overweight), 1212 with a BMI of 30-39.9 (Obese Class 1), 321 with a BMI of 40-49.9 (Obese Class 2), and 70 with a BMI >50 (Obese Class 3). Patients with a BMI <18.5 were significantly more likely to be readmitted to the hospital within 30 days following surgery (OR 3.64; p<0.05) compared to other weight categories (Table 1). Overweight, Obese Class 1, and Obese Class 2 patients had significantly lower lengths of hospital stay following HA than underweight patients.

**DISCUSSION:** Our results indicate that, counterintuitively, obese class I, II, and III patients are at statistically significantly lower risk of post-operative bleeds following HA, than patients with normal BMIs. Likewise, our data brings to light the fact that, paradoxically, underweight patients have the greatest odds of readmission, following HA, relative to normal BMI. This effect size is further compounded given that all analyses were controlled for age, race, sex, basic health profile (as per ASA class), and common comorbidities. Therefore, orthopaedic surgeons must be aware of post-operative challenges when operating on this patient cohort. Limitations of this study include a lack of long term followup and a lack of patient reported outcome measures to assess functional status and patient satisfaction after surgery. Future studies should further investigate if certain indications for surgery are contributing to these findings more so than others. Additionally, this study cannot assess the reason for surgical intervention or distinguish between various etiologies of injury, whether traumatic, degenerative, or otherwise.

**SIGNIFICANCE/CLINICAL RELEVANCE:** Patients who are underweight and are undergoing a shoulder hemiarthroplasty are at higher risk of readmission compared to normal range BMI patients. Recognizing this risk allows for the development of specific perioperative care strategies to address this issue. This highlights the need for heightened awareness and a comprehensive approach towards tailored rehabilitation, to decrease readmission rates for the underweight population.

**REFERENCES:** **1:** Lin DJ, Wong TT, Kazam JK. Shoulder Arthroplasty, from Indications to Complications: What the Radiologist Needs to Know. *Radiographics*. 2016;36(1):192-208. **2:** Matsen FA 3rd, Clinton J, Lynch J, Bertelsen A, Richardson ML. Glenoid component failure in total shoulder arthroplasty. *J Bone Joint Surg Am*. 2008;90(4):885-896. **3:** R Core Team (2023). R: A language and environment for statistical computing. Vienna, Austria. <https://www.R-project.org/>

IMAGES and TABLES:

Odds of Complications Stratified by BMI Category										
Perioperative Data	Underweight < 18.5		Overweight 25-29.9		Obese Class 1 30-39.9		Obese Class 2 40-49.9		Obese Class 3 > 50	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Bleed	0.20 (-3.46 - 0.46)	0.128	0.55 (-1.07 - (-0.13))	< 0.05	0.19 (-2.22 - (-1.09))	< 0.001	0.26 (-2.11 - (-0.61))	< 0.001	0.10 (-4.39 - (-0.27))	< 0.05
Readmission	3.64 (0.20 - 2.39)	< 0.05	0.77 (-0.90 - 0.37)	0.41	0.51 (-1.32 - (-0.03))	< 0.05	0.47 (-1.68 - 0.16)	0.11	1.87 (-0.45 - 1.71)	0.25

Table 1. Perioperative data comparing the odds of complication among patients undergoing shoulder hemiarthroplasty, stratified by BMI grouping.

Influence of BMI on Perioperative Hospital Stay Length in Total Hip Arthroplasty										
Perioperative Data	Difference Underweight- Normal		Difference Overweight- Normal		Difference Obese Class 1- Normal		Difference Obese Class 2- Normal		Difference Obese Class 3- Normal	
	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value
Hospital Admission to Operation	1.10	0.93	0.20	1.00	-0.03	1.00	-0.22	0.18	0.00	1.00
Days from Operation to Discharge	0.45	0.97	-0.54	< 0.01	-0.64	< 0.001	-0.61	< 0.001	-0.28	0.89
Total Length of Hospital Stay	1.54	0.94	-0.72	< 0.01	-0.67	0.10	-0.84	< 0.001	-0.28	0.98

Table 2. Perioperative data comparison between patients undergoing hemiarthroplasty, stratified by BMI grouping.