Sex differences in utilization and perioperative outcomes of arthroscopic rotator cuff repair

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Background: As the volume and proportion of patients treated arthroscopically for rotator cuff repair increases, it is important to recognize sex differences in utilization and outcomes.
Methods: Patients who underwent arthroscopic rotator cuff repair between 2010 and 2019 were identified in the American College of Surgeons National Surgical Quality Improvement Program registry. Baseline demographic and clinical characteristics were collected, and information concerning utilization, operative time, length of hospital stay, days from operation to discharge, readmission, and adverse events were analyzed by sex.
Results: Of 42,443 included patients, 57.7% were male and 42.3% were female. Comparably, females were generally older ($P < .001$) and less healthy as indicated by American Society of Anesthesiologists class ($P < .001$) and rates of obesity (52.0% vs. 47.8%, $P < .001$), chronic obstructive pulmonary disease (4.0% vs. 2.7%, $P < .001$), and steroid use (2.7% vs. 1.6%, $P < .001$). Females experienced shorter operative times (mean difference [MD] 11.5 minutes, $P < .001$), longer hospital stays (MD 0.03 days, $P < .001$), longer times from operation to discharge (MD 0.03 days, $P < .001$), and more minor adverse events (odds ratio [OR], 1.75; 95% confidence interval [CI], 1.24-2.47) after baseline adjustment. Conversely, rates of serious adverse events (OR, 0.69; 95% CI, 0.55-0.86) and readmissions (OR, 0.88; 95% CI, 0.66-0.97) were lower among females. Disparities in utilization increased over the study period ($P = .008$), whereas length of stay ($P = .509$) and adverse events ($P = .967$) remained stable.
Conclusion: Sex differences among patients undergoing arthroscopic rotator cuff repair are evident, indicating the need for further research to understand and address the root causes of inequality and optimize care for all.

Although healthcare providers strive for equal treatment of all patients, research suggests that implicit bias may disproportionately affect patient care based on race, ethnicity, sex, and socioeconomic status.[1,2,21,28] In particular, several studies examining sex differences among patients undergoing orthopedic surgeries report that females present in more advanced disease states, which is subjectively reflected by a greater degree of baseline pain-related physical dysfunction.[38,47] Moreover, female patients report higher perioperative pain scores and may be at greater risk for chronic opioid use following surgery.[38,40] Whether sex differences across patient-reported outcome measures are secondary to differences in delivery of patient care founded in physician bias or simply due to incongruent baseline morphology remains a topic of discussion.[43] Nevertheless, it is critical to recognize such differences as they may influence clinical decision-making and patient expectations following surgical treatment.[31]

Sex differences among those undergoing arthroscopic rotator cuff repair are particularly important to recognize due to the increasing popularity of the procedure. Advances in minimally invasive surgical techniques have allowed surgeons to repair an increasing proportion of rotator cuff tears arthroscopically, and a recent national database study revealed that the volume of total rotator cuff repairs increased by 188% between 2007 and 2015.[14,16] Sabo et al[41] studied patient-reported outcomes between men and women undergoing rotator cuff surgery and found no differences in

Table I
Demographic and clinical characteristics of male and female patients undergoing arthroscopic rotator cuff repair.

