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Shoulder arthroscopy in elderly patients: malnutrition and early postoperative outcomes

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Background: This study investigates the association between the Geriatric Nutritional Risk Index (GNRI), a simple, readily available malnutrition risk index, and 30-day postoperative complications following shoulder arthroscopy.

Methods: The American College of Surgeons National Surgical Quality Improvement Program database was used to identify all patients aged ≥65 years who underwent shoulder arthroscopy between 2015 and 2021. The study population was indexed into 3 cohorts of preoperative GNRI: normal/reference (GNRI >98), moderate malnutrition (92≤ GNRI ≤98), and severe malnutrition (GNRI <92). Multivariate logistic regression analysis was conducted to investigate the connection between preoperative GNRI and postoperative complications.

Results: Severe malnutrition was independently significantly associated with a greater likelihood of any complication (odds ratio [OR]: 11.70, 95% confidence interval [CI]: 8.58-15.94; $P < .001$), sepsis (OR: 26.61, 95% CI: 10.86-65.21; $P < .001$), septic shock (OR: 7.53, 95% CI: 1.56-36.32; $P = .012$), blood transfusions (OR: 25.38, 95% CI: 6.40-100.59; $P < .001$), pulmonary embolism (OR: 7.25, 95% CI: 1.27-41.40; $P = .026$), surgical site infection (OR: 22.08, 95% CI: 7.51-64.97; $P < .001$), nonhome discharge (OR: 15.75, 95% CI: 9.83-25.23; $P < .001$), readmission (OR: 2.69, 95% CI: 1.52-4.74; $P < .001$), unplanned reoperation (OR: 6.32, 95% CI: 2.23-17.92; $P < .001$), length of stay >2 days (OR: 23.66, 95% CI: 16.25-34.45; $P < .001$), and mortality (OR: 14.25, 95% CI: 2.89-70.40; $P = .001$).

Conclusion: GNRI-based malnutrition is strongly predictive of perioperative complications following shoulder arthroscopy in geriatric patients and has utility as an adjunctive risk stratification tool.

Shoulder arthroscopy is a procedure that is used for the diagnosis and treatment of conditions such as rotator cuff tears, shoulder dislocations, labrum repair, and débridement of tissue or cartilage. Because of its minimally invasive nature and relatively low risk of complications, shoulder arthroscopy as a procedure has increased in popularity.[3] Shoulder pathologies are more frequently seen in older patients.[22] A growing elderly population in the United States, with estimates of 21% of the US population to be aged more than 65 years by 2030, contributes to the growing incidence of shoulder arthroscopic procedures.[29] Therefore, it is important to acknowledge the higher potential for postoperative complications in older patients.[21,26]

Malnutrition is a notable risk factor for postoperative complications in elderly patients.[9] It may often be overlooked in patient assessments. Nutritional status may be altered by the presence of chronic disease and immobility and diminished by the natural muscle catabolism that occurs with aging.[13] Several forms of screening have proven to be effective in detecting malnutrition in orthopedic studies while being predictors for negative postoperative outcomes.[3,4,7] These include serological values such as albumin and lymphocytes, as well as questionnaires and indexes like the Mini Nutritional Assessment and Geriatric Nutritional Risk Index (GNRI).[1,5]

Various studies in oncology, gastroenterology, and cardiology have shown the prognostic utility of GNRI.[16,17,28] However, there lacks evidence on the prognostic value of GNRI following arthroscopic shoulder procedures. The purpose of this study was to examine the complications associated with worsening malnutrition based on GNRI.

Institutional review board approval was not required for this study.

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Table I
Shoulder arthroscopy cases by primary billing code.

CPT code	Procedure name	Number	%
Minor		1955	28.5
29826	Subacromial decompression with acromioplasty	376	5.5
29823	Extensive débridement	611	8.9
29822	Limited débridement	321	4.7
29824	Distal claviculectomy	489	7.1
29825	Lysis and resection of adhesions with or without manipulations	84	1.2
29820	Partial synovectomy	18	0.3
29819	Foreign-body removal	17	0.2
29821	Complete synovectomy	39	0.6
Major		4904	71.5
29827	Rotator cuff repair	4610	67.2
29807	Superior labrum anterior and posterior lesion repair	63	0.9
29806	Capsulorrhaphy	80	1.2
29828	Biceps tenodesis	151	2.2

CPT, Current Procedural Terminology.

