Is routine distal clavicle resection necessary in rotator cuff repair surgery? A systematic review and meta-analysis

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Abstract

Background: The objective of the present study was to perform a systematic review and meta-analysis of randomized controlled trials looking at the effect of distal clavicle resection in patients undergoing rotator cuff repair (RCR).

Methods: A systematic literature search was undertaken to identify randomized controlled trials looking at RCR +/- distal clavicle resection. Primary clinical outcome measures included in the meta-analysis were American Shoulder Elbow Society (ASES) score, pain on visual analogue scale and range of motion in forward elevation.

Results: The systematic review identified three studies with a total of 203 participants. Those who underwent distal clavicle resection in conjunction with RCR had worse pain and acromioclavicular joint tenderness at 3-month follow-up. This difference, however, was not observed at the 24-month follow-up. The mean difference (95% confidence interval) for the ASES score was 0.45 (–3.67 to 4.58) and pain on visual analogue scale was –0.27 (–0.70 to 0.16).

Conclusions: Routine distal clavicle resection in the setting of rotator cuff repair does not result in improved outcomes for patients with no difference being observed at 24 months post surgery. The results of our systematic review and meta-analysis do not support routine distal clavicle resection when performing RCR.

Keywords

acromioclavicular joint arthritis, distal clavicle resection, meta-analysis, rotator cuff repair, systematic review

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Introduction

Rotator cuff tendon tears, in particular of the supraspinatus tendon, are common in patients aged over 50 years.^{1–3} Most tears are degenerative in nature, and some may occur following simple trauma. The majority of rotator cuff tears can be managed non-operatively with appropriate analgesia, physiotherapy exercises and subacromial cortisone injections.⁴ In patients with ongoing shoulder pain and dysfunction, shoulder arthroscopy and rotator cuff repair (RCR) may be considered.⁴

Given the nature of these injuries and tears, it is common to find degenerative changes in the acromioclavicular (AC) joint during physical examination, pre-operative imaging and arthroscopic examination of the joint. The AC joint is often arthritic and has inferiorly directed osteophytes, which may elicit impingement shoulder pain and cause rotator cuff tendon tears.^{5–7} Inferior spurs of the distal clavicle have been associated

with damage to and eventual ruptures of the supraspinatus tendon.^{5,7,8}

Distal clavicle resection (DCR) is an additional surgical option in patients undergoing shoulder arthroscopy and RCR. At the time of arthroscopy, the lateral end of the clavicle and associated inferiorly projecting osteophytes are identified and excised.⁹ Clearance of approximately 7 mm to 8 mm is achieved to reduce impingement and AC joint associated shoulder pain and reduce the possibility of re-tear of the rotator cuff tendon following repair.¹⁰ A DCR is not without risk. DCR has the potential to make the

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clavicle unstable as a result of the resection of coracoclavicular ligaments, as well as increase postoperative pain and the duration of recovery following surgery.^{10–13} Currently, there is no consensus amongst shoulder surgeons as to whether routine DCR should be performed in patients undergoing shoulder arthroscopy and RCR.^{2,5,8,10,12}

The aim of the present study was to perform a systematic review and meta-analysis of all available randomized controlled trials looking at the role of routine DCR in patients undergoing RCR.

Materials and methods

Study design

The present study is reported in accordance with the 2009 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and the research protocol.¹⁴ A systematic review and meta-analysis was conducted analyzing DCR in the setting of RCR. Only randomized controlled clinical trials, in patients aged >45 years, with at least 12 months of follow-up, were included.

Outcome measures

Functional outcomes including shoulder-specific patient-derived scores, pain using visual analogue scale, range of motion, presence or absence of AC joint tenderness, as well as other adverse events (such as rotator cuff tendon re-tear, re-operation and AC joint instability) were evaluated.