Variables	Total N = 42,443(%)	Female N = 17,960(%)	Male N = 24,483(%)	P value
Age group (y)				<.001*
0-24	203 (0.5)	60 (0.3)	143 (0.6)	
25-34	719 (1.7)	203 (1.1)	516 (2.1)	
35-44	3223 (7.6)	1112 (6.2)	2111 (8.6)	
45+	38,297 (90.2)	16,584 (92.3)	21,713 (88.7)	
Race				<.001*
Black or African American	4353 (10.3)	2280 (12.7)	2073 (8.5)	
White	38,090 (89.7)	15,680 (87.3)	22,410 (91.5)	
BMI category				<.001*
Normal ($\leq$24.9 kg/m^2)	6559 (15.6)	3554 (19.9)	30,05 (12.4)	
Overweight (25.0-29.9 kg/m^2)	14,706 (34.9)	5018 (28.1)	9688 (39.8)	
Obese ($\geq$30.0 kg/m^2)	20,910 (49.6)	9273 (52.0)	11,637 (47.8)	
Diabetes mellitus				.884*
No	35,461 (83.5)	15,000 (83.5)	20,461 (83.6)	
Yes	6982 (16.5)	2960 (16.5)	4022 (16.4)	
ASA class				<.001*
1	3269 (7.7)	1049 (5.8)	2220 (9.1)	
2	24,310 (57.3)	10,271 (57.2)	14,039 (57.4)	
3	14,844 (35.0)	6632 (36.9)	8212 (33.6)	
Smoker (within past 1 y)				<.001*
No	36,082 (85.0)	15,413 (85.8)	20,669 (84.4)	
Yes	6361 (15.0)	2547 (14.2)	3814 (15.6)	
History of severe COPD				<.001*
No	41,059 (96.7)	17,234 (96.0)	23,825 (97.3)	
Yes	1384 (3.3)	726 (4.0)	658 (2.7)	
History of CHF				.758*
No	42,382 (99.9)	17,933 (99.8)	24,449 (99.9)	
Yes	61 (0.1)	27 (0.2)	34 (0.1)	
Hypertension requiring medication				.373*
No	22,392 (52.8)	9430 (52.5)	12,962 (52.9)	
Yes	20,051 (47.2)	8530 (47.5)	11,521 (47.1)	
Steroid use for chronic condition				<.001*
No	41,567 (97.9)	17,470 (97.3)	24,097 (98.4)	
Yes	876 (2.1)	490 (2.7)	386 (1.6)	

ASA, American Society of Anesthesiologists; *BMI*, body mass index; *CHF*, congestive heart failure; *COPD*, chronic obstructive pulmonary disease.
P-values < .05 were considered statistically significant.
  *Chi-square test.

functional outcomes or pain scores within 12 months postoperatively. While this study analyzed sex differences in a small subset of patients undergoing arthroscopic rotator cuff repair, there remains an absence of studies examining this topic utilizing a large, national cohort of patients.

The purpose of this study was, therefore, to retrospectively analyze a national database to investigate sex-related differences in utilization and several perioperative outcomes among patients following arthroscopic rotator cuff repair. Additionally, sex differences in total operative time, length of total hospital stay, and time from surgery to discharge were examined.

Materials and methods

This retrospective cohort study was conducted using data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database for the years 2010-2019. The ACS-NSQIP is a nationally validated, outcomes-based registry containing voluntarily provided data concerning more than 300 perioperative variables from over 700 participating medical institutions, including academic and private, community and tertiary, and inpatient and outpatient centers.[24,36,45] No attention is paid to payer type to promote a reasonably representative sample of United States payer types, including private, public, and self-pay patients. Baseline characteristics and 30-day perioperative outcomes are recorded directly from the electronic medical record by a team of well-trained surgical clinical reviewers through a process consistently shown to demonstrate excellent inter-rater reliability.[8,9,46] As data from the ACS-NQSIP is deidentified and

relies on no direct patient contact, this study was granted institutional review board approval by Mass General Brigham IRB Protocol #2021P001230.

Adult patients aged 18 years or older who underwent primary arthroscopic rotator cuff repair were identified using current procedural terminology code 29827. Baseline demographic (patient age, sex, body mass index [BMI], race, smoking status) and clinical (American Society of Anesthesiologists [ASA] class, diabetes mellitus, steroid use for chronic condition, severe chronic obstructive pulmonary disease [COPD], congestive heart failure [CHF], hypertension requiring medication) data were recorded. Collected data were subsequently analyzed to determine sex-related differences in (1) utilization rates, (2) total operative time, (3) length of total hospital stay, (4) days from operation to discharge, (5) rates of 30-day readmission, and (6) rates of 30-day adverse events. Adverse events were further classified as serious or minor in accordance with previous ACS-NSQIP analyses.[10,27,29] Explicitly, serious adverse events included death, reoperation, pulmonary complications (unplanned intubation, mechanical ventilation >48 hours), pneumonia, cardiac complications (cardiac arrest, myocardial infarction), renal complications (progressive renal insufficiency, acute renal failure), thromboembolic complications (deep vein thrombosis /thrombophlebitis, pulmonary embolism), deep wound complications (deep incisional surgical site infection [SSI], joint space infection, wound dehiscence), and sepsis, while minor adverse events consisted of superficial SSI and urinary tract infection. Sex-specific trends in procedure utilization rates, length of stay, and serious adverse events over time were also assessed.

