AAOS
American Academy of Orthopaedic Surgeons

Management of Rotator Cuff Injuries

Evidence-Based Clinical Practice Guideline

Adapted by:
The American Academy of Orthopaedic Surgeons Board of Directors
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Endorsed by:

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American Orthopaedic Society for Sports Medicine

APTA
American Physical Therapy Association

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This clinical practice guideline (CPG) 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 clinical practice guideline 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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FDA Clearance

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SUMMARY OF RECOMMENDATIONS

Recommendations are formed when there is sufficient evidence by which to create a directional statement. This is defined as evidence from two or more high quality studies (i.e., a strong recommendation), two or more moderate quality studies (i.e., a moderate recommendation), or statements resulting in a strong or moderate strength following Evidence to Decision (EtD) Framework upgrading and/or downgrading.

MANAGEMENT OF SMALL TO MEDIUM TEARS

Both physical therapy and operative treatment result in significant improvement in patient-reported outcomes for patients with symptomatic small to medium full-thickness rotator cuff tears.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

LONG TERM NON-OPERATIVE MANAGEMENT

Patient reported outcomes (PROs) improve with physical therapy in symptomatic patients with full-thickness rotator cuff tears. However, the rotator cuff tear size, muscle atrophy, and fatty infiltration may progress over 5 to 10 years with non-operative management.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

OPERATIVE MANAGEMENT VS NON-OPERATIVE MANAGEMENT

Healed rotator cuff repairs show improved patient-reported and functional outcomes compared to physical therapy and unhealed rotator cuff repairs.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★☆

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

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ACROMIOPLASTY & ROTATOR CUFF REPAIR

The routine use of acromioplasty as a concomitant treatment is not suggested for therapeutic benefit as compared to arthroscopic repair alone for patients with small to medium sized full-thickness rotator cuff tears.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★☆

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

DIAGNOSIS (CLINICAL EXAMINATION)

Clinical examination can be useful to diagnose or stratify patients with rotator cuff tears; however, a combination of tests will increase diagnostic accuracy compared to any single clinical examination test.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

DIAGNOSIS (IMAGING)

MRI, MRA, CT and ultrasound are useful adjuncts to a clinical exam and radiographs for identifying rotator cuff tears.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

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POST-OP MOBILIZATION TIMING
POST-OP SLING USE

Postoperative clinical and patient-reported outcomes are similar for small to medium sized full-thickness rotator cuff tears managed with early mobilization or delayed mobilization (delayed up to 8 weeks) for patients who have undergone arthroscopic rotator cuff repair.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Following arthroscopic rotator cuff repair, in certain patient populations, outcomes are not adversely affected with immediate weaning of sling use to allow active ROM for ADLs compared to prolonged sling use because similar post-operative healing, functional outcomes, and patient-reported outcomes are achieved.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★☆

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

SUPERVISED EXERCISE VS UNSUPERVISED EXERCISE

Visits of physical therapy for supervision of exercises that are performed independently at home do not provide greater improvements in pain and function outcomes (at 3 months, up to 1 year) compared to a single session of physical therapist instruction followed by an independent home program in patients following arthroscopic rotator cuff repair for small tears.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★☆

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

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CORTICOSTEROID INJECTIONS FOR ROTATOR CUFF TEARS

The use of a single injection of corticosteroids with local anesthetic can be considered for short-term improvement in both pain and function for patients with shoulder pain. In patients who cannot tolerate corticosteroids, injectable NSAIDs may be considered.

Quality of Evidence: High

Strength of Recommendation: Moderate ★★★☆ (Downgraded)

Evidence from two or more "High" quality studies with consistent findings recommending for or against the intervention. Recommendation was downgraded based on the EtD framework.

PROLOTHERAPY

Prolotherapy is not recommended for use in patients with full-thickness rotator cuff tear.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

HIGH-GRADE PARTIAL-THICKNESS ROTATOR CUFF TEARS

Conversion to full-thickness or transtendinous/in-situ repair can be performed in patients that failed conservative management with high-grade partial-thickness rotator cuff tears.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

PARTIAL ROTATOR CUFF TEAR

Debridement or repair of high-grade partial-thickness cuff tears that have failed physical therapy can be performed; however, repair of high-grade partial tears can improve outcomes.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

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BIOLOGICAL AUGMENTATION WITH PLATELET DERIVED PRODUCTS

Biological augmentation of rotator cuff repair with platelet-derived products is not recommended for improving patient-reported outcomes; however, limited evidence supports the use of liquid platelet rich plasma (PRP) in the context of decreasing retear rates.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

SINGLE-ROW VS DOUBLE ROW REPAIR – PATIENT REPORTED OUTCOMES

Double row rotator cuff repair constructs are not recommended for improving patient-reported outcomes compared to single row repair constructs.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

SINGLE-ROW VS DOUBLE ROW REPAIR - RETEARS

Double row repairs can result in lower overall retear rates after primary repair and improved patient-reported outcomes in large (>3cm) repairs. However, when evaluating for only full-thickness retears, double row repairs are not significantly favored.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

MARROW STIMULATION

Marrow stimulation at the time of rotator cuff repair does not improve patient-reported outcomes; however, this technique may decrease retear rates in patients with larger tear sizes.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

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DERMAL ALLOGRAFTS

The use of human dermal allografts to augment rotator cuff repair can lead to lower retear rates and better patient-reported outcomes, but porcine allograft is not suggested for use in rotator cuff augmentation.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★☆

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

BIOINDUCTIVE IMPLANTS

The use of bioinductive tendon implants to augment rotator cuff repair or as an alternative to non-augmented repair can lead to lower retear rates and better patient-reported outcomes.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

OPEN VS ARTHROSCOPIC REPAIRS

Evidence shows no difference in long-term (> 1 year) patient-reported outcomes or cuff healing rates between open and arthroscopic repairs; however, arthroscopic-only technique is associated with better short-term improvement in post operative recovery of motion and decreased visual analog scale (VAS) scores.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Recommendation was downgraded based on the EtD framework.

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POSTOPERATIVE PAIN MANAGEMENT

Multimodal analgesia programs or non-opioid individual modalities can be considered to provide added benefit for postoperative pain management following rotator cuff repair.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

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SUMMARY OF OPTIONS

Options are formed when there is little or no evidence on a topic. This is defined as low quality evidence or a single moderate quality study (i.e., a limited strength option), no evidence or only conflicting evidence (i.e., a consensus option), or statements resulting in a limited or consensus strength following Evidence to Decision (EtD) Framework upgrading and/or downgrading.

HYALURONIC ACID INJECTIONS FOR ROTATOR CUFF PATHOLOGY

The use of hyaluronic acid injections may be considered in the non-operative management of rotator cuff pathology with no tears.

Quality of Evidence: High

Strength of Option: Limited ★★☆☆ (Downgraded)

Evidence from two or more "High" quality studies with consistent findings recommending for or against the intervention. Recommendation was downgraded based on the EtD Framework.

PLATELET RICH PLASMA (PRP) INJECTION IN PARTIAL-THICKNESS TEARS

The routine use of platelet rich plasma is not supported for the treatment of rotator cuff tendinopathy or partial tears.

Quality of Evidence: High

Strength of Option: Limited ★★☆☆ (Downgraded)

Evidence from two or more "High" quality studies with consistent findings recommending for or against the intervention. Recommendation was downgraded based on the EtD Framework.

MULTIPLE STEROID INJECTIONS FOR ROTATOR CUFF TEARS

Multiple steroid injections may compromise the integrity of the rotator cuff, which may affect attempts at subsequent repair.

Quality of Evidence: High

Strength of Option: Limited ★★☆☆ (Downgraded)

Evidence from two or more "High" quality studies with consistent findings recommending for or against the intervention. Recommendation was downgraded based on the EtD Framework.

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PLATELET RICH PLASMA (PRP) INJECTION IN FULL-THICKNESS TEARS

Evidence suggests that the routine use of PRP in the non-operative management of full-thickness rotator cuff tears may not be indicated.

Quality of Evidence: Moderate
Strength of Option: Limited ★★☆☆ (Downgraded)
Evidence from two or more "Moderate" or "Low" quality studies respectively with consistent findings or evidence from a single "High" or "Moderate" quality study respectively recommending for or against the intervention. Recommendation was downgraded based on the EtD Framework.

UNREPAIRABLE TEARS WITHOUT ARTHROPATHY (NON-REVERSE ARTHROPLASTY)

In the absence of reliable evidence, it is the opinion of the workgroup that physical therapy, biceps tenotomy/tenodesis, partial repair, tendon transfer, superior capsular reconstruction, arthroscopic debridement, balloon spacers, graft interposition, or graft augmentation (non-porcine) can improve patient-reported outcomes.

Quality of Evidence: Moderate, Low (mixed interventions)
Strength of Option: Consensus ★☆☆☆ (Downgraded)
Evidence from two or more "Moderate" or "Low" quality studies respectively with consistent findings or evidence from a single "High" or "Moderate" quality study respectively recommending for or against the intervention. Recommendation was downgraded based on the EtD Framework.

MASSIVE UNREPAIRABLE ROTATOR CUFF TEAR WITHOUT ARTHROPATHY (REVERSE ARTHROPLASTY)

In the absence of reliable evidence, it is the opinion of the workgroup that in patients with massive, unrepairable tears and significant functional loss who have failed other treatments, reverse arthroplasty can improve patient-reported outcomes.

Quality of Evidence: Low
Strength of Option: Consensus ★☆☆☆ (Downgraded)
Evidence from two or more "Low" quality studies with consistent findings or evidence from a single "Moderate" quality study recommending for or against the intervention. Recommendation was downgraded based on EtD Framework.

MASSIVE UNREPAIRABLE TEARS WITH ARTHROPATHY (REVERSE ARTHROPLASTY)

In the absence of reliable evidence, it is the opinion of the workgroup that after failure of conservative treatment, reverse shoulder arthroplasty for massive unrepairable tears with glenohumeral joint arthritis can improve patient-reported outcomes.

Quality of Evidence: Low
Strength of Option: Consensus ★☆☆☆ (Downgraded)

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Evidence from two or more "Low" quality studies with consistent findings or evidence from a single "Moderate" quality study recommending for or against the intervention. Recommendation was downgraded based on the EtD Framework.

SURGICAL TREATMENT VS. PHYSICAL THERAPY FOR LOW- OR INTERMEDIATE-GRADE PARTIAL-THICKNESS TEARS

In the absence of reliable evidence, it is the opinion of the workgroup that physical therapy can improve outcomes in patients with low-grade or intermediate-grade partial-thickness rotator cuff tears. In patients with persistent pain and functional impairment after appropriate non-operative treatment, surgery can improve outcomes.

Quality of Evidence: Consensus
Strength of Option: Consensus ★☆☆☆
There is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of sufficient evidence, the guideline workgroup is making a recommendation based on their clinical opinion.

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INTRODUCTION

OVERVIEW

This clinical practice guideline is based on a systematic review of published studies with regard to the management of rotator cuff injuries. In addition to providing practice recommendations, this guideline also highlights limitations in the literature and areas that require future research. This guideline is intended to be used by all qualified and appropriately trained physicians and surgeons involved in the management of rotator cuff injuries. It is also intended to serve as an information resource for decision makers and developers of practice guidelines and recommendations.

GOALS AND RATIONALE

The purpose of this clinical practice guideline is to help improve treatment based on the current best evidence. Current evidence-based medicine (EBM) standards demand that physicians use the best available evidence in their clinical decision making. To assist them, this clinical practice guideline consists of a systematic review of the available literature regarding the management of rotator cuff injuries. The systematic review detailed herein was conducted between October 2023 and June 2024, with the final search performed on June 7, 2024 and demonstrates where there is good evidence, where evidence is lacking, and what topics future research must target in order to improve the management of rotator cuff tears. AAOS staff and the physician workgroup systematically reviewed the available literature and subsequently wrote the following recommendations based on a rigorous, standardized process. Musculoskeletal care is provided in many different settings by many different providers. We created this guideline as an educational tool to guide qualified physicians through a series of treatment decisions in an effort to improve the quality and efficiency of care. This guideline should not be construed as including all proper methods of care or excluding methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment must be made in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution.

