Original Article

Increased 30-Day Postoperative Readmission and Medical Complication Rates Among Patients 65 Years and Older Following Arthroscopic Rotator Cuff Repair

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Purpose: The purpose of this study is to use a large national database to assess short-term adverse events following arthroscopic rotator cuff repair in patients 65 years and older. **Methods:** The ACS NSQIP database was queried to identify patients that underwent arthroscopic rotator cuff repair between December 31, 2015, and January 1, 2017. Patients were split into two groups: 1) between 40-65 years old and 2) 65+ years old. Cases involving open rotator cuff repair, total shoulder arthroplasty, hemiarthroplasty, and emergency surgery were excluded. Exact matching was used to control for confounding variables, including sex, body mass index (BMI), American Society of Anesthesiologists (ASA) score, operative time, and several medical comorbidities. After matching, the incidence of several 30-day patient complication measures was compared between the groups. Binary logistic regression was used to identify covariates associated with various 30-day complications. **Results:** A total of 17,880 patients were included in the study. 69.4% ($n = 12,404$) patients were between 40 and 65 years old and 30.6% ($n = 5,476$) patients were 65+ years old. After matching, 9,210 patients were included in the final analysis. After matching, patients 65 years and older were more likely to experience 30-day unplanned readmission ($P = .035$) and overall medical complications ($P = .036$). There were no significant differences in most 30-day complication measures, including mortality ($P = .250$), reoperation ($P = .449$), non-home discharge ($P = .255$), surgical complications ($P = .146$), and several medical complications, including myocardial infarction ($P = .165$), deep venous thromboembolism ($P = .206$), pulmonary embolism ($P = .196$), and cerebrovascular accident ($P > .999$) between the two age groups. **Conclusions:** In this matched cohort study, patients 65 years and older experienced a higher rate of 30-day unplanned readmission and overall medical complications following elective arthroscopic rotator cuff repair relative to patients under 65. However, these older patients did not have significantly worse rates of other 30-day complication measures, including mortality, reoperation, return to the OR, and non-home discharge.

Introduction

A substantial transformation in the United States' age structure is currently under way, with the 65 and older cohort of Americans expected to double to nearly 90 million people between 2010 and 2050.[1] The wide-ranging implications of this shift are not only expected to affect the overall population, size, and diversity of the country, but also demands on social programs, including Social Security and Medicare. Within the world of healthcare, elective orthopaedic procedures are strongly linked to increased life expectancy and will likely see the greatest increase in demand, with rising incidence of conditions like osteoarthritis.[2] Given this increasing life expectancy, it is important for physicians performing elective orthopaedic procedures to understand the risks specific to this older population. This will enable providers to address quality-of-life issues in balance with potential underlying medical comorbidities in order to optimize short-term outcomes in this population.

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Degenerative rotator cuff tear (RCT) and repair represent increasingly important issues as the American population ages.[3] In addition to being painful, degenerative RCT also has a major impact on patients' ability to perform activities of daily living.[4] The pain and functional disability associated with degenerative RCT is not only associated with a marked decrease in quality of life,[5,6] but is also a strong predictor of depression, anxiety, and sleep disturbance.[7] Such findings once again call attention to identifying appropriate surgical candidates and balancing the risk of poor short-term outcomes with the potential to eliminate pain and improve function with surgical intervention.

Degenerative rotator cuff tear (RCT) is already a common pathology, particularly in the elderly, and RCT repair is increasingly performed even in historically contraindicated cases involving considerable fatty degeneration.[8] Like many elective procedures, the decision to pursue operative versus nonoperative management for rotator cuff pathology is inherently challenging. This is further complicated in patients with advanced age, who may benefit less from surgery, but have a greater comorbidity profile. While these decisions are multifactorial, one consideration is the risk of short-term complications and poor outcomes. One study suggested that elderly patients were not at increased risk of short-term complications if these patients met specific health criteria prior to surgery.[9] In contrast, another recent study found that being 65 years and older was associated with 30-day postoperative complications following arthroscopic rotator cuff repair.[10] When assessing the risk of short-term complications, it is important to consider confounding variables, particularly in elderly patients who may present with comorbidities and poorer baseline health status. The purpose of this study is to use a large national database to assess the short-term adverse events following arthroscopic rotator cuff repair in patients 65 years and older. We hypothesize that after matching, patients aged 65 years and older will have similar short-term complication rates following arthroscopic rotator cuff repair relative to adult patients between 40 and 65 years old.

