Gender-Based Differences In Mid-Term Clinical Outcomes And Patient Acceptable Symptomatic State Attainment After Arthroscopic Rotator Cuff Repair: Minimum 2-Year Follow Up

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PII: S2059-7754(24)00105-6
DOI: https://doi.org/10.1016/j.jisako.2024.06.002
Reference: JISAKO 283

To appear in: Journal of ISAKOS

Received Date: 31 December 2023
Revised Date: 5 June 2024
Accepted Date: 6 June 2024

Please cite this article as: Zeng GJ, Hao Y, Lie DTT, Gender-Based Differences In Mid-Term Clinical Outcomes And Patient Acceptable Symptomatic State Attainment After Arthroscopic Rotator Cuff Repair: Minimum 2-Year Follow Up, Journal of ISAKOS, https://doi.org/10.1016/j.jisako.2024.06.002.

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Gender-Based Differences In Mid-Term Clinical Outcomes And Patient
Acceptable Symptomatic State Attainment After Arthroscopic Rotator
Cuff Repair: Minimum 2-Year Follow Up
Abstract

Objective

There is paucity of literature on the impact of patients’ gender on recovery and treatment success after arthroscopic rotator cuff repair. This study investigates the effect of gender on patient-reported outcomes preoperatively and postoperatively (minimum 2 years), and to determine if gender affects attainment of patient acceptable symptomatic state (PASS) thresholds.

Methods

266 patients (117 males, 149 female), who underwent primary arthroscopic rotator cuff repair for atraumatic, full-thickness tears, were included. Functional outcomes and pain scores were collected preoperatively and postoperatively. Percentage of attainment of PASS for the various outcome scores was calculated and compared between males and females.

Results

Women had statistically significantly poorer functional outcome and pain scores preoperatively and at 1 and 2 years postoperatively (P<0.01). They also experienced less improvement in outcome scores throughout the postoperative period. Women had statistically significantly lower rates of PASS attainment at 2 years postoperatively.
Conclusion

Women experience greater pain and poorer shoulder function compared with men preoperatively, and up to 2 years postoperatively. Women are less likely to achieve patient acceptable symptom state thresholds postoperatively, compared to their male counterparts.

Word count: 320

Keywords: Arthroscopic rotator cuff repair; clinical outcomes; patient acceptable symptomatic state; gender-based differences

Study Design: Retrospective Cohort Study

Level of evidence: III

What are the new findings

- Women tend to seek treatment for rotator cuff tears at a later age
- Women are less likely to achieve patient acceptable symptom state thresholds postoperatively after arthroscopic rotator cuff surgery.
- Women experience greater pain and poorer shoulder function compared to their male counterparts pre and postoperatively
Introduction

Rotator cuff tears have a reported prevalence of up to 36.6% in the general population with up to a third of tears being symptomatic. They are a leading cause of pain and disability in the shoulder [1–3]. Etiological factors for development of rotator cuff tears include overuse, trauma and impingement, while common metabolic risk factors include diabetes, hypertension, hyperlipidemia[4] and smoking[5]. Arthroscopic rotator cuff repair (ARCR) is the most common surgical modality for treatment of symptomatic full thickness rotator cuff tears[6]. There is existing literature on sex-based differences in clinical outcomes and satisfaction rates post-surgery for this condition, though limited, and data appears to be mixed[7].