INTENDED USERS

This guideline is intended to be used by orthopaedic surgeons and physicians managing patients with rotator cuff injuries. Typically, orthopaedic surgeons will have completed medical training, a qualified residency in orthopaedic surgery, and some may have completed additional sub-specialty training. Adult primary care physicians, geriatricians, hospital based adult medicine specialists, physical therapists, occupational therapists, nurse practitioners, physician assistants, emergency physicians, and other healthcare professionals who routinely see this type of patient in various practice settings may also benefit from this guideline. Rotator cuff injury management is based on the assumption that decisions are predicated on the patient and/or the patient's qualified heath care advocate having physician communication with discussion of available treatments and procedures applicable to the individual patient. Once the patient and/or their

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advocate have been informed of available therapies and have discussed these options with their physician, an informed decision can be made. Clinician input based on experience with conservative management and the clinician's surgical experience and skills increases the probability of identifying patients who will benefit from specific treatment options. This guideline is not intended for use as a benefits determination document.

PATIENT POPULATION

This document addresses the management of rotator cuff injuries in adults. It is not intended to address the management of pediatric patients with rotator cuff injuries.

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. report 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 quality-adjusted life years (QUALYs) of 0.62, compared to nonoperative treatment. 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 $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 degradation 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 rotator cuff tear (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

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have RCTs. From their study on 306 cadavers with an average age of 59 years, Lohr and Uhthoff noted a 19.9% and 32% prevalence of full- and partial-thickness tears, respectively (Sher, 1995; Tempelhof, 1999; Lohr, 2007). Not all of these tears are symptomatic.

RISK FACTORS

Because most rotator cuff tears are largely caused by the normal wear and tear that goes along with aging, people over 40 are at greater risk. People who do repetitive lifting or overhead activities, e.g. painters and carpenters, are also at higher risk for rotator cuff tears.. Athletes are especially vulnerable to overuse tears, particularly in the setting of repetitive microtrauma as observed in tennis players and baseball pitchers. Although overuse tears caused by sports activity or overhead work also occur in younger people, most tears in young adults are caused by a traumatic injury, like a fall or shoulder dislocation (OrthoInfo, 2007).

POTENTIAL BENEFITS, HARMS, AND CONTRAINDICATIONS

There are risks associated with both operative and non-operative treatment of rotator cuff injuries. For example, surgical complications include infection, stiffness, and potentially increased recovery time, and non-operative complications include potential increased structural damage over time and possible functional limitations. Treatment contraindications vary widely based on the specific condition and individual patient characteristics. Contraindications vary widely based on the treatment and the patient.

FUTURE RESEARCH

Consideration for future research is provided for each recommendation within this document. High quality studies comparing the outcomes of operative and non-operative treatment of rotator cuff pathology of all types remains a major gap in knowledge. Ideally, studies will have a minimum of 5-year of follow-up in order to better understand the efficacy of each treatment. Future studies should focus more on how comorbidities such as diabetes mellitus, hypertension, hypercholesterolemia, smoking, and BMI affect RC injury outcomes... Questions persist regarding the timing of physical therapy after surgery, and the need for formal therapy versus a supervised home program. While widely employed in practice, the risks and benefits of corticosteroid injections in patients with rotator cuff tears remain unclear. The risk and expense of orthobiologics in rotator cuff surgery remains difficult to fully assess, even though multiple high-quality studies are currently available. The use of either allograft or xenograft patches for augmentation of rotator cuff repair or for superior capsular reconstruction has yet to be scientifically proven. Finally, given the opioid epidemic, high-quality studies of multimodal analgesia for rotator cuff surgery would seem to be a matter of public policy. Consideration for future research is provided for each recommendation within this document. High-strength, level one studies comparing the outcomes of operative and non-treatment of rotator cuff pathology of all types remains a major gap in knowledge.

METHODS

The methods used to perform this systematic review were employed to minimize bias and enhance transparency in the selection, appraisal, and analysis of the available evidence. These processes are vital to the development of reliable, transparent, and accurate clinical recommendations. To view the full AAOS clinical practice guideline methodology please visit https://www.aaos.org/quality/research-resources/methodology/ .

This clinical practice guideline evaluates the management of rotator cuff injuries and patient outcomes. The AAOS' approach incorporates practicing physicians (clinical experts) and methodologists who are free of potential conflicts of interest relevant to the topic under study, as recommended by clinical practice guideline development experts.[1]

This clinical practice guideline was prepared by the AAOS Rotator Cuff Injuries physician development group (clinical experts) with the assistance of the AAOS Clinical Quality and Value (CQV) Department (methodologists). To develop this clinical practice guideline, the clinical practice guideline development group held an introductory meeting on August 20, 2023 to establish the scope of the clinical practice guideline. As the physician experts, the clinical practice guideline development group defined the scope of the clinical practice guideline by creating PICO Questions (i.e. population, intervention, comparison, and outcome) that directed the literature search. The AAOS Medical Librarian created and executed the search (see eAppendix 1 for search strategy).

LITERATURE SEARCHES

The systematic review begins with a comprehensive search of the literature. Articles considered were published prior to the start date of the search in a minimum of three electronic databases; PubMed, EMBASE, and the Cochrane Central Register of Controlled Trials. The medical librarian conducts the search using key terms determined from the guideline development group's PICO questions.

A CQV methodologist will review/include only primary literature but will supplement the electronic search with a manual search of the bibliographies of secondary literature sources, such as systematic reviews, as available. The methodologist will then evaluate all recalled articles for possible inclusion based on the study selection criteria and will summarize the evidence for the guideline workgroup who assist with reconciling possible errors and omissions.

A study attrition diagram is provided that details the numbers of identified abstracts, recalled and selected studies, and excluded studies that were evaluated in the CPG. The search strategy used to identify the abstracts is also included in eAppendix 1 of the CPG documents.

DEFINING THE QUALITY OF EVIDENCE

The quality of evidence for a recommendation is determined by the quality and quantity of included literature for the statement. Statements with evidence from two or more "High" quality studies are considered to have "High

Quality Evidence." Statements with evidence from two or more "Moderate" quality studies, or evidence from a single "High" quality study are considered to have "Moderate Quality Evidence." Statements with evidence from two or more "Low" quality studies or evidence from a single "Moderate" quality study are considered to have "Low Quality Evidence." Statements with evidence from one "Low" quality study or no supporting evidence are considered to have "Very Low Quality Evidence" or "Consensus", respectively.

DEFINING THE STRENGTH OF RECOMMENDATION

Judging the quality of evidence is only a steppingstone towards arriving at the strength of a CPG recommendation. The strength of recommendation also takes into account the quality, quantity, and the trade-off between the benefits and harms of a treatment, the magnitude of a treatment's effect, and whether data exists on critical outcomes. Using these considerations and the GRAGE Evidence to Decision Framework (EtDF), recommendations can be upgraded or downgraded a maximum of two quality levels, when necessary. For full strength methodology, please visit https://www.aaos.org/quality/research-resources/methodology/ .

Strength of recommendation expresses the degree of confidence one can have in a recommendation. As such, the strength expresses how possible it is that a recommendation will be overturned by future evidence. It is very difficult for future evidence to overturn a recommendation that is based on many high quality randomized controlled trials that show a large effect. It is much more likely that future evidence will overturn recommendations derived from a few small retrospective comparative studies. Consequently, recommendations based on the former type of evidence are given a "strong" strength of recommendation and statements based on the latter type of evidence are presented as "Options" to the practicing clinician, rather than a directional recommendation, with either a "limited" strength or, in the event of no supporting or only conflicting evidence, a "consensus" strength. For any "consensus" strength option, the decision to include a statement in the CPG is at the discretion of the guideline development group.

VOTING ON THE RECOMMENDATIONS

The recommendations and their strength were voted on by the guideline development group members during the final meeting. If disagreement between the guideline development group occurred, there was further discussion to see whether the disagreement(s) could be resolved. Recommendations were approved and adopted in instances where a simple majority (51%) of the guideline development group voted to approve; however, the guideline development group had consensus (100% approval) when voting on every recommendation for this guideline. Any recommendation strength upgrade or downgrade based on the Evidence-to-Decision Framework

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requires a super majority (75%) approval of the workgroup.

PROGNOSTIC PICO EVIDENCE SUMMARIES

AAOS CPG methodology has been updated to remove prognostic factor recommendations from the formal CPG document, as they do not fit the criteria for creating actionable guideline recommendations. Instead, Prognostic Summaries of Evidence (PSEs) documents are produced for prognostic PICO questions included in AAOS CPGs and published separately as a companion document 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.

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UNDERSTANDING THE QUALITY OF EVIDENCE AND STRENGTH OF STATEMENT

Table I. Strength and Quality Descriptions

Statement Strength	Evidence Quality	Statement Description	Strength Visual
Strong	High*	Evidence from two or more "High" quality studies with consistent findings recommending for or against the intervention. Or Rec is upgraded using the EtD framework.	
Moderate	Moderate*	Evidence from two or more "Moderate" quality studies with consistent findings or evidence from a single "High" quality study recommending for or against the intervention. Or Rec is upgraded or downgraded using the EtD framework.	
Limited	Low*	Evidence from two or more "Low" quality studies with consistent findings or evidence from a single "Moderate" quality study recommending for or against the intervention. Or Rec is downgraded using the EtD framework.	
Consensus*	Very Low, or Consensus*	Evidence from one "Low" quality study, no supporting evidence, or Rec is downgraded using the EtD framework. In the absence of sufficient evidence, the guideline workgroup is making a statement based on their clinical opinion.	

*Unless statement was upgraded or downgraded in strength, using the EtD Framework.

Table II. Interpreting the Strength of a Recommendation or Option

Strength of Statement	Patient Counseling (Time)	Decision Aids	Impact of Future Research
Strong	Least	Least Important, unless the evidence supports no difference between two alternative interventions	Not likely to change
Moderate	Less	Less Important	Less likely to change
Limited	More	Important	Change possible/anticipated
Consensus	Most	Most Important	Impact unknown

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REVIEW PERIOD

Following the final meeting, the CPG draft undergoes a 3-week review period for additional input from external content experts. Written comments are provided on the structured review form. All reviewers are required to disclose their conflicts of interest.

Specialty societies relevant to the topic are solicited for nominations of individual reviewers approximately six weeks before the final meeting. The review period is announced as it approaches, and others interested are able to volunteer to review the draft. The chairs of the guideline workgroup review the draft of the guideline prior to dissemination.

Some specialty societies (both orthopaedic and non-orthopaedic) ask their evidence-based practice (EBP) committee to provide review of the guideline. The organization is responsible for coordinating the distribution of our materials and consolidating their comments onto one form. The chair of the external EBP committees provides disclosure of their conflicts of interest (COI) and manages the potential conflicts of their members.

Again, the AAOS asks for comments to be assembled into a single response form by the specialty society and for the individual submitting the review to provide disclosure of potentially conflicting interests. The review stage gives external stakeholders an opportunity to provide evidence-based direction for modifications that they believe have been overlooked. Since the draft is subject to revisions until its approval by the AAOS Board of Directors as the final step in the guideline development process, confidentiality of all working drafts is essential.

The CPG is also provided to members of the AAOS Board of Directors (BOD), members of the Research and Quality Council (RQC), members of the Board of Councilors (BOC), and members of the Board of Specialty Societies (BOS) and members of the Committee on Evidence-Based Quality and Value (EBQV) for review and comment. The CPG is automatically forwarded to the AAOS BOD, RQC, and EBQV so that they may review it and provide comment prior to being asked to approve the document. Based on these bodies, over 200 commentators have the opportunity to provide input into each CPG.