Materials and Methods

Overview

This is a retrospective cohort study. All data were obtained from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP). Studies using the ACS NSQIP database have been designated as exempt by Institutional Review Board oversight, given that this is a database with deidentified data. The ACS NSQIP is a surgical outcomes database with proven reliability that was created to measure and improve the quality of surgical care.[11,12] The data provided to users are deidentified as defined by the Health Insurance Portability and Accountability Act (HIPAA). Any attempt by researchers to identify patients is strictly prohibited. In the year 2017, there were over 1 million surgical cases reported by over 700 participating hospitals in the ACS NSQIP initiative.[13] Each participating institution has a designated clinical reviewer that has been trained to record relevant data for various surgical cases.[13] Auditing procedures ensure the reliability of reported data.[12] The ACS NSQIP database has been employed to study short-term outcomes and complication rates after a wide array of surgical procedures, including the field of orthopaedics.[14-16]

Search and Inclusion/Exclusion Criteria

The ACS NSQIP database was queried to identify patients undergoing arthroscopic rotator cuff repair at participating institutions between January 1, 2015, and December 31, 2017. The Current Procedural Terminology (CPT) code 29827 was used to identify all cases. Cases were split into two groups based upon patient age at the time of surgery: 1) patients between 40 and 65 years old and 2) patients 65 years and older. Patients with open rotator cuff repair (CPT 23410, 23412, 23420), total shoulder arthroplasty (CPT 23472), hemiarthroplasty (CPT 23470), emergent surgery, and incomplete data were excluded for purposes of this study.

Predictor Variables

As outlined in the user guide of the ACS NSQIP, the database provides over 150 variables, including several preoperative risk factors. For this study, the following variables were extracted and assessed for each patient: sex, age, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, and several medical comorbidities: diabetes, smoking, chronic obstructive pulmonary disease (COPD), ascites, congestive heart failure (CHF), hypertension, renal failure, dialysis, chronic steroid use, bleeding disorder, and transfusion within 48 hours. Additionally, operative time was included as a variable of interest.

Exact Matching

To adjust for differences in patient health and other potential confounding variables between the two age groups, exact matching was used to create a 1:1 pairing of patients between the two groups. Patients were matched based on several predictor variables: sex, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, and medical comorbidities, such as diabetes, smoking, chronic obstructive pulmonary disease (COPD), ascites, congestive heart failure (CHF), hypertension, renal failure, dialysis, chronic steroid use, bleeding disorder, transfusion within 48

Table 1. Demographics, Patient Variables, and Comorbidity Burden of the Cohort Prior to Matching

	40-65 Years Old [$n = 12,404$]		65+ Years Old [$n = 5,476$]		P
Sex					**<.001**
Male	7,342	59.2%	2,989	54.6%	
Female	5,062	40.8%	2.487	45.4%	
BMI (kg/m^2)					
Underweight	112	0.9%	55	1.0%	.516
Normal	1,771	14.3%	943	17.2%	**<.001**
Overweight	4,188	33.8%	2,153	39.3%	**<.001**
Obese Class I	3,415	27.5%	1,433	26.2%	.059
Obese Class II	1,743	14.1%	592	10.8%	**<.001**
Obese Class III	1,175	9.5%	300	5.5%	**<.001**
Comorbidities					
Diabetes	1,969	15.9%	1,136	20.7%	**<.001**
Smoking	2,230	18.0%	405	7.4%	**<.001**
COPD	318	2.6%	241	4.4%	**<.001**
Ascites	0	0.0%	1	0.02%	.132
Congestive heart failure	11	0.09%	14	0.3%	**.006**
Hypertension	5,061	40.8%	3,419	62.4%	**<.001**
Renal failure	0	0.0%	2	0.04%	.094
Dialysis	14	0.1%	10	0.2%	.240
Chronic steroid use	241	1.9%	135	2.5%	**.025**
Bleeding disorder	128	1.0%	124	2.3%	**<.001**
Transfusion within 48 hours	1	0.01%	1	0.02%	.519
ASA Class					
Class 1 (No disturbance)	1,254	10.1%	160	2.9%	**<.001**
Class 2 (Mild disturbance)	7,526	60.7%	2,745	50.1%	**<.001**
Class 3 (Severe disturbance)	3,530	28.5%	2,479	45.3%	**<.001**
Class 4+ (Life threatening)	91	0.7%	88	1.6%	**<.001**
Operative time					
Under 60 minutes	3,274		1,618		<.001
Between 60 and 89 minutes	4,061		1,905		.004
90+ minute	5,069		1,953		<.001