In a study on differences between men and women undergoing major orthopaedic surgery, Katz et al found that women had much worse functional status than men prior to surgery, and had comparable or greater functional improvement following surgery[8]. Pertaining to rotator cuff disease, the prevalence of rotator cuff tears have been reported to be greater in male patients compared to their female counterparts[9]. Razmjou et al’s study in 2016 reported greater delay in time to surgery, increased incidence of repetitive injuries, as well as greater disability in women who sustained rotator full thickness rotator cuff tears[10]. On the other hand, Daniels et al reported no sex-based differences in patient-reported outcomes at 1-year follow-up after primary arthroscopic rotator cuff repair[11]. Rudisill et al found that females who underwent ARCR were generally older, had longer hospital stays and longer time to discharge[7], while Heyer et al found that males gender was a statistically significant risk factor for complications after ARCR[12].
Apart from conventional clinical outcome measures, other parameters, such as Patient Acceptable Symptom State (PASS)\[13,14\] may be utilized. While traditional outcome measures rely on objective parameters, PASS incorporates the element of subjective patient evaluation, in assessing efficacy of treatment\[15\]. PASS is defined as the symptomatic state at which patients deem acceptable to consider themselves well\[16\]. PASS provides clinically meaningful information to interpret results from objective outcome measures\[17\] and is widely utilized in various specialties, orthopaedics included. Attainment of PASS may be indicative of therapeutic efficacy at the individual level. While various PASS estimates have been calculated in preceding studies for clinical outcome measures in rotator cuff disease\[18\], few have studied gender-related differences in PASS attainment for rotator cuff disease. Baettig et al reported no statistically significant correlation between patients satisfaction and gender following reconstructive shoulder surgery\[19\].

The primary objective of this study was to assess for gender-based differences in patient-reported clinical outcomes preoperatively and postoperatively (1 year and 2 years) following rotator cuff repair for full thickness rotator cuff tears. The secondary objective was to evaluate for gender-based differences in attainment of PASS following surgery.

**Methods**

**Population Characteristics, Inclusion and Exclusion Criteria**

This study was approved by the local ethics board. A retrospective review of our database yielded 266 patients who underwent arthroscopic double row rotator cuff repair between 2010 and 2016. All surgeries were performed by a fellowship trained surgeon. All patients
had image-proven full thickness atraumatic rotator cuff tears on either ultrasound or magnetic resonance imaging. Inclusion criteria for surgery was failed conservative therapy (drugs, physiotherapy and analgesics including injectables for 6 months. All patients with partial tears, preceding trauma, isolated subscapularis tears, or concomitant shoulder conditions such as frozen shoulder, instability or dislocations were excluded.

Outcomes Measurements

Outcomes were measured preoperatively and at 1 and 2 years postoperatively. Range of movement (forward flexion and abduction) was charted. Clinical outcome measures evaluated include Constant Shoulder Score (CSS), Oxford Shoulder Score (OXF), University of California at Los Angeles (UCLASS) Shoulder Rating Scale[20–23]. In addition, a Visual Analog Scale (VAS) ranging was employed for quantification of pain[24]. These outcomes scores provide patients with evidence-based information for decision-making pertaining to their care. They also give surgeons an objective benchmark to assess efficacy of surgery. For PASS estimates for CSS, OXF and UCLASS at 2 years postoperatively were adapted from a preceding study, and had values of 65, 46 and 30 respectively[25]. PASS estimate for VAS was approximated to 1.5 based on a preceding study by Chamberlain et al[15].

Statistical analysis

Statistical analysis was performed in consultation with a biostatistician from our local institution. Descriptive analysis for baseline and post-operation outcome scores was performed, and paired t-test was utilized for comparative assessment. Statistical analysis was performed using R software version 3.5.1 (R core Team(2017)) and statistical significance was defined as p < 0.05.
**Results**

**Demographics**

The study comprised 117 male and 149 female patients. Males, with an average age of 59.3 ± 9.7 years, were younger than females who averaged 62.9 ± 9.6 years, a difference that was statistically significant (p=0.003). There was no significant difference in BMI between the genders (p=0.428). (Table 1)

**Outcome measures**

Preoperatively, females had statistically significantly poorer range of movement (forward flexion). Females had statistically significantly poorer CSS, OXF, UCLASS and VAS preoperatively and at 1 and 2 years postoperatively (P<0.01) (Table 1). Additionally, women experienced less improvement in OXF at postoperative 1 and 2 years (P<0.01), and UCLASS (P=0.02) at postoperative 1 year (Table 2). Women had statistically significantly lower rates of PASS attainment at 2 years postoperatively for CSS (P<0.01), OXF (P=0.03) and VAS (P=0.02) (Table 3).
Discussion

In this study, we found that women experience greater pain and poorer shoulder function compared with men preoperatively, and up to 2 years postoperatively. They also sought surgery at an older age. Lastly, we found that women are less likely to achieve patient acceptable symptom state thresholds postoperatively, compared to their male counterparts.