Table II

Comparison of outcomes between male and female patients following arthroscopic rotator cuff repair.

Variables	Total N = 42,443(%)	Female N = 17,960(%)	Male N = 24,483(%)	P value
Total operation time				<.001[§]
N	42,403	17,944	24,459	
Mean ± SD (minutes)	89.5 ± 45.9	83.1 ± 43.4	94.1 ± 47.1	
Length of total hospital stay				<.001[§]
N	42,433	17,957	24,476	
Mean ± SD (days)	0.2 ± 2.4	0.20 ± 3.1	0.14 ± 1.7	
Days from operation to discharge				<.001[§]
N	42,443	17,960	24,483	
Mean ± SD	0.13 ± 1.4	0.16 ± 1.3	0.12 ± 1.5	
Readmission				.166[†]
No	40,503 (98.93)	17,181 (99.01)	23,322 (98.87)	
Yes	437 (1.07)	171 (0.99)	266 (1.13)	
Serious adverse events				.002[†]
No	42,090 (99.17)	17,839 (99.33)	24,251 (99.05)	
Yes	353 (0.83)	121 (0.67)	232 (0.95)	
Death				.340[‡,*]
No	42,433 (99.98)	17,954 (99.97)	24,479 (99.98)	
Yes	10 (0.02)	6 (0.03)	4 (0.02)	
Reoperation				.016[†]
No	42,325 (99.72)	17,923 (99.79)	24,402 (99.67)	
Yes	118 (0.28)	37 (0.21)	81 (0.33)	
Unplanned intubation				.949[†]
No	42,419 (99.94)	17,950 (99.94)	24,469 (99.94)	
Yes	24 (0.06)	10 (0.06)	14 (0.06)	
Ventilator >48 Hours				.778[†]
No	42,430 (99.97)	17,955 (99.97)	24,475 (99.97)	
Yes	13 (0.03)	5 (0.03)	8 (0.03)	
Pneumonia				.974[†]
No	42,386 (99.87)	17,936 (99.87)	24,450 (99.87)	
Yes	57 (0.13)	24 (0.13)	33 (0.13)	
Cardiac arrest				.142[‡,*]
No	42,436 (99.98)	17,955 (99.97)	24,481 (99.99)	
Yes	7 (0.02)	5 (0.03)	2 (0.01)	
Myocardial infarction				.017[†]
No	42,417 (99.94)	17,955 (99.97)	24,462 (99.91)	
Yes	26 (0.06)	5 (0.03)	21 (0.09)	
Progressive renal insufficiency				.656[‡,*]
No	42,438 (99.99)	17,957 (99.98)	24,481 (99.99)	
Yes	5 (0.01)	3 (0.02)	2 (0.01)	
Acute renal failure				.268[‡,*]
No	42,440 (99.99)	17,960 (100.0)	24,480 (99.99)	
Yes	3 (0.01)	0 (0.00)	3 (0.01)	
DVT/Thrombophlebitis				.167[†]
No	42,378 (99.85)	17,938 (99.88)	24,440 (99.82)	
Yes	65 (0.15)	22 (0.12)	43 (0.18)	
Pulmonary embolism				.056[†]
No	42,375 (99.84)	17,939 (99.88)	24,436 (99.81)	
Yes	68 (0.16)	21 (0.12)	47 (0.19)	
Deep incisional SSI				.034[†]
No	42,429 (99.97)	17,958 (99.99)	24,471 (99.95)	
Yes	14 (0.03)	2 (0.01)	12 (0.05)	
Wound dehiscence				.729[‡,*]
No	42,435 (99.98)	17,956 (99.98)	24,479 (99.98)	
Yes	8 (0.02)	4 (0.02)	4 (0.02)	
Joint space infection				.031[‡,*]
No	42,432 (99.97)	17,959 (99.99)	24,473 (99.96)	
Yes	11 (0.03)	1 (0.01)	10 (0.04)	
Sepsis				.856[†]
No	42,428 (99.96)	17,954 (99.97)	24,474 (99.96)	
Yes	15 (0.04)	6 (0.03)	9 (0.04)	
Minor adverse events				<.001[†]
No	42,309 (99.68)	17,883 (99.57)	24,426 (99.77)	
Yes	134 (0.32)	77 (0.43)	57 (0.23)	
Superficial SSI				.140[†]
No	42,393 (99.88)	17,944 (99.91)	24,449 (99.86)	
Yes	50 (0.12)	16 (0.09)	34 (0.14)	
Urinary tract infection				<.001[†]
No	42,359 (99.80)	17,899 (99.66)	24,460 (99.91)	
Yes	84 (0.20)	61 (0.34)	23 (0.09)	

