

# Severity of Malnutrition is Associated with Poorer Outcomes in the Elderly Revision Total Knee Arthroplasty Patient

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**INTRODUCTION:** The rapidly growing geriatric population in the United States has resulted in a greater incidence of total knee arthroplasty (TKA) and revision total knee arthroplasty (rTKA). With a growing number of rTKAs performed each year, it is pertinent to understand patient risk factors associated with poorer postoperative outcomes. Malnutrition is a well-documented orthopedic surgery risk factor linked to an increased rate of adverse postoperative outcomes. In the past, serum albumin has been used as a marker for malnutrition. However, mixed evidence regarding its validity as a proxy for malnutrition has led to newer risk indices to be developed. The Geriatric Nutritional Risk Index (GNRI), a simple validated malnutrition risk assessment for geriatric patients, is calculated using serum albumin, body weight, and ideal body weight. The purpose of this study is to investigate the relationship between GNRI and early postoperative outcomes following rTKA.

**METHODS:** The American College of Surgeons National Surgical Quality Improvement (NSQIP) database was queried for all patients age >65 who underwent rTKA for a non-infectious cause from 2015 to 2021. 30-day postoperative complications following rTKA 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 9,409 patients were included in this study: 6,658 in the normal nutrition group, 1,636 in the moderate malnutrition group, and 1,115 in the severe malnutrition group. After controlling for associated patient demographics, moderate malnutrition was found to be independently significantly associated with a greater likelihood of any complications (odds ratio [OR] 1.74, 95% confidence interval [CI] 1.55-1.95; P < 0.001), blood transfusions (OR 2.33, 95% CI 1.92-2.82; P < 0.001), surgical site infection (SSI) (OR 1.74, 95% CI 1.31-2.32; P < 0.001), non-home discharge (OR 1.82, 95% CI 1.61-2.06; P < 0.001), readmission (OR 1.32, 95% CI 1.07-1.65; P = 0.011), length of stay (LOS) > 2 days (OR 1.83, 95% CI 1.63-2.04; P < 0.001), and mortality (OR 2.83, 95% CI 1.22-6.60; P = 0.016). Severe malnutrition was independently significantly associated with a greater likelihood of any complication (OR 5.92, 95% CI 4.89-7.17; P < 0.001), septic shock (OR 7.62, 95% CI 2.57-22.61; P < 0.001), pneumonia (OR 4.93, 95% CI 2.53-9.62; P < 0.001), unplanned reintubation (OR 3.93, 95% CI 1.79-8.61; P < 0.001), cardiac arrest or myocardial infarction (OR 3.29, 95% CI 1.73-6.27; P < 0.001), stroke (OR 5.13, 95% CI 1.75-15.00; P = 0.003), blood transfusions (OR 3.85, 95% CI 3.16-4.68; P < 0.001), on ventilator > 48 hours (OR 5.93, 95% CI 1.89-18.59; P = 0.002), SSI (OR 2.61, 95% CI 1.93-3.52; P < 0.001), wound dehiscence (OR 2.39, 95% CI 1.37-4.16; P = 0.002), acute renal failure (OR 4.84, 95% CI 1.27-18.53; P = 0.021), non-home discharge (OR 2.87, 95% CI 2.49-3.32; P < 0.001), readmission (OR 1.89, 95% CI 1.49-2.39; P < 0.001), unplanned reoperation (OR 1.54, 95% CI 1.12-2.12; P = 0.008), LOS > 2 days (OR 5.45, 95% CI 4.60-6.46; P < 0.001), and mortality (OR 6.95, 95% CI 3.23-14.93; P < 0.001).

**DISCUSSION:** In geriatric patients with GNRI-based malnutrition, the overall rate of complication following rTKA was found to increase with more severe malnutrition. Our findings show that abnormal preoperative GNRI strongly predicts early postoperative complications following rTKA in geriatric patients and support its utility as an adjunctive risk stratification tool for geriatric patients undergoing rTKA. Given the increasing surgical volume of rTKA 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:** A better understanding of GNRI's prognostic value for the elderly rTKA patient may aid surgeons in better selecting surgical candidates, identifying modifiable risk factors, and promoting favorable patient outcomes.

## IMAGES AND TABLES:

**Table 1.** 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.

Complications	Moderate malnutrition	Severe malnutrition
	OR, P value (95% CI)	OR, P value (95% CI)
Any complication	1.74, <0.001 (1.55-1.95)	5.92, <0.001 (4.89-7.17)
Septic shock	--	7.62, <0.001 (2.57-22.61)
Pneumonia	1.69, 0.184 (0.78-3.67)	4.93, <0.001 (2.53-9.62)
Unplanned reintubation	--	3.93, <0.001 (1.79-8.61)
Cardiac arrest or myocardial infarction	--	3.29, <0.001 (1.73-6.27)
Stroke	0.51, 0.525 (0.06-4.09)	5.13, <b>0.003</b> (1.75-15.00)
Blood transfusions	2.33, <0.001 (1.92-2.82)	3.85, <0.001 (3.16-4.68)
On ventilator > 48 hours	--	5.93, <b>0.002</b> (1.89-18.59)
Surgical site infection	1.74, <0.001 (1.31-2.32)	2.61, <0.001 (1.93-3.52)
Wound dehiscence	--	2.39, <b>0.002</b> (1.37-4.16)
Acute renal failure	--	4.84, <b>0.021</b> (1.27-18.53)
<i>Clostridioides difficile</i> infection	--	2.08, 0.149 (0.77-5.64)
Non-home discharge	1.82, <0.001 (1.61-2.06)	2.87, <0.001 (2.49-3.32)
Readmission	1.32, <b>0.011</b> (1.07-1.65)	1.89, <0.001 (1.49-2.39)
Unplanned reoperation	--	1.54, <b>0.008</b> (1.12-2.12)
Length of stay > 2 days	1.83, <0.001 (1.63-2.04)	5.45, <0.001 (4.60-6.46)
Mortality	2.83, <b>0.016</b> (1.22-6.60)	6.95, <0.001 (3.23-14.93)

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