Materials and methods

We queried the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database for all patients who underwent shoulder arthroscopy between 2015 and 2021. The study was exempt from approval by our University's Institutional Review Board because the NSQIP database is fully deidentified. Data in the NSQIP database are obtained from more than 600 hospitals in the United States, are collected by trained surgical clinical reviewers, and are periodically audited to maintain high fidelity.

Current Procedural Terminology codes were used to identify 97,874 patients who underwent shoulder arthroscopy between 2015 and 2021. The procedures used as selection criteria and their respective Current Procedural Terminology codes are listed in Table I. The exclusion criteria inherent to the NSQIP database exclude all cases for patients aged less than 18 years. Seventy four thousand one hundred twenty four patients with missing height, weight, or preoperative albumin values required to calculate GNRI, were excluded, leaving 23,750 patients. Next, 13,012 cases were excluded for missing American Society of Anesthesiologists (ASA) classification, functional health status, or were aged <65 years, leaving a total of 10,738 patients to be included in this study. GNRI was then calculated for each patient using the following formula, using weight (lb) and albumin (g/L).[1,7,15]

$$GNRI = (1.489 * Albumin) + \left(41.7 * \frac{Weight}{WLo}\right)$$

WLo is the ideal weight, calculated for male and female gender using the Lorentz equations, using height (cm)[1,7,15]:

$$WLo_{male} = (Height - 100) + \frac{Height - 150}{4}$$

$$WLo_{female} = (Height - 100) - \frac{Height - 150}{2}$$

For patients with weight exceeding their ideal weight, the ratio of Weight/WLo was capped at 1.[7,15]

The remaining study population (Fig. 1) was then indexed into 3 cohorts based on their preoperative GNRI: normal/reference (GNRI >98), moderate malnutrition (92 ≤GNRI ≤98), and severe malnutrition (GNRI <92). These validated cutoffs were chosen based on pre-existing research on GNRI.[7]

Variables collected in this study included patient demographics, comorbidities, surgical characteristics, and 30-day postoperative complication data. Patient demographics included gender, age, body mass index (BMI), functional status, ASA classification, smoking status, and preoperative steroid use. Preoperative comorbidities included congestive heart failure (CHF), diabetes, hypertension, severe chronic obstructive pulmonary disease (COPD), bleeding disorders, and disseminated cancer. Surgical characteristics included procedure type (major or minor, classified in Table I) and total operation time. Thirty-day complications included the following: sepsis, septic shock, pneumonia, unplanned reintubation, urinary tract infection, cardiac arrest or myocardial infarction (MI), stroke, blood transfusions, deep vein thrombosis, pulmonary embolism (PE), on ventilator >48 hours, surgical space infection (SSI), wound dehiscence, acute renal failure, *Clostridioides difficile* (*C. diff*) infection, nonhome discharge, readmission, unplanned reoperation, length of stay (LOS) >2 days, and mortality.

All statistical analyses were conducted using SPSS Software version 26.0 (IBM Corp., Armonk, NY, USA). Patient demographics and comorbidities were compared between cohorts using bivariate logistic regression. Multivariate logistic regression was used to identify independent associations between preoperative GNRI and postoperative complications significant on bivariate analysis. That is, complications significantly associated with preoperative GNRI on bivariate analysis subsequently underwent multivariate analysis, with significant demographic and comorbidity factors on bivariate analysis to account for potential confounding patient variables. Odds ratios (ORs) were reported with 95% confidence intervals (CIs). The level of statistical significance was set at $P < .05$.