DVT, deep vein thrombosis; *SD*, standard deviation; *SSI*, surgical site infection.

[*]Exact test.
[†]Chi-square test.
[‡]Fisher's exact test.
[§]Negative binomial model.

Table III

Adjusted analyses comparing perioperative outcomes between male and female patients undergoing arthroscopic rotator cuff repair.

Outcomes	Sex	Adjusted rate ratio (95% CI)	P Value	Estimated mean difference
Total operation time	Female vs Male	0.88 (0.88-0.89)	<.001	−11.50 minutes
Length of total hospital stay	Female vs Male	1.24 (1.13-1.36)	<.001	0.03 days
Days from operation to discharge	Female vs Male	1.26 (1.16-1.38)	<.001	0.03 days

CI, confidence interval.

Note: Adjusted for age, race, body mass index, American Society of Anesthesiologists class, smoking status, history of COPD, and steroid use for chronic condition.

Table IV

Adjusted analyses comparing postoperative outcomes between male and female patients following arthroscopic rotator cuff repair.

Outcomes	Gender	Adjusted OR (95% CI)	P Value
Readmission	Female vs Male	0.80 (0.66-0.97)	.025
Serious adverse events	Female vs Male	0.69 (0.55-0.86)	.001
Minor adverse events	Female vs Male	1.75 (1.24-2.47)	.001

CI, confidence interval; *OR*, odds ratio.

Note: Adjusted for age, race, body mass index, American Society of Anesthesiologists class, smoking status, history of severe COPD, and steroid use for chronic condition.

Table V

Rates of arthroscopic rotator cuff repair utilization.

Year	Total N	Female N (%)	Male N (%)
Total (2010-2019)	42,433	17,960 (42.3)	24,483 (57.7)
2010	1128	482 (41.7)	646 (57.3)
2011	1481	608 (41.1)	873 (58.9)
2012	2193	966 (44.0)	1227 (56.0)
2013	2984	1325 (44.4)	1659 (55.6)
2014	3938	1669 (42.4)	2269 (57.6)
2015	4973	2108 (42.4)	2865 (57.6)
2016	5982	2592 (43.3)	3390 (56.7)
2017	6662	2825 (42.4)	3837 (57.6)
2018	6355	2597 (40.9)	3758 (59.1)
2019	6747	2788 (41.3)	3959 (58.7)

Statistical analysis

Statistical analyses were conducted using SAS software version 9.4 (SAS Institute, Cary, NC, USA). Continuous variables are reported as means and standard deviations, and categorical variables are reported as percentages. Baseline unadjusted analyses were performed using Student t-tests for continuous variables and Pearson chi-square or Fisher's exact tests for categorical variables as appropriate to determine sex-related differences. To adjust for differences in baseline demographic and clinical characteristics other than sex, multivariate analyses were performed using binomial logistic regression, and results are reported as odds ratios (ORs), mean differences (MDs), and rate ratios with 95% confidence intervals (CIs). Additionally, sex-by-year interactions were added to the models via Cochran−Armitage Trend testing to assess trends in disparities over time.[3,11] P values < .05 were considered significant.

