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Plication of the posterior capsule for intraoperative posterior instability during anatomic total shoulder arthroplasty

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Background: Restoration of soft tissue balance for intraoperative posterior instability during anatomic total shoulder arthroplasty (TSA) is particularly difficult. The effectiveness of posterior capsular plication (PCP) in restoring soft tissue balance is largely unknown. The purpose of this study was to report the outcomes, complications, and reoperations of primary TSA in which a PCP was performed to correct excessive intraoperative posterior subluxation.

Methods: Thirty-eight shoulders (37 patients) underwent PCP for intraoperative posterior instability during anatomic TSA. The mean (standard deviation) age was 68 (10) years, and the median (range) clinical and radiographic follow-up periods were 60 (10-154) and 48 (1.5-154) months, respectively. A retrospective chart review was conducted to obtain clinical and radiographic data.

Results: TSA resulted in significant improvements in pain and range of motion. The mean (standard deviation) Simple Shoulder Test and American Shoulder and Elbow Surgeons scores were 9.4 (2.7) and 81.1 (19.8), respectively. PCP resulted in restoration of soft tissue balance in 27 shoulders (71%). The remaining 11 shoulders had evidence of posterior subluxation, including posterior dislocation in 2 shoulders. Revision surgery was performed in only 3 shoulders (7.9%), all for instability. However, there was a high rate of radiographic glenoid component loosening (12 shoulders, 32%). Overall results were excellent in 24 (63.2%), satisfactory in 10 (26.3%), and unsatisfactory in 4 (10.5%) shoulders. Recurrence of posterior subluxation was associated with worse motion and strength as well as with a higher rate of glenoid loosening.

Conclusions: PCP seems to correct excessive intraoperative posterior subluxation in approximately two-thirds of the shoulders undergoing anatomic TSA. However, posterior subluxation does recur in the remaining third, and the overall rate of radiographic glenoid loosening is of concern.

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

Keywords: Total shoulder arthroplasty; posterior instability; capsular plication; capsular tightening; posterior capsular plication; soft tissue balance

Total shoulder arthroplasty (TSA) is a common procedure that has been reported to provide successful outcomes in terms of pain relief and function.[2,4,6,10] End-stage glenohumeral degenerative joint disease with an intact and functional

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rotator cuff is a common indication. The underlying structural pathologic process of primary glenohumeral osteoarthritis varies. A number of shoulders develop progressive posterior subluxation over time; when this posterior subluxation is severe, soft tissue balance at the time of TSA may be extremely difficult to achieve, and postoperative subluxation may continue to occur intraoperatively and postoperatively, compromising the overall outcome.

When excessive intraoperative posterior subluxation is noted at the time of TSA, a number of changes may be trialed to achieve adequate soft tissue balance. Provided component version and bone loss management have been optimized, trial heads of increasing thickness may be used to tension the posterior capsule and cuff while still allowing subscapularis repair. In some shoulders, intraoperative posterior subluxation continues. In these circumstances, posterior capsular plication (PCP) has been recommended in the past, but there are limited data about its effectiveness or how it may influence final range of motion (ROM). Alternatively, surgeons currently consider intraoperative conversion to a reverse shoulder arthroplasty.

Even though good results have been reported with reverse shoulder replacement in patients with primary osteoarthritis and posterior subluxation,[5] reverse arthroplasty may be associated with complications less commonly seen with anatomic TSA, including stress fractures of the acromion, brachial plexopathy, and progressive glenoid bone loss secondary to notching. In addition, reverse arthroplasty does not seem to restore the same ROM as anatomic TSA in patients with osteoarthritis, especially in regard to internal rotation. For these reasons, a clear understanding of the value of PCP in anatomic TSA may help delineate the relative indications of these 2 surgical options in patients with intraoperative posterior instability.

The purpose of this study was to report the clinical and radiographic outcomes, complications, and reoperations of primary anatomic TSA in patients additionally undergoing PCP to correct excessive posterior intraoperative subluxation.

