Arthroscopic Joint Preservation in Severe Glenohumeral Arthritis Using Interpositional Human Dermal Allograft

Robert U. Hartzler, M.D., M.S., Sabelo Melapi, B.S., Joe F. de Beer, M.D., and Stephen S. Burkhart, M.D.

Purpose: To investigate the outcomes of arthroscopic glenoid resurfacing (AGR) for severe glenohumeral arthritis at short- to medium-term follow-up. **Methods:** We performed a multicenter retrospective review of consecutive patients undergoing AGR (2005-2013) with a minimum of 2 years' follow-up or until revision. Patients lost to follow-up and those included in a prior study were excluded. The indications for AGR were severe primary shoulder osteoarthritis without significant bone loss in younger, higher-demand patients. Outcome measures included revision, pain and American Shoulder and Elbow Surgeons (ASES) scores, and range of motion. Exact logistic regression was used to assess preoperative risk factors for revision. **Results:** Forty-three shoulders with an average of 60 months' clinical follow-up underwent AGR. The rate of revision to prosthetic arthroplasty was 23% (95% confidence interval [CI], 12%-39%) after a mean of 45 months. The visual analog scale pain score (0-10) improved from a median of 7 to 2 (median difference [Δ], 4 [95% CI, 3-6]; $P < .0001$), representing pain relief similar to total shoulder arthroplasty in young patients. Improvements in the median ASES score (from 47 to 76; Δ, 28 [95% CI, 17-40]; $P < .0001$), active forward elevation (from 110° to 140°; Δ, 20° [95% CI, 10°-35°]; $P < .0001$), and active external rotation (from 0° to 20°; Δ, 10° [95% CI, 5°-20°]; $P < .0001$) were noted. The mean age of revised shoulders (60 years [95% CI, 54-66 years]) was higher than that of surviving shoulders (53 years [95% CI, 50-57 years], $P = .005$). The preoperative ASES score of revised shoulders (34 [95% CI, 27-42]) was lower than that of surviving shoulders (47 [95% CI, 43-51], $P = .006$). No complications were noted. **Conclusions:** AGR with dermal allograft is a safe option for joint preservation in selected patients, provides pain relief, and has an acceptable rate of revision to prosthetic arthroplasty at short-term to midterm follow-up. Increased age and lower preoperative ASES score were risk factors for failure of AGR. **Level of Evidence:** Level IV, therapeutic case series.

From The San Antonio Orthopaedic Group and Burkhart Research Institute for Orthopaedics (R.U.H., S.S.B.), San Antonio, Texas, U.S.A.; and Cape Shoulder Institute (S.M., J.F.d.B.), Cape Town, South Africa.

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Address correspondence to Robert U. Hartzler, M.D., M.S., The San Antonio Orthopaedic Group, 150 E Sonterra Blvd, Ste 300, San Antonio, TX 78258, U.S.A. E-mail: Hartzler.rob@gmail.com

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In certain patients, prosthetic shoulder arthroplasty is an undesirable surgical option for glenohumeral arthritis. For young or very active patients, surgeons might seek an alternative or interim procedure because of concerns over prosthetic longevity, complications, and tissue preservation.[1-5] Other patients may wish to avoid prosthetic arthroplasty because of risk aversion, unwillingness to comply with activity restrictions, or negative perceptions of joint replacement surgery.[6,7]

Arthroscopic techniques for debridement or resurfacing of the arthritic shoulder have been previously proposed as alternatives to prosthetic arthroplasty and have been reported to improve pain and function.[8-15] Advantages of arthroscopic surgery for shoulder arthritis include a low rate of complications, the preservation of tissue, and the avoidance of postoperative activity restrictions. On the other hand, these techniques are technically challenging. Furthermore, previous studies have shown that techniques involving

debridement alone are more likely to result in inferior results with an increasing severity of arthritis.[13,16]

Techniques for and outcomes of arthroscopic glenoid resurfacing (AGR) have been previously reported.[8-12,17] Since these initial reports of meniscus,[12] xenograft,[8,9] or double-layered dermal allograft[10,11] interposition, the techniques for AGR have been further refined, particularly with the use of thicker (nominal 2 mm), single-layer, human dermal allograft as the resurfacing implant. The purpose of this study was to investigate whether AGR for severe glenohumeral arthritis resulted in improved clinical outcomes at short- to medium-term follow-up. We hypothesized that AGR would improve patient outcomes with an acceptable rate of revision to prosthetic arthroplasty.