ASA, American Society of Anesthesiologists; BMI, body mass index; COPD, chronic obstructive pulmonary disease.

hours, and operative time. Of note, body mass index (BMI) was matched as a categorical variable: underweight (below 18.5), normal (18.5-24.9), overweight (25.0-29.9), obese class I (30.0-34.9), obese class II (35.0-39.9), and obese class III (40.0+). Operative time was also matched as a categorical variable: 1) under 60 minutes, 2) between 60-89 minutes, and 3) over 90 minutes. Cases were matched 1:1 based on exact matching of all covariates—meaning that each case pair had identical values for each of the aforementioned covariables. For cases that produced more than one identical match, the pairs were chosen through randomization.

Complication Measures

The ACS NSQIP database provides several 30-day patient complication measures, as outlined in the User Guide for the Participant Use Data File (PUF), which contains deidentified aggregate patient-level data available to researchers. For this study, the 30-day complications of interest were: return to the operating room, readmission, reoperation, non-home discharge, mortality, surgical complications (superficial and deep surgical site infections, dehiscence, bleeding requiring transfusion), and medical complications (wound infection, pneumonia, reintubation, failure to wean intubation, pulmonary embolism, renal insufficiency, renal failure, urinary tract infection, cerebrovascular accident, cardiac arrest, myocardial infarction, deep venous thromboembolism, systemic sepsis, and septic shock). The rate of these complications were compared between the two age groups of interest, both prior to and after matching.

Statistical Analyses

Pearson's chi-squared and Fisher's exact tests were used to compare the prevalence of the aforementioned predictor variables and complication measures between the two groups, both prior to and after exact matching. Fisher's exact tests were used to compare rare events—specifically, if there were less than 5 patients in a category. Otherwise, all categorical variables were compared using chi-squared tests. Any continuous variables were compared using unpaired *t*-tests. After exact matching, binary logistic regression was used to identify any covariates (e.g., sex, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, and medical comorbidities—diabetes,

Table 2. Short-Term Outcome Complication Measures and Complication Rates Prior to Matching

	40-65 Years Old [n = 12,404]		65+ Years Old [n = 5,476]		P
Readmission	115	0.9%	84	1.5%	**<.001**
Reoperation	35	0.3%	12	0.2%	.448
Non-home discharge	76	0.6%	51	0.9%	**.019**
Mortality	4	0.03%	1	0.02%	.606
Surgical complications					
Overall	14	0.1%	4	0.07%	.610
Superficial surgical site infection	8	0.06%	2	0.04%	.733
Deep surgical site infection	4	0.03%	1	0.02%	>.999
Dehiscence	2	0.02%	0	0.0%	>.999
Bleeding	1	0.01%	2	0.04%	.224
Medical complications					
Overall	79	0.6%	70	1.3%	**<.001**
Wound infection	5	0.04%	2	0.04%	>.999
Pneumonia	12	0.1%	16	0.3%	**.002**
Reintubation	4	0.03%	4	0.07%	.259
Failure to wean intubation	3	0.02%	3	0.05%	.379
Pulmonary embolism	29	0.2%	11	0.2%	.760
Renal insufficiency	2	0.02%	2	0.04%	.591
Renal failure	1	0.01%	2	0.04%	.224
Urinary tract infection	15	0.1%	19	0.3%	**.001**
Cerebrovascular accident	2	0.02%	2	0.04%	.591
Cardiac arrest	3	0.02%	1	0.02%	>.999
Myocardial infarction	7	0.06%	12	0.2%	**.002**
Deep venous thromboembolism	15	0.1%	8	0.1%	.665
Systemic sepsis	4	0.03%	4	0.07%	.259
Septic shock	1	0.01%	2	0.04%	.224

