J Shoulder Elbow Surg (2017) ■■, ■■–■■

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

ORIGINAL ARTICLE

Outcomes of arthroscopic revision rotator cuff repair with acellular human dermal matrix allograft augmentation

Eric A. Hohn, MD*, Blake P. Gillette, MD, Joseph P. Burns, MD

Southern California Orthopedic Institute, Van Nuys, CA, USA

Background: The purpose was to assess the minimum 2-year patient-reported outcomes and failure rate of patients who underwent revision arthroscopic rotator cuff repair augmented with acellular human dermal matrix (AHDM) allograft for repairable retears.

Methods: From 2008-2014, patients who underwent revision rotator cuff repair augmented with AHDM with greater than 2 years' follow-up by a single surgeon were retrospectively reviewed. Data regarding surgical history, demographic characteristics, and medical comorbidities were collected. Outcome data included American Shoulder and Elbow Surgeons (ASES) and Single Assessment Numeric Evaluation (SANE) scores, as well as rotator cuff healing on magnetic resonance imaging or ultrasound. Retears and subsequent surgical procedures were characterized.

Results: A total of 28 patients met our inclusion criteria, and 23 (82%) were available for follow-up at 2 years. The mean age was 60.1 ± 9.3 years (range, 43-79 years), with a mean follow-up period of 48 ± 23 months. All patients had at least 1 prior rotator cuff repair. Of the 23 patients, 13 (56%) underwent postoperative imaging, and 4 of these 13 (31%) had a retear. A reoperation was performed in 3 of 23 patients (13%). Among the 6 patients with both preoperative and postoperative outcome scores, we saw improvement in the ASES score from 56 to 85 ($P = .03$) and in the SANE score from 42 to 76 ($P = .03$). The full cohort's mean postoperative ASES and SANE scores were 77 and 69, respectively.

Conclusion: AHDM allograft augmentation is a safe and effective treatment method for patients with full-thickness rotator cuff retears. Further research is needed with larger studies to confirm these findings from our small cohort of patients.

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

Keywords: Rotator cuff; revision; shoulder; arthroscopy; allograft; augmentation; acellular human dermal matrix

The incidence of rotator cuff surgery continues to increase, with a recent study showing a 6-fold increase in arthroscopic repair from 1996 to 2006 in the United States.[7] Moreover, a single-state surgical database showed that even with a decline in open rotator cuff surgery, the total number of repairs doubled from 2000 to 2007.[14] Primary arthroscopic rotator cuff repair of small to medium tears is generally

Institutional review board approval was obtained before the initiation of this study (Western IRB, study No. 1155091).

*Reprint requests: Eric A. Hohn, MD, Southern California Orthopedic Institute, 6815 Noble Ave, Van Nuys, CA 91405, USA.

E-mail address: erichohn@gmail.com (E.A. Hohn).

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https://doi.org/10.1016/j.jse.2017.09.026

successful; however, several risk factors for failure have been identified, including large tear size, poor tendon quality, increased degree of retraction, and the presence of fatty degeneration, among others.[11,18] Repair of larger tears has an increased risk of non-healing, approaching 94% in some studies.[5,10] Although structural failure is not always correlated with clinical failure,[20] several studies have demonstrated a clinical benefit in patients with a healed rotator cuff.[13,15,17,21,28]

A study by Shamsudin et al[25] showed that patients undergoing revision rotator cuff repair are twice as likely to have retears and have worse postoperative pain and function compared with those undergoing primary repair. Rotator cuff revision surgery is often complicated by tendon loss or retraction, bone defects, and retained hardware. Poor tissue quality also negatively affects both the quality of surgical repair and subsequent healing.[8,16,19] As these patients are less likely to achieve optimal outcomes with standard repair techniques, alternative surgical and biological approaches should be investigated.