Gender-based differences in early postoperative outcomes after rotator cuff repair have been studied in preceding studies. Cho et al found that women had more pain and slower recovery of range of motion in the initial 3 months post-surgery[26]. Razmjou et al found that female patients who underwent surgeries reported more emotional difficulties postoperatively[27]. He also studied differences in disability between men and woman after rotator cuff repair, and found that women with rotator cuff pathology suffered from greater levels of pre and post-operative disability (up to 6 months)[28]. The overall findings from our study align with what has been found in preceding literature. In addition, our study also demonstrates that these gender-based differences in functional outcomes may persist up to 2 years postoperatively.

Okoroha et al found that female patients underwent shoulder arthroplasty at an older age. Findings from our study concur with this point as we found that females who underwent surgery were of higher age than males (statistically significant). We postulate that these differences may be due to women having higher threshold to seek surgery. Consequently, by
the time they present to the clinic, they may have poorer scores compared to their male
counterparts due to greater duration of symptoms.

With regard to PASS in rotator cuff disease and surgery, PASS estimates for CSS, UCLASS, OXF and VAS have been established prior. Xu et al found the PASS thresholds for CSS, UCLASS, OXF to be 65, 46 and 30 respectively postoperatively at 2 years, and also found that they had excellent predictive value in defining treatment success after arthroscopic rotator cuff surgery[25]. This study however, did not manage to evaluate for gender-based differences in PASS attainment.

The closest available study on gender-based differences in PASS attainment after shoulder surgery was by Chamberlain et al, who studied PASS estimates for American Shoulder and Elbow Surgeons (ASES) score and Simple Shoulder Test (SST) scores after total shoulder arthroplasty[15]. The study found that females required a higher ASES and SST score to reach an acceptable state.

Our study is the first study to evaluate gender-based differences in PASS attainment after arthroscopic rotator cuff repair. The novel finding from our study that women are less likely to achieve patient acceptable symptom state thresholds postoperatively contributes to the existing body of knowledge regarding gender-differences in pain, function and attainment of clinical satisfaction after shoulder surgery and can provide clinicians with information to better address patient’s expectations regarding postoperative recovery, during preoperative consultation.

One major strength of our study was that all surgeries were performed by a single high-volume orthopaedic surgeon. In doing so, heterogeneity in surgical technique and
postoperative regimen is minimized, providing more reliable results. Our study also had a uniform follow up period with low dropout rate of 3% at the end of 2 years. One possible limitation is that findings from this study may not be generally applicable, as PASS estimates are usually population-specific and values may differ across different populations, depending on assessment methods and population characteristics. Regardless, results obtained from this study may still be useful and provide a benchmark for future similar studies. Also, factors including adherence to post-surgery rehabilitation instructions, receipt of proper rehabilitation guidance, use of analgesic drugs, and joint cavity injection, which were not captured, may confound results.

Conclusion

Women with rotator cuff tears tend to seek treatment later, and experience greater pain and disability before and after surgery compared to their male counterparts. They are also less likely to attain satisfaction from surgery. Larger well-designed prospective studies focusing on both clinical and radiological post-operative outcomes would be beneficial to support these findings.
References


Table 1. Baseline characteristics, preoperative and postoperative scores, classified by gender

<table>
<thead>
<tr>
<th></th>
<th>Male (n=117)</th>
<th>Female (n=149)</th>
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</table>

