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Outcome of lower trapezius transfer to reconstruct massive irreparable posterior-superior rotator cuff tear

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Background: Management of massive irreparable posterior-superior rotator cuff tear can be very challenging. This study reports the outcome of the lower trapezius transfer to reconstruct massive irreparable posterior-superior rotator cuff tear.

Methods: Included were 33 patients with an average age of 53 years (range, 31-66 years). All patients had symptomatic massive irreparable rotator cuff tear that failed conservative or prior surgical treatment and underwent reconstruction with lower trapezius transfer prolonged by Achilles tendon allograft. The tear was considered irreparable based on the magnetic resonance imaging finding of ≥2 full-thickness rotator cuff tears associated with shortening and retraction of the tendon to the level of the glenoid and a high grade of fatty infiltration of the muscles. This was confirmed at the time of the surgery.

Results: At an average follow-up of 47 months, 32 patients had significant improvement in pain, subjective shoulder value, and Disabilities of the Arm, Shoulder and Hand score and shoulder range of motion, including flexion, 120°; abduction, 90°; and external rotation 50°. One patient, with a body mass index of 36 kg/m^2, required débridement for an infection and then later underwent shoulder fusion. Patients with >60° of preoperative flexion had more significant gains in their range of motion. Shoulder external rotation improved in all patients regardless of the extent of the preoperative loss of motion.

Conclusions: Transfer of the lower trapezius prolonged with Achilles tendon allograft to reconstruct massive irreparable posterior-superior rotator cuff tear may lead to good outcome in most patients, specifically for those who have preoperative flexion of >60°.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: lower trapezius transfer; posterior-superior irreparable rotator cuff tear; Achilles tendon; fatty atrophy; massive irreparable tear; Goutallier grade III or IV

Rotator cuff tear is a common cause of shoulder pain and loss of function.[9,40] In cases of large reparable rotator cuff tear, good pain relief and improvement of shoulder function over a long-term follow-up period have been reported after arthroscopic or open repair. However, in patients with massive rotator cuff tear associated with fatty atrophy, retear after attempted repair has been reported in up to 90%.[15] In this subset of patients, the rotator cuff is considered massive and irreparable when the tear involves 2 or more tendons with shortening and retraction of the tendons to the level of the glenoid associated with advanced fatty atrophy (Goutallier grade III or IV fatty infiltration).[22] Proximal migration of the

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humeral head is considered an additional indication of irreparability of the rotator cuff tear.[28,34]

Recommended surgical management options include arthroscopic débridement or partial cuff repair, or both.[2] The main advantage of such an approach is that it is minimally invasive, with potential quicker recovery. In most instances, however, especially in young patients, it may not improve the symptoms, and these may potentially worsen over time secondary to possible progression of the tear, loss of the containment of the humeral head on the glenoid, and progressive proximal migration of the humeral head associated with worsening of the glenohumeral joint cartilage degeneration.[2,30]

Tendon transfers have the potential to restore shoulder function by reconstructing the muscle function of the irreparable rotator cuff tear. There are several options of transfers to reconstruct all types of rotator cuff tears. For the management of irreparable posterior-superior rotator cuff tears, the most common transfer described is the latissimus dorsi, with or without teres major, with variable outcome reported depending on patient selection.[12,17,20,33,38] The senior author (B.T.E.) reported good to excellent outcomes of lower trapezius transfer to reconstruct shoulder external rotation in a paralytic shoulder.[10]

Because of the promising outcome of lower trapezius transfer in the paralytic shoulder, we began performing lower trapezius transfer prolonged with Achilles tendon allograft to reconstruct posterior superior-rotator cuff tear in nonparalytic patients. This study reports the outcome of the lower trapezius transfer prolonged with Achilles tendon allograft to reconstruct massive irreparable posterior-superior rotator cuff tear.

Materials and methods

The study included 33 patients who underwent transfer of the lower trapezius to reconstruct posterosuperior rotator cuff with at least 2 years of follow-up. The indications for surgery included (1) persistent pain, weakness, and limitation in range of motion of the shoulder; (2) magnetic resonance imaging (MRI) demonstrating a massive irreparable tear of the posterosuperior rotator cuff with tendon retraction and muscle belly fatty atrophy; (3) failed conservative treatment; and (4) normal function of the lower trapezius.