Results

Compared to the normal nutrition group, the moderate malnutrition group was statistically significant for female gender ($P < .001$), older age groups ($P < .001$), greater BMI groups ($P < .001$), ASA classification ≥3 ($P < .001$), and chronic steroid use ($P < .001$) (Table II). The moderate malnutrition group was also significant for minor procedures ($P < .001$). Compared to the normal nutrition group, the severe malnutrition group was statistically significant for older age groups ($P < .001$), abnormal BMI groups ($P = .024$), dependent functional status ($P < .001$), ASA classification ≥3 ($P < .001$), chronic steroid use ($P < .001$), comorbid CHF ($P < .001$), diabetes ($P < .001$), COPD ($P < .001$), bleeding disorders ($P < .001$), and disseminated cancer ($P < .001$). The severe malnutrition group was also statistically significant for minor procedures ($P < .001$) and shorter total operative time ($P < .001$).

Compared to the normal nutrition group, the moderate malnutrition group was associated with any complication ($P < .001$), sepsis ($P = .007$), deep vein thrombosis ($P = .044$), nonhome discharge ($P < .001$), readmission ($P = .002$), unplanned

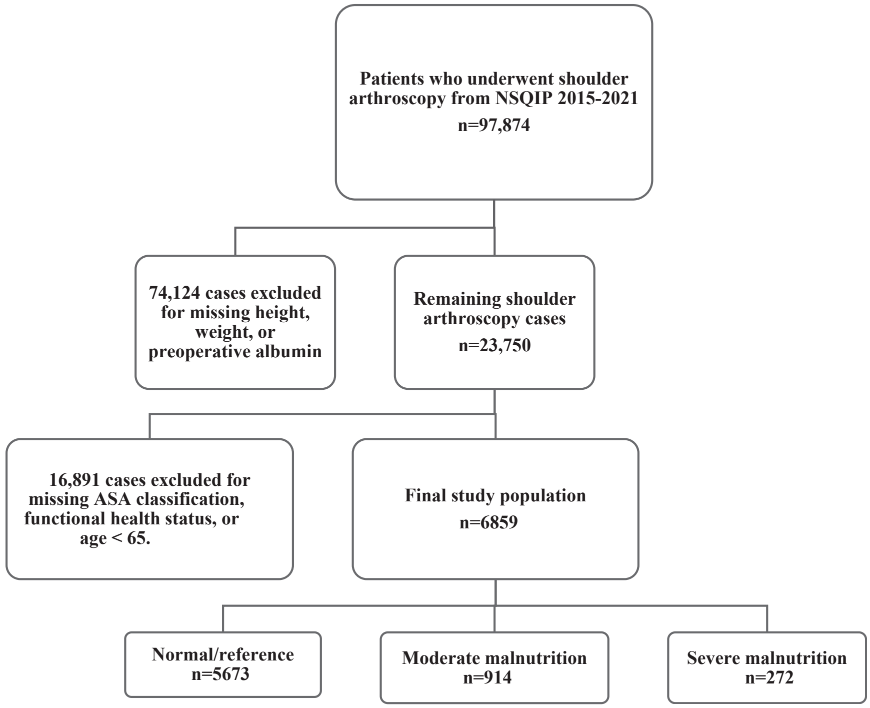

Figure 1 Case selection schematic. *NSQIP*, National Surgical Quality Improvement Program; *ASA*, American Society of Anesthesiologists.

reoperation (P < .001), and LOS >2 days (P < .001) (Table III). Compared to the normal nutrition group, the severe malnutrition group was associated with any complication (P < .001), sepsis (P < .001), septic shock (P < .001), pneumonia (P = .002), cardiac arrest or MI (P = .001), stroke (P = .018), blood transfusions (P < .001), PE (P = .018), failure to wean off a ventilator within 48 hours (P < .001), SSI (P < .001), acute renal failure (P < .001), *C. diff* infection (P < .001), nonhome discharge (P < .001), readmission (P < .001), unplanned reoperation (P < .001), LOS >2 days (P < .001), and mortality (P < .001).