smoking, chronic obstructive pulmonary disease (COPD), ascites, congestive heart failure (CHF), hypertension, renal failure, dialysis, chronic steroid use, bleeding disorder, transfusion within 48 hours, and operative time) that were associated with each individual 30-day complication measure. Of note, age was also modeled as a continuous variable to investigate an association between increasing age and various 30-day complications after matching for potential confounding variables. The cutoff for statistical significance was defined as $P < .05$ for all analyses. All statistical tests were completed using the IBM SPSS version 24 (Armonk, NY: IBM Corp).

Results

17,780 patients were included in the final analysis. Prior to matching, there were many significant differences in the patient-specific variables between the two age groups. Generally, older patients were more likely to have a poorer overall health compared to younger patients. Specifically, patients 65 years and older were significantly more likely to present as ASA Class 3 and 4+, as well as with comorbidities of diabetes, COPD, congestive heart failure, hypertension, chronic steroid use, and bleeding disorder. Younger patients were more significantly more likely to present with Class II and III obesity and were also significantly more likely to present as smokers (Table 1).

Prior to matching, older patients had higher rates of 30-day complications relative to younger patients. Specifically, patients 65 years and older were significantly more likely to experience readmission, non-home discharge, overall medical complications, pneumonia, urinary tract infections, and myocardial infarction (Table 2).

Exact matching yielded a subgroup of 9,210 patients (e.g., 4,605 patients in each age group). After matching, patients from both age groups had identical distributions of various potential predictor variables—sex, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, and medical comorbidities—diabetes, smoking, chronic obstructive pulmonary disease (COPD), ascites, congestive heart failure (CHF), hypertension, renal failure, dialysis, chronic steroid use, bleeding disorder, and transfusion within 48 hours of surgery (Table 3).

Older patients were more likely relative to the matched younger cohort to experience 30-day unplanned readmission ($P = .035$) and overall medical complications ($P = .036$), with pneumonia ($P = .089$) having the lowest associated P value of any specific medical complication. However, patients in this older cohort were not more likely to have increased rates of most 30-day complication measures, including mortality ($P = .250$), reoperation ($P = .449$), non-home discharge ($P = .255$), overall surgical complications ($P = .146$), and several medical complications,

Table 3. Demographics, Patient Variables, and Comorbidity Burden of the Cohort After Matching