Results

In total, 42,443 patients undergoing arthroscopic rotator cuff repair between 2010 and 2019 met the inclusion criteria, including 24,483 (57.7%) male and 17,960 (42.3%) female patients. Overall, female patients were older ($P < .001$) and less healthy than their male counterparts as indicated by higher ASA class ($P < .001$) and greater rates of obesity (52.0% vs. 47.8%, $P < .001$), history of COPD (4.0% vs. 2.7%, $P < .001$), and steroid use for chronic conditions (2.7% vs. 1.6%, $P < .001$). Rates of smoking within one year prior to surgery

were lower among females, however (14.2% vs. 15.6%, $P < .001$). Notably, the female cohort also consisted of a greater proportion of Black or African American patients than the male cohort (12.7% vs. 8.5%, $P < .001$). No differences between groups were observed for rates of diabetes mellitus, history of CHF, or hypertension requiring medication. A complete summary of baseline demographic and clinical characteristics is provided in Table I.

Perioperative outcomes of arthroscopic rotator cuff repair

Significant sex-related differences in total operative time, length of total hospital stay, and days from operation to discharge following arthroscopic rotator cuff repair were noted on unadjusted analyses (Table II). Despite achieving shorter operative times than male patients (83.1 ± 43.4 vs. 94.1 ± 47.1 minutes, $P < .001$), female patients demonstrated longer total hospital stays (0.20 ± 3.1 vs. 0.14 ± 1.7 days, $P < .001$) and greater time from operation to discharge (0.16 ± 1.3 vs. 0.12 ± 1.5 days, $P < .001$) compared to male patients. Female patients were less likely to experience serious adverse events (0.67% vs. 0.95%, $P = .002$), as rates of reoperation (0.21% vs. 0.33%, $P = .016$), myocardial infarction (0.03% vs. 0.09%, $P = .017$), deep incisional SSI (0.01 % vs. 0.05%, $P = .034$), and joint space infection (0.01% vs. 0.04%, $P = .031$) were higher among males. In contrast, overall rates of minor adverse events were higher among females (0.43% vs. 0.23%, $P < .001$), though this was apparently a reflection of an increased incidence of urinary tract infection (0.34% vs. 0.09%, $P < .001$) as there was no difference between males and females in incidence of superficial SSI (0.09% vs. 0.14%, $P = .140$).

After adjusting to control for age, race, BMI, ASA class, smoking status, history of COPD, and steroid use for chronic conditions, differences in perioperative outcomes between male and female patients remained significant. Compared to males, total operation time was 11.5 minutes shorter for females ($P < .001$), while length of total hospital stay (MD 0.03 days, $P < .001$) and days from operation to discharge (MD 0.03 days, $P < .001$) were also increased (Table III). Moreover, rates of readmission (OR, 0.80; 95% CI, 0.66-0.97; $P = .025$) and serious adverse events (OR, 0.69; 95% CI, 0.55-0.86; $P = .001$) were 20% and 31% lower among female than male patients, respectively, though rates of minor adverse events were 75% higher (OR, 1.75; 95% CI, 1.24-2.47; $P = .001$; Table IV).

Trends in arthroscopic rotator cuff repair

The proportion of arthroscopic rotator cuff repair procedures performed for male and female patients varied from year to year; however, analysis of trends in relative utilization rates revealed the proportion of procedures performed for female patients slightly decreased between 2010 and 2019 at an average rate of 0.011% annually ($P = .008$; Table V, Fig. 1). Length of total hospital stay decreased over the study period for both male (coefficient −0.10, $P < .001$) and female (coefficient −0.08, $P < .001$) patients, though disparities between sexes persisted ($p_{trend} = 0.509$). Additionally, rates of serious adverse events for male (coefficient 0.005, $P = .900$)
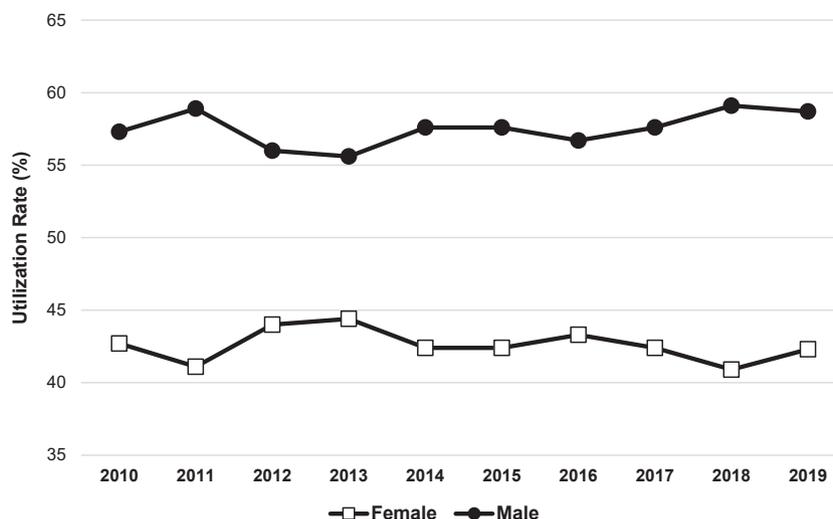
Figure 1 Trends in relative utilization of arthroscopic rotator cuff repair among males and females between 2010 and 2019.