Several new techniques have been developed in an effort to improve outcomes in patients who are at high risk of failure. Biological tissue scaffolds have been introduced as a way to reduce repair tension and enhance healing of the rotator cuff. A variety of biological scaffold materials have been used with favorable results, including human acellular dermis,[6] fascia lata,[1] and porcine dermal collagen.[12] Preliminary biomechanical and clinical evidence suggests that rotator cuff augmentation may be a safe and effective method for the treatment of massive, retracted rotator cuff tears.[1-3,6,22,26] Barber et al[2] showed that primary repair of large rotator cuff tears had a significantly higher healing rate when augmented with acellular human dermal matrix (AHDM) allograft (85% compared with 40%). Data regarding the use of biological scaffold augmentation in revision rotator cuff repair are lacking and are limited to open repair only.[22,24]

The purpose of the study was to (1) evaluate the clinical outcomes with American Shoulder and Elbow Surgeons (ASES) and Single Assessment Numeric Evaluation (SANE) scores at a minimum of 2 years' follow-up and (2) evaluate the retear rate and need for subsequent surgery in patients with a previous failed rotator cuff repair who underwent revision arthroscopic surgery with AHDM allograft augmentation. Our hypothesis was that augmentation with AHDM allograft would be a safe and reliable treatment option for patients with failed rotator cuff repairs.

Methods

Study design

Between 2008 and 2014, all patients who underwent arthroscopic revision repair of full-thickness (>2 cm) rotator cuff tears augmented with AHDM allograft by a single surgeon (J.P.B.) were identified for this retrospective case-series study. The minimum subjective follow-up period was set at 2 years. The inclusion criteria included full-thickness retears of the supraspinatus and/or infraspinatus that had occurred after prior open or arthroscopic repair, measuring 2 cm or greater in size in the anterior-to-posterior plane. Any degree of tissue atrophy, degeneration, or fatty infiltration was included. Patients with concomitant pathologies such as superior labral anterior-posterior tears, chondromalacia, biceps pathology, or subscapularis tears were included. The exclusion criteria were advanced osteoarthritis according to the Samilson-Prieto classification of grade 2 or higher,[23] active infection, or a rotator cuff tendon that could not be mobilized with a residual gap of less than 1 cm. Minimum 2-year follow-up data were obtained using validated shoulder questionnaires.

Surgical treatment

The decision to perform rotator cuff repair with patch augmentation was based on preoperative evaluations and magnetic resonance imaging (MRI) appearance, as well as intraoperative tendon quality and mobility. Rotator cuff repair with AHDM augmentation was indicated for patients with full-thickness recurrent tearing of the supraspinatus and/or infraspinatus tendons after failed prior surgery, measuring 2 cm in size from anterior to posterior, with poor tendon quality. Any degree of muscle atrophy and fatty infiltration was acceptable, and all Goutallier grades were included in this study. If the cuff tendon could not be sufficiently mobilized with a residual gap of less than 1 cm, other options such as débridement, partial repair, tendon transfer, reverse total shoulder replacement, or a bridging allograft repair were considered, and those patients were excluded from the study. For all cases included in this series, the AHDM allograft was used for augmentation (not bridging) where the native rotator cuff tendon was secured to the medial footprint on the tuberosity. The graft was placed over the top of the rotator cuff tendon and secured circumferentially: anteriorly, posteriorly, and medially to the remaining rotator cuff tissue and laterally to the greater tuberosity, as previously described.[2,27,30]

Surgical technique

After the administration of a regional interscalene block and induction of general anesthesia, the patient is placed in the lateral decubitus position. All bony prominences are carefully padded, and an axillary roll is placed. Ten pounds of balanced suspension in 70° of abduction is used for glenohumeral access, 15 lb in 15° of abduction is used for bursal access, and 10 lb in approximately 45° of abduction is used as a middle position for accessing the lateral aspect of the greater tuberosity in the bursal space. The operative field is prepared and draped using sterile techniques. Standard posterior and anterosuperior portals are established, a diagnostic arthroscopy is performed, and all intra-articular pathologies are addressed as necessary. An accessory lateral portal is established, and a diagnostic subacromial bursoscopy is performed. The rotator cuff tendon quality and mobility are assessed, and intra- and extra-articular releases are performed using an elevator and radiofrequency probe when necessary. The decision of whether to perform rotator cuff repair with or without augmentation is then made. Tears with normal to excellent tendon quality are repaired primarily, whereas tendons with atrophy, poor-quality suture holding, and abnormal fatty infiltration are selected for augmentation. Retained anchors and sutures from prior surgical procedures are then removed as indicated. If the