	40-65 Years Old [$n = 4,605$]		65+ Years Old [$n = 4,605$]		P
Sex					
Male	2,575	(55.9%)	2,575	(55.9%)	>.999
Female	2030	(44.1%)	2030	(44.1%)	>.999
BMI (kg/m^2)					
Underweight	26	(0.6%)	26	(0.6%)	>.999
Normal	750	(16.3%)	750	(16.3%)	>.999
Overweight	1,779	(38.6%)	1,779	(38.6%)	>.999
Obese Class I	1,236	(26.8%)	1,236	(26.8%)	>.999
Obese Class II	541	(11.7%)	541	(11.7%)	>.999
Obese Class III	274	(6.0%)	274	(6.0%)	>.999
Comorbidities					
Diabetes	871	(18.9%)	871	(18.9%)	>.999
Smoking	352	(7.6%)	352	(7.6%)	>.999
COPD	92	(2.0%)	92	(2.0%)	>.999
Ascites	0	(0.0%)	0	(0.0%)	>.999
Congestive heart failure	0	(0.0%)	0	(0.0%)	>.999
Hypertension	2,685	(58.3%)	2,685	(58.3%)	>.999
Renal failure	0	(0.0%)	0	(0.0%)	>.999
Dialysis	0	(0.0%)	0	(0.0%)	>.999
Chronic steroid use	62	(1.3%)	62	(1.3%)	>.999
Bleeding disorder	31	(0.7%)	31	(0.7%)	>.999
Transfusion within 48 hours	0	(0.0%)	0	(0.0%)	>.999
ASA Class					
Class 1 (No disturbance)	156	(3.4%)	156	(3.4%)	>.999
Class 2 (Mild disturbance)	2,607	(56.6%)	2,607	(56.6%)	>.999
Class 3 (Severe disturbance)	1,827	(39.7%)	1,827	(39.7%)	>.999
Class 4+ (Life threatening)	15	(0.3%)	15	(0.3%)	>.999
Operative time					
Under 60 minutes	1,312	(28.5%)	1,312	(28.5%)	>.999
Between 60-89 minutes	1,585	(34.4%)	1,585	(34.4%)	>.999
90+ minutes	1,708	(37.1%)	1,708	(37.1%)	>.999

ASA, American Society of Anesthesiologists; BMI, body mass index; COPD, chronic obstructive pulmonary disease.

including myocardial infarction ($P = .165$), deep venous thromboembolism ($P = .206$), pulmonary embolism ($P = .196$), and urinary tract infection ($P = .220$), among others (Table 4).

Upon performing a binary logistic regression model, likelihood ratios for various 30-day complication measures after matching were also calculated as a function of predictor variables including age (5-year unit increases in age), ASA classification, BMI/obesity classification, and sex. After matching, readmission was 1.154 [1.036−1.285] times more likely for each 5-year increase in age. A preoperative hypertension diagnosis or ASA 3+ classification resulted in 2.097 (1.314−3.346) and 1.963 (1.321−2.919) times higher likelihood of short-term readmission. Reoperation and non-home discharge rates were 4.012 (1.752−9.185) and 2.806 (1.407−5.597) times more likely if patients were classified as ASA 3+ or Obesity Class III, respectively. Overall medical complications were 1.026 (1.001−1.053), 0.554 (0.356−0.861), 0.214 (0.076−0.603), and 8.454 (1.907−37.484) times more likely for each 5-year increase in age, males, normal weight patients, and ASA 4 patients, respectively (Table 5).

Discussion

In this matched cohort study, patients 65 years and older experienced a higher rate of 30-day unplanned readmission and overall medical complications following elective arthroscopic rotator cuff repair. Age as a continuous variable was found to be predictive of 30-day unplanned readmission and overall medical complications. However, these older patients did not have significantly worse rates of other 30-day complication measures, including mortality, reoperation, return to the OR, and non-home discharge—as well as a variety of specific medical/surgical complications. After controlling for several potential confounding variables in a logistic regression model, high ASA classification was found to be a particularly strong predictor of various complication measures, including readmission, reoperation, and medical complications. Overall, the results of this study support our hypothesis that patients aged 65 years and older will have similar short-term complication rates following arthroscopic rotator cuff repair relative to patients between 40-65 years-old. Our findings stand despite patients 65 years and older being more likely to present for surgery as ASA Class 3 and 4+, as well as with various comorbidities. Findings of

Table 4. Short-Term Outcome Complication Measures and Complication Rates After Matching

