

Management of Rotator Cuff Injuries

Prognostic Factor Evidence Summary

Supplement to:

The American Academy of Orthopaedic Surgeons Clinical Practice Guideline on the Management of Rotator Cuff Injuries

Disclaimer

This evidence summary was developed by a physician volunteer clinical practice guideline development group based on a formal systematic review of the available scientific and clinical information and accepted approaches to treatment and/or diagnosis. This evidence summary is not intended to be a fixed protocol, as some patients may require more or less treatment or different means of diagnosis. Clinical patients may not necessarily be the same as those found in a clinical trial. Patient care and treatment should always be based on a clinician's independent medical judgment, given the individual patient's specific clinical circumstances.

Disclosure Requirement

In accordance with AAOS policy, all individuals whose names appear as authors or contributors to the clinical practice guideline filed a disclosure statement as part of the submission process. All panel members provided full disclosure of potential conflicts of interest prior to voting on the recommendations contained within this clinical practice guideline.

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Introduction

Burden Of Disease

Shoulder disease is a major cause of musculoskeletal disability in the United States. Chronic shoulder pain has been estimated to affect approximately 8% of all American adults, second only to chronic knee pain in our society's burden of musculoskeletal disease. Rotator cuff pathology is the leading cause of shoulder-related disability seen by orthopaedic surgeons, and surgical volume is on the rise (Narvy 2016). One study, for example, notes a 141% increase in rotator cuff repairs from 1996 to 2006 in the United States (Colvin, 2012). When reviewing the costs of rotator cuff repair, Mather et. al. estimate that approximately 250,000 rotator cuff repairs, are performed annually in the U.S with accumulated societal savings estimated to total \$13,771 per patient over their lifetime as well as a mean difference in QALYs of 0.62, compared to nonoperative treatment (Mather, 2013). The study investigates direct and indirect costs as viewed from a societal perspective, as opposed to hospital or orthopaedic practice, defining direct costs as those associated with diagnosis and treatment based on national average Medicare reimbursements, and indirect costs as lost income due to inability to work or lower wages, missed workdays, and disability payments (Mather, 2013) This ultimately calculates to a lifetime societal savings of of \$3,442,750,000. indicating that rotator cuff repair can be a cost-effective option for patients who may require this treatment.

Etiology

Rotator cuff tears have two main causes: injury and degeneration. Acute tears are usually due to injury. This type of tear can occur in isolation or with other shoulder injuries, such as a broken collarbone or dislocated shoulder. Degenerative tears are more common and are the result of a wearing down of the tendon that occurs slowly over time. This degeneration naturally occurs as we age. Rotator cuff tears are more common in the dominant arm (OrthoInfo, 2007).

Incidence And Prevalence

Approximately 4.5 million patient visits related to shoulder pain occur each year in the United States. More than two-thirds of patients treated with rotator cuff repair are of working age. The prevalence of rotator cuff tears increases with age, with 54% of asymptomatic patients aged 60 years and greater having sustained either a partial or complete RCT on magnetic resonance imaging. Ultrasound (US) studies by Tempelhof et al. reveal that 13% of individuals in their fifth decade, 20% in their sixth decade, and 31% in their seventh decade of life have RCTs. From their study on 306 cadavers, Lohr and Uthoff noted a 19% and 32% prevalence of full and partial thickness tears, respectively (Sher, 1995; Tempelhof, 1999; Lohr, 2007). Not all of these tears are symptomatic.

Methods

Prognostic summaries of evidence (PSEs) are produced for prognostic PICO questions included in AAOS Clinical Practice Guidelines (CPGs), full CPG methodology can be found here: <https://www.aaos.org/globalassets/quality-and-practice-resources/methodology/cpg-methodology-september-2023.pdf>. CPGs rely on the clinician work group to determine the scope of the guideline and all PICO questions therein. AAOS CPG methods have been updated to remove prognostic recommendations from the formal CPG document as they do not fit the criteria for an actionable recommendation. PSEs are compiled from searches that result from the a priori workgroup defined prognostic PICO question(s) to support shared decision making and patient-clinician communication. PSEs do not recommend for or against any interventions, but rather provide a summary of the current available evidence. As such, PSEs do not undergo a formal review period nor public comment. PSEs are published as a companion to the parent CPG.

Modifiable Risk Factors

BMI

Low-quality studies indicate increased BMI leads to poorer PROs and increased retear rates (Fares, 2023; Manop, 2023, Ersen, 2023; Park, 2020; Kim, 2018; Daumillare, 2023) or non-inferior PROs/retear rates (Gutman, 2021; Sahoo, 2023; Yeom, 2022; Wylie 2018; Sahin, 2023; Joo, 2022; Lee, 2023; Buyukdogan, 2021; Potter, 2015; Cvetanovich, 2019; Lee, 2024). The quality of evidence is low but suggests that BMI does not affect PROs, despite increased rate of recurrent injury.

