

Position statement: management of rotator cuff tears in adults

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We sought to compare success and re-tear rates of surgically treated full-thickness tears of the rotator cuff in men and women older than 18 years of age to develop a guideline intended for orthopedic surgeons and other health care providers who assess, counsel and care for these patients. We searched Medline, Embase and Cochrane databases through to Apr. 20, 2021, and included all English-language randomized trials comparing single-row versus double-row fixation via arthroscopic approaches; latissimus dorsi transfer (LDT) versus partial rotator cuff repair, lower trapezius transfer (LTT), and superior capsular reconstruction (SCR); and early versus late arthroscopic rotator cuff repair for traumatic tears. We also considered observational studies comparing LDT with LTT and partial repair and studies comparing early versus late treatment of traumatic rotator cuff tears. Outcomes of interest were functional outcomes, pain outcomes, and re-tear rates associated with these interventions. We rated the quality of the evidence and strength of recommendations using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach. This guideline will benefit patients seeking surgical intervention of full thickness rotator cuff tears by improving counselling on surgical treatment options and outcomes. It will also benefit surgical providers by expanding their knowledge of various surgical approaches. Data presented could be used to develop frameworks and tools for shared decision-making.

Nous avons voulu comparer les taux de succès de la réparation chirurgicale d'une rupture transfixiante de la coiffe des rotateurs et les taux de rupture itérative chez les hommes et les femmes de plus de 18 ans pour concevoir un guide destiné aux chirurgiens orthopédistes et autres prestataires de soins de santé qui évaluent, conseillent et traitent ces patients. Pour ce faire, nous avons effectué des recherches dans les bases de données Medline, Embase et Cochrane jusqu'au 20 avril 2021, et avons retenu tous les essais randomisés publiés en anglais portant sur : l'efficacité comparée de la réparation arthroscopique à simple rang et à double rang; l'efficacité du transfert du muscle grand dorsal comparativement à la réparation partielle de la coiffe des rotateurs, au transfert du trapèze inférieur et à la reconstruction capsulaire supérieure; et une comparaison de la réparation précoce et tardive de la coiffe des rotateurs à la suite d'une rupture traumatique. Nous avons aussi retenu les études observationnelles comparant le transfert du muscle grand dorsal au transfert du trapèze inférieur et à la réparation partielle, ainsi que les études comparant le traitement précoce et tardif des ruptures traumatiques de la coiffe des rotateurs. Les paramètres d'intérêt étaient la capacité fonctionnelle, la douleur et le taux de rupture itérative associés à ces interventions. Nous avons évalué la qualité des données probantes et la force des recommandations à l'aide de l'approche GRADE (Grading of Recommendations Assessment, Development, and Evaluation). Ce guide bénéficiera aux patients ayant besoin d'une intervention chirurgicale pour une rupture transfixiante de la coiffe des rotateurs en offrant de meilleurs conseils sur les options de traitement chirurgical et leurs résultats. Il aidera aussi les chirurgiens à acquérir des connaissances sur les différentes approches chirurgicales. Les données présentées pourront être utilisées pour mettre au point des cadres et outils favorisant la prise de décision partagée.

Degenerative tearing of the rotator cuff is one of the most common disorders of the shoulder.^{1,2} Rotator cuff tears may result in considerable pain, typically experienced over the lateral aspect of the shoulder, although patients may describe pain in other areas.³ Pain may be worsened when there is degeneration of the long head of the biceps tendon.³ Pain associated with the rotator cuff is typically exacerbated with forward elevation of the arm and is often accompanied by nocturnal pain and the

Key points

- Double-row fixation in arthroscopic rotator cuff repair, although superior in some objective outcomes (e.g., healing rates), is similar to single-row fixation for subjective outcomes in the short to medium term.
- There are many options for the treatment of massive tears of the rotator cuff.
- The subjective functional and pain outcomes in the treatment of massive tears of the rotator cuff with latissimus dorsi tendon transfer are similar to those of other surgical treatment options, including partial rotator cuff repair, lower trapezius tendon transfer and superior capsular reconstruction.
- Patients should be counselled that there are limited existing data, including poor evidence regarding functional outcomes and pain, regarding the treatment of massive rotator cuff tears.
- Patients should be counselled that there are limited existing data, including poor evidence regarding functional outcomes and pain, regarding the timing of treatment of traumatic rotator cuff tears; in the absence of high-quality data, the current best practice recommendation is to treat traumatic tears within 12 weeks of injury.
- Objective outcomes often differ from subjective outcomes, and an exploration of patient expectations is essential before every rotator cuff operation.
- There is a lack of data on the long-term durability of all soft tissue surgical options.