After controlling for all significant patient demographic and comorbidity factors, an adjusted multivariate regression analysis was conducted (Table IV). Compared to the normal nutrition group, the moderate malnutrition group was independently associated with a greater likelihood of any complications (OR: 1.84, 95% CI: 1.40-2.42; P < .001), sepsis (OR: 3.75, 95% CI: 1.30-10.86; P = .015), nonhome discharge (OR: 2.09, 95% CI: 1.21-3.61; P = .008), readmission (OR: 1.66, 95% CI: 1.09-2.52; P = .017), unplanned reoperation (OR: 4.23, 95% CI: 1.82-9.84; P < .001), and LOS >2 days (OR: 2.37, 95% CI: 1.59-3.55; P < .001). The severe malnutrition group was independently associated with a greater likelihood of any complication (OR: 11.70, 95% CI: 8.58-15.94; P < .001), sepsis (OR: 26.61, 95% CI: 10.86-65.21; P < .001), septic shock (OR: 7.53, 95% CI: 1.56-36.32; P = .012), blood transfusions (OR: 25.38, 95% CI: 6.40-100.59; P < .001), PE (OR: 7.25, 95% CI: 1.27-41.40; P = .026), SSI (OR: 22.08, 95% CI: 7.51-64.97; P < .001), nonhome discharge (OR: 15.75, 95% CI: 9.83-25.23; P < .001), readmission (OR: 2.69, 95% CI: 1.52-4.74; P < .001), unplanned reoperation (OR: 6.32, 95% CI: 2.23-17.92; P < .001), LOS >2 days (OR: 23.66, 95% CI: 16.25-34.45; P < .001), and mortality (OR: 14.25, 95% CI: 2.89-70.40; P = .001).

Discussion

When compared to patients with normal nutrition, worsening nutritional status was independently associated with greater rates of postoperative complications. This finding concurs with preexisting literature.[7,10,12,15,24] Our study discovered a greater likelihood of any complication, sepsis, nonhome discharge, readmission, unplanned reoperation, and increased LOS for both degrees of malnutrition. For complications independently associated with both moderate and severe malnutrition, severe malnutrition was generally found to have stronger associations: any complication (OR 1.84 in moderate malnutrition vs. 11.70 in severe malnutrition), sepsis (OR 3.75 vs. 26.61), nonhome discharge (OR 2.09 vs. 15.75), readmission (OR 1.66 vs. 2.69), unplanned reoperation (OR 4.23 vs. 6.32), and LOS >2 days (OR 2.37 vs. 23.66).

Poor nutrition is a highly prevalent comorbidity within the elderly population and has been shown to adversely affect postoperative outcomes in numerous areas of surgery, including cardiovascular, gastrointestinal, and orthopedic surgery.[7,16,28] Through the use of GNRI, the present study found that 13.3% and 4.0% of 6859 patients aged more than 65 years undergoing shoulder arthroscopy experienced moderate or severe malnutrition, respectively. These results reflect that of similar studies on elective geriatric orthopedic procedures, reporting that 8.5%-12.3% of patients were malnourished, using serum albumin concentration as a proxy.[6,14] Although shoulder arthroscopy is a minimally invasive procedure with complication rates as low as 1.6%, elderly patients are at a higher risk to experience adverse outcomes as a consequence of age and other comorbidities, including malnutrition.[22] To our knowledge, this is the first study to describe both moderate and severe malnutrition as independent risk factors for postoperative complications following shoulder arthroscopy in the geriatric population. Furthermore, this supports growing evidence of the utility that GNRI holds as a predictor of nutrition status in preoperative risk assessment of elderly patients.[7,10,12,15,24]

Several studies have successfully used albumin levels alone to assess malnutrition and predict a greater risk of adverse events following surgery. In assessing elderly hip-fracture surgery patients, a study found that albumin levels less than 3.5 g/dL correlated with readmission, reintubation, reoperation, infection, and

Table II
Patient demographics and comorbidities for patients with preoperative normal GNRI, moderate malnutrition, and severe malnutrition.