and female (coefficient 0.007, $P = .807$) patients, as well as disparities between the two sexes ($p_{trend} = 0.967$), remained largely unchanged.

Discussion

The development of arthroscopic methods for rotator cuff repair has enabled surgeons to substantially increase procedural volume while maintaining excellent outcomes.[14,16,30] Although arthroscopic repair has been shown to offer patients quicker recovery with potentially less pain and morbidity relative to more traditional open and mini-open techniques,[19,20,48,49] whether males and females equitably benefit from such methodological advances remains uncertain. The present study therefore compared rates of utilization, operative time, length of hospital stay, readmission, and adverse events between sexes using the ACS-NSQIP registry. Between 2010 and 2019, female patients comprised a smaller proportion of arthroscopic rotator cuff repair procedures relative to male patients. Total operative time was shorter among females, though measures of length of total hospital stay and time from operation to discharge were each longer than for males. Moreover, female patients exhibited higher rates of minor adverse events within 30 days of surgery, whereas male patients were more likely to experience serious adverse events and readmission. As a secondary analysis, trends in relative utilization, length of total hospital stay, and rates of serious adverse events were examined. Results indicate the proportion of procedures performed for female patients slightly decreased over the study period, whereas both sexes experienced similar reductions in the length of total hospital stay, and rates of adverse events remained stable. These findings warrant the consideration of clinicians and researchers alike as they show sex-related disparities in utilization and perioperative outcomes exist as more than merely a reflection of differences in baseline demographic or clinical characteristics, highlighting the need for further research to identify root causes and address inequality in arthroscopic rotator cuff repair.

Numerous differences in baseline demographic and clinical characteristics were noted between male and female cohorts. Female patients were generally older and less healthy, exhibiting higher rates of obesity, COPD, and steroid use for chronic conditions

than males. Racial differences were also noted, as the female cohort consisted of a relatively larger proportion of Black and African American patients. However, such inconsistencies did not explain disparities in perioperative outcomes. Instead, sex differences in total operative time, length of total hospital stay, time from operation to discharge, readmission, and incidence of serious and minor adverse events persisted even after adjusting for age, race, BMI, ASA class, smoking status, history of COPD, and steroid use for chronic conditions.

To our knowledge, this study is the first to explore sex differences in arthroscopic rotator cuff repair utilization and outcomes in a large, nationwide cohort of patients. Disparities identified herein build upon previous research comparing patient-reported outcomes between male and female patients, which has produced mixed findings to date. In a study of 283 patients, Daniels et al[13] observed women to report higher pain and lower shoulder function scores than men both preoperatively and within 3 months following surgery, translating to increased need for narcotic pain medication. Nevertheless, women did achieve greater improvements than males in both scores following surgery, demonstrating the benefit of arthroscopic repair for female patients. In contrast, Sabo et al[41] more recently demonstrated no significant differences in patient-reported pain or function at any timepoint within one year of surgery, though results may have been limited by a smaller sample size. Interestingly, the authors noted women were more likely to undergo rotator cuff repair on the dominant arm, have smaller tear size, and have full rotator cuff repair than men. However, the extent to which these factors impact patient-reported outcomes is a topic of debate. Rather, Wylie et al[50] determined mental health to be more strongly associated with patient-reported outcomes than tear characteristics, and differences in gender-based societal norms concerning pain expression and activity demands have also been postulated as potential influences.[13,39,41] Thus, though findings of the current study demonstrate significant sex differences in objective measures of total operative time, length of hospital stay, and rates of adverse events among a much larger patient cohort, the underlying factors responsible for such disparities remain to be fully understood.