inability to sleep on the affected side.³ Dysfunction of the affected arm is common and, as a consequence, patients frequently report difficulty with activities of daily living, limitations with overhead use of the arm, and lack of strength, particularly above shoulder level.³ Loss of strength on external rotation is common with larger posterolateral tears involving the infraspinatus, and loss of strength on internal rotation is associated with subscapularis tears and may limit using the arm behind the back.⁴

First-line management of rotator cuff tears includes conservative options, such as physiotherapy directed at regaining range of motion and dynamic rotator cuff strength, nonsteroidal anti-inflammatory agents, and corticosteroid injections.⁵ When conservative measures fail or are not acceptable to individual patients, surgical treatments may be offered. Of all the symptoms associated with rotator cuff tears, pain is the most amenable to improvement with surgery, although functional improvement also typically occurs.⁶

Both open and arthroscopic approaches are standard for the treatment of rotator cuff tears, and either approach may be used based on surgeon experience and training.⁷ Arthroscopic approaches offer the benefit of being minimally invasive, but both open and arthroscopic techniques are commonly used. The most common arthroscopic techniques are the single-row and double-row techniques, and suture-bridge configurations using suture anchors.⁸ There is a lack of clear evidence regarding which of these techniques is superior in terms of clinical outcomes and healing rates.

There is continued controversy surrounding the optimal treatment of massive rotator cuff tears. Historically, a rotator cuff tear was defined as massive if the tear was

greater than 5 cm or if 2 or more tendons were detached.^{9,10} Recently, a Delphi consensus study on the definition of massive cuff tears concluded with 90% agreement that a massive cuff tear should be defined as tendon retraction to the glenoid rim in the coronal or axial plane and/or a tear with more than 67% of the greater tuberosity footprint exposed, as measured in the sagittal plane.¹¹

Surgical intervention may be considered when non-operative management of massive cuff tears fails. Denard and colleagues¹² reported a 91% success rate for repair in a study of 126 massive rotator cuff tears.¹² However, a recent systematic review identified a re-tear rate of 79% following repair of massive rotator cuff repairs.¹³ The review identified 9 studies including 448 patients who were assessed with ultrasonography, magnetic resonance imaging, or computed tomography angiography at a minimum of 6 months following repair of a massive rotator cuff repair.

An unusual phenomenon has been observed with failed repairs of massive rotator cuff tears, which is that post-operative outcomes are still commonly improved (i.e., pain levels) in patients with structural failure of the repaired tendon.¹⁴ However, it has also been observed that functional outcomes are typically superior if the repair remains intact.¹⁵ Rotator cuff deficiency has also been shown to result in abnormal positioning of the humeral head in the glenoid fossa, typically with superior translation of the humeral head, resulting in eccentric loads across the glenohumeral joint.¹⁶ This can lead to abnormal wear patterns and subsequent arthritic changes.¹⁷⁻¹⁹

Owing to the high structural failure rates after arthroscopic repair of massive posterolateral rotator cuff tears, several alternatives to repair have been proposed. Currently, the most common alternate options include partial repair of the rotator cuff, tendon transfers of the latissimus dorsi or lower trapezius,¹⁸ and superior capsular reconstruction (SCR).²⁰ Additional surgical options, such as reverse shoulder arthroplasty,²¹ exist with long-term outcome data, and newer techniques, such as the subacromial balloon spacer,²² remain under investigation.

The incidence of acute traumatic rotator cuff tears ranges from 2.3% to 17.7% of all rotator cuff tears.²³ These tears are often massive in size. It has been observed that over time, rotator cuff tears may increase in size and, if large enough, will gradually develop unwanted changes to the muscle quality, including atrophy and fatty infiltration.²⁴ Fatty degeneration is irreversible and is associated with significantly higher tendon re-tear rates following surgical repair.²⁴⁻²⁶ Therefore, early surgical repair may result in higher rates of success in achieving complete tendon healing, and has the potential to prevent or arrest progressive fatty infiltration of the rotator cuff. However, there is a lack of consensus regarding optimal timing and level of improvement.