	40-65 Years Old [$n = 4,605$]		65+ Years Old [$n = 4,605$]		P
Readmission	44	(1.0%)	66	(1.4%)	**.035**
Reoperation	16	(0.3%)	12	(0.3%)	.449
Non-home discharge	27	(0.6%)	36	(0.8%)	.255
Mortality	3	(0.1%)	0	(0.0%)	.250
Surgical Complications					
Overall	8	(0.2%)	3	(0.1%)	.146
Superficial surgical site infection	5	(0.1%)	1	(0.0%)	.219
Deep surgical site infection	1	(<0.1%)	1	(0.0%)	>.999
Dehiscence	1	(<0.1%)	0	(0.0%)	>.999
Bleeding	1	(<0.1%)	1	(0.0%)	>.999
Medical Complications					
Overall	32	(0.7%)	51	(1.1%)	**.036**
Wound infection	3	(0.1%)	2	(0.0%)	.655
Pneumonia	5	(0.1%)	12	(0.3%)	.089
Reintubation	0	(0.0%)	4	(0.1%)	.125
Failure to wean intubation	0	(0.0%)	3	(0.1%)	.250
Pulmonary embolism	10	(0.2%)	5	(0.1%)	.196
Renal insufficiency	0	(0.0%)	1	(0.0%)	>.999
Renal failure	1	(0.0%)	2	(0.0%)	>.999
Urinary tract infection	9	(0.2%)	15	(0.3%)	.220
Cerebrovascular accident	1	(0.0%)	1	(0.0%)	>.999
Cardiac arrest	2	(0.0%)	1	(0.0%)	.564
Myocardial infarction	4	(0.1%)	9	(0.2%)	.165
Deep venous thromboembolism	3	(0.1%)	7	(0.2%)	.206
Systemic sepsis	1	(0.0%)	3	(0.1%)	.317
Septic shock	0	(0.0%)	2	(0.0%)	.157

significant differences in readmission and overall medical complication rates between the two cohorts after matching are of uncertain clinical significance and may have stemmed from more sensitive readmission measures taken due to a patient's higher age, as well as increased rates of complications unrelated to the arthroscopic rotator cuff repair procedure.

This study found significant differences in both unmatched preoperative patient variables and comorbidities, as well as matched postoperative complications. Older patients (65+ years old) were more likely to present with poorer overall health profiles, as characterized by their higher proportion of ASA Class 3 and 4+ categorization and comorbidities, including diabetes, COPD, congestive heart failure, hypertension, chronic steroid use, and bleeding disorder. While younger patients (40-65 years old) presented with lower, healthier ASA classifications, they were more likely to present with Class II and Class III obesity and were also more likely to be smokers.

Table 5. Risk Factors Associated With Various 30-Day Complication Measures After Matching

Complication Measure	Likelihood Ratio [95% CI]
Readmission	
Age (per 5-year unit increase)	1.154 [1.036−1.285]
Hypertension	2.097 [1.314−3.346]
ASA 3+	1.963 [1.321−2.919]
Reoperation	
ASA 3+	4.012 [1.752−9.185]
Non-home discharge	
Obesity Class III	2.806 [1.407−5.597]
Mortality	N.S.
Surgical complications	N.S.
Medical complications	
Age (per 5-year unit increase)	1.026 [1.001−1.053]
Male	0.554 [0.356−0.861]
Normal weight	0.214 [0.076−0.603]
ASA 4	8.454 [1.907−37.484]

ASA, American Society of Anesthesiologists; CI, confidence interval; N.S., not significant.

Previous studies[10,17] have provided contrasting conclusions regarding the incidence and significance of short-term complications following rotator cuff repair in elderly patients. Padaki et al. found that patients over 65 had nearly double the odds of having a postoperative complication following arthroscopic rotator cuff repair, with three times the risk of respiratory complications six times the risk of a urinary tract infection (UTI).[10] These findings align quite closely with those of our study prior to matching, as our study found double the odds of overall postoperative medical complications and three times the odds of both pneumonia and UTI incidence. In contrast, Witney-Lagen et al. found that postoperative complication rates did not differ between patient cohorts older or younger than 75.[17] Our study found that while patients over 65 years old were at increased risk for short-term complications following arthroscopic rotator cuff repair relative to younger

patients, the risk of age as an independent risk factor may be overstated per our findings after matching. After matching, the only differences in short-term complications were that older patients had a slightly higher incidence of unplanned readmission and overall medical complications within 30 days of surgery. Other studies have identified advanced age as an important risk factor for unplanned hospital readmission[18-21] and medical complications, including pneumonia[22-24] following a variety of orthopaedic procedures, with COPD, male sex, and dependent functional status also emerging as top predictors of postoperative complications.[19,22-24] Per our study, complications for arthroscopic rotator cuff repair in patients 65 years and older may be most contingent on other predictor variables, including ASA and BMI classification rather than these COPD, sex, functional status, or age alone, underscoring the need for detailed patient selection protocols.