It is interesting that female patients constituted a smaller percentage of arthroscopic rotator cuff repair procedures with growing disparity over the study period, particularly as women have been

shown to display higher rates of multidirectional shoulder instability and generalized joint laxity which may predispose to rotator cuff injury.[5,12,32] This supports the notion that shoulder pathology is not explained solely by sex-related anatomic differences but more likely stems from a complex interplay of multiple causes including the effects of sex hormones and inflammatory mediators.[23] Genetic factors have also been implicated, as Figueiredo et al[17] reported variation in collagen haplotype and dysregulation of matric metalloproteinases to impact injury risk in males and females, respectively. Moreover, the prevalence of asymptomatic rotator cuff pathology may differ between males and females, further contributing to differential need for arthroscopic rotator cuff repair.[37] Another noteworthy finding of the present study was that although female patients experienced higher rates of minor adverse events within 30 days, women exhibited lower rates of serious adverse events and readmission compared to men even after adjusting for baseline characteristics. The greater rate of minor adverse effects among females is evidently driven by an increased incidence of urinary tract infection, and this difference is likely a consequence of anatomic and hormonal contributions that naturally place females at greater risk rather than secondary to surgical intervention. The finding that males experience a higher rate of severe adverse events is in accordance with previous literature demonstrating similarly increased risk of death, myocardial infarction, and sepsis following orthopedic procedures including total shoulder arthroplasty,[25,42] lower extremity arthroplasty,[35,44] and spine surgery.[4,34] There are a number of possible explanations for these results. For example, various risk factors have been shown to differentially affect risk for myocardial infarction among males and females.[33] Thus although analyses were adjusted for patient demographics and comorbidities, baseline risk for myocardial infarction may still be greater among men than women prior to surgery. Differences in joint space infection rates may stem from an increased risk for *Cutibacterium acnes* infection among males, as male gender is a known risk factor for C acnes infection particularly following shoulder procedures, with up to 71% of cases occurring in men.[6] While there was insufficient data to delineate the reasons for differences in serious adverse event rates between male and female patients in the present study, it is not surprising that increased risk for severe adverse events was paired with higher rates of readmission among men.

There are several limitations to consider when interpreting the results of this study. Alhough the ACS-NSQIP registry is a high-quality source of nationwide data validated by clinically trained reviewers, patient outcomes are only followed for 30 days following surgery, limiting capture of complications beyond this period and potentially underestimating rates of postoperative adverse event. Moreover, rates of adverse events are only captured for patients who seek care at an institution participating in the ACS-NSQIP. Information concerning surgeon experience, preoperative assessment, hospital volume, and procedural details were not documented, nor were more detailed clinical characteristics such as size and chronicity of rotator cuff tear, number of tendons affected, and extent of arthritis. Thus, their potential impact on arthroscopic rotator cuff repair utilization and perioperative outcomes could not be assessed. Relatedly, variation in postoperative rehabilitation was not evaluated despite their potential to attenuate risk for certain complications (eg, deep vein thrombosis). As a consequence of the large number of patients included in this study, analyses may produce results that are statistically but not clinically significant. For example, the mean difference in time between operation and discharge between male and female patients was statistically significant but measured only 0.03 days. Nevertheless, the ACS-NSQIP database remains an excellent resource for analysis of surgical utilization and short-term outcomes.[7,9,15,18,22,26]

Conclusion

As the use of arthroscopic techniques for rotator cuff repair continues to rise, it is imperative to recognize and characterize differences in procedure utilization and perioperative outcomes across patient groups. The present study focuses specifically on sex differences and demonstrates women to constitute a relatively smaller proportion of arthroscopic rotator cuff repair procedures, experience shorter operative time and longer hospital stay, and face greater risk of early postoperative minor adverse events, whereas male patients are at greater risk for severe adverse events and readmission following surgery. By highlighting sex-related disparities in rotator cuff repair, this study indicates the need for further research to understand and address the root causes of inequality and optimize orthopedic care for all.

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