Literature search

Two independent reviewers (AL and AKM) searched the Cochrane Central Register of Controlled Trials (CENTRAL) (the Cochrane Library Issue 2, February 2016), MEDLINE (1946 to February 2016) and EMBASE (1974 to February 2016) databases using the OVID platform to identify relevant studies and manual review of reference lists of identified articles. All of the resulting titles and abstracts were screened for possible inclusion, with discrepancies resolved by discussion and by contacting study authors to clarify data discrepancies where necessary to reach consensus. After this initial search, the citations of included articles were carefully examined to locate further studies.

Data extraction

Two review authors (AL and AKM) extracted data independently from included studies. A data extraction

form was developed and piloted using the Cochrane Consumers and Communication Review Group Data Extraction Template. Data extracted included the following items: details of the study, methods, assessment of bias, study population, intervention, results and key conclusions as stated by the study authors. We contacted study authors for additional information or data about the included studies or for clarification of the study methods as required. Where available, data from different follow-up time points (3 months, 12 months and 24 months) were collected.

One review author (AL) entered all extracted data into RevMan, and another author (AKM) worked independently to check data for accuracy against the data extraction.

Risk of bias assessments

Evaluation of each study for potential risk of bias was undertaken. Two reviewers (AL and AKM) independently reviewed each of the included studies for selection bias, performance bias, detection bias and attrition bias, along with any other limitation that may inhibit study interpretation.

Synthesis of results

The following measures of treatment effect were included:

Continuous outcomes

1. Measure of shoulder function – American Shoulder Elbow Society (ASES) score.
2. Pain on visual analogue scale, with zero being no pain and 10 being most pain.
3. Range of motion in forward flexion – as measured by a goniometer.

For continuous outcome measures, data were analyzed based on the mean (SD) and the number of people assessed for both the intervention and comparison groups to calculate mean difference (MD) and 95% confidence interval (CI).

Dichotomous outcomes

1. AC joint tenderness – on direct palpation.
2. Re-tear of the rotator cuff repair – as assessed at 6 months with repeat imaging, including magnetic resonance imaging (MRI) scan, computed tomography arthrogram or ultrasound scan.
3. Re-operation on the shoulder – for any reason.
4. AC joint instability – as assessed at 6 months with appropriate weight bearing X-rays or an MRI scan.

For dichotomous outcomes, data were analyzed based on the number of events and the number of people assessed in the intervention and comparison groups. We used these to calculate the risk ratio and 95% CI.

Data synthesis

Where studies were considered sufficiently similar (based on consideration of population and intervention) to allow synthesis of data using meta-analysis, we assessed the degree of heterogeneity by visual inspection of forest plots and by examining the chi-squared test for heterogeneity. We quantified heterogeneity using the I^2 statistic. We considered an I^2 value of 50% or more to represent substantial levels of heterogeneity but interpreted this value in light of the size and direction of effects and strengths of the evidence for heterogeneity, based on the p value from the chi-squared test.

RevMan, version 5.3 (Cochrane, London, UK) was utilized for data synthesis. The decision to meta-analyze data or not was based on an assessment of whether the interventions in the included trials were similar enough in terms of participants, settings, intervention, comparison and outcome measures to ensure meaningful conclusions from a statistically pooled result. As a result of the lack of variability in the populations of the included studies, we used a fixed-effects model for meta-analysis.

Results

Description of studies

A total of 536 potentially eligible records were identified through electronic searches of the databases. This included 196 records from Medline and 340 records from EMBASE. Following removal of duplicates, as well as removing those by title and abstract, nine articles remained for detailed review. The screening and selection process is outlined in a PRISMA flow chart (Figure 1).

Results of the search

Of the nine articles identified for detailed review, four assessed interventions not relevant to this review and were excluded.^{10,15–17} Five trials assessed the relevant comparison of RCR +/- distal clavicle resection^{1,2,6,8,18} Of the five manuscripts, two were excluded^{1,2} because they were incorrect study type. Three randomized controlled trials were included in the systematic review and meta-analysis.^{6,8,18}

Figure 1. PRISMA flow chart.

Included studies

Three trials evaluated the role of DCR, in the setting of an arthroscopic RCR. The inclusion criteria in the three studies were very similar, with participants having similar baseline characteristics (age, sex and tear size). One study included participants with painful AC joints.⁶ This was assessed by both physical examination, as well as positive result from a diagnostic injection of local anesthetic. The remaining two studies included participants with asymptomatic AC joint arthritis.^{8,18}

A total of 203 participants across the three studies were included. Of these, 91 underwent shoulder arthroscopy, rotator cuff repair and distal clavicle resection. The remaining 112 had shoulder arthroscopy and rotator cuff repair. Only data from one study was available for analysis at 3 months.¹⁸ This study had a total of 83 participants.

The 3-month outcome data with 83 participants showed evidence that distal clavicle resection resulted in both increased pain on visual analogue scale (mean difference 1.4, 95% CI = 0.72 to 2.08, $p < 0.00001$), as well as AC joint tenderness (risk ratio 61, 95% CI = 3.82 to 982.4, $p = 0.004$).¹⁸ However, this difference was not observed at the 24-month follow-up.

For ASES, pain on visual analogue scale and AC joint tenderness all 203 participants contributed data to the final outcome. The summary mean difference in the ASES score (fixed-effects model) was 0.45 (95% CI = -3.67 to 4.58) (Figure 2). Using pain on visual analogue scale, the summary mean difference (fixed-effects model) was -0.27 (95% CI = -0.70 to 0.16) (Figure 3). The risk ratio for AC joint tenderness was 1.54 (95% CI = 0.65 to 3.62) (Figure 4).

Two studies^{6,8} with 120 participants reported on range of motion in forward flexion and rotator cuff re-tear at 6 months following surgery. No statistically significant difference was found between the two groups of patients. The re-tear rate risk ratio (fixed-effects model) was 0.79 (95% CI = 0.39 to 1.58) (Figure 5). There was also no statistically significant difference found when looking at re-operation rate or AC joint instability at the 24-month follow-up (Table 1).

On review of the data both visually via forest plots and considering the I^2 statistic, it was concluded that the data for all studies was very homogeneous because

the 95% CIs overlapped significantly with very similar results. This was echoed by the I^2 statistic across the majority of data, with the I^2 statistic being 0% to 15%. The results from sensitivity analyses using a random effects model were very similar, with minimal changes with slight widening of confidence intervals.

Discussion

The objective of this systematic review was to identify, summarize and combine the available evidence related to distal clavicle resection in the setting of patients undergoing rotator cuff repair. The principal finding of our meta-analysis and systematic review is that, at 2 years following surgery, routine distal clavicle resection in the setting of rotator cuff repair does not result in improved outcomes for patients. No difference was found in functional outcome scores and adverse events in patients who underwent DCR in the setting of RCR and those who underwent RCR alone.

Figure 2. Forest plot of comparison: distal clavicle resection (DCR) versus no DCR 2-year continuous outcomes: shoulder function (assessed using American Shoulder Elbow Society score) for all three studies. CI, confidence interval.

Figure 3. Forest plot of comparison: distal clavicle resection (DCR) versus no DCR 2-year continuous outcomes: pain on visual analogue scale. CI, confidence interval.

Figure 4. Forest plot of comparison: distal clavicle resection (DCR) versus no DCR 2-year dichotomous outcomes: acromioclavicular joint tenderness. CI, confidence interval.

Figure 5. Forest plot of comparison: distal clavicle resection (DCR) versus no DCR 2-year dichotomous outcomes: integrity of cuff repair (rotator cuff re-tear rate). CI, confidence interval.

Table 1. Distal clavicle resection compared with no distal clavicle resection for shoulder arthroscopy and rotator cuff repair: summary of findings.

Outcomes	Number of participants (reference)	Risk ratio (RR)/mean difference (MD)	95% Confidence interval	p-value
ASES	203 ^{6,8,18}	MD 0.45	−3.67 to 4.58	0.83
Pain on visual analogue scale	203 ^{6,8,18}	MD −0.27	−0.70 to 0.16	0.22
AC joint tenderness	203 ^{6,8,18}	RR 1.52	0.65 to 3.62	0.32
Rotator cuff re-tear	120 ^{6,8}	RR 0.79	0.39 to 1.58	0.50
Re-operation rate	125 ^{6,18}	RR 0.76	0.10 to 5.87	0.79
AC joint instability	161 ^{8,18}	RR 5.0	0.25 to 100.89	0.96

AC, acromioclavicular joint; ASES, American Shoulder Elbow Society

A number of recently published systematic reviews have reported on the impact of additional AC joint procedures in patients undergoing RCR, although the evidence is limited. Heerspink et al.¹⁹ included 12 prospective studies that describe prognostic factors affecting outcome in primary RCR into their systematic review, of which only one reported on the effect of AC joint surgery on functional outcome following RCR. It was concluded that there is limited evidence for additional AC joint procedures having a negative influence on functional outcome (odds ratio = 0.29, 95% CI = 0.13 to 0.64).

Other studies have also reported on the effect of AC joint procedures on cuff integrity. Fermont et al.²⁰ included 10 articles in their systematic review looking at prognostic factors for successful recovery after arthroscopic rotator cuff repair of which one reported on the effect of a concomitant AC joint procedure. A relationship between concomitant acromioclavicular joint procedures and a worse postoperative repair quality was demonstrated in their study but no explanation was offered.

Similarly, Saccomanno et al.²¹ performed a systematic review analyzing prognostic factors influencing the outcome of rotator cuff repair and reported on the effect of AC joint procedures on rotator cuff repair. Two of the studies included showed an association between AC joint procedures and rotator cuff re-tear (odds ratio = 4.51, 95% CI = 1.99 to 10.22); however, Saccomanno et al.²¹ highlight that, given the overall low quality of the evidence, it was not possible to reach any definitive conclusion regarding the most relevant predictors of outcome of rotator cuff repair. By contrast, our meta-analysis showed no difference in either functional outcome scores or adverse events at 2 years following surgery in those undergoing RCR or RCR with distal clavicle resection.

Our systematic review has a number of weaknesses. First, because we limited our review to level 1 randomized controlled trials, only three studies were available for review. Furthermore, all three studies were published in South Korea. This may make the generalizability of the results outside of this population difficult. Second, only one study reported outcome data for each individual time point (6 weeks, 12 weeks and 1 year).¹⁸ As a result of a lack of data, we were unable to compare outcomes at these additional time points.

To our knowledge, the present study is the first systematic review and meta-analysis of randomized controlled trials to look specifically at the role of routine distal clavicle resection in the setting of rotator cuff repair. The studies included in the meta-analysis were all prospective randomized controlled trials that randomized patients to either arthroscopic distal clavicle resection combined with rotator cuff repair or isolated

rotator cuff repair alone.^{6,8,18} The inclusion of only randomized controlled trials ensured that only studies with the lowest risk of bias were included.²² The strict inclusion criteria allowed us to effectively analyze the data and observe the results of this intervention. By only including level 1 randomized controlled trials, we present the highest quality and least biased evidence available on this topic.²³

Conclusions

The results of our meta-analysis and systematic review show that routine distal clavicle resection in the setting of rotator cuff repair does not result in improved outcomes for patients with no difference being observed at 24 months post surgery. The only major difference observed being worse pain and AC joint tenderness at 3 months following surgery, with this difference not being seen at 24 months. However, there is currently no consensus regarding routine distal clavicle resection in the setting of arthroscopic rotator cuff repair. The lack of prospective, randomized trials limits our ability to recommend routine distal clavicle resection. There is a need for further randomized controlled trials to investigate whether routine distal clavicle resection is justified in this setting. Until further evidence becomes available, individual patient factors and needs should guide the surgeon on the use of this procedure.

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Ethical review and patient consent

Not required for this article.

Level of evidence

Level II: meta-analysis.

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