	Normal (GNRI >98)	Moderate malnutrition (92 ≤GNRI ≤98)		Severe malnutrition (GNRI <92)	
	Number (%)	Number (%)	*P* value	Number (%)	*P* value
Overall	5673 (100.0)	914 (100.0)		272 (100.0)	
Gender			**<.001**		.442
Female	2618 (46.1)	505 (55.3)		132 (48.5)	
Male	3055 (53.9)	409 (44.7)		140 (51.5)	
Age			**<.001**		**<.001**
65-74	4575 (80.6)	671 (73.4)		169 (62.1)	
75-84	1039 (18.3)	218 (23.9)		74 (27.2)	
≥85	59 (1.0)	25 (2.7)		29 (10.7)	
BMI (kg/m^2)			**<.001**		**.024**
<18.5	23 (0.4)	8 (0.9)		5 (1.8)	
18.5-29.9	3047 (53.7)	433 (47.4)		125 (46.0)	
30-34.9	1557 (27.4)	230 (25.2)		80 (29.4)	
35-39.9	692 (12.2)	150 (16.4)		35 (12.9)	
≥40	354 (6.2)	93 (10.2)		27 (9.9)	
Functional status prior to surgery			.209		**<.001**
Dependent	35 (0.6)	9 (1.0)		20 (7.4)	
Independent	5638 (99.4)	905 (99.0)		252 (92.6)	
ASA classification			**<.001**		**<.001**
≤2	2610 (46.0)	323 (35.3)		50 (18.4)	
≥3	3063 (54.0)	591 (64.7)		222 (81.6)	
Smoker			.560		.216
No	5269 (92.9)	844 (92.3)		258 (94.9)	
Yes	404 (7.1)	70 (7.7)		14 (5.1)	
Steroid use			**<.001**		**<.001**
No	5479 (96.6)	860 (94.1)		250 (91.9)	
Yes	194 (3.4)	54 (5.9)		22 (8.1)	
Comorbidities					
CHF	45 (0.8)	8 (0.9)	.797	20 (7.4)	**<.001**
Diabetes	1401 (24.7)	249 (27.2)	.099	92 (33.8)	**<.001**
Hypertension	3746 (66.0)	623 (68.2)	.206	185 (68.0)	.500
COPD	275 (4.8)	58 (6.3)	.056	28 (10.3)	**<.001**
Bleeding disorder	148 (2.6)	30 (3.3)	.245	40 (14.7)	**<.001**
Disseminated cancer	12 (0.2)	2 (0.2)	.965	8 (2.9)	**<.001**
Procedure type			**<.001**		**<.001**
Minor	1491 (26.3)	297 (32.5)		167 (61.4)	
Major	4182 (73.7)	617 (67.5)		105 (38.6)	
Total operation time (minutes)			.051		**<.001**
0-79	3298 (58.1)	555 (60.7)		198 (72.8)	
80-128	1695 (29.9)	270 (29.5)		53 (19.5)	
≥129	680 (12.0)	89 (9.7)		21 (7.7)	

GNRI, Geriatric Nutritional Risk Index; *BMI*, body mass index; *ASA*, American Society of Anesthesiologists; *CHF*, congestive heart failure; *COPD*, chronic obstructive pulmonary disease.
Bold *P* values indicate statistical significance with $P < .05$.

mortality.[23] Comparably, patients with hypoalbuminemia undergoing open rotator cuff repair were more likely to experience readmission and a greater length of hospital stay.[20] However, the prognostic ability of albumin as a proxy for malnutrition is limited by hydration, inflammation, diabetes, and other diseases that may affect serum albumin levels regardless of nutrition status.[1] As a result, nutritional risk indexes may serve well as additional screening adjacent to albumin levels. In fact, when comparing 4 different nutritional tools, GNRI was found to have the greatest predictive capacity in detecting malnutrition in a cohort of 167 orthopedic and 103 neurosurgical patients and was associated with infectious complications and increased LOS.[10]

GNRI is an objective measure that does not rely on the function of the patient or subjective assessment by caretakers, which greatly benefits elderly patients who may be cognitively impaired.[1] Moreover, its use of routinely measured serological and anthropometric data further supports its integration into preoperative measures to assess comorbidity.[11] In our study, significantly associated comorbidities for both moderate and severe malnutrition cohorts undergoing shoulder arthroscopy included older age, abnormal BMI groups, increased ASA classification, and chronic steroid use. Severely malnourished patients were most likely to be comorbid with more chronic conditions, including CHF, diabetes, COPD, bleeding disorders, and disseminated cancer.