Patients with higher BMI may be at higher risk for perioperative complications, yet the literature supports that these patients should be treated surgically if indicated, as they can expect improved patient reported outcomes.

Patients with higher BMI generally start with lower scores on patient reported outcome measures. Future research should investigate if this starting point changes with weight loss, and how this affects the improvement in patient reported outcomes after surgery.

Comorbidities

Low-quality studies indicate inferior PROs and inferior healing rates in patients with comorbidities such as smoking consumption (Nicholson, 2019; Naimark, 2018; Yoon, 2024; Galasso, 2024; Djahangiri, 2013; Lawson, 2022; Park, 2018; Joo, 2022; Daumillare, 2023; Lobo-Escolar, 2021). There are other studies that suggest tobacco consumption has no effect on retear rates or PROs (Yeom, 2023; Liu, 2020; Ladermann, 2021; Baverel, 2021; Ravindra, 2018; Mori, 2013; Assuncao, 2023; Sahoo, 2023; Aagaard, 2023; Mukadam, 2024; Wylie, 2018; Kessler, 2018; Lee, 2023; Buyukdogan, 2021; Potter, 2015; Qian, 2022; Cvetanovich, 2019; Tashjian, 2006).

While perioperative complications could be increased when performing rotator cuff repair surgery on patients with multiple comorbidities, this should not be used as a contraindication for surgery. Patients should be counseled that they may be at increased risk for poorer outcomes compared to patients who are healthier.

While the number of comorbidities does influence patient reported outcomes after rotator cuff repair surgery, it would be important to understand the risk stratification of specific comorbidities to accurately make recommendations about the expected outcomes.

Diabetes

Low-quality conflicting evidence predominates. Some studies indicated non-inferior tear rates and PROs (Chen, 2020; Assuncao, 2023; Ersen, 2023; Park, 2015; Galasso, 2024; Aagaard, 2023; Lawson, 2022; Mukadam, 2024; Joo, 2022; Lee, 2023; Qian, 2022; Cvetanovich, 2019); whereas others indicated worse PROs and higher retear rates (Chung, 2012; Reddy, 2023; Kim, 2018; Sahin, 2023; Lee, 2024). Some studies demonstrated diametrically opposed conclusions (PROs) and pain scores in the same study (Sayegh, 2022; Kessler, 2018).

There are no undue risks or harms when performing rotator cuff repair on patient who have diabetes, other than perioperative complications related to having diabetes (e.g. adhesive capsulitis). Patients should be counseled to ensure that patient reported outcomes are poorer compared to patients without diabetes.

Future research should determine if adequate control of diabetes will improve patient reported outcomes and improve healing after rotator cuff repair.

Patient Expectations

One low quality study (Henn 2007) indicated that lower patient expectations was an independent risk factor for inferior VAS pain, SST, VAS function, VAS QOL, DASH, and SF-36 (all subscales) outcome scores at 1 year following rotator cuff repair. The authors found that greater preoperative expectations correlated with better postoperative patient reported outcome scores.

There are no undue risks or harms when performing rotator cuff repair on patients with different expectations after surgery, however patient reported outcomes may be lower in patients with lower expectations and patients should be advised of this finding.

There is currently very little research on optimal ways to evaluate and influence patient expectation.

Behavioral Health

Several low quality studies reported no significant outcomes at 1 year when investigating the role of mental and behavioral health in patients treated for rotator cuff tear (Baltassat 2024, Cho 2015, Potter 2015, Wang2022). A single low quality study (Lobo-Escolar 2021) however reported that at 3.5 years, those without depression had significantly better symptomatic retear rates.

There are no undue risks or harms when performing rotator cuff repair on patients with behavioral health issues, however, appropriate management of any mental health issues should also be advised in all patients.

Smoking

Numerous low quality studies investigated the role of smoking on outcomes in patients treated for rotator cuff tear (Aagaard 2023, Assuncao 2023, Baumgarten 2020, Baverel 2021, Berglund 2018, Bond 2018, Buyukdogan 2021, Cvetanovich 2019, Daumillare 2023, Djahangiri 2013, Joo 2022, Kessler 2018, Ladermann 2021, Lawson 2022, Lee 2023, Liu 2020, Lobo-Escolar 2021, Mori 2013, Mori 2021, Mukadam 2024, Naimark 2018, Nicholson 2019, Ozcamdalli 2021, Park 2018, Potter 2015, Qian 2022, Ravindra 2018, Sahin 2023, Sahoo 2023, Wylie 2018, Yau 2024, Yeom 2022, Yeom 2023, Yoon 2024, Zanini 2022).