Methods

A retrospective review was undertaken at each orthopaedic center to identify patients who underwent AGR with minimum 2-mm-thick human dermal allograft with a minimum of 2 years' follow-up or until revision. The study period was from 2005 through 2013 and included consecutive series of patients from each center during these periods. The exclusion criteria were patients operated on through 2005 (J.F.d.B.) who were analyzed previously for another study[11] and those lost to follow-up. The indications for performing AGR included patients with primary shoulder osteoarthritis in whom nonoperative treatment had failed and who desired to undergo an arthroscopic, nonprosthetic arthroplasty procedure. Indicated patients were typically younger (age <60 years) and/or high-demand patients, although age and activity level were not formal inclusion or exclusion criteria. Contraindications for AGR included osteoarthritis with severe bone loss and inflammatory arthritis.

Preoperative clinical data were collected prospectively and reviewed retrospectively by 2 authors (R.U.H. and S.M.). The radiographic grade of glenohumeral arthritis was assigned by the senior authors (S.S.B. and J.F.d.B.) preoperatively using the classification of Samilson and Prieto.[18] Postoperative data were collected by a follow-up survey (S.S.B.) or phone interview (J.F.d.B.) for most patients. Clinical outcomes included a pain score (0-10), the American Shoulder and Elbow Surgeons (ASES) score (ASES Standardized Shoulder Assessment Form, patient self-report section),[19] and the Subjective Shoulder Value.[20] Postoperative range of motion was self-reported[21] or assessed clinically by one of the senior authors during routine clinical follow-up. For patients who underwent revision, the final pre-revision clinical outcomes (pain, range of motion, outcome scores) were used in the analysis.

Surgical Technique

The surgical technique was similar for the senior authors (S.S.B. and J.F.d.B.) and has been previously reported.[10] In brief, the patient is positioned in the lateral decubitus position with the arm in balanced suspension with an arm holder (STaR Sleeve; Arthrex, Naples, FL). Typically, posterior, anterosuperior, anterior, and posterolateral arthroscopic portals are used for the operation. Glenohumeral joint debridement is performed as needed for visualization, and a 270° capsular release is performed with electrocautery, sparing only the superior capsule. Glenoid preparation follows, which includes removal of remaining cartilage and soft tissue, light burring to bleeding bone, and microfracture. If the glenoid is biconcave, the central ridge is removed with a burr. The glenoid is measured, and the graft is sized and cut on a back table. Allograft fixation may be performed with suture anchors or to the labrum with free sutures. The inferior glenoid sutures are fixed either by placing anchors or by passing suture through the labrum, and one limb of each is retrieved through the anterosuperior portal. The sutures are passed through the graft and secured with mulberry knots, and then the graft is shuttled into the joint through the anterosuperior portal. Circumferential graft fixation with a minimum of 6 points completes the operation.

In this series no patient received a double-folded allograft, as had been reported previously.[10,11] The allograft was human dermis (GraftJacket MaxForce Extreme [Wright Medical, Arlington, TN], used by J.F.d.B., or Arthroflex [Arthrex], used by S.S.B.). The postoperative rehabilitation protocol varied based on the security of graft fixation and the surgeon. When fixation was very secure, passive range of motion with table slides and passive supine external rotation was initiated in the early postoperative period. Patients wore a sling for 3 weeks (J.F.d.B.) or 6 weeks (S.S.B.) postoperatively and then started active range of motion. Strengthening began at either 6 weeks (J.F.d.B.) or 3 months (S.S.B.).

Statistical Analysis

Categorical variables were described by number and relative proportion and were compared by the Fisher exact test. Mean and 95% confidence interval (CI) were calculated for normally distributed variables. Median and 95% CI were calculated for non-normal variables and generally reported throughout for consistency. Continuous variables were assessed with the t test or Wilcoxon rank sum test depending on their distribution. Exact logistic regression was used to assess preoperative risk factors for association with revision to prosthetic arthroplasty. For all analyses, 2-tailed $P < .05$ was considered significant.

Results

Forty-six shoulders in 45 patients underwent AGR during the study period. Of the shoulders, 3 (6%) were