Immune dysfunction frequently occurs because of inadequate nutrition and can impair T-cell function, phagocytosis, and complement protein formation.[2] This increases severity of and susceptibility to infection and delays wound healing.[27] In the present study, malnutrition cohorts were at increased infectious complications with worse nutritional status, including sepsis, septic shock, and SSI. Several surgery studies corroborate these findings, reporting malnutrition as predicted by GNRI as an independent risk factor for infectious complications.[7,15,24]

In the present study, the likelihood of adverse perioperative events related to hospital stay and discharge occurring increased with poorer nutritional status. Both moderate and severe malnutrition categories experienced greater rates of nonhome discharge, readmission, unplanned reoperation, and extended length of hospital stay. Similarly, in a study of outpatient arthroscopic rotator cuff repair, malnutrition assessed by hypoalbuminemia was significantly associated with hospitalization and increased LOS.[19] This study showed that severe malnutrition was independently associated with a greater risk of mortality following shoulder arthroscopy. Upper limb studies have also reported an increased

Table III
Bivariate analysis of 30-day postoperative complications in patients with preoperative normal GNRI, moderate malnutrition, and severe malnutrition.

	Normal (GNRI >98)	Moderate malnutrition (92 ≤GNRI ≤98)		Severe malnutrition (GNRI <92)	
	Number (%)	Number (%)	*P* value	Number (%)	*P* value
Any complication	234 (4.1)	81 (8.9)	**<.001**	134 (49.3)	**<.001**
Sepsis	9 (0.2)	6 (0.7)	**.007**	27 (9.9)	**<.001**
Septic shock	3 (0.1)	1 (0.1)	.529	7 (2.6)	**<.001**
Pneumonia	14 (0.2)	2 (0.2)	.873	4 (1.5)	**.002**
Unplanned reintubation	9 (0.2)	0 (0.0)	.999	2 (0.7)	.050
UTI	27 (0.5)	2 (0.2)	.288	0 (0.0)	.998
Cardiac arrest or MI	7 (0.1)	2 (0.2)	.475	3 (1.1)	**.001**
Stroke	6 (0.1)	1 (0.1)	.975	2 (0.7)	**.018**
Blood transfusions	3 (0.1)	2 (0.2)	.120	13 (4.8)	**<.001**
DVT	4 (0.1)	3 (0.3)	**.044**	1 (0.4)	.140
PE	6 (0.1)	3 (0.3)	.109	2 (0.7)	**.018**
On ventilator >48 hours	7 (0.1)	0 (0.0)	.999	4 (1.5)	**<.001**
SSI	8 (0.1)	4 (0.4)	.064	13 (4.8)	**<.001**
Wound dehiscence	1 (0.0)	0 (0.0)	1.000	0 (0.0)	1.000
Acute renal failure	3 (0.1)	0 (0.0)	.999	4 (1.5)	**<.001**
Clostridioides difficile infection	2 (0.0)	0 (0.0)	.999	4 (1.5)	**<.001**
Nonhome discharge	47 (0.8)	22 (2.4)	**<.001**	75 (27.6)	**<.001**
Readmission	104 (1.8)	31 (3.4)	**.002**	22 (8.1)	**<.001**
Unplanned reoperation	14 (0.2)	10 (1.1)	**<.001**	12 (4.4)	**<.001**
Length of stay >2 days	82 (1.4)	41 (4.5)	**<.001**	117 (43.0)	**<.001**
Mortality	3 (0.1)	2 (0.2)	.120	9 (3.3)	**<.001**

GNRI, Geriatric Nutritional Risk Index; *UTI*, urinary tract infection; *MI*, myocardial infarction; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *SSI*, surgical space infection.
Bold *P* values indicate statistical significance with $P < .05$.

Table IV
Multivariate analysis of 30-day postoperative complications in patients with preoperative normal GNRI, moderate malnutrition, and severe malnutrition.

	Moderate malnutrition (92 ≤GNRI ≤98)	Severe malnutrition (GNRI <92)
	OR, *P* value (95% CI)	OR, *P* value (95% CI)
Any complication	1.84, **<.001** (1.40-2.42)	11.70, **<.001** (8.58-15.94)
Sepsis	3.75, **.015** (1.30-10.86)	26.61, **<.001** (10.86-65.21)
Septic shock	–	7.53, **.012** (1.56-36.32)
Pneumonia	–	2.72, .153 (0.69-10.75)
Cardiac arrest or MI	–	2.44, .335 (0.40-14.91)
Stroke	–	3.41, .167 (0.60-19.44)
Blood transfusions	–	25.38, **<.001** (6.40-100.59)
DVT	–	–
PE	–	7.25, **.026** (1.27-41.40)
On ventilator >48 hours	–	3.36, .095 (0.81-13.93)
SSI	–	22.08, **<.001** (7.51-64.97)
Acute renal failure	–	4.64, .084 (0.81-26.42)
Clostridioides difficile infection	–	5.73, .177 (0.46-72.01)
Nonhome discharge	2.09, **.008** (1.21-3.61)	15.75, **<.001** (9.83-25.23)
Readmission	1.66, **.017** (1.09-2.52)	2.69, **<.001** (1.52-4.74)
Unplanned reoperation	4.23, **<.001** (1.82-9.84)	6.32, **<.001** (2.23-17.92)
Length of stay >2 days	2.37, **<.001** (1.59-3.55)	23.66, **<.001** (16.25-34.45)
Mortality	–	14.25, **.001** (2.89-70.40)

GNRI, Geriatric Nutritional Risk Index; *OR*, odds ratio; *CI*, confidence interval; *MI*, myocardial infarction; *DVT*, deep vein thrombosis; *PE*, pulmonary embolism; *SSI*, surgical space infection.
Dashes represent associations not significant in bivariate analysis and were not included in multivariate analysis.
Bold *P* values indicate statistical significance with $P < .05$.

risk of death in malnourished patients, including total shoulder arthroplasty, as well as lower limb procedures such as total knee arthroplasty.[8,25] Mortality is an unlikely complication of shoulder arthroscopy, occurring in as little as 0.04% of patients.[18]

We found that GNRI holds strong predictive value for early postoperative complications following shoulder arthroscopy in geriatric patients. These results support the utility of GNRI as an adjunctive preoperative risk stratification tool for geriatric patients undergoing arthroscopic shoulder procedures. While we are not advocating for the use of GNRI as the sole assessment criteria or as the final decider of whether a patient should pursue an arthroscopic shoulder procedure, we nevertheless believe that GNRI holds value as a simple efficacious risk assessment tool that should be used to aid pre-existing nutritional assessments. While GNRI is not always required as part of the preoperative assessment of a geriatric shoulder arthroscopy patient, we recommend that it be considered for those with reasonable risk of malnutrition based on other preoperative assessments such as history, physical examination, and routine preoperative laboratory studies. Additionally, surgeons should consider the nature of the arthroscopic procedure, its indications, and its necessity when deciding how to interpret GNRI in patient selection. For example, a less extensive procedure such as limited débridement may have a lower GNRI threshold (more malnourished), below which may require reconsideration of arthroscopy, compared to a more extensive procedure such as rotator cuff repair. Or, a patient whose function or quality of life is severely affected by their shoulder pathology may have a lower GNRI threshold (more malnourished), below which may require reconsideration of arthroscopy, compared to a patient with a milder condition.

There are limitations encountered by this study. The American College of Surgeons NSQIP database provides a large amount of data and has been consistently used to assess adverse outcomes in orthopedic procedures. However, the information provided by the database does not extend past 30 days postoperatively, restricting our ability to evaluate long-term outcomes such as functionality and quality of life, which would provide more insight into outcomes past the early postoperative period on. Further studies should be conducted to investigate the long-term prognostic value of preoperative GNRI in geriatric patients undergoing shoulder arthroscopy. Furthermore, the NSQIP database does not report factors such as the experience of the surgeon and the institution type where the procedure was performed. These factors may have provided further insight into the results of our study.

Conclusion

Among geriatric patients with predicated malnutrition based on GNRI, the overall rate of complication following shoulder arthroscopy was found to increase with increasing severity of malnutrition. Our findings suggest that GNRI has strong predictive value for early postoperative complications following shoulder arthroscopy in geriatric patients and supports its utility as an adjunctive risk stratification tool for geriatric patients undergoing shoulder arthroscopy. By better selecting surgical candidates, orthopedic surgeons may reduce postoperative adverse events, minimize hospital stay, and promote favorable patient outcomes.

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