Table 1. Key to Grading of Recommendations, Assessment, Development and Evaluating Quality of Evidence

Grade	Definition
Strength of recommendation	
Strong	The desirable effects outweigh the undesirable effects (strong recommendation for), or the undesirable effects outweigh the desirable effects (strong recommendation against).
Conditional*	Desirable effects probably outweigh the undesirable effects (weak recommendation for), or the undesirable effects probably outweigh the desirable effects (weak recommendation against).
Quality of evidence	
High	The true effect lies close to that of the estimate of the effect.
Moderate	The true effect is likely to be close to the estimate of the effect, but there is a possibility that the true effect is substantially different than the estimate of the effect.
Low	The true effect may be substantially different from the estimate of the effect.
Very low	The true effect is very likely to be substantially different from the estimate of effect.

*Conditional recommendations should not be interpreted to mean weak evidence or uncertainty of the recommendation.
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Table 2: Implications of strong and conditional recommendations, by guideline user

Perspective	Strong recommendation (i.e., “We recommend that...” or “We recommend to not...”)	Conditional recommendation (i.e., “We suggest...” or “We suggest to not...”)
Authors	The net desirable effects of a course of action outweigh the effects of an alternative course of action.	It is less clear whether the net desirable consequences of a strategy outweigh the alternative strategy.
Patients	Most individuals in the situation would want the recommended course of action, while only a small proportion would not.	Many individuals in the situation would want the suggested course of action, but many would not.
Clinicians	Most individuals should receive the suggested course of action. Adherence to this course of action according to the guideline could be used as a quality criterion or performance indicator.	Recognize that patient choices will vary by individual. Patients must be helped to arrive at a care decision consistent with their values and preferences.
Policy-makers	The recommendation can be adapted as policy in most settings.	The recommendation can serve as a starting point for debate, with the involvement of many stakeholders.

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This position statement provides recommendations for selection of single-row versus double-row fixation in arthroscopic cuff repair based on objective and imaging outcomes, reviews soft-tissue treatment options for massive rotator cuff tears, and provides recommendations regarding optimal timing of surgical intervention in traumatic rotator cuff tears.

METHODOLOGY

A systematic review and meta-analysis was conducted.²⁷ We searched Medline, Embase and Cochrane databases through to Apr. 20, 2021, and included all English-language randomized trials comparing single-row versus double-row fixation via arthroscopic approaches; latissimus dorsi transfer (LDT) versus partial rotator cuff repair, lower trapezius transfer (LTT), and SCR; and early versus late arthroscopic rotator cuff repair for traumatic tears. We also considered observational studies comparing LDT with LTT and partial repair and studies

comparing early versus late treatment of traumatic rotator cuff tears. Outcomes of interest were functional outcomes, pain outcomes, and re-tear rates associated with these interventions. We rated the quality of the evidence and strength of recommendations using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach (Table 1 and Table 2).

RECOMMENDATIONS

1. Patients with full-thickness tears of the rotator cuff seeking surgical intervention should be counselled about the higher risk of objective failure regarding healing, but similar patient-reported outcomes with single-row compared to double-row fixation in arthroscopic rotator cuff repair (*Strong, moderate*).
2. Appropriately trained surgeons may consider a number of treatment options for massive tears of the rotator cuff, including partial arthroscopic cuff repair, LDT, LTT, and SCR, considering the similar overall

patient-reported outcome measures in the short and medium term (*Conditional, very low*).

- In the absence of reliable evidence regarding the optimal timing of surgical intervention for traumatic rotator cuff tears, current best practice is to treat traumatic rotator cuff tears within 12 weeks of injury, or as soon as reasonably possible (*Conditional, very low*).

All summary statements refer to repair of the rotator cuff or other surgical options in the short-term (up to 2 yr), except when specified otherwise.

Single-row versus double-row fixation

We included the following procedures: arthroscopic single-row repair, arthroscopic double-row repair and suture-bridge repair. Fifteen randomized controlled trials were included in the meta-analysis^{6,28-41}; only 1 of them evaluated the outcomes of suture-bridge repair.⁴¹

Single-row repair results in similar functional outcomes as double-row repair (standardized mean difference 0.08, 95% confidence interval [CI] -0.09 to 0.24). Similarly, postintervention pain as determined using a visual analogue scale (VAS) did not differ between single-row and double-row techniques (standardized mean difference -0.01, 95% CI -0.52 to 0.49) (Box 1 and Box 2). Healing of the tendon was more likely with double-row repair than with single-row repair; the relative risk of re-tear with single-row compared to double-row fixation was 1.56 (95% CI 1.06 to 2.29).

Box 1: Summary statement 1, recommendation 1

Single-row fixation was similar to double-row fixation in arthroscopic cuff repair for the outcomes of:

- Overall patient-reported outcome measures for function (*moderate level of evidence*)
- Overall patient-rated pain measures (*moderate level of evidence*)

Box 2: Summary statement 2, recommendation 1

Double-row fixation was superior to single-row fixation for the outcome of:

- Objective measures of healing by ultrasonography or magnetic resonance imaging (*moderate level of evidence*)

Massive rotator cuff tears

We identified only 1 randomized trial comparing LDT with SCR.⁴² There was a statistically nonsignificant trend toward superiority in American Shoulder and Elbow Surgeons (ASES) functional scores in favour of SCR. The VAS scores did not differ significantly between treatments. We did not identify any randomized trials comparing LDT with LTT or partial repair. Three prospective comparative studies were

included,⁴³⁻⁴⁵ and data were pooled from 2 studies comparing LDT with partial repair.^{43,44} Both studies reported minimum 12-month outcomes in 45 patients⁴³ and in 40 patients,⁴⁴ respectively, undergoing either LDT or partial repair. The functional outcome scores and pain scores were similar between groups (Box 3). Woodmass and colleagues⁴⁵ compared arthroscopy-assisted LDT ($n = 16$) with arthroscopy-assisted LTT ($n = 8$) at 24-month follow-up. Functional and pain scores did not differ significantly between groups, although there was a trend toward higher functional scores in the LTT group.

Box 3: Summary statement 3, recommendation 2

Latissimus dorsi transfer was similar to partial rotator cuff repair, lower trapezius transfer and superior capsular reconstruction for the outcomes of:

- Overall patient-reported outcome measures for function (*very low level of evidence*)
- Overall patient-rated pain measures (*very low level of evidence*)

EARLY VERSUS LATE REPAIR OF TRAUMATIC ROTATOR CUFF TEARS

In the few studies that compared functional and pain outcomes in patients with traumatic rotator cuff tears, the timing of treatment varied considerably among the studies.⁴⁶⁻⁴⁹ In 3 of the 4 comparative studies, follow-up times were short (4, 9 and 14 mo, respectively), and 3 of the 4 studies did not show any significant differences in functional or pain outcomes between early and late intervention (Box 4).

Box 4: Summary statement 4, recommendation 3

Current data are inconclusive for the outcomes regarding the optimal timing of treatment of traumatic tears of the rotator cuff; the available data indicate that "sooner is better," but "how soon" is not accurately known at this time (*very low level of evidence*).

DISCUSSION

Our systematic review included comparative studies of surgical procedures in the operative management of rotator cuff tears. Following a rigorous methodology, experts in shoulder surgery reviewed the available literature. Patient-reported outcomes and VAS pain scores were used to compare treatments.

Limitations

No clear conclusions could be drawn regarding the treatment of massive rotator cuff tears given the paucity of comparative data. We were unable to make any evidence-based recommendations regarding the optimal

timing of surgical treatment for massive rotator cuff tears. However, we recommend treatment of traumatic large to massive rotator cuff tears within 3 months, given the possibility of progression of fatty infiltration and tendon retraction that may worsen with time.

Other than in the comparison between single- and double-row fixation, few randomized trials were found, and the grading of outcomes was generally low to moderate owing to small numbers of patients and the possibility of bias.

CONCLUSION

Surgeons counselling patients on operative options for rotator cuff repair should be aware that there are similar subjective outcomes in the medium term for single- and double-row fixation, but there are differences in objective tendon healing and structural failure between the 2 techniques. There is limited literature directly comparing functional outcomes or pain after the various surgical procedures for the treatment of massive rotator cuff tears. The level of comparative evidence for these procedures is low. Consequently, partial repair, SCR, LDT or LTT may be considered when surgery is indicated.

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