Neer Award 2016: Outpatient total shoulder arthroplasty in an ambulatory surgery center is a safe alternative to inpatient total shoulder arthroplasty in a hospital: a matched cohort study

Tyler J. Brolin, MD, Ryan P. Mulligan, MD, Frederick M. Azar, MD, Thomas W. Throckmorton, MD*

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

Background: Recent emphasis on safe and efficient delivery of high-quality health care has increased interest in outpatient total joint arthroplasty. The purpose of this study was to evaluate the safety of outpatient total shoulder arthroplasty (TSA) by comparing episode-of-care complications in matched cohorts of patients with anatomic TSA as an outpatient or inpatient procedure.

Methods: Thirty patients with outpatient TSA at a freestanding ambulatory surgery center (ASC) were compared with an age- and comorbidities-matched cohort of 30 patients with traditional inpatient TSA to evaluate 90-day episode-of-care complications, including hospital admissions or readmissions and reoperations. Two-tailed *t*-tests were used to evaluate differences, and differences of $P < .05$ were considered statistically significant.

Results: No significant differences were found between the ASC and hospital cohorts regarding average age, preoperative American Society of Anesthesiologists score, operative indications, or body mass index. No patient required reoperation. There were no hospital admissions from the ASC cohort and no readmissions from the hospital cohort. Minor complications in the ASC cohort were arthrofibrosis in 2 patients and mild asymptomatic anterior subluxation in 1 patient; the only major complication was in an outpatient who fell 11 weeks after surgery and disrupted his subscapularis repair. Three minor complications in the hospital cohort were mild asymptomatic anterior subluxation, blood transfusion, and superficial venous thrombosis. The complication rates (13% vs. 10%) were not significantly different.

Conclusions: Outpatient TSA is a safe alternative to hospital admission in appropriately selected patients. Further investigation is warranted to evaluate the longer term outcomes and cost-effectiveness of outpatient TSA.

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

© 2017 Journal of Shoulder and Elbow Surgery Board of Trustees. All rights reserved.

Keywords: Total shoulder arthroplasty; ambulatory surgery center; hospital; outcomes; cost-effectiveness; safety; complications

Total shoulder arthroplasty (TSA) is a well-recognized treatment for glenohumeral arthritis that can reliably restore function and provide pain relief for patients in whom nonoperative management has failed. Improvements in implant design and instrumentation as well as improved surgical techniques have decreased the overall complication rate of TSA,[9] which has contributed to the increasing demand for TSA, with an average increase of 9.4% per year.[12]

As the American health care policy environment continues to evolve, increasing emphasis has been placed on high-quality health care that can be delivered in a safe and efficient manner, which has increased interest in outpatient total joint arthroplasty. Concerns about the adequacy of pain control and the possibility of perioperative complications have generally kept total joint arthroplasty an inpatient procedure, although the average length of stay after total joint arthroplasty is declining, with no compromise in patient safety or satisfaction.[14,22,23] Successful outpatient total knee arthroplasty (TKA), unicompartmental knee arthroplasty (UKA), and total hip arthroplasty (THA)[3,6,7,11,13,21] have led to increased interest in outpatient TSA.

Previous studies have documented decreased morbidity and mortality of TSA compared with TKA and THA,[15,17] but reported complication rates still range from 2.8% to 12%, depending on study design.[1,2,8,9,16,27] Singh et al reported a 90-day risk for a cardiac event after TSA of 2.6% and for a thromboembolic event, 1.2%.[26] One concern about outpatient total joint arthroplasty is whether this would lead to an increase in complication rate or subsequent need for hospital admission, possibly leading to unfavorable outcomes.[10,22,25] Preliminary studies of outpatient THA and TKA have been promising; however, there is no literature regarding the safety of outpatient TSA done in an ambulatory surgery center (ASC).[6,7,11,13,21]

To determine if outpatient TSA has rates of hospital admissions or readmissions, reoperations, and complications similar to those with inpatient TSA, we compared quality-of-care measures including hospital admissions or readmissions, reoperations, and complications in matched cohorts of patients who had TSA at a freestanding ASC or a traditional inpatient hospital setting.

Materials and methods

Clinic records were queried to isolate all primary unilateral TSAs performed at a single freestanding ASC as identified by *Current Procedural Terminology* code 23472. Only primary anatomic TSAs were included; hemiarthroplasties, reverse TSAs, and revision shoulder arthroplasties were excluded. Thirty consecutive patients had TSAs done by a single surgeon between April 2012 and April 2015. All patients had radiographic and clinical indications for TSA, and nonoperative management had failed to alleviate their symptoms. An age- and comorbidities-matched cohort of 30 patients with primary anatomic TSA by the same surgeon done in the traditional inpatient hospital setting was used for comparison.

Patients for whom outpatient TSA was indicated were offered that option on the basis of several criteria, including the patient's wishes, social situation, and overall health status. For those undergoing outpatient TSA, a preanesthetic evaluation at the ASC was performed under supervision of a staff anesthesiologist and included a thorough review of health history and medications. Patients undergoing inpatient TSA were evaluated in similar fashion at the hospital before surgery. There were no differences in surgical technique between inpatient and outpatient groups; all procedures were done with the patient in the beach chair position under general anesthesia using muscle paralysis. A deltopectoral approach and subscapularis tenotomy were used in all patients. After surgery, patients in the ASC were evaluated in the postanesthesia care unit. Once pain control was adequate and patients could ambulate and urinate without assistance, they were discharged to home. An ASC staff member called the patients the following day to ensure adequate pain control and to answer any questions. Patients with inpatient TSA were transferred from the postanesthesia care unit to the hospital floor once the same criteria were met. On the day after surgery, patients were discharged to home after clearance from an internal medicine consultant. Patients with pain control or mobility problems were discharged after those were corrected, typically the following day.

A multimodal pain management program was used for both groups, including long- and short-acting oral oxycodone, gabapentin, and celecoxib, both immediately before and after surgery. An intraoperative periarticular injection consisting of liposomal bupivacaine, bupivacaine with epinephrine, and ketorolac was placed in the deltoid, pectoralis major, and soft tissues around the incision.

Postoperative rehabilitation was standardized by protocol with sling immobilization and passive range of motion for the first 6 weeks. Between 6 and 12 weeks, patients began use of the operative 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.

Retrospective review of both the hospital and clinic electronic medical records was used to collect all data. Patient-specific demographic data included diagnosis, age, sex, comorbidities, American Society of Anesthesiologists (ASA) score, body mass index (BMI), and operative extremity. Surgical details, such as the need for glenoid bone grafting or rotator cuff repair, were obtained from the operative notes. The 90-day episode-of-care data including complications, reoperations, and hospital admissions or readmissions also were recorded. Complications were defined as any deviation from the standard postoperative course that might jeopardize health or function and were categorized as minor or major, depending on their effect on overall outcome.

Two-tailed *t*-tests were used to evaluate differences between the ASC and inpatient groups. Differences of $P < .05$ were considered statistically significant.

Results

No statistically significant differences were found between the ASC and hospital cohorts regarding age, preoperative ASA score, operative indication, or BMI (Table I).

All patients in the ASC group were discharged to home on the day of surgery without complications. The mean length

Table I   Patient demographics

Characteristic	ASC	Hospital	P value
Age, years	52.6 (33-68)	54.2 (28-63)	.39
Sex	23 M, 7 F	14 M, 16 F	.03
BMI	31.6 (20.6-55.7)	31.5 (22.7-44.3)	.96
ASA score	2.1	2.3	.33
Extremity	13 R, 17 L	18 R, 12 L	.30
Operative indication			
Osteoarthritis	24	27	.47
Inflammatory arthritis	2	2	1.00
Post-traumatic arthritis	2	0	.49
Osteonecrosis	1	1	1.00
Postcapsulorrhaphy arthritis	1	0	1.00

ASC, ambulatory surgery center; *ASA*, American Society of Anesthesiologists; *BMI*, body mass index.

of stay for the hospital cohort was 1.1 days, with 27 of 30 patients discharged on postoperative day 1. Three additional patients met discharge criteria on postoperative day 2. The reasons for the additional hospital day were pain control in 2 patients and dizziness with subsequent difficulty in mobilization in the other patient. No patient from either group required reoperation. There were no hospital admissions from the ASC cohort and no readmissions from the hospital cohort.

The rates of complications were not significantly different between groups (13% vs. 10%; $P = 1.0$). Minor complications occurred in 3 (10%) of the ASC cohort: arthrofibrosis in 2 patients, both of whom were still undergoing physical therapy at 3 months postoperatively, and mild asymptomatic anterior subluxation seen on follow-up radiographs in 1 patient. One patient (3%) in the ASC cohort had a fall at 11 weeks after surgery that resulted in a traumatic disruption of his subscapularis repair, which was considered a major complication. He has declined any surgical intervention at this point. Three (10%) minor complications also occurred in the hospital cohort; 1 patient required a blood transfusion for acute blood loss anemia, 1 patient developed a superficial venous thrombosis, and mild asymptomatic anterior subluxation was seen on postoperative radiographs in another. There were no cardiopulmonary complications in either group (Table II).

Discussion

As the number of total joint arthroplasties continues to rise in the United States, surgeons and health care policy makers seek ways to provide efficient care without compromising patient safety. One such method of efficiency and cost-savings is transitioning traditionally inpatient procedures, such as total joint arthroplasty, to outpatient procedures. Studies of lower extremity arthroplasty have demonstrated the safety and efficacy of outpatient UKA, TKA, and THA.[6,7,11,13,21] An examination of 105 consecutive unselected patients with outpatient UKA showed that all were able to be discharged home the same day as surgery with only 1 readmission for a deep

Table II   The 90-day episode-of-care complications

	ASC	Hospital	P value
Total complications	4 (13.3%)	3 (10.0%)	1.00
Infection	0	0	1.00
Anterior subluxation	1 (3.3%)	1 (3.3%)	1.00
Subscapularis failure	1 (3.3%)	0	1.00
Arthrofibrosis	2 (6.7%)	0	.49
Superficial venous thrombosis	0	1 (3.3%)	1.00
Blood transfusion	0	1 (3.3%)	1.00
Readmission within 90 days	0	0	1.00
Reoperation within 90 days	0	0	1.00

ASC, ambulatory surgery center.

infection.[11] A matched cohort of 64 patients with either outpatient or inpatient TKA had no perioperative complications in either group, no hospital admissions in the outpatient group, and no difference in functional outcomes scores.[21] Another prospectively observed group of 111 patients with TKA found that 94% of patients were able to be discharged on the day of surgery; there were 8 readmissions and 2 emergency department visits within 3 months after surgery. Importantly, there were no deaths or cardiopulmonary complications in this group of unselected patients.[6] A review of reports of outpatient THA demonstrates similar findings. One study prospectively observed 150 patients who had outpatient THA and found that all patients were able to be discharged on the day of surgery, with 1 readmission and 9 emergency department visits within the 3-month follow-up period.[7] Another showed no hospital readmissions and a high degree of satisfaction at 6-month follow-up of 53 patients with outpatient THA.[13]

Although the morbidity and mortality after TSA appear to be lower than after THA and TKA, there has been no literature to support outpatient TSA.[4,15,17] An analysis of 15,414 THAs, 34,471 TKAs, and 994 TSAs done between 2000 and 2009 showed significantly lower mortality and complication rates for TSA than for TKA and THA.[15] This was

corroborated by an analysis of the Veterans Administration National Surgical Quality Improvement Program database from 1999 to 2006, which showed decreased mortality, lower complication rate, shorter hospitalization, and fewer readmissions after TSA than after THA and TKA.[17] Although there have been 2 small studies presenting outpatient TSA as a viable option in regard to pain control, this is the first study to directly evaluate episode-of-care measures including complications, reoperations, and admissions or readmissions of TSA done in a freestanding ASC compared with those done in a hospital setting.[18,20] The results of this matched cohort study indicate that outpatient TSA is a safe and viable option for appropriately selected patients.

The short-term complication rates after TSA vary in the literature from 2.8% to 9.4%, depending on the definition of a complication and the length of follow-up.[8,15-17,27] We chose the 90-day postoperative period as our time point to assess complications, reoperations, and hospital admissions or readmissions because this encompasses the global surgical period, and we believed this was reasonable to reflect the postoperative course. Complications were liberally defined as any event that had the potential to jeopardize the patient's health or function. Still, our complication rates of 13% for the ASC group and 10% for the hospital group are comparable to previously reported rates and were not significantly different between groups. Furthermore, the only medical complication was 1 episode of superficial venous thrombosis, which is of questionable clinical significance and occurred in the hospital cohort. There were 2 patients with postoperative stiffness at their 3-month postoperative visit who were enrolled in further physical therapy. Anterior subluxation was noted on outpatient radiographic follow-up in 2 patients, both of whom were clinically asymptomatic. The one major complication was a traumatic subscapularis disruption after a fall in the ASC group. The patient has declined further surgical intervention.