Several studies reported significantly worse results for patients who smoked as compared to those who did not for the outcomes of post-operative healing, retear rate, ASES, score DASH score, OSS score, EQ-5D, Constant Murley score, SF-36 and VAS Pain.

Not all studies reported significant differences between smokers and non-smokers however, smoking's harmful effects on health have been documented in a multitude of literature over the past several decades and patients should be counseled in cease tobacco and nicotine usage whenever possible,¹⁻⁹. Smoking has been linked to not only cardiovascular, respiratory and reproductive diseases but also to impaired operative healing and increase risk of infection^{1,9}.

Pre-Operative Stiffness

Five low quality studies investigated the effect of pre-operative shoulder stiffness on outcomes in patients treated for rotator cuff tear (Kim 2018b, Kim 2023a, Kim 2023b, Quian 2022, Zhang 2020). No significant findings were reported for the outcomes of AEs (retear, revision), Composite Scores (Constant Murley Total score, OSS, UCLA score, KSS score), Function (forward flexion, ISOMAX strength, External Rotation, Internal Rotation), or Pain (VAS pain (10mm)).

There are no undue risks or harms when performing rotator cuff repair on patients with preoperative shoulder stiffness, however patient satisfaction may be lower in these patients compared to those without preoperative shoulder stiffness and patients should be advised of this finding (Quian 2022).

Non-modifiable Risk Factors

Age

Conflicting high and moderate level of evidence for (Rashid, 2017; Randelli, 2011; Toro, 2022; Milano, 2010) and against (Lapner, 2012; Lapner, 2023) age as an independent risk factor for higher failure rates and poorer outcomes after rotator cuff repair. (Milano, 2010) and (Grasso, 2009) have conflicting results regarding DASH and Constant scores specific to this PICO.

While older age is associated with higher failure rates and poorer patient reported outcomes, age alone should not be used as a contraindication for rotator cuff repair, as failure to heal is related to multiple variables. Older patients should be counseled that they would be at increased risk for failure and poorer outcomes than younger patients who undergo rotator cuff repair.

Degenerative rotator cuff disease is a phenomenon of aging, yet there is great variability in this phenomenon. Future research is needed to distinguish chronological age from physiologic age, and healing will likely improve when *age related* changes to the rotator cuff are better understood and manipulated.

Worker's Compensation Claims

Conflicting low-quality evidence indicates worse depression and inferior PROs in worker's compensation patients undergoing rotator cuff repair in the following studies (Ziedas, 2023; Frangiamore, 2020; Assuncao, 2023; Cvetanovich, 2019), whereas other studies indicate non-inferior outcomes, similar rates of work resumption, and retear rates (Tashjian, 2020; Imai, 2019; Kessler, 2018; Mori, 2021).

There are no undue risks or harms when performing rotator cuff repair on patients who have pending worker's compensation claims, however patients should be counseled that patient reported outcomes are better when no claim is present.

It would be important to know what features (job satisfaction, manual labor job, resiliency, etc.) might predict poorer patient reported outcomes after rotator cuff repair in the population of worker's compensation patients.

Social Determinants of Health

Various social determinants of health were investigated for their effect on outcomes in patients treated for rotator cuff tear. Two low quality studies investigated the effect of Area Deprivation Index (ADI) scores with one reporting that patients with higher ADIs were more likely to have higher failure of healing rates (Ardebol 2023) and the other reporting no significant differences in ASES scores (Sprowls 2024).

One low quality study reported worse PROMIS Depression scores in patients treated for rotator cuff tears who had coverage with Public Insurance or Worker's Compensation compared to those with Private Insurance. (Ziedas 2023). Another low quality study similarly reported worse retear rates in patients treated for rotator cuff tears who had coverage with Korean Medicaid compared to those with Korean National Health Insurance. (Lee 2024).

Two low quality studies also reported that patients with a manual labor occupation had worse retear rates compared to those with non-manual occupations or manual labor occupations but with less activity (Lee 2024, Manop 2023). The Lee 2024 study also found no significant differences between urban and rural residences or education level.

There are no undue risks or harms when performing rotator cuff repair on patients with various social determinants of health, however patients should be counseled on possible risks and outcomes that may be expected.

Future research will be important in investigating what determinants might predict poorer patient reported outcomes after rotator cuff repair in various populations and how any additional risk can be addressed.

Risk Factors Without Sufficient Evidence

The following risk factors lacked sufficient evidence for discussion in this summary: Marijuana/THC/CBD use, Athletic Status, Sedentary Lifestyle, and COVID-19 Status/History/Severity. Future research will be important in investigating how these variables can impact patient outcomes after rotator cuff repair in order to provide appropriate patient counseling and treatment.

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