†p-value*
<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>59.3 ± 9.7</td>
<td>62.9 ± 9.6</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>25.7 ± 4.4</td>
<td>25.3 ± 4.6</td>
<td>0.428</td>
</tr>
<tr>
<td>Preoperative ROM for</td>
<td>102.1 ± 35.1</td>
<td>92.9 ± 37</td>
<td>0.039</td>
</tr>
<tr>
<td>forward flexion (degrees)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative ROM for</td>
<td>88.5 ± 38.6</td>
<td>79.4 ± 39.7</td>
<td>0.061</td>
</tr>
<tr>
<td>abduction (degrees)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Preoperative Scores</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSS</td>
<td>45.5 ± 18</td>
<td>36 ± 18.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>OXF</td>
<td>28.3 ± 9.6</td>
<td>34.9 ± 11.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>UCLASS</td>
<td>16.4 ± 4.5</td>
<td>14.4 ± 5.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>VAS</td>
<td>6.1 ± 2.2</td>
<td>6.8 ± 2.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Postoperative (1 year) Scores</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSS</td>
<td>71.2 ± 14</td>
<td>63.6 ± 14</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>OXF</td>
<td>15.3 ± 11.7</td>
<td>19.9 ± 12.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>UCLASS</td>
<td>29.3 ± 4.1</td>
<td>27.5 ± 5.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>VAS</td>
<td>4.8 ± 2.9</td>
<td>5.1 ± 3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Postoperative (2 years) Scores</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSS</td>
<td>76.9 ± 11</td>
<td>68.1 ± 12</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>OXF</td>
<td>13.5 ± 3.5</td>
<td>16 ± 6.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>UCLASS</td>
<td>30.7 ± 4</td>
<td>29 ± 5.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>VAS</td>
<td>0.6 ± 1.5</td>
<td>1.6 ± 2.3</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data presented as Mean ± SD or % (n)

*Boldface* indicates statistical significance

ROM = Range of movement

CSS = Constant Shoulder Score; OXF = Oxford Shoulder Score; UCLASS = University of California at Los Angeles (UCLASS) Shoulder Rating Scale; VAS = Visual Analog Scale for Pain

BMI = body mass index, SD = standard deviation

†p-value was calculated for the comparison between the Male and Female groups using the Student’s t-test

Table 2. Change in Patient-Reported Outcomes from baseline, at postoperative 1 and 2 years, classified by gender
Table 3. Comparison of Patient Acceptable Symptomatic State (PASS) threshold attainment between male and female patients for each patient-reported outcome measure (PROM), classified by gender

<table>
<thead>
<tr>
<th></th>
<th>Male (n=117)</th>
<th>Female (n=149)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Change at 1-year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSS</td>
<td>12.9 ± 34.1</td>
<td>16.5 ± 31.3</td>
<td>0.560</td>
</tr>
<tr>
<td>OXF</td>
<td>15.3 ± 11.7</td>
<td>19.9 ± 12.3</td>
<td><strong>0.002</strong></td>
</tr>
<tr>
<td>UCLASS</td>
<td>40.9 ± 12.6</td>
<td>37.1 ± 13</td>
<td><strong>0.019</strong></td>
</tr>
<tr>
<td>VAS</td>
<td>4.8 ± 2.9</td>
<td>5.1 ± 3</td>
<td>0.532</td>
</tr>
<tr>
<td><strong>Change at 2-years</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSS</td>
<td>31.5 ± 17.7</td>
<td>32.1 ± 18.3</td>
<td>0.772</td>
</tr>
<tr>
<td>OXF</td>
<td>14.8 ± 9.7</td>
<td>18.9 ± 11.7</td>
<td><strong>0.002</strong></td>
</tr>
<tr>
<td>UCLASS</td>
<td>14.1 ± 5.9</td>
<td>14.6 ± 6.3</td>
<td>0.524</td>
</tr>
<tr>
<td>VAS</td>
<td>5.4 ± 2.6</td>
<td>5.2 ± 3.1</td>
<td>0.592</td>
</tr>
</tbody>
</table>

CSS = Constant Shoulder Score; OXF = Oxford Shoulder Score; UCLASS = University of California at Los Angeles (UCLASS) Shoulder Rating Scale; VAS = Visual Analog Scale For Pain

Data presented as Mean ± SD or n (%)

*Boldface* indicates statistical significance

†p-value was calculated for the comparison between the Male and Female groups using the Student’s t-test
Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: