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ORIGINAL ARTICLE

Reverse shoulder arthroplasty for irreparable massive rotator cuff tears: a systematic review with meta-analysis and meta-regression

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Background: Massive rotator cuff tears (MRCTs) are very large tears that are often associated with an uncertain prognosis. Indeed, some MRCTs even without osteoarthritis are considered irreparable, and non-anatomic solutions are needed to improve the patient's symptoms. Reverse shoulder arthroplasty (RSA) is an option that can provide a more predictable pain relief and recovery of function. Nonetheless, outcomes after RSA for irreparable MRCTs have not been well defined. The aim of this study was to quantitatively aggregate the findings associated with the use of RSA in this subset of patients and analyze the effect on patient functional status and pain.

Methods: A comprehensive search was performed until October 2015 using MEDLINE, Scopus, Cochrane Database of Systematic Reviews, and Central Register of Controlled Trials databases. Studies that assessed the outcomes of RSA in patients with irreparable MRCT without osteoarthritis (with at least 2 years of follow-up) were included. If the results of MRCT without osteoarthritis were not possible to subgroup, the study was excluded. Methodologic quality was assessed using the Coleman Methodology Score.

Results: Included were 6 studies (266 shoulders) with a follow-up ranging from 24 to 61.4 months. The mean Coleman Methodology Score was 58.2 ± 11.8 points. There was an overall improvement from preoperative to postoperative assessments of the clinical score (Cohen $d = 1.35$, $P < .001$), forward flexion ($d = 0.50$, $P = .009$), external rotation ($d = 0.40$, $P < .001$), function ($d = 1.04$, $P < .001$), and pain ($d = –0.89$, $P < .001$).

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Conclusion: Patients with irreparable MRCT without presence of osteoarthritis have a high likelihood of achieving a painless shoulder and functional improvements after RSA.
Level of evidence: Level IV; Meta-Analysis

Keywords: Massive; chronic; irreparable; rotator cuff tears; pseudoparalytic shoulder; reverse shoulder arthroplasty

Massive rotator cuff tears (MRCTs) are very large tears that are difficult to repair and are often associated with an uncertain prognosis.[55] They are usually chronic lesions and associated with myotendinous retraction,[47,69,70] atrophy, and fatty infiltration of the muscles.[20,28] The clinical presentation typically includes a painful and pseudoparalytic shoulder, which is defined as a shoulder with active shoulder elevation of less than 90° in the presence of free passive anterior elevation.[25,66] However, some patients with irreparable MRCTs are able to maintain elevation of more than 90° but have intractable pain.[51]

The degenerative changes of the musculotendinous unit increase over time and are associated with loss of elasticity and poor biologic and mechanical tissue properties. These changes adversely affect and, in some cases, hamper the surgical reattachment and healing of the musculotendinous unit to the bone.[23,26,28-31,44,46,58]

The definition of MRCT lesion is still not consensual,[10,11,14,23,25,56,64,70] and the 2 most widely used systems are based on the dimension of tendon retraction (with a diameter >5 cm) [11,14] and based on the number of tendons affected, with a minimum of 2 complete tendon tears.[23,25,64,70] Following these criteria, MRCTs have been reported as ranging from 10% to 40% of all rotator cuff tears and 80% of recurrent tears.[1,9,15,16,33,36,37,42,45,63] Moreover, Hamada et al[34] radiographically classified MRCTs by the acromiohumeral distance (AHD), degenerative changes of the acromion, and narrowing of the glenohumeral joint space. The 5-grade classification presumes to reflect the temporal evolution of rotator cuff tears and is as follows: in grade 1 the AHD is maintained (≥6 mm) and narrows in grade 2 (≤5 mm); in grade 3, an acetabulization in addition to the grade 2 narrowing is seen; in grade 4, narrowing of the glenohumeral joint is added to the grade 3 features, and grade 5 comprises a humeral head collapse. Only Hamada grade 1, 2, or 3 patients are considered to have a MRCT without associated arthritis.

Computed tomography scanning[27,28] and magnetic resonance imaging[20] have been proposed as critical tools to detect MRCTs and to grade the associated prognostic factors such as the tear size, tendon retraction, and fatty infiltration. The information obtained can be used to estimate the quality and, consequently, the reparability of the torn musculotendinous unit.[36,52,57,68] However, determining which rotator cuff tears constitute an irreparable MRCT can be difficult and somewhat arbitrary.[51] Nevertheless, in the presence of severe and fixed retraction of the musculotendinous unit (grade 3 on the classification system of Patte[54]), severe cuff muscle fatty infiltration (grade 3 or 4 on the Goutallier classification for computed tomography scan[27,28] or Fuchs classification for magnetic resonance imaging[20]), or proximal humeral migration with narrowing of the acromiohumeral space (<6 mm) on the anteroposterior view in neutral rotation,[65] the RCT can be considered chronic and irreparable.

Surgical treatment is advised in an irreparable MRCT without arthritis (Hamada grade 1-3), associated with significant pain, and when nonoperative treatment has failed to improve the symptoms. However, surgical treatment remains a challenge owing to the technical difficulties and unpredictability of the results of the repair, which has led orthopedic surgeons to seek alternative options to treat MRCTs.

Many palliative interventions have been proposed, including long head of the biceps tenotomy or tenodesis,[4,61] subacromial débridement,[21] tendon transfers,[22,24,50,52] superior capsular reconstruction,[48,49] partial rotator cuff repair,[3,13] rotator cuff débridement,[17,21,53] and reverse shoulder arthroplasty (RSA).[7,18,38,51,59,62] Nevertheless, the appropriate surgical intervention for the specific individual patient has not been widely agreed upon, and currently, strong scientific data to support any of the available surgical options is lacking.

RSA is presented as an option that can provide a more predictable pain relief and recovery of function.[7,38,51] Nonetheless, outcomes after RSA for irreparable MRCTs have not been well defined in the scientific literature. Therefore, the purpose of the current work was to conduct a systematic review and a meta-analytic procedure on the outcomes of RSA to treat adult patients presenting with chronic, irreparable MRCTs. The hypothesis was that RSA would improve pain and function of patients presenting with chronic, irreparable MRCTs that had failed to improve after nonoperative treatment.

Materials and methods

Search strategy

The systematic review of the literature was conducted according the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which aims to improve the standard of reporting of systematic reviews and meta-analyses.[43] The protocol was a priori registered at the International Prospective Register of Systematic Reviews (PROSPERO) (http://www.crd.york.ac.uk/PROSPERO 2015:CRD42015026902).

In October 2015, a comprehensive database search was performed of the MEDLINE, Scopus, the Cochrane Database of