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ORIGINAL ARTICLE

Tobacco use predicts a more difficult episode of care after anatomic total shoulder arthroplasty

Daniel B. Wells, MD, Andrew M. Holt, MD, Richard A. Smith, PhD, Tyler J. Brolin, MD, Frederick M. Azar, MD, Thomas W. Throckmorton, MD*

University of Tennessee-Campbell Clinic, Department of Orthopaedic Surgery & Biomedical Engineering, Memphis, TN, USA

Background: In the current health care environment, it is becoming increasingly important to recognize risks factors that may affect a patient's postoperative outcome. To determine the potential impact of tobacco as a risk factor, we evaluated postoperative pain, narcotic use, length of stay, reoperations, and complications in the global 90-day episode of care for patients undergoing anatomic total shoulder arthroplasty (TSA) who were current tobacco users, former users, or nonusers.

Methods: Database search identified 163 patients with primary anatomic TSA done for glenohumeral arthritis; these were divided into 3 groups: current tobacco users (28), nonusers (88), and former users (47). All surgeries were done with the same technique and implants.

Results: Patients in the current tobacco use group had significantly higher visual analog scale scores preoperatively and at 12 weeks postoperatively than nonusers and former users. Mean improvement in visual analog scale scores was significantly less in current tobacco users. Cumulative oral morphine equivalent use at 12 weeks was significantly higher in current tobacco users than in nonusers and former users. The average oral morphine equivalent per day was also significantly higher in the current tobacco users than in nonusers and former users. There were no significant differences in length of stay or complications.

Conclusions: Although length of stay, complication rates, hospital readmissions, and reoperation rates were not significantly different, tobacco users reported increased postoperative pain and narcotic use in the global period after TSA. Former tobacco users were found to have a postoperative course similar to that of nonusers, suggesting that discontinuation of tobacco use can improve a patient's episode of care performance after TSA.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

Keywords: Total shoulder arthroplasty; 90-day episode of care; tobacco use; outcomes; complications; postoperative pain

The demand for primary total shoulder arthroplasty (TSA) has been steadily increasing during the last decade, and projections based on the Nationwide Inpatient Sample suggest this trend is likely to continue.[8,17,25] TSA has been shown to provide predictable pain relief and postoperative outcomes, with reports of long-term survival and satisfaction rates ranging from 87% to 95%.[23,24] Whereas there is an abundance of data

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*Reprint requests: Thomas W. Throckmorton, MD, 1211 Union Avenue, Suite 510, Memphis, TN 38104, USA.

E-mail address: tthrockmorton@campbellclinic.com (T.W. Throckmorton).

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supporting the use of TSA in the treatment of advanced glenohumeral arthritis, studies investigating patient-specific risk factors, including tobacco use, that may predict early postoperative outcomes are lacking.

Tobacco use has been shown to be a major risk factor for the development of postoperative complications in elective orthopedic surgery.[22] In the total hip and knee arthroplasty literature, multiple studies have shown that patients who use tobacco are at an increased risk for both wound complications and deep infections.[9,18,19,30,31] Not only are patients undergoing elective joint surgery at an increased risk for wound complications and infections, they also are at risk for adverse functional outcomes that require revision surgery.[30] Wound complications, infections, and revision surgery lead to decreased patient satisfaction and increased hospital readmissions.[5,29] Surgical complications after joint arthroplasty leading to hospital readmissions have been shown to significantly increase costs to the health systems, with a reported average of $36,038 for total hip arthroplasty readmissions and $27,979 for total knee arthroplasty readmissions.[5]

During the past decade, increased attention has been directed toward the economic aspects of patient care. In particular, emphasis has been placed on providing the best possible care for the least possible cost, the so-called value equation.[27,28] This is particularly relevant because rates of shoulder arthroplasty are increasing by approximately 9.4% per year.[8] In response, payors have shifted from the traditional fee-for-service model of medicine toward one of value-based care. This often takes the form of bundled payment plans, whereby 90-day global costs of care are covered by a single payment, with the increased cost burden associated with any adverse events leading to decreased value of the procedure. This protocol establishes incentives for surgeons to provide high-quality, cost-effective care. During this same time, some payors have begun to transition to a system that either financially rewards or penalizes health care providers on the basis of subjective patient-reported outcomes. Recognizing risk factors that have the potential to increase cost burden and to decrease the value of procedures is especially relevant in the evolution of these payment models.

In an effort to determine the effects of tobacco as a potential risk factor for both decreased patient-reported outcomes and increased cost burden, we evaluated postoperative pain, narcotic use, length of stay, reoperations, and complications in the global 90-day episode of care for patients who had anatomic TSA and who were current tobacco users, former tobacco users, or nonusers.

Materials and methods

A database search identified patients with a diagnosis of glenohumeral arthritis who were treated with primary anatomic TSA; those with hemiarthroplasties, reverse TSAs, and revision TSAs were excluded. Others excluded were patients lost to follow-up and patients with incomplete medical records. All patients had radiographic and clinical indications for TSA, and nonoperative management had failed to relieve their symptoms.

There were no differences in surgical technique among the current tobacco users, nonusers, and former tobacco users. All procedures were done with the patient in the beach chair position under general anesthesia. After a standard deltopectoral approach, a biceps tenodesis and subscapularis tenotomy were done before release of the inferior capsule and dislocation of the humeral head. After final implant insertion, all shoulders exhibited appropriate head height, version, motion, and stability. The subscapularis and rotator intervals were closed with heavy nonabsorbable suture.

Patients who had TSA before February 2014 received an interscalene nerve block for postoperative pain control; after that time, an intraoperative periarticular injection consisting of liposomal bupivacaine, bupivacaine with epinephrine, and ketorolac was used. This standardized injection was placed in the deltoid, pectoralis major, and soft tissues around the incision. These interventions were supplemented with intravenous and oral narcotic medications as needed.

A standardized postoperative rehabilitation protocol consisted of sling immobilization and passive range of motion for the first 6 weeks. During postoperative weeks 6 through 12, patients began using the extremity for gentle activities in front of the body and continued passive range of motion in physical therapy. Isometric strengthening was initiated at 10 weeks, with unrestricted use of the arm allowed at 12 weeks.

Patients were identified as current tobacco users, nonusers, or former users by health history on intake forms and clinical interview. Former tobacco users were defined as patients who reported cessation of tobacco use longer than 3 months before their initial surgical evaluation. Visual analog scale (VAS) scores for pain were recorded at the preoperative visit and at 2-, 6-, and 12-week visits after surgery. Oral morphine equivalents (OMEs) were recorded for in-hospital use, discharge medications, and prescriptions given at 2-, 6-, and 12-week visits. This was complemented by query of a statewide narcotic prescriptions database. Hospital and clinic medical records were reviewed retrospectively to collect data pertaining to patient-specific demographics, complications, reoperations, length of stay, and hospital readmissions.

Statistical analyses for preoperative and postoperative measurements were performed using Student *t*-tests and analysis of variance, with $P < .05$ considered statistically significant.

Results

Of the 163 patients with primary TSAs identified, 28 were current tobacco users, 88 were nonusers, and 47 were former users. An interscalene nerve block was used in 18 current tobacco users, 56 nonusers, and 39 former users. An injected periarticular liposomal bupivacaine mixture was used in 10 current tobacco users, 32 nonusers, and 8 former users. There was no statistical difference in the percentage of patients receiving an interscalene block between the tobacco-use group and the no-use and former-use groups ($P = 1.0$ and $P = .09$, respectively), and there were no differences in VAS or OME use between patients who had interscalene blocks and those who had periarticular injections. There were also no statistically significant differences among the groups regarding sex, operative indication, comorbidities, laterality, or