The chairs of the guideline workgroup, the manager of the AAOS CQV unit, and the Director of AAOS CQV draft the initial responses to comments that address methodology. These responses are then reviewed by the chair and co-chair, who respond to questions concerning clinical practice and techniques. All comments received and the initial drafts of the responses are also reviewed by all members of the guideline development group. All proposed changes to recommendation language as a result of the review period are based on the evidence. Final revisions are summarized in a report that is provided alongside the guideline document throughout the remainder of the approval processes and final publication.

The AAOS believes in the importance of demonstrating responsiveness to input received during the review process and

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welcomes the critiques of external specialty societies. Following final approval of the guideline, all individual responses are posted on our website http://www.aaos.org/quality with a point-by-point reply to each non-editorial comment. Reviewers who wish to remain anonymous notify the AAOS to have their names de-identified; their comments, our responses, and their COI disclosures are still posted.

THE AAOS CPG APPROVAL PROCESS

This final clinical practice guideline draft must be approved by the AAOS Committee on Evidence Based Quality and Value, and subsequently the AAOS Research and Quality Council and the AAOS Board of Directors. These decision-making bodies are described in the RC CPG eAppendix 1. Their charge is to approve or reject its publication by majority vote.

REVISION PLANS

This clinical practice guideline represents a cross-sectional view of current treatment and may become outdated as new evidence becomes available. This clinical practice guideline will be revised in accordance with new evidence, changing practice, rapidly emerging treatment options, and new technology. This clinical practice guideline will be updated or withdrawn in five years.

CPG DISSEMINATION PLANS

The primary purpose of the present document is to provide interested readers with full documentation of the best available evidence for various procedures associated with the topic of this review. Publication of most clinical practice guidelines is announced by an Academy press release, articles authored by the clinical practice guideline development group and published in the Journal of the American Academy of Orthopaedic Surgeons, and articles published in AAOS Now. Most clinical practice guidelines are also distributed at the AAOS Annual Meeting in the Resource Center. The final guideline recommendations and their supporting rationales will be hosted on www.OrthoGuidelines.org.

Selected clinical practice guidelines are disseminated by webinar, the AAOS Learning Management System (LMS), Media Briefings, and by distributing them at relevant Continuing Medical Education (CME) courses and at the AAOS Resource Center.

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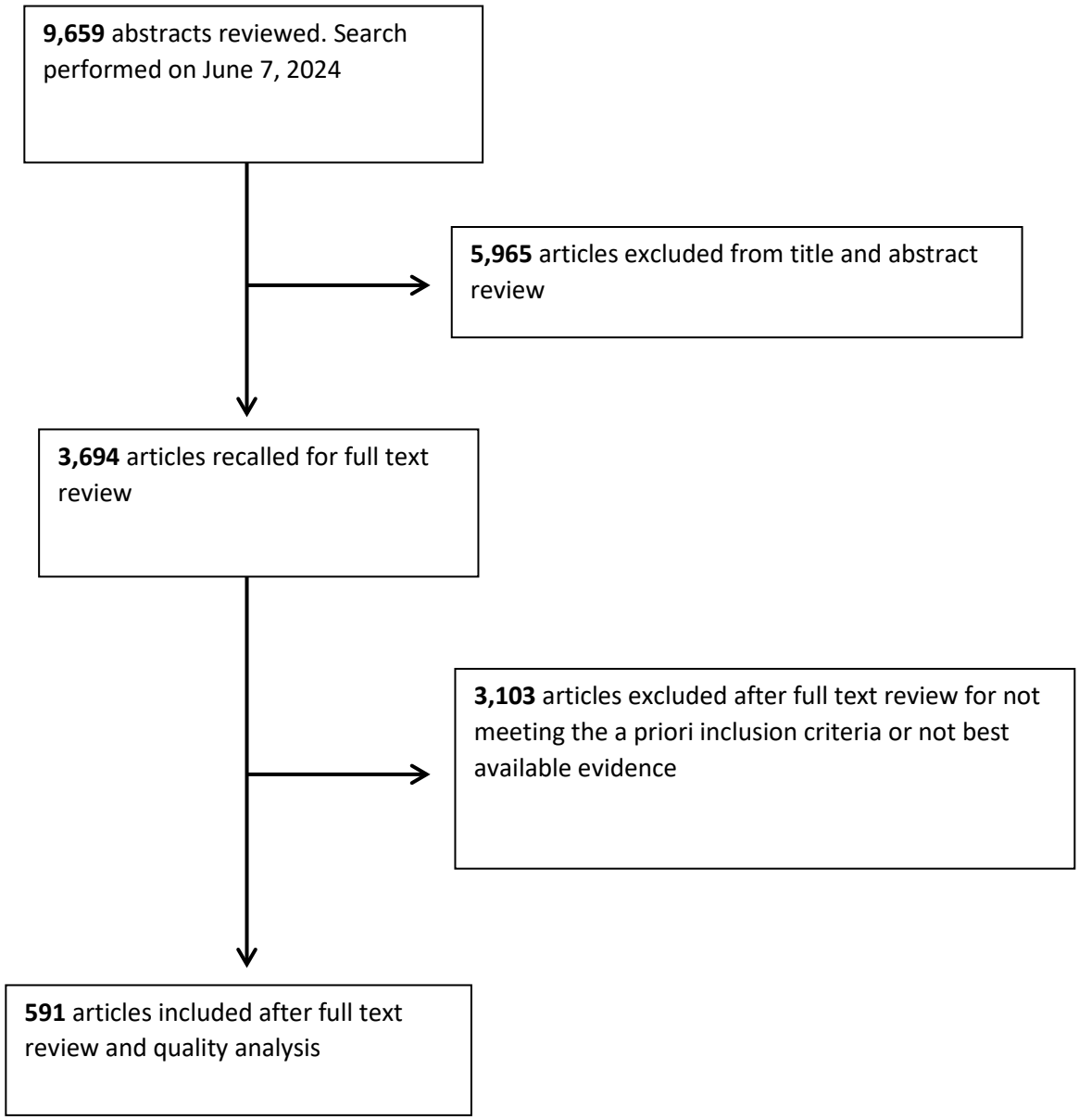
Study Attrition Flowchart*



**Study attrition data also includes articles that have been used to support the supplemental prognostic evidence summary.*

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RECOMMENDATIONS

Recommendations are formed when there is sufficient evidence by which to create a directional statement. This is defined as evidence from two or more high quality studies (i.e. a strong recommendation), two or more moderate quality studies (i.e. a moderate recommendation), or statements resulting in a strong or moderate strength following Evidence to Decision Framework upgrading and/or downgrading.

MANAGEMENT OF SMALL TO MEDIUM TEARS

Both physical therapy and operative treatment result in significant improvement in patient-reported outcomes for patients with symptomatic small to medium full-thickness rotator cuff tears.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

Two prospective randomized controlled trials comparing physical therapy to operative repair for the treatment of small to medium rotator cuff tears showed substantial improvement in patient-reported outcomes (PROs) and strength over time (Moosmayer, 2019; Kukkonen 2021). At 5-year follow up, Moosmayer, et.al., reported that the results of primary repair were superior to physical therapy, with the mean group differences of 5.3 for the Constant score ($p=0.05$) and 9.0 for the ASES score ($p<0.001$); however, the differences in PROs were below the accepted minimal clinically important difference (Moosmayer, 2014). At 5 years, Kukkonen, et.al., reported no significant differences in the mean change of the Constant score ($p=0.84$) and pain (VAS) ($p=0.74$) between physical therapy and surgical repair in patients with small to medium rotator cuff tears (Kukkonen, 2021). At 10-year follow up, differences of 9.6 points (95%CI 3.6 to 15.7 points; $p = 0.002$) in the Constant score and 15.7 points in the ASES score [95% CI, 9.3 to 22.1 points]; $p < 0.001$) emerged in favor of surgery (Moosmayer, 2019). In summary, both physical therapy and operative repair groups demonstrated clinically meaningful improvement in those patients with symptomatic small to medium rotator cuff tears in regard to PROs, health related quality of life, and strength (Moosmayer, 2019; Kukkonen, 2021).

In patients with a traumatic rotator cuff tear, a single high quality prospective randomized controlled trial (Ranebo, 2020) demonstrated improvements in patient outcomes at 1 year in both physical therapy and surgical treatment groups. No significant differences were found between surgical repair and non-operative physical therapy management (10 visits across 16 weeks) with 1-year follow up in PROs with Constant-Murley Score ($p=0.68$), WORC ($p=0.62$), Pain (NPR) and (Euro) quality of life visual analog scale.

In a prospective randomized trial (Cederqvist, 2021), patients with rotator cuff disease (including no tears) who failed a 3-month (15 sessions) multi-modal physical therapy intervention were randomized to continued physical therapy management or surgical repair. In a subgroup of patients identified with a small to medium full-thickness rotator cuff tear, there were significant improvements with both physical therapy and surgical repair in pain (VAS) and Constant score in groups at 2 years in both groups. There was no difference between groups in pain improvements (mean difference: 7, 95% CI −3 to 17; $p=0.19$). While there was a statistically significant difference

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(mean difference: 7.0, 95% CI 1.8 to 12.2; p=0.008) between groups in Constant score, differences were small and fell below thresholds to be clinically important.

Risks and Harms of Implementing this Recommendation

There may be risks associated with implementing this recommendation for patients electing a prolonged course of non-operative management who eventually wish to proceed with surgical repair. In one randomized trial (Moosmayer, 2019), a subset of patients (n=14) allocated to physical therapy who later crossed over to secondary surgery had improvements in patient outcomes, but the Constant score was significantly less (i.e. 10.0 points, p = 0.03) compared with that of the primary tendon repair group.

Future Research

Continued comparative studies between non-operative treatment with physical therapy and surgical repair with or without post-operative supervised physical therapy in younger patients, traumatic tears, and acute on chronic traumatic tears, larger tear sizes and modern approaches to rehabilitation and surgical methods are needed. Additionally, studies with patient outcomes beyond 5 years are needed to better understand the true effectiveness and efficacy of each treatment over the long term.

Additional References

1. Moosmayer S, Lund G, Seljom US, et al. Tendon repair compared with physiotherapy in the treatment of rotator cuff tears: a randomized controlled study in 103 cases with a five-year follow-up. *J Bone Joint Surg Am*. 2014;96(18):1504-1514. doi:10.2106/JBJS.M.01393

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LONG TERM NON-OPERATIVE MANAGEMENT

Patient-reported outcomes (PROs) improve with physical therapy in symptomatic patients with full-thickness rotator cuff tears. However, the rotator cuff tear size, muscle atrophy, and fatty infiltration may progress over 5 to 10 years with non-operative management.

Quality of Evidence: High

Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

Two prospective randomized controlled trials with 5- to 10-year follow up comparing physical therapy only to operative repair for treatment of small to medium rotator cuff tears have shown that physical therapy can result in improved patient outcomes, but the rotator cuff tears continue to enlarge with time (Moosmayer, 2019; Kukkonen, 2021). At the 10-year follow-up of the patients treated with physical therapy, there was an increase in tear size > 5 mm in 19 patients (59%) and >10 mm in 13 patients (41%) (Moosmayer, 2019). In contrast, retears (full- or partial-thickness) occurred in patients treated surgically in only 21% (10 patients) after 1 year, 28% (13 patients) after 5 years, and 34% (16 patients) after 10 years. After an average of 8.8 years, 49% (18/37) of patients who were treated non-operatively also showed substantial muscle atrophy and 41% (15/37) fatty degeneration to a degree of 3 or 4 in (Moosmayer, 2017). Kukkonen et al. reported 2-year imaging outcomes showing that the patients with tears treated with physical therapy instructed home exercise program enlarged from an average of 9.6 mm to 11.7 mm, while the repaired tendons tear size decreased from 8.4 mm to 4.2 mm ($p<0.01$), suggestive of retears in some patients (Kukkonen, 2015).