One of the limits to outpatient total joint arthroplasty has been concern about cardiopulmonary events. Although the risk of a cardiac or thromboembolic complication after TSA is small, it can be devastating in an unmonitored environment.[26] Fortunately, research has identified certain risk factors associated with these events, including increased age, increasing comorbidity index, and previous cardiac events.[10,16,26] Eligibility for TSA in the ASC cohort was determined after both the surgeon and a staff anesthesiologist reviewed each patient's health status, medical history, and medications. We believe this step is of critical importance to selection of patients and is reflected in our data, as there were no cardiopulmonary complications in either group.

The mean lengths of stay after total joint arthroplasty are declining and the reasons are multifactorial. In particular, improvements in blood management and pain control have been instrumental in this process.[2,5,19,24] Currently, the average hospital stay for TSA is 2.2 days[14]; however, in this study of 2 relatively healthy patient cohorts, the average stay was 1.1 days in the hospital group, and all outpatients were discharged to home the same day as surgery without subsequent medical complications. This indicates that a carefully selected subset of patients traditionally offered hospital admission for TSA can be safely treated with an outpatient procedure.

The average age of patients undergoing TSA ranges from 64 to 69 years in the recent literature.[8,14-17,27] In contrast, our patients were younger, with an average age of 52.6 years in the ASC cohort. This is important to recognize, although somewhat intuitive, as younger patients are likely more healthy with greater physiologic reserve and are more able to tolerate an outpatient total joint replacement. To control for the selection of younger patients for outpatient TSA, we selected an age- and comorbidities-matched cohort with inpatient TSA, with no statistically significant differences in age, comorbidities, BMI, or ASA scores. We do not, however, interpret our results to mean that outpatient TSA is applicable to all patients, but we do believe it is a safe and viable option for appropriately selected patients.

Among the limitations of this study are its retrospective nature and lack of random assignment of patients to the inpatient or outpatient cohort. Although there were no differences in age, ASA score, or BMI, other patient factors likely contributed to the choice of outpatient or inpatient TSA. Because our investigation was primarily of the safety of outpatient TSA, no functional outcomes or cost comparison data were included, both of which are topics for future study. Finally, these were relatively small cohorts involving 1 surgeon's experience. Whereas this factor makes it difficult to generalize the data, it is an advantage in that the cohorts had minimal variation in surgical technique or postoperative care.

Conclusions

This is the first study to examine the episode-of-care complication, reoperation, and admission or readmission rates for patients with outpatient TSA at a freestanding ASC. Results demonstrate that TSA in the outpatient ASC setting is a safe and viable alternative to routine hospital admission in appropriately selected patients.

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

1. Aldinger PR, Raiss P, Rickert M, Loew M. Complications in shoulder arthroplasty: an analysis of 485 cases. Int Orthop 2010;34:517-24. http://dx.doi.org/10.1007/s00264-009-0780-7

2. Anthony CA, Westermann RW, Gao Y, Pugely AJ, Wolf BR, Hettrich CM. What are risk factors for 30-day morbidity and transfusion in total shoulder arthroplasty? A review of 1922 cases. Clin Orthop Relat Res 2015;473:2099-105. http://dx.doi.org/10.1007/s11999-014-4107-7

3. Aynardi M, Post Z, Ong A, Orozco F, Sukin DC. Outpatient surgery as a means of cost reduction in total hip arthroplasty: a case-control study. HSS J 2014;10:252-5. http://dx.doi.org/10.1007/s11420-014-9401-0

4. Belmont PJ Jr, Goodman GP, Waterman BR, Bader JO, Schoenfeld AJ. Thirty-day postoperative complications and mortality following total knee arthroplasty: incidence and risk factors among a national sample of 15,321 patients. J Bone Joint Surg Am 2014;96:20-6. http://dx.doi.org/10.2106/JBJS.M.00018

5. Berend ME, Berend KR, Lombardi AV Jr. Advances in pain management: game changers in knee arthroplasty. Bone Joint J 2014;96B(Suppl A):7-9. http://dx.doi.org/10.1302/0301-620X.96B11.34514

6. Berger RA, Kusuma SK, Sanders SA, Thill ES, Sporer SM. The feasibility and perioperative complications of outpatient knee arthroplasty. Clin Orthop Relat Res 2009;467:1443-9. http://dx.doi.org10.1007/s11999-009-0736-7

7. Berger RA, Sanders SA, Thill ES, Sporer SM, Della Valle C. Newer anesthesia and rehabilitation protocols enable outpatient hip replacement in selected patients. Clin Orthop Relat Res 2009;467:1424-30. http://dx.doi.org/10.1007/s11999-009-0741-x

8. Chalmers PN, Gupta AK, