Malnutrition, Perioperative Risk Stratification, and the Geriatric Total Shoulder Arthroplasty Patient

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INTRODUCTION: As indications for total shoulder arthroplasty (TSA) broaden, technology progresses, and surgical techniques advance, an increasing number of geriatric patients will undergo TSA. Malnutrition is often underrecognized and untreated in the geriatric surgical patient and is known to be associated with poor postsurgical outcomes. While low serum albumin has conventionally been used to determine nutrition status, it has been criticized for its failure to account for other factors involved in the physiology of nutrition. The Geriatric Nutrition Risk Index (GNRI) is a simple, yet robust, measure of malnutrition in elderly patients calculated using patient weight, ideal body weight, and serum albumin levels. This study aims to determine whether malnutrition estimated by GNRI is an independent predictor of adverse outcomes following TSA.

METHODS: The American College of Surgeons National Surgical Quality Improvement (NSQIP) database was queried for all patients age >65 who underwent TSA from 2015 to 2021. 30-day postoperative complications following TSA as well as patient demographics and comorbidities were collected. GNRI was then calculated for each patient using body weight, ideal body weight determined by the Lorenz equation, and preoperative serum albumin levels. The study population was then indexed into 3 cohorts based on their preoperative GNRI: normal (GNRI > 98), moderate malnutrition (92 ≤ GNRI ≤ 98), and severe malnutrition (GNRI < 92). Bivariate logistic regression analysis was used to identify significant patient factors and postoperative complications associated with moderate and severe malnutrition. Subsequently, multivariate logistic regression analysis was used to identify postoperative complications independently associated with moderate and severe malnutrition.

RESULTS: A total of 11,411 patients were included in this study: 9,046 in the normal nutrition group, 1,721 in the moderate malnutrition group, and 644 in the severe malnutrition group. After controlling for associated patient demographics, moderate malnutrition was found to be independently associated with a greater likelihood of any complications (odds ratio [OR] 1.74, 95% confidence interval [CI] 1.54-1.96; P < 0.001), blood transfusions (OR 1.52, 95% CI 1.09-2.11; P = 0.013), failure to wean off a ventilator within 48 hours (OR 3.84, 95% CI 1.26-11.72; P = 0.018), wound dehiscence (OR 15.80, 95% CI 1.61-155.28; P = 0.018), non-home discharge (OR 1.90, 95% CI 1.63-2.22; P < 0.001), readmission (OR 1.54, 95% CI 1.19-1.99; P = 0.001), unplanned reoperation (OR 1.87, 95% CI 1.27-2.74; P = 0.001), length of stay (LOS) > 2 days (OR 1.85, 95% CI 1.63-2.12; P < 0.001), and mortality (OR 3.38, 95% CI 1.32-8.71; P = 0.011). Severe malnutrition was found to be independently associated with a greater likelihood of any complication (OR 3.33, 95% CI 2.80-3.97; P < 0.001), sepsis (OR 9.83, 95% CI 2.94-32.85; P < 0.001), pneumonia (OR 3.30, 95% CI 1.71-6.38; P < 0.001), unplanned reintubation (OR 5.77, 95% CI 2.47-13.51; P < 0.001), urinary tract infection (OR 2.15, 95% CI 1.19-3.87; P = 0.011), stroke (OR 3.57, 95% CI 1.18-10.84; P = 0.024), blood transfusions (OR 5.27, 95% CI 3.86-7.20; P < 0.001), failure to wean off a ventilator within 48 hours (OR 7.64, 95% CI 2.29-25.55; P < 0.001), *Clostridioides difficile* infection (OR 4.17, 95% CI 1.21-14.32; P = 0.023), non-home discharge (OR 3.56, 95% CI 2.92-4.34; P < 0.001), readmission (OR 2.05, 95% CI 1.46-2.89; P < 0.001), LOS > 2 days (OR 3.27, 95% CI 2.73-3.92; P < 0.001), and mortality (OR 4.61, 95% CI 1.51-14.04; P = 0.007).

DISCUSSION: Among geriatric patients with malnutrition based on GNRI, the rate of complications following TSA was found to increase with increasing severity of malnutrition. Our findings suggest that GNRI is a strong predictor of 30-day postoperative complications following TSA in geriatric patients and supports the use of GNRI as an adjunctive tool in the risk stratification of geriatric patients undergoing TSA. Given the increasing surgical volume of TSA in elderly patients and the poor surgical outcomes associated with malnutrition, it is important to identify malnutrition in the preoperative selection of surgical candidates. This study used a large sample size and adjusted for patient demographics, comorbidities, and operative variables. This study was limited by the inherent limitations of the NSQIP database.

SIGNIFICANCE/CLINICAL RELEVANCE: Validating the predictive value of the GNRI in geriatric patients undergoing TSA supports its use as an adjunctive tool in preoperative risk stratification to reduce postoperative adverse events, minimize hospital stay, and promote favorable patient outcomes.

IMAGES AND TABLES:

Table I. Multivariate analysis of 30-day postoperative complications in patients with preoperative normal GNRI, moderate malnutrition, and severe malnutrition. Dashes represent associations not significant in bivariate analysis and were not included in multivariate analysis. Bold P values indicate statistical significance with P < 0.05.

	Moderate malnutrition OR, P value (95% CI)	Severe malnutrition OR, P value (95% CI)
Any complication	1.74, **<0.001** (1.54-1.96)	3.33, **<0.001** (2.80-3.97)
Sepsis	0.81, 0.844 (0.10-6.53)	9.83, **<0.001** (2.94-32.85)
Pneumonia	--	3.30, **<0.001** (1.71-6.38)
Unplanned reintubation	2.25, 0.050 (1.00-5.06)	5.77, **<0.001** (2.47-13.51)
Urinary tract infection	--	2.15, **0.011** (1.19-3.87)
Cardiac arrest or myocardial infarction	2.05, 0.052 (0.99-4.23)	--
Stroke	--	3.57, **0.024** (1.18-10.84)
Blood transfusions	1.52, **0.013** (1.09-2.11)	5.27, **<0.001** (3.86-7.20)
On ventilator > 48 hours	3.84, **0.018** (1.26-11.72)	7.64, **<0.001** (2.29-25.55)
Wound dehiscence	15.80, **0.018** (1.61-155.28)	5.94, 0.246 (0.29-120.12)
***Clostridioides difficile* infection**	--	4.17, **0.023** (1.21-14.32)
Non-home discharge	1.90, **<0.001** (1.63-2.22)	3.56, **<0.001** (2.92-4.34)
Readmission	1.54, **0.001** (1.19-1.99)	2.05, **<0.001** (1.46-2.89)
Unplanned reoperation	1.87, **0.001** (1.27-2.74)	1.58, 0.142 (0.86-2.89)
Length of stay > 2 days	1.85, **<0.001** (1.63-2.12)	3.27, **<0.001** (2.73-3.92)
Mortality	3.38, **0.011** (1.32-8.71)	4.61, **0.007** (1.51-14.04)

GNRI, Geriatric Nutritional Risk Index; OR, odds ratio; CI, confidence interval.