Risks and Harms of Implementing this Recommendation

Patients treated non-operatively are at risk for reduced strength with rotator cuff tear progression. Moosmayer, et.al., compared patients treated with physical therapy that had an increase in tear size ≤ 5mm to those that progressed to > 5mm and reported the > 5mm group showed a loss of strength at 5-year follow-up (between-group difference of 4.2 kg, p=0.02) (Moosmayer, 2014). In a prospective cohort study, the Constant score was 81 points for patients with tear size increases < 20 mm compared to 58.5 points in those ≥ 20 mm (p=0.008) (Moosmayer, 2017). Patients who select physical therapy should be informed that over a 10-year period their tear size may progress, and this could lead to a substantial decline in their perceived and measurable outcomes. Surveillance with serial clinical evaluation and imaging for patients treated non-operatively following a rotator cuff tear may be considered if surgical repair remains a viable option.

Future Research

Continued long term comparative studies between physical therapy and surgical repair investigating larger tear sizes with pre-and postoperative advanced imaging studies are needed. It is still unclear what factors influence tear progression and if tear progression advances enough to preclude future repair and subsequent resolution of symptoms.

Additional References

1. Moosmayer S, Lund G, Seljom US, et al. Tendon repair compared with physiotherapy in the treatment of rotator cuff tears: a randomized controlled study in 103 cases with a five-year follow-up. *J Bone Joint Surg Am*. 2014;96(18):1504-1514. doi:10.2106/JBJS.M.01393

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2. Moosmayer S, Gärtner AV, Tariq R. The natural course of nonoperatively treated rotator cuff tears: an 8.8-year follow-up of tear anatomy and clinical outcome in 49 patients. *J Shoulder Elbow Surg*. 2017;26(4):627-634. doi:10.1016/j.jse.2016.10.002

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OPERATIVE MANAGEMENT VS NON-OPERATIVE MANAGEMENT

Healed rotator cuff repairs show improved patient-reported and functional outcomes compared to physical therapy and unhealed rotator cuff repairs.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

Rationale

In a 1-year prospective randomized controlled trial (RCT) comparing physical therapy to surgical repair for treatment of small to massive rotator cuff tears, Lambers Heerspink, et.al., reported a superior Constant score for intact repairs (88.5) compared to physical therapy (75.6, $p<0.05$) and re-tears (73.2) (Lambers Heerspink, 2015).

In the 10-year follow up study, Moosmayer et al (2019) identified a retear in 34% patients who were treated by primary repair. A comparison of the Constant score after 10 years between the 16 patients with a retear at the last follow-up (76.9 points) and the 31 patients with an intact repair (82.9 points) showed a better result for intact repairs, with a between-group difference of 6.0 points (95% CI, 0.2 to 11.8 points; $p = 0.04$) (Moosmayer, 2019). In contrast, the 32 patients with 5-year and 10-year sonography treated by physical therapy only, patients with tear progression of >10 mm had a Constant score of 63.9 points, an outcome that was inferior by 14.0 points (95% CI, 4.1 to 24.0 points; $p = 0.007$) compared with the score of 78 points in patients with tear progression <10 mm (Moosmayer, 2019). Identification of factors contributing to tear progression was not conducted.

In summary, tear progression occurs in some patients treated non-operatively over time, and the degree of tear size progression correlates negatively with patient outcomes. Retears also occur in some patients who undergo surgical repair, which also negatively impacts patient outcomes. This appears to occur to a lesser extent in the long term.

Risks and Harms of Implementing this Recommendation

There may be a risk of inferior patient-reported outcomes for patients who elect non-operative treatment in the long-term (10 years). In a prospective randomized trial with a 10 year follow up, a statistically significant difference in patients allocated to physical therapy who later crossed over to secondary surgery ($p = 0.03$) compared to primary surgery was shown (Moosmayer, 2019). Fourteen patients who had crossed over from physiotherapy to secondary surgery had an outcome on the Constant score that was 10.0 points inferior compared with that of the primary tendon repair group (Moosmayer, 2019).

Future Research

Continued long term comparative studies comparing multimodal supervised physical therapy and surgical repair in patients with larger tear sizes, and longitudinal studies with pre-and postoperative advanced imaging are needed. Identification of risk factors leading to tear progression in patients treated non-operatively and retears in those treated operatively would be important.

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ACROMIOPLASTY & ROTATOR CUFF REPAIR

The routine use of acromioplasty as a concomitant treatment is not suggested for therapeutic benefit as compared to arthroscopic repair alone for patients with small to medium sized full-thickness rotator cuff tears.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

Rationale

One high and seven moderate quality studies (Woodmass, 2022; MacLean, 2020; Waterman, 2021; Abrams, G. 2014; Gartsman, G. 2004; MacDonald, P. 2011; Milano, G. 2007; Shin S. 2012) evaluated the effect of acromioplasty on rotator cuff repair of small and medium sized tears. Overall, acromioplasty did not have an effect on outcomes with the exception of one study which found a higher reoperation rate in patients without acromioplasty. Gartsman, Milano, Abrams, and Shin performed randomized prospective studies demonstrating no difference in outcomes with and without acromioplasty at the time of rotator cuff repair.

MacDonald, et al. evaluated 86 randomized patients with and without acromioplasty and also found no difference in patient reported outcomes; however, there was a higher reoperation rate in the group without acromioplasty. Four of the patients subsequently had a second surgery for acromioplasty. One had a type 2 acromion, and the others had a type 3 acromion.

The included literature comprised populations of all RC patients, and did not restrict to include only certain patients with pathology that may benefit from acromioplasty. There may be certain situations where acromioplasty is needed to optimize visualization and/or for technical optimization during a RTC repair, (i.e., suture passing and shuttling, anchor insertion, canula placement).

Risks and Harms of Implementing this Recommendation

There is no risk or harm in implementing this recommendation.

Future Research

Continued long term comparative studies between acromioplasty and surgical repair investigating larger tear sizes with pre-and postoperative advanced imaging studies should be performed Future studies should also review the potential outcomes of acromioplasty on recovery, function, and PROs.

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DIAGNOSIS (CLINICAL EXAMINATION)

Clinical examination can be useful to diagnose or stratify patients with rotator cuff tears; however, a combination of tests will increase diagnostic accuracy compared to any single clinical examination test.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

Evidence from 11 high quality studies (Ackmann, 2021; Anauate Nicolao, 2022; Bullock 2018; Ercan, 2021, Fieseler, 2022a; Franca, 2022; Saragaglia, 2021; Sgroi, 2018; Sgroi, 2019; Yazigi Junior, 2021; Villafane, 2015) indicate that the following tests are useful to diagnosis a full-thickness rotator cuff tear: Bear Hug Test, Belly Press Test, Empty Can Test, External Rotator Lag Sign, External Rotation Resistance Test, Full Can Test, Hawkins Test, Hug Up Test, Internal Rotation Lag Sign (IRLS) Test, Internal Rotation Resistance Test (IRRT) Test, Internal Rotation Resistance Test At Maximal 90 Degrees Of Abduction And Maximal External Rotation (IRRTM) Test, Jobe Test, Lateral Jobe Test, Lift Off Test, Neer Test, Patte Test, And Yocum Test. Generally, these tests are better at ruling in than ruling out full-thickness rotator cuff tears.

Risks and Harms of Implementing this Recommendation

There is no known harm to patients by implementing this recommendation, but there could potentially be a slightly higher reoperation rate on patients who did not undergo the concomitant procedures.

Future Research

Future research could be performed to elucidate risk factors for reoperation rates in certain groups who did not undergo concomitant procedures.

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DIAGNOSIS (IMAGING)

MRI, MRA, CT and ultrasound are useful adjuncts to a clinical exam and radiographs for identifying rotator cuff tears.

Quality of Evidence: High
Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

Ultrasound

Evidence from seven high and 25 moderate quality studies evaluating the use of ultrasound for diagnosing rotator cuff tears indicates that ultrasound can be a useful adjunct to clinical exam and radiographs for identifying rotator cuff tears (Yazigi Junior, 2018; Porta, 2023; Day, 2016; Chauhan, 2024; Frere, 2021; Cheng, 2015; Saragaglia, 2021; Wang, 2022, Sabharwal, 2019; Zhu, 2022; Gill, 2023; Gormeli, 2014; Moosmayer, 2007; Aminzadeh, 2020; El-Shewi, 2019; Duan, 2021; Agarwal, 2021; Gulshan, 2019; Wang, 2023a; Yoon, 2020; Shapla, 2024; Ahmad, 2018; Reddy, 2022; Prakash, 2024; Reddy, 2024; van der Kraats, 2023; Dirkx, 2020; Wang, 2023b; Tang, 2019; Li, 2023a; Li, 2023b, Waldt 2007). The positive likelihood ratios (LR+) of the studies were generally found to be in the strong and moderate range with the negative likelihood ratios demonstrating a greater spread from poor to strong.

Magnetic Resonance Arthrography (MRA)

Evidence from 2 high and 12 moderate quality studies evaluating MRA for the diagnosis of rotator cuff tears indicates that MRA can be a useful adjunct to clinical exams and radiographs for identifying rotator cuff tears. (Duc 2006, Hahn, 2021, Magee, 2016; Groarke, 2021; Magee, 2018; Dirkx, 2020; Schreinemachers, 2009; Lee, 2018; Pfirrmann, 1999; Waldt, 2007; Herold, 2006; Probyn, 2007; Singer, 2020; Khil, 2021). A meta-analysis of 6 studies (appendix 2) analyzing the use of MRA for diagnosing all size RC tears, reported the pooled LR+ to be 20.87 (95% CI 6.65-65.47; $i^2 = 51.26$) with the majority of studies analyzed reporting LR+ values greater than 10, suggesting that MRA is a strong rule in test. Furthermore, the studies also reported LR- values in the weak to strong range with the majority being moderate or strong.

Magnetic Resonance Imaging (MRI)

Evidence from eight high and thirty-three moderate quality studies evaluating MRI for the diagnosis of rotator cuff tears indicates that MRI can be a useful adjunct to clinical exam and radiographs for identifying rotator cuff tears (Bullock, 2018; Lenz, 2021; Sill, 2022; Nigues, 2022; Haider, 2024; Hahn, 2022; Zappia, 2021; Ercan, 2021, Mohtadi, 2004; Lee, 2021; Apostolopoulos, 2019; Beer, 2021; Wang, 2022; Incesoy, 2021; Ahn, 2022; Hasegawa, 2023; Jeong, 2018; Kim, 2021; Sugimori, 2022; Atinga, 2021; Kilic, 2024a; Kilic, 2024b; Ringshawl, 2020; Siriwanarangsun, 2023; Fazal Gafoor, 2023; Jung, 2024; Mi, 2024; Sabharwal, 2019; Zhu, 2022; Gill, 2023; Li, 2023a; Magee, 2016; Groarke, 2021; Magee, 2018; Dirkx, 2020; Wagner, 2021; Chowdhury, 2023; Tang, 2019; Li, 2023b; Thiagarajan, 2021; Gowda, 2024). A meta-analysis of 8 studies (appendix 2) analyzing the use of MRI for diagnosing all size RC tears reported the pooled LR- to be 0.10 (95% CI 0.06-0.14; $i^2 = 8.15$) suggesting that MRI is a strong rule out test. Furthermore, the studies also reported LR+ values in the poor to strong range with the majority being in the weak to strong range.

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CT

Evidence from five moderate quality studies evaluating CT for the diagnosis of rotator cuff tears indicates that CT can be a useful adjunct to clinical exam and radiographs for identifying rotator cuff tears (Allam, 2019; Dirkx, 2020; Magee, 2018; Ma, 2022; Gomez-Vieira, 2019). This evidence was upgraded to be included with this strong recommendation because it is widely available and may be demanded clinically where MRI is not available. Furthermore, the use of CT in diagnosing RC tears may be useful for patients with cardiac restrictions.

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POST-OP MOBILIZATION TIMING
POST-OP SLING USE

Postoperative clinical and patient-reported outcomes are similar for small to medium-sized full-thickness rotator cuff tears managed with early mobilization or delayed mobilization (delayed up to 8 weeks) for patients who have undergone arthroscopic rotator cuff repair.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Following arthroscopic rotator cuff repair, in certain patient populations, outcomes are not adversely affected with immediate weaning of sling use to allow active ROM for ADLs compared to prolonged sling use because similar post-operative healing, functional outcomes, and patient-reported outcomes are achieved.

Quality of Evidence: Moderate
Strength of Recommendation: Moderate 

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

Rationale
Four high quality and four moderate quality randomized controlled trials (Guity, 2023; Keener, 2014; Kjaer, 2021; Mazzocca, 2017; Cuff, 2012; De Roo, 2015; Duzgun, 2014; Koh, 2014) evaluated post-operative mobilization paradigms following rotator cuff repair. All 6 studies compared the outcomes of patients who began mobilization exercises of their shoulder within 0-2 weeks post-operatively against patients who delayed mobilization exercises for between 4-8 weeks post-operatively. In each of the reviewed studies, patients were immobilized in a sling for an equivalent length of time irrespective of group assignment. The consistency of sling use between groups allows our analysis to focus on "mobilization" as defined by the timing the first visit of supervised physical therapy. For nearly all measures, including post-operative rotator cuff healing, patient-reported outcome measures, and post-operative medication use, early and delayed mobilization paradigms yield similar outcomes.

Early mobilization favors improved range of motion (Cuff, 2012; Duzgun, 2014; Keener, 2014; Mazzocca, 2017) and quality of life patient-reported outcome measures (Mazzocca, 2017) when compared to patients who delayed mobilization, but these differences become negligible by 6 months post-operatively.

Delayed mobilization until 4-8 weeks post-operatively is associated with higher rates of post-operative healing. However, these differences do not reach statistical significance in the 5 best available evidence studies which analyzed rotator cuff integrity (Cuff, 2012; DeRoo, 2015; Keener, 2014; Koh, 2014; Mazzocca, 2017). Post-operative healing was analyzed by US and/or MRI from 7 days (Mazzocca et. al. 2017) through up to 2 years post-operatively (Keener, 2014; Koh, 2014).

In summary, early (0-2 weeks) or delayed (4-8 weeks) mobilization defined by initiation of passive and

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active-assistive range of motion interventions with supervised physical therapy yield similar outcomes in rotator cuff healing, range of motion, and patient-reported outcome scores. Early mobilization tends to favor improved range of motion through the first 6 months post-operatively while delaying mobilization exercises is associated with higher rates of post-operative healing particularly for tears of larger size.

Three prospective randomized trials (Sheps, 2019; Littlewood, 2021; Tirefort, 2019) examined early mobilization defined as discontinuation of sling use. Studies compared immediate weaning from sling and active range of motion to comfort compared to consistent sling use for 4-6 weeks following arthroscopic rotator cuff repair. Mobilization with physical therapist /surgeon instructed passive, or active assistive home exercise programs were the same in both groups for the first 4 weeks. Self-reported fidelity of sling use was assessed and different between groups as intended. Enrolled patients in Sheps, 2019 included full-thickness tears, 70% that were less than 3cm and 30% were greater than 3cm (excluding subscapularis), repaired arthroscopically with surgeon preference (at least 90% were double row/ trans-osseous equivalent) (Sheps 2019). No abduction pillow was used with sling. Enrolled patients in Littlewood et al included 89% full thickness and 11% partial thickness atraumatic rotator cuff tears (mean 2.7cm). Enrolled patients in Tirefort, 2019 included full thickness tears less than 3cm, considered small to medium. At 6 weeks (Sheps, 2019; Littlewood, 2021; Tirefort, 2019), early motion patients had significantly better active motion than the continuous sling use patients; no other group differences were noted. In follow-up over 24 months, Tirefort showed better SANE scores (85.8 ± 10.7 versus 79.4 ±11.6, p = 0.011) and lower VAS pain scores (0.8 ± 1.1 versus 1.5± 1.6, p = 0.031) in the no sling group, but no group differences in range of motion, and pain, strength, or health related quality of life were found in Sheps. The retear rate at 3 months in Littlewood was 40% in continuous sling use and 30% in early motion groups, at 12-months postoperative in Sheps was 30% in early motion versus 33% in continuous sling use groups, and there was no significant differences in tendon integrity at 6 months in Tirefort. In summary, outcomes are not adversely affected with immediate weaning from sling use allowing for active motion to comfort, compared to 4-6 weeks of standard sling use as it yields similar post-operative healing, functional outcomes, and patient-reported outcomes following arthroscopic rotator cuff repair. Early mobilization with immediate weaning from sling yields earlier improvements in active motion.

Risks and Harms of Implementing this Recommendation

Because the early and delayed mobilization protocols yield similar results there is no known harm from implementing this recommendation. Timing for discharge of sling use should be determined by shared decision making with the patient based on numerous patient specific factors that impact repair healing in order to reduce risk of retears during post-operative rehabilitation.

Future Research

This PICO question using the term mobilization was updated to include: 1. the timing of post-operative mobilization exercises, defined in the 6 studies reviewed here, as the initiation of supervised physical therapy intervention of manual passive range of motion, active assistive, and active motion exercises, and 2. immediate weaning sling use, defined in 3 studies. A physical therapy visit for mobilization passively or therapist active assistive exercises may not be the measure most indicative of stress on the healing repair. Absolute load and cyclic loading have been identified as factors affecting suture durability in biomechanical studies. Counting the number of physical therapy visits assumes that the amount of load and the cycles across the tendon-suture-bone interface are consistent for therapist assisted mobilization within each physical therapy session and home exercise protocols. Perhaps it is not surprising that there are few differences between early and delayed rehabilitation protocols when the measure of dosing is initiation of supervised physical therapy with variations in the timing of passive and active assisted range of motion or sling use. If researchers want to further elucidate the differential impacts of loading a rotator cuff repair, either a more finite measure of dosing should be used for

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mobilization (number of total cycles) or tracking use outside of a sling with activity monitors in supervised physical therapy, home exercises, and with active motion with activities of daily living should be utilized. Studies should evaluate short-term outcomes (6-12 weeks), or the rehabilitation protocols need to be more disparate. At minimum, future research should examine the dose and load of mobilization, home exercise, and active motion out of the sling over the course of post-operative care. Finally, more patient-centric disease-specific outcome measures such as the WORC quality of life score (Mazzocca et. al.) should be routinely incorporated to determine the direct impact on the patient of differing rehabilitation protocols.

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SUPERVISED EXERCISE VS UNSUPERVISED EXERCISE

Visits of physical therapy for supervision of exercises that are performed independently at home do not provide greater improvements in pain and function outcomes (at 3 months, up to 1 year) compared to a single session of physical therapist instruction followed by an independent home program in patients following arthroscopic rotator cuff repair for small tears.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

Rationale

Both a physical therapist instructed home exercise program and physical therapy supervision of the independent home exercise program improve patient pain and function outcomes in patients following arthroscopic rotator cuff repair for full-thickness tears isolated to only the supraspinatus (Karppi 2020). A randomized trial of patients having undergone arthroscopic repair for small rotator cuff tear compared a single session instruction of a 2-phase (AAROM; strengthening) home exercise program to a program that included additional visits to a physical therapist who supervised the patient doing the same independent home exercise program. There were no clinically meaningful differences in pain and function outcomes (Constant score, subjective shoulder value) at 3 months and 1 year follow up.

To evaluate traditional multimodal physical therapy compared to an independent home exercise program (HEP) for rehabilitation following rotator cuff repair, two conflicting studies (moderate quality) were identified (Lisinski 2012; Hayes 2004). Hayes et al (2004) supervised physical therapy treatment consisted of manual therapy, pain management with modalities, exercise and advice. The results showed that at 6, 12 and 24 weeks post-operative, comparable improved outcomes in strength (evaluated with manual muscle testing only), range of motion, and self-reported outcomes were demonstrated for individualized supervised physiotherapy treatment and standardized unsupervised home exercise program progressed by the surgeon only, though functional deficits of 14% and 32% were reported in the individualized physiotherapy group and standardized home exercise group, respectively, at 24 weeks post-operatively. Methodological limitations include a high number (28%) of patients (9/32) allocated to the independent home exercise program group crossed over to the supervised therapy group with analysis conducted by group allocation only. Additionally, missing data accounted for up to 31% of assessment results for the PT group, and 44% of assessment results for the HEP group, increasing risk of type II error. In contrast, Lisinski et al also conducted a randomized trial showing supervised multi-modal physical therapy treatment (manual therapy, mobilization exercises and strengthening) compared to an independent home exercise program that resulted in improved short term (3 and 6 week) outcomes (AROM; Pain VAS).

Risks and Harms of Implementing this Recommendation

There are potential harms of cost and resources when physical therapist interventions for postoperative rehabilitation following rotator cuff repair is limited only to supervision of the same exercises done independently at home and is not consistent with skilled physical therapy management.

Future Research

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Future research should evaluate short- and long-term pain, function and clinical outcomes and compare traditional post-operative physical therapy management that is multimodal (manual therapy including mobilization and mobilization exercises, neuromuscular control training, functional activities, and continual assessment and progression/modification of home exercise program) to phased post-operative surgeon instructed home exercise programs for rehabilitation of patients following full-thickness rotator cuff repairs. Future research is needed to identify which patients may need traditional multimodal physical therapy, including neuromuscular re-education and manual therapy, compared to a home-directed program. Future studies that are stratified by tear size are also needed. The one high-level study referenced above was done on a small tear population only and may not be applicable to larger tears.

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CORTICOSTEROID INJECTIONS FOR ROTATOR CUFF TEARS

The use of a single injection of corticosteroids with local anesthetic can be considered for short-term improvement in both pain and function for patients with shoulder pain. In patients who cannot tolerate corticosteroids, injectable NSAIDs may be considered.

Quality of Evidence: High

Strength of Recommendation: Moderate ★★★☆ (Downgraded)

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

Rationale

Multiple high- and moderate-quality studies indicate that corticosteroid (CS) injections for patients with rotator cuff pathology are beneficial with regards to pain (VAS/SPS) level reduction (Moosmayer 2023; ElGendy 2023; Daghiani, 2023; Raeesi, 2022; Lee, 2022; Hopewell, 2021; Ekeberg, 2009; Alvarez, 2005; Kang, 2016; Abolhasani 2019; Hsieh, 2021; Carroll, 2018; Boonard, 2018; Sari, 2020; Babaei-Ghazani, 2019; Darrieutort-Lafitte, 2019; Liu, 2019; Louwerens, 2020; Holt, 2013; Eyigor, 2010; Penning, 2012; Atar, 2023; Hsieh, 2023; Hajivandi, 2021; Vergili, 2021; Apivatgaroon, 2023; Pasin, 2019; Ebadi, 2023; Dogan, 2021; Battaglia, 2017; Lee, 2017; Rabini, 2012; Lin, 2014).

Moosmayer et al (high quality study) demonstrated improved QuickDash and EQ-5D-5L outcomes at 1.5 months after corticosteroid injection, but not at 4, 8, 12, 24 months. When compared to physical therapy (PT), corticosteroid injections provided better QuickDash/SPADI/WORC scores (Daghiani, 2023). These studies indicate short-term benefit regarding pain level and function. Due to the heterogeneity of patient-reported outcomes and variability of study findings, the strength of the recommendation was downgraded to moderate.

Risks and Harms of Implementing this Recommendation

Corticosteroid injections in the setting of rotator cuff tears may be detrimental to the healing potential following rotator cuff repair. Considering that rotator cuff diagnoses are clinical, a single corticosteroid injection may be given to confirm the presence of a symptomatic rotator cuff tear but may adversely affect outcomes if performed in temporal proximity to surgical intervention.

Future Research

Further research is recommended to determine the role of corticosteroid injections in the various settings of rotator cuff pathology.

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PROLOTHERAPY

Prolotherapy is not recommended for use in patients with full-thickness rotator cuff tears.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

None of the high-level studies indicated benefit with prolotherapy versus control. Three moderate quality studies demonstrated the following results: better SPADI at three months (Kazempour Mofrad, 2021) with prolotherapy when compared to exercise, improved pain level (Chang, 2021), and better patient satisfaction (Bertrand, 2016). One low quality study (Eroglu, 2022) demonstrated better PROs (SPADI, WORC) when compared to exercise (PT).

When comparing prolotherapy to CS injection, there are four high quality, three moderate quality, and two low quality studies. Lin et al (2023) found better SPADI scores, improved pain, and ROM with CS injection, whereas Sari et al (2020) and Cole et al (2018) found no differences (ASES, WORC; OSS, ROM, strength) despite improved pain with CS at 1.5 months (Sari). Sabaah et al (2020) found better pain control at 3 months with prolotherapy than CS injection.

Based upon the studies, prolotherapy is not recommended for patients with full-thickness rotator cuff tears.

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HIGH-GRADE PARTIAL-THICKNESS ROTATOR CUFF TEARS

Conversion to full-thickness or transtendinous/in-situ repair can be performed in patients that failed conservative management with high-grade partial-thickness rotator cuff tears.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

There were two high quality studies (Kim, 2015; Shin, 2012) and two moderate quality studies (Castagna, 2015; Franceschi, 2013). The remainder of published studies either had too few subjects (<20) or were low quality level IV studies. Kim 2015 noted no difference in either clinical outcomes or re-tear rates comparing transtendinous RC repair versus tear completion with RC repair in Ellman III partial-thickness rotator cuff tears. Bursal side cuff tears had a higher retear rate with either technique. Shin, 2012 noted similar outcomes for the two groups, but noted a significantly faster recovery with tear completion. Retears were higher in the tear completion group but did not reach statistical significance. Castagna 2015 looked at a total of 74 patients randomized to transtendinous repair versus tear completion with repair. There were no significant differences between the two groups. Franceschi 2013 reported that outcomes and retear rates were comparable between transtendinous repair and tear completion with repair.

Future Research

Additional high-quality Level I studies with longer follow-up would be helpful in determining the longevity of these procedures, as well as establishing the risk of retears.

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PARTIAL ROTATOR CUFF TEAR

Debridement or repair of high-grade partial-thickness cuff tears that have failed physical therapy can be performed; however, repair of high-grade partial tears can improve outcomes.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale
Jeong (Jeong, 2023) performed a high quality prospective randomized controlled trials (RCT) comparing debridement versus repair of Yoo and Rhea type 2B (partial ¼ to 1/3 of the footprint) subscapularis tears in 65 patients. The authors noted no difference in clinical outcomes, pain scores, or range of motion, however for the repair group showed significantly better SSC muscle strength compared with the debridement group at 5-year follow-up.

In another high-quality study, Wang (Wang, 2021) and colleagues compared the effects of debridement versus repair of Ellman grade 2 (25-50%) bursal-sided partial-thickness rotator cuff tears. In the author's publication on 85 patients at short term follow up of 18 months, there was no difference between the two groups in clinical outcomes, pain scores, or MRI findings in terms of muscle atrophy or fat infiltration between the two groups.

Risks and Harms of Implementing this Recommendation
While, given the level of evidence, overtreatment or undertreatment of partial-thickness rotator cuff tears may occur, the available data suggests that only minimal or no harm would be associated with implementing this recommendation.

Future Research
High strength comparative studies between debridement and partial tear repair may further clarify the utility of these two techniques in managing partial rotator cuff tears. Further data characterizing the utility of repair of different partial-thickness tear sizes may also be of benefit.

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BIOLOGICAL AUGMENTATION WITH PLATELET DERIVED PRODUCTS

Biological augmentation of rotator cuff repair with platelet-derived products is not recommended for improving patient-reported outcomes; however, limited evidence supports the use of liquid platelet rich plasma (PRP) in the context of decreasing re-tear rates.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

Several high strength studies confirm that the addition of liquid platelet-rich plasma or platelet-rich fibrin does not significantly change patient-reported outcomes.

Ten high- and seven moderate-quality studies (Antuna, 2013; Castricini, 2011; Malavolta, 2014; Malavolta, 2018; Pandey, 2016; Randelli, 2011; Randelli, 2022 (b); Rossi, 2024; Snow, 2020; Zumstein, 2016; Jo, 2015; Sanchez-Villacanas, 2021; Walsh, 2018; Wang, 2015; Zhang, 2016; Zhang, 2022; Zhang, 2023) investigated the effect of liquid platelet rich plasma (PRP) on post-operative full-thicknessfull-thickness re-tear rates. In pooled analysis, when stratifying by partial-thickness and full-thickness retear, neither grouping demonstrated lower relative risk of retear with PRP vs no PRP (RR = 1.5 (0.27-8.30) and RR 0.74 (0.48, 1.15) respectively, however, when tear type wasn't stratified, the RR was 0.43 (0.28, 0.66) in favor of the PRP group.

With respect to platelet rich fibrin, there is insufficient evidence to make a recommendation for or against its utilization in reducing post-operative rotator cuff re-tear rates. Due to limited numbers in the pooled analysis, subgroup analyses for rotator cuff tear size could not be performed.

Risks and Harms of Implementing this Recommendation

There are no known harms associated with the use of PRP.

Future Research

Future studies should standardize the type of PRP formulation utilized or at the very least measure the concentrations of key constituents. Furthermore, larger studies will allow for controlled statistical analyses that consider the effect of confounders such as fixation constructs, marrow venting, size of tears, etc. Consistency in the definition of rotator cuff re-tear is also encouraged.

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SINGLE-ROW VS DOUBLE ROW REPAIR – PATIENT REPORTED OUTCOMES

Double row rotator cuff repair constructs are not recommended for improving patient-reported outcomes compared to single row repair constructs.

Quality of Evidence: High
Strength of Recommendation: Strong ★★★★

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

Seven high quality randomized controlled trials (RCTs) comparing single row versus double row constructs for full-thickness rotator cuff tears reported significant improvement in all patient-reported outcomes (PROs) at final follow-up; however, there were no clinically meaningful difference in PROs between the two repair groups **(**Franceschi, 2016; Franceschi, 2007; Grasso, 2009; Heuberer, 2020; Koh, 2011; Lapner, 2012; Lapner, 2021(a))**.** Two moderate quality RCTs reported significant improvement in PROs (UCLA scores, ASES scores, or strength testing) favoring double row repair in patients with >3cm full-thickness rotator cuff tears (Ma, 2012; Carbonel, 2012). Aydin, 2010 reported no difference in the Constant scores or complication rates between the two groups of single row (N=34) and double row (N=34) repair at final follow-up. Barber, 2016 also reported no difference in all PROs between single row (N=20) compared to double row (N=20) repair for full-thickness cuff tears less than 3cm augmented with platelet-rich plasma fibrin membrane. The failure rate at final follow-up was also similar between both groups, 3 out of 20 (15%) in each group. Furthermore, Burks,, 2009, Franceschi et al, Koh et al, and Lapner et al also found no clinically meaningful difference in the PROs between single row and double row repair for full-thickness rotator cuff tears at final follow-up. Ma et al also reported similar UCLA and ASES scores at final follow-up comparing single to double row repair. However, in the subset of patients with >3cm full-thickness tears, the authors reported significantly better shoulder strength in abduction and external rotation with double row repair at final follow-up. In the largest RCT comparing the outcome of single row versus double row repair, Carbonel et al reported similar PROs in patients with 1cm to 3cm tears. However, in patients with > 3cm tears, double row repair showed superior results in both UCLA and ASES scores compared to single row repair.

Risks and Harms of Implementing this Recommendation

There is no harm to patients by implementing this recommendation for small to medium size rotator cuff tears. However, in patients with larger rotator cuff tears (>3cm), single row vertical mattress repair may result in inferior PROs and higher failure rates compared to double row repair constructs.

Future Research

Future research needs to be performed to evaluate for both PROs and failure rates based on imaging and reoperation rates between single row compared to double row repair for larger full-thickness rotator cuff tears >3cm in size.

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SINGLE-ROW VS DOUBLE ROW REPAIR - RETEARS

Double row repairs can result in lower overall retear rates after primary repair and improved patient-reported outcomes in large (>3cm) repairs. However, when evaluating for only full-thickness re-tears, double row repairs are not significantly favored.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale
Seven high and five moderate quality randomized controlled trials (RCTs) utilizing magnetic resonance imaging (MRI) reported the re-tear rates after single row versus double row repair in patients with full-thickness rotator cuff tears (Heuberer, 2020; Franceshi, 2016; Franceschi, 2007; Grasso, 2009; Koh, 2011; Lapner, 2012; Lapner, 2021a; Barber 2016; Burks, 2009; Imam 2020; Carbonel, 2012; Chen, 2023; Adil, 2023; Bae, 2024; Bushnell, 2021; Chen, 2019; Dogar, 2021; Hantes, 2018; Ma 2012; Moon, 2018; Pandey, 2021; Plachel, 2020; Pulatkan, 2020; Rhee, 2023; Tashjian, 2018; Xie, 2023; Yoon, 2019).

A meta-analysis of the available pooled data indicated that double row repairs can result in lower partial retear rates than single row repairs (RR = 0.50 (0.28, 0.89). When re-tears are defined as full-thickness, however, while the studies trended in favor of double row repairs, the pooled results did not reach significance (RR = 0.76 (0.36, 1.60)).

Risks and Harms of Implementing this Recommendation
There is no harm to patients by implementing this recommendation. However, partial and full-thickness re-tear rates may be higher after single vertical mattress repair compared to double row in patients with full-thickness rotator cuff tears. The clinical significance is unknown.

Future Research
Future research should be performed to evaluate failure rates based on imaging and reoperation rates when comparing single row to double row repair for full-thickness rotator cuff tears. Research also needs to be done to better identify the clinical significance of a partial-thickness re-tear after arthroscopic rotator cuff repair.

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MARROW STIMULATION

Marrow stimulation at the time of rotator cuff repair does not improve patient-reported outcomes; however, this technique may decrease re-tear rates in patients with larger tear sizes.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale
Five-high and two moderate quality studies demonstrated that marrow stimulation (MS) does not have an effect on patient-reported outcomes such as the constant score (Ruiz Iban, 2021; Shibata, 2023; Lapner, 2021(b); Lapner, 2023; Milano, 2013; Toro, 2022; Hong, 2024(a)). One low quality study (Taniguchi, 2015) did demonstrate a decrease in re-tear rates. A high-quality study by Milano (2013) demonstrated decreased re-tear rates in larger tears

Risks and Harms of Implementing this Recommendation
The risk of complications with MS is low. If several microfracture holes are made in the footprint that are too close together there is the theoretical potential of comprising the fixation strength of suture anchors.

Future Research
Future studies should be large enough that the statistical analyses will allow for consideration of confounders such as fixation constructs, size of tears, etc. Consistency in the definition of a rotator cuff re-tear is also encouraged.

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DERMAL ALLOGRAFTS

The use of human dermal allografts to augment rotator cuff repair can lead to lower retear rates and better patient-reported outcomes, but porcine allograft is not suggested for use in rotator cuff augmentation.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate 

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

Rationale

Two moderate strength studies (Barber, 2012; Lee, 2022) and one small, but high-quality study (Snow 2023) support the use of human dermal allograft for rotator cuff augmentation. The remainder of published studies either had too few subjects (<20) or involved interposition rather than augmentation of rotator cuff repair. Barber et al., in a moderate quality study, involved a comparison of two-tendon three-centimeter tears with or without an acellular human dermal matrix allograft augmentation. Both Constant scores and re-tear rates were significantly improved with use of the allograft augmentation with no adverse events related to the allograft. Snow performed a pilot study with 20 patients in each group, suggesting a lower retear rate (Sugiya 4-5) in rotator cuff repair augmented with human dermal allograft. Meta-analysis of high quality and moderate quality studies of porcine allograft suggest no benefit for either retear rate or patient-reported outcome measures.

Risks and Harms of Implementing this Recommendation

The use of dermal allografts increases operating time and thus may increase infection rates and other surgical time-related complications. Use of dermal allografts may also substantially increase the cost of rotator cuff surgery.

Future Research

Given the risks and costs involved with these devices, high quality studies would be useful to definitively establish the benefits of these devices.

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BIOINDUCTIVE IMPLANTS

The use of bioinductive tendon implants to augment rotator cuff repair or as an alternative to non-augmented repair can lead to lower retear rates and better patient-reported outcomes.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

Two high quality studies have addressed bioinductive collagen-based tendon implants. Ruiz Iban studied 124 patients with medium to large rotator cuff tears in a randomized clinical trial of double row rotator cuff repair with and without bioinductive tendon implant augmentation and found a significantly lower retear rate with augmentation, though functional outcomes did not demonstrate any differences. Camacho Chacon performed a RCT of 60 patients with smaller tears and an intact rotator cable. This study compared double row repair with primary repair using only the bioinductive tendon implant. They found better functional outcomes, a lower retear rate, and higher quality tendon tissue on biopsy with bioinductive tendon implant repair. They also noted faster return to work in the tendon implant group.

Risks and Harms of Implementing this Recommendation

The use of bioinductive tendon implants increases operating time and thus may increase infection rates and other surgical time-related complications. Use of bioinductive tendon implants may also substantially increase the cost of rotator cuff surgery.

Future Research

Given the risks and costs involved with these devices, high quality studies would be useful to definitively establish the benefits of these devices.

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OPEN VS ARTHROSCOPIC REPAIRS

Evidence shows no difference in long-term (> 1 year) patient-reported outcomes or cuff healing rates between open and arthroscopic repairs; however, the arthroscopic-only technique is associated with better short-term improvement in post operative recovery of motion and decreased visual analog scale (VAS) scores.

Quality of Evidence: High
Strength of Recommendation: Strong 

Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention. Also requires no reasons to downgrade from the EtD framework.

Rationale

There were two high quality studies (Carr, 2017; Mohtadi, 2008) comparing the outcome of arthroscopic and either open or mini-open repair and seven moderate quality studies (Carbonel, 2012; Hasler, 2020; Jithesh, 2024; Liu, 2017; MacDermid, 2021; Ribeiro, 2023; van der Zwaal, 2013) comparing perioperative pain and morbidity between arthroscopic and open rotator cuff repair.

None of these seven studies reported any significant difference in the outcome of any of the three techniques. Multiple other comparative studies of lower quality exist regarding this topic, some with differing outcomes, but only the best available evidence was considered in the development of this recommendation.

In a prospective, randomized high quality study, Carr et al. (2017) evaluated the outcome of 273 patients randomized to either open/mini-open, or all-arthroscopic repair. There was no difference in outcome scores, with a 40% healing rate in both groups. This study extended the preliminary results of Carr et al. study reported in 2014.

Mohtadi et al. 2008 published a high-quality study comparing open to mini-open repair showed no difference in PROs between techniques at average follow-up of 28 months. No post-operative imaging was performed.

In a moderate quality prospective randomized study of 100 patients, Liu et al. 2017 showed no difference in outcome between all-arthroscopic and mini-open repairs for either patient-reported outcomes, retear rates, or occurrence of adhesive capsulitis at one year.

Van der Zwaal et al. 2013 presented a moderate-quality study comparing all-arthroscopic to mini-open repair at one year. Final PROs, retear rates, and presence of associated adhesive capsulitis were similar between both groups.

In evaluating the literature which forms the basis for this recommendation, two moderate-quality studies (Liu et al. 2017 and Van der Zwaal et al. 2013) showed faster short-term recovery with all-arthroscopic repair. Liu et al. 2017 showed significant differences in both range of motion and VAS scores, as well as superior scores on both the DASH and Constant PRJOs up to one-month postoperatively. Liu concluded that the all-arthroscopic procedure has better recovery at short-term follow-ups. Similarly, Van der Zwaal et al. noted improved range of motion, VAS, and DASH scores at six weeks comparing all-arthroscopic to mini-open repair. They felt that "Patients do attain the benefits of treatment somewhat sooner (6 weeks) with the arthroscopic procedure."

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Risks and Harms of Implementing this Recommendation

There are no risks associated with implementing this recommendation.

Future Research

Given the conflicting information available regarding improvements in post-operative pain and early recovery with all-arthroscopic repair, further studies are needed in this area to establish benefits of this procedure.

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POSTOPERATIVE PAIN MANAGEMENT

Multimodal analgesia programs or non-opioid individual modalities can be considered to provide added benefit for postoperative pain management following rotator cuff repair.

Quality of Evidence: Moderate

Strength of Recommendation: Moderate ★★★☆

Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention. Also requires no or only minor concerns addressed in the EtD framework.

Rationale

Two high and three moderate quality articles (Jildeh, 2022; Hofmann-Kiefer, 2008; Chillemi, 2024; Oh, 2018; Yun, M. J. 2012), addressed a variety of individual and multimodal pain management modalities. Based on this literature, it is clear that any one of a variety of non-opioid medications and/or modalities has a positive impact on patient pain control in the post-operative period. It should be noted that most of the literature validated a singular approach against a singular control group and did not perform a direct comparison against all other options. Similarly, indirect comparisons of the literature review findings using network meta-analysis were not statistically feasible. This led to the inability to rank order pain management modalities in a "most effective" to "least effective" manner. Additionally, there is heterogeneity within the literature with regard to the use of and type of regional anesthetic, which may influence the amount of and timeline for oral pain medication following surgery. Because of this, the guideline development group framed the pain management recommendations as a more general list of pain management modalities, both singular and multimodal, which exhibited comparative efficacy, as compared to their within-study comparisons. Further, higher level studies are needed in order to encourage multi-modal, opiate-sparing pain medicine regimes moving forward.

Hofmann-Kiefer, 2008 (High-Quality) compared pain scores as well as functional outcomes between patients who received patient-controlled interscalene block (PCISB) and those who received patient-controlled IV opioid-based analgesia (PCA) after open shoulder surgery. In the PCISB group, pain outcomes (Constant Pain Score, Overall VAS pain, VAS pain at rest, and VAS pain during activity), fentanyl consumption, and averages for nausea and/or vomiting were significantly better than in the PCA group.

Jildeh, 2022 (High-Quality) compared VAS scores, PROMIS scores, patient satisfaction, and adverse drug events in the early post-operative period (post-op days 1-10) between patients who received a multimodal non-opiate IV program (ketorolac, gabapentin, methocarbamol, acetaminophen) and those who received oral opioids (oxycodone) after arthroscopic rotator cuff surgery. In the multimodal group, the average days of constipation and nausea, as well as pain levels on postoperative days 1 and 4, were significantly lower than in the oxycodone group.

Yun, 2012 (Moderate-Quality) compared outcomes between patients who received subacromial patient-controlled analgesia (SA-PCA w/ ropivacaine) and those who received intravenous patient-controlled analgesia (IV-PCA w/ fentanyl, ketorolac, and ondansetron) after arthroscopic rotator cuff repair. In the SA-PCA group, requested bolus dose at 8hrs postop, frequency of bolus dose at 4 hours postop, postop nausea, VAS Pain at 1hr postop, and postop patient satisfaction were significantly better than in the IV-PCA group.

Defining multimodal therapy as using multiple but different modalities of pain management therapies simultaneously in the same post-operative period, the study group was able to arrive at the second

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multimodal pain management recommendation (recommendation B). The evidence assessing multimodal pain management supported the use of multimodal pain management treatment compared to a single modal approach.

Risks and Harms of Implementing this Recommendation

While the study group's conclusion that there are various successful options of both singular and multimodal post-operative pain management has moderate strength of evidence, the analysis did not include a risk-benefit comparison of options. Each individual medication or modality carries its own inherent risks and benefits which should be taken into account by the health care provider prescribing the intervention.

Future Research

The analysis of this question has exposed the need for future research particularly into the pros and cons of each medication, modality, and multimodal program, in comparison to each other. The collective data and indirect comparisons from the high-quality articles cited in this recommendation could be used to perform a network meta-analysis, providing valuable information to best guide future management.

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OPTIONS

Options are formed when there is little or no evidence on a topic. This is defined as low quality evidence or a single moderate quality study (i.e., a limited strength option), no evidence or only conflicting evidence (i.e., a consensus option), or statements resulting in a limited or consensus strength following Evidence to Decision Framework upgrading and/or downgrading.

HYALURONIC ACID INJECTIONS FOR ROTATOR CUFF PATHOLOGY

The use of hyaluronic acid injections may be considered in the non-operative management of rotator cuff pathology with no tears.

Strength of Evidence: High

Strength of Recommendation: Limited  (Downgraded)

Description: Evidence from two or more "High" quality studies with consistent findings recommending for against the intervention. Recommendation has been downgraded based on the EtD framework.

Rationale

Due to the heterogeneity of patient-reported outcomes and variability of study findings, the strength of the recommendation has been downgraded to limited.

Several high- and moderate- quality studies investigated the potential benefit of hyaluronic acid (HA) versus control. Hsieh et al (high quality, 2021; subacromial – subdeltoid injections) did not find any benefit with HA over saline injection in the short term except at 2 months (VAS for pain with activity). Cai et al (high quality, 2019; subacromial injections) found improved VAS (pain), ASES, and CM scores at one year follow-up. The Cai study utilized PRP + HA in one of their treatment arms. Clinical benefit from this admixture could not be definitively attributed to PRP or HA; as such, the authors' conclusions should be carefully considered. Chou et al (high quality, 2010; subacromial bursa injections) found improved CM scores at one year with HA versus control group. Penning et al (high quality, 2012; subacromial injections) demonstrated improved "functional mobility test" scores at 3 months, but not at any further point in follow-up.

When comparing CS versus HA, there are two high (Hsieh, 2021; Penning, 2012) and one moderate quality (Lim, 2014, glenohumeral joint injections) studies. Penning found CS to be superior to HA with regards to CM at short term follow-up (3 months). Hsieh et al treatment results varied depending on outcome measure and follow-up duration.

Risks and Harms of Implementing this Recommendation

There are no known risks to hyaluronic acid injections that are specific to shoulders or the rotator cuff.

Future Research

Further research may be conducted to further define the role of hyaluronic acid injections in rotator cuff pathology.

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PLATELET RICH PLASMA (PRP) INJECTION IN PARTIAL-THICKNESS TEARS

The routine use of platelet rich plasma is not supported for the treatment of rotator cuff tendinopathy or partial tears.

Strength of Evidence: High

Strength of Recommendation: Limited  (Downgraded)

Description: Evidence from two or more "Low" quality studies with consistent findings or evidence from a single "Moderate" quality study recommending for against the intervention or diagnostic or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

Rationale

The included PRP studies reveal heterogeneity in outcome reporting, variability in conclusions (contradictory in some studies), and non-superiority when compared to established treatments such as CS. As such, the strength of recommendation has been downgraded to limited.

Several high- and moderate- quality studies investigated the use of PRP for cuff tendinopathy or partial-thickness tear. Beginning with the high-quality studies, El-Sherif et al (2023) demonstrated better pain control, SPADI scores, and range of motion (ROM) when compared to saline. Sari et al (2020) found improved ASES and WORC scores with PRP versus lidocaine injection. Cai et al (2019) demonstrated better VAS pain levels and outcome scores (ASES, CM) when comparing PRP to saline and PRP + HA to saline at one year follow-up. In contradistinction, Schwitzguebel and coauthors (2019), found no benefit of PRP over saline with regards to outcome scores (SANE, CM). Additionally, Kesikburun et al (high quality, 2013) found no benefit of PRP over saline using PROs (WORC, SPADI), VAS pain level, and ROM. Akan et al (moderate quality, 2019) compared physical therapy (PT) to PRP, and found PRP to be superior when evaluating CM, QuickDash, and SDI as end outcomes. Similarly, Serya et al (moderate quality, 2021) found PRP to be superior to PT when using DASH outcome and with respect to ROM. Nejati et al (moderate quality, 2017) found conflicting results when comparing PRP versus PT depending on the outcome (WORC versus DASH) and motion/strength parameter. There was a trend towards exercises providing better ROM when compared to PRP. Rha et al (moderate quality, 2013) found PRP to be superior to "dry needling" using SPADI as PRO and ROM.