Methods

The Mayo Clinic Total Joint Registry database was used to identify all patients who underwent a primary anatomic TSA between 1975 and December 2013 by any of the 3 senior surgeons (J.W.S., R.H.C., and J.S.S.). The medical records of these patients were reviewed to identify a study group by the following inclusion criteria: age >18 years, PCP performed during the index procedure to correct excessive intraoperative posterior subluxation of the prosthetic humeral head, minimum clinical follow-up of 2 years (or until failure), use of all-polyethylene glenoid components, and preoperative and postoperative anterior-posterior and axillary view plain radiographs available for review. Patients were excluded if the indication for TSA was malunion, nonunion, or inflammatory/neuropathic destructive arthropathy. Shoulders replaced using a metal-backed glenoid component or those that required structural bone graft were also excluded. After patients were identified, a retrospective review of the medical charts was conducted to obtain the relevant data for this study. After data collection, a radiographic assessment session was conducted in which all preoperative, early follow-up, and last follow-up radiographs were evaluated by 2 senior surgeons (J.W.S. and J.S.S.) blinded to the clinical outcomes.

Patients

A total of 1673 primary anatomic TSA procedures were performed in the study period by the 3 senior surgeons. Of these, 47 shoulders (46 patients) had undergone PCP during the index procedure. Nine patients were not included because of a different underlying diagnosis or clinical follow-up of <2 years. This left a total sample of 38 shoulders (in 37 patients) available for the study. Of the 38 cases, 23 could be seen in the office for follow-up (60.5%), and the rest returned a validated follow-up questionnaire through our Institutional Total Joint Registry.[7]

There were 32 men and 5 women (1 male patient had bilateral TSA) with a mean (standard deviation [SD]) age of 67.7 (10.4) years. The mean (SD) of height, weight, and body mass index were 1.7 (0.1) m, 93.4 (19.7) kg, and 29.7 (5.9), respectively. There were 36 right-handed and 2 left-handed patients, with 24 TSAs performed on the dominant side and 14 performed on the nondominant side. The indications for TSA were primary osteoarthritis (35), posttraumatic osteoarthritis (2), and avascular necrosis with secondary end-stage arthritis (1). All but 1 patient had a minimum follow-up of 2 years. Despite a length of follow-up of 10 months, this patient was included because of failure of the primary TSA before 2 years. Therefore, the median (range) of clinical follow-up was 60 (10-154) months.

Surgical procedures

All operations were performed through a deltopectoral approach. After implantation of the glenoid component, the humeral head trial was placed and stability evaluated. In cases of posterior subluxation of >40% to 50%, the head size thickness and diameter were increased in an attempt to tension the posterior soft tissues while still allowing subscapularis closure. In all shoulders included in this study, posterior subluxation persisted and a PCP was added.

A bone hook was used to retract the humerus laterally to create a working space for the PCP procedure. Then, multiple nonabsorbable sutures were placed lateral to medial to shorten the posterior capsule (Fig. 1, *A*). All the sutures were first placed and then the bone hook was removed to allow adequate tightening of the sutures as they are tied (Fig. 1, *B*). The procedure shortens the posterior structures and potentially provides better soft tissue balance in selected patients. The three senior authors performed the PCP through this technique.

After surgery, these shoulders were immobilized in external rotation for 6 weeks. Passive ROM was started during the first week with an internal rotation limit of 20°, external rotation limit of 30°, and elevation limit of 90° in the plane of the scapula for 4 weeks. Forward flexion ROM was not allowed during this period.

The mean (SD) operative time was 136 (59) minutes. There were 23 Comprehensive Total Shoulder System prostheses (Biomet, Warsaw, IN, USA), 12 Cofield (monoblock or modular) Shoulder System prostheses (Smith & Nephew, Memphis, TN, USA), 2 ReUnion TSA (Stryker, Mahwah, NJ, USA), and 1 Neer II prosthesis (3M Company, St. Paul, MN, USA). All glenoid components and 2 of the humeral components were cemented. Bone graft was not used in any of the cases. There were 36 pegged and 2 keeled