There were 27 men and 6 women, with an average age of 53 years (range, 31-66 years). The right dominant shoulder was involved in 22 patients. Symptoms included progressively worsening shoulder pain, weakness, and limitations in shoulder motion. Eleven patients had no prior surgeries, but the remaining 22 patients had undergone an average of 2 prior surgeries (range, 1-5). All 22 patients had an attempt at a prior full or partial rotator cuff repair by arthroscopic or open technique (3 patients had undergone 2 prior repairs and 2 patients had 3 undergone 3 prior repairs). In addition, 10 patients had prior surgeries not related to rotator cuff tear, including biceps tenotomy/tenodesis, subacromial decompression, acromioclavicular joint resection, and labral repair.

All patients were active and did repetitive lifting activities, such as weight lifting, light labor, or daily repetitive lifting of objects 10 pounds or greater. Thirteen patients reported heavy lifting activities, including construction workers, farmers, lifting heavy wood, boxes, or animals. The mechanism of injuries included slipping on ice in 6, falling from stairs in 4, car accident in 5, motorcycle accident in 4, sports injury (football, hockey) in 6, and repetitive heavy lifting (farmers) in 8. The average duration of symptoms was 9 months (range, 5-43 months).

Patients who presented to our clinic with symptomatic massive irreparable rotator cuff tear had already established diagnosis elsewhere and were sent to our clinic to be evaluated for potential tendon transfer. Patients aged older than 55 to 60 years and who could have been potentially good candidates for reverse shoulder arthroplasty were aware of this option but did not want it mainly because of the restrictions and potential complications associated with it.

On examination, patients exhibited wide variation in the manifestations of their rotator cuff tear, regardless of the extent of the tear and degree of fatty atrophy. All patients showed variable degrees of loss of active shoulder function, with average shoulder flexion of 70° (range, 20°-120°), abduction of 40° (range, 20°-70°), external rotation of 20° (range, −50° to 40°), and internal rotation, measured by determining the spinous process level where the patients can place their thumb, to L3 (range, L5-T10).

On more focused examination, all patients had a positive Jobe test and external rotation weakness with the arm to the side (muscle strength average, M3; range, 2-4). External rotation lag in 27 patients averaged 30° (range, 20°-70°). Results of the belly-press test and lift-off test were normal in 25 patients and were partially positive in 8 patients. Some patients had scapula dyskinesia on examination; however, examination in all patients showed the periscapular muscles (including the lower trapezius) were normal.

Imaging included 3-view radiographs of the shoulder and MRI in all patients. Radiographs showed proximal migration of the humeral leading to a mean acromiohumeral distance of 2.3 mm, with no sign of cuff tear arthropathy in 26 patients. MRI showed massive rotator cuff tear (all patients had at least 2 full-thickness rotator cuff tears, involving at least the supraspinatus and infraspinatus) that we determined preoperatively to be irreparable based on the advanced fatty atrophy involving the torn muscles (Goutallier grade III-IV) and retraction of the torn tendon medial to the level of the glenoid. Of note, the infraspinatus fatty atrophy was usually more advanced than the supraspinatus. In addition, 10 patients had tear of the teres minor, and 11 patients had evidence of fatty atrophy in the teres minor muscle belly despite not having a tendon tear presence on imaging. Thirteen patients had associated tear of the upper part of the subscapularis, but no patients had full-thickness tear or fatty atrophy of the subscapularis. In addition, 13 shoulders showed minimal narrowing and arthritic changes of the glenohumeral joint, but gross arthritic changes on radiographic evaluation was absent in all patients. All patients had acromiohumeral distance of less than 5 mm before surgery, with no evidence of acetabulization, which indicated grade 2 according to the Hamada classification.[23]

Outcome measures included pain levels, shoulder range of motion, shoulder subjective value (SSV), and Disabilities of Arm, Shoulder and Hand (DASH) score. Pain was quantified as none, mild, moderate with activities, moderate at rest, or severe. Range of motion was measured using a standard goniometer.[21] The DASH score is a standardized, validated measure to quantify shoulder pain and function.[6,7,25] Furthermore, external rotation muscle strength was graded by the modified version of British Medical Research Council scale.[36]

In addition to descriptive statistics, univariate analysis was used to compare the differences between preoperative and postoperative data using the 2-sample χ^2 test (or Fisher exact test) for categoric variables, or the Student t test of unequal variance for continuous and categoric variables. All analyses were performed using JMP 8