There are multiple high and moderate level studies comparing PRP to CS with regards to pain level, PROs, and ROM. Some studies such as Vaquerizo et (2023) and Prasad et al (2024) found PRP injections to be better with respect to CM, OSS, QuickDash, and pain level. Others such as Dadgostar et al (2021), Barreto et al (2019), and Oudelaar et al (2021) did not reach the same conclusions (found equivalency). Regarding adverse events, neither treatment modality demonstrated superiority. The study by Halm-Pozniak (2023) cannot be included as it compares PRP with a recombinant scaffold versus CS.

There are two studies comparing PRP to HA, one of high (Cai, 2019) and the other of low (Huang, 2022) quality. Cai found conflicting results when comparing PRP to HA PROs (ASES, CM, and VAS scores) with a trend favoring PRP. Huang found no difference with regards to SPADI and ROM when comparing PRP and HA.

There is one moderate quality study (Markazi, 2022) that compared PRP versus keterolac. There was a trend towards better PROs, ROM, and pain relief with PRP.

There are two high quality (Abd Karim, 2023; Sari 2020) and one moderate quality (Sabaah, 2020) studies comparing PRP versus prolotherapy. Abd Karim et al did not find benefit of PRP compared to

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prolotherapy with regard to PROs (ASES, SPADI) pain relief, and ROM. Sari found better PRO (WORC) at 6 months and similar pain scores with PRP compared to prolotherapy. Sabaah found better pain control at 6 months with prolotherapy.

Risks and Harms of Implementing this Recommendation
There are no known risks to PRP injections that are specific to shoulders or the rotator cuff.

Future Research
Further research may be conducted to further define the role of PRP injections in rotator cuff pathology. Future studies should standardize the technique and type of PRP formulation utilized and measure the concentrations of key components.

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MULTIPLE STEROID INJECTIONS FOR ROTATOR CUFF TEARS

Multiple steroid injections may compromise the integrity of the rotator cuff, which may affect attempts at subsequent repair.

Strength of Evidence: High

Strength of Recommendation: Limited  (Downgraded)

Description: Evidence there is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of reliable evidence, the guideline workgroup is making a recommendation based on their clinical opinion.

Rationale

Four high, four moderate and two low quality studies investigated the use of multiple steroid injections in treating rotator cuff rears (Abolhasani, 2019; Damjanov, 2018; Vaquerizo, 2023; Hsieh, 2021; Rabini, 2012; Sabaah, 2020; Hsieh, 2023, Eyigor, 2010; Sadeghifar, 2022; De Castro Correia, 2023). This recommendation was downgraded to limited strength for heterogeneity and inconclusive results. None of the reviewed studies provided evidence for or against repeated CS injections due to adverse events such as rotator cuff integrity.

Risks and Harms of Implementing this Recommendation

Corticosteroid injections in the setting of rotator cuff tears may be detrimental to the healing potential following rotator cuff repair. A single corticosteroid injection may be given to confirm the presence of rotator cuff pathology but may adversely affect outcomes if performed in temporal proximity to surgical intervention.

Future Research

Further research is recommended to determine the role of corticosteroid injections in the various settings of rotator cuff pathology.

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PLATELET RICH PLASMA (PRP) INJECTION IN FULL-THICKNESS TEARS

Evidence suggests that the routine use of PRP in the non-operative management of full-thickness rotator cuff tears may not be indicated.

Strength of Evidence: Moderate

Strength of Recommendation: Limited  (Downgraded)

Description: Evidence there is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of reliable evidence, the guideline workgroup is making a recommendation based on their clinical opinion.

Rationale

Two moderate quality studies investigated the use of platelet rich plasma injections in mixed populations of partial and full-thickness rotator cuff tears (Akan, 2019; Centeno, 2024). This recommendation was downgraded to limited strength for heterogeneity and inconclusive results. None of the reviewed studies provide substantial evidence for or against PRP, and its impact in the scenario of an established full-thickness rotator cuff tear.

Risks and Harms of Implementing this Recommendation

There are no known risks to PRP injections that are specific to shoulders or the rotator cuff.

Future Research

Further research may be conducted to further define the role of PRP injections in rotator cuff pathology. Future studies should standardize the technique and type of PRP formulation utilized and measure the concentrations of key components.

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UNREPAIRABLE TEARS WITHOUT ARTHROPATHY (NON-REVERSE ARTHROPLASTY)

In the absence of reliable evidence, it is the opinion of the workgroup that physical therapy, biceps tenotomy/tenodesis, partial repair, tendon transfer, superior capsular reconstruction, arthroscopic debridement, balloon spacers, graft interposition, or graft augmentation (non-porcine) can improve patient-reported outcomes.

Strength of Evidence: Moderate, Low (mixed interventions)

Strength of Recommendation: Consensus  (Downgraded)

Description: Evidence there is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of reliable evidence, the guideline workgroup is making a recommendation based on their clinical opinion.

Rationale

The recommendation was downgraded for heterogeneity, and generalizability. There are three high quality studies (Metcalfe, 2022; Ono, 2022; Wong, 2021) and two moderate quality studies (Ozturk, 2021; Verma, 2022) from the exhaustive research that the AAOS team performed on this PICO. Studies of high and moderate quality comparing specific treatments as below demonstrated conflicting results such as ballon spacer placement. Two studies suggest dermal allograft augmentation may provide benefit in patients with MIRCTs. One study indicated a better pain score with improved motion with SCR versus tendon transfer. The remaining studies are all low quality, and do not allow for definitive recommendations regarding management of MIRCTs without arthropathy.

Metcalfe et al (high quality) demonstrated worse outcomes (CM, function) despite improved WORC when comparing balloon spacer placement versus debridement.
Verma et al (moderate quality) concluded better WORC and forward elevation with balloon spacer placement versus partial repair and improved WORC versus debridement; other studies regarding this technique are of low quality.

Wong et al (high quality) demonstrated comparatively better WORC, DASH, AHD, forward elevation, and abduction with dermal allograft augmentation after “maximal rotator cuff repair with debridement.” Ono et al (high quality) demonstrated superior ASES scores in patients that underwent inter-positional human dermal allograft versus SCR at one year. This finding became nonsignificant at two-year follow-up. Ozturk et al (moderate quality) demonstrated improved pseudoparalysis and VAS pain scores with SCR versus tendon transfer with nonsignificant improvement in all other outcome measures.

Risks and Harms of Implementing this Recommendation

Nonsurgical and surgical options remain available to patients with MIRCTs without arthropathy. Those patients who are directed towards the nonsurgical path may not experience appreciable improvement in pain relief and/or function impacting his/her quality of life including independence with ADLs. Each surgical option has distinct risks and potential outcomes which may not be acceptable to the patient, thus requiring additional surgical intervention/revision.

Future Research

Future research is required to evaluate long term outcomes comparing non-surgical versus surgical and surgical versus surgical modalities in this clinical setting.

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MASSIVE UNREPAIRABLE TEARS WITH ARTHROPATHY (REVERSE ARTHROPLASTY)

In the absence of reliable evidence, it is the opinion of the workgroup that after failure of conservative treatment, reverse shoulder arthroplasty for massive unrepairable tears with glenohumeral joint arthritis can improve patient-reported outcomes.

Strength of Evidence: Limited

Strength of Recommendation: Consensus  (Downgraded)

Description: Evidence there is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of reliable evidence, the guideline workgroup is making a recommendation based on their clinical opinion.

Rationale

The recommendation was downgraded for heterogeneity, generalizability, and applicability. Ameziane et al (2024, moderate quality) demonstrated better CM scores and internal rotation when performing RSA and SSC repair (versus non-repair) in patients with MIRCTs. Baek et al (2022, low quality) compared outcomes between patients who underwent RSA with LDTM transfer versus RSA alone for cuff-tear arthropathy. The LDTM transfer group had significantly better average CM scores, activities of daily living, internal rotation, toileting, belly-press test, bear-hug test, lift-off test, and strength. The remaining studies (i.e. comparing HA versus RSA, medialized versus lateralized RSA, HA, etc.) are of low quality. Based upon these findings (heterogeneity, generalizability, applicability), the strength of recommendation has been downgraded to consensus.

Risks and Harms of Implementing this Recommendation

Reverse shoulder arthroplasty is an option in patients with MIRCTs and glenohumeral arthropathy. Those patients who undergo RSA may not experience complete resolution of his/her shoulder symptoms and may not achieve clinically significant improvement. Additionally, this specific surgical option has distinct risks, complications, and potential outcomes which may not be acceptable to the patient, thus requiring additional surgical intervention/revision.

Future Research

Future studies are necessary to confirm RSA as a long-term solution in patients with rotator cuff arthropathy when compared to non-surgical and other surgical options.

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MASSIVE, UNREPAIRABLE ROTATOR CUFF TEAR WITHOUT ARTHROPATHY (REVERSE ARTHROPLASTY)

In the absence of reliable evidence, it is the opinion of the workgroup that in patients with massive, unrepairable tears and significant functional loss who have failed other treatments, reverse arthroplasty can improve patient-reported outcomes.

Strength of Evidence: Limited

Strength of Recommendation: Consensus  (Downgraded)

Description: Evidence there is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of reliable evidence, the guideline workgroup is making a recommendation based on their clinical opinion.

Rationale

The recommendation was downgraded for heterogeneity, generalizability, and applicability. The studies were of low quality and did not demonstrate superiority of one treatment option over another (HA versus RSA). Specific studies such as Ameziane et al (2024, moderate quality) demonstrated better CM scores and internal rotation when performing RSA and SSC repair (versus non-repair) in patients with MIRCTs. Baek et al (2022, low quality) compared outcomes between patients who underwent RSA with LDTM transfer versus RSA alone for cuff tear arthropathy. The LDTM transfer group had significantly better average CM scores, activities of daily living, internal rotation, toileting, belly-press test, bear-hug test, lift-off test, and strength. The remaining studies (i.e. comparing HA versus RSA, medialized versus lateralized RSA, HA, etc.) are of low quality. Based upon these findings (heterogeneity, generalizability, applicability), the strength of recommendation has been downgraded to consensus.

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SURGICAL TREATMENT VS. PHYSICAL THERAPY FOR LOW- OR INTERMEDIATE-GRADE PARTIAL-THICKNESS TEARS

In the absence of reliable evidence, it is the opinion of the workgroup that physical therapy can improve outcomes in patients with low-grade or intermediate-grade partial-thickness rotator cuff tears. In patients with persistent pain and functional impairment after appropriate non-operative treatment, surgery can improve outcomes.

Strength of Evidence: Consensus

Strength of Recommendation: Consensus 

Description: Evidence there is no supporting evidence, or limited level evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of reliable evidence, the guideline workgroup is making a recommendation based on their clinical opinion.

Rationale

A scoping review and best evidence synthesis was conducted for the treatment of partial-thickness rotator cuff tears (Eubank, 2024). No studies that compared PT versus surgery outright were identified, but in cohorts both surgery and PT had favorable outcomes. Evidence informing this topic is most likely found in studies reviewing "impingement", but as these studies may not report on radiologic evidence of partial tears they do not fit our inclusion criteria and cannot be used here. It is difficult to discern between partial-thickness rotator cuff tears and subacromial pain syndrome/subacromial impingement. Nonsurgical treatment including physical therapy is suggested for partial-thickness tears due to low evidence of progression of tear severity. Treatment of partial-thickness tears should follow guidelines for subacromial pain (Planchar, 2021).

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