The decision to pursue surgery for rotator cuff pathology is multifactorial and should consider both short- and long-term outcomes and complication rates. This decision is further complicated by advanced age. The risk factors of decreased vascularization and limited neovascularization potential in elderly patients and their effect on healing potential[25] are of marked importance in this decision. The risk of retear, which occurs in ~20-40% of patients after surgical repair,[26,27] should also be considered, especially given the association between increased patient age and recurrent tear.[26] Additionally, there are important quality-of-life considerations to take into account; these not only include pain and functional disability, but also psychological complications, including depression, anxiety, and sleeping disorders.[7] As such, there is still some disagreement regarding elderly patients undergoing elective arthroscopic rotator cuff repair. Short-term complications, the focus of this paper, and debate over their significance are factors that require physician and patient discussion during the consultation period.

Appropriate consideration during the patient selection process should also be given to rotator cuff tear characteristics, including tear size, type, fatty infiltration, and planned repair constructs. For instance, Ok et al. divided massive rotator cuff tears into three types: anterosuperior, posterosuperior, and anteroposterior—and found distinctive postoperative outcomes, including retear rate relative to each tear category.[28] The positive relationship between the amount of fatty infiltration in rotator cuff muscles and postoperative complications, including nonhealing and retear has also been studied and affirmed repeatedly,[29-33] with preoperative grading of fatty infiltration now common practice using the Goutallier classification system.[29] As opposed to arthroplasties that replace degenerative tissue with implants, tendon-to-bone healing in rotator cuff repair does not have this option, placing considerable emphasis on the importance of repair constructs used during the procedure. Although this study did not differentiate between different types of repair constructs, current literature supports the notion that double-row repair constructs optimize tendon-to-bone healing and restoration of shoulder strength during rotator cuff repair.[34]

Other studies have begun to assess the safety of elective orthopaedic procedures in the elderly population specifically. It has been shown that total hip arthroplasty remains a safe and viable treatment modality in patients over 90 years old (nonagenarians).[35] Another study analyzed risks specific to nonagenarians undergoing elective total joint arthroplasty and recommended that while comorbidities did not differ significantly between nonagenarians and younger patients, complications, including longer mean length-of-stay and higher readmission rate, were more characteristic of this cohort and needed to be addressed in a shared preoperative decision-making process.[36] Further studies on elderly patients undergoing primary knee arthroplasty and lumbar spine surgery found similar trends in these complications and highlighted the role of the low BMI and decreased functional status as risk factors.[37,38] Collectively, these studies underscore the need for thoughtful preoperative discussions and further research on the critical balance between short-term safety and long-term quality-of-life.

Future research should include long-term prospective studies, as well as studies reporting patient-reported outcomes to effectively capture postoperative pain and functional outcomes. Studies that include patient-reported outcomes should also aim to provide insight into potential discrepancies in the statistical versus clinical significance of the significant variables highlighted in this study. Future research should also continue to probe the relative strength of various predictor variables, including age, ASA, and BMI/obesity classification, sex, and various comorbidities in order to inform proper patient selection methods.

Limitations

Limitations of this study include its retrospective nature and limited data capture, which only included 30-day postoperative data. Furthermore, variables specific to the rotator cuff pathology, such as acuity or amount of fatty atrophy, as well as specifics of the anesthesia and surgical intervention, are not available through the database. Additional variables, including tear size, type, and repair constructs, were not included in this study.

Conclusions

In this matched cohort study, patients 65 years and older experienced a higher rate of 30-day unplanned readmission and overall medical complications following elective arthroscopic rotator cuff repair

relative to patients under 65. However, these older patients did not have significantly worse rates of other 30-day complication measures, including mortality, reoperation, return to the OR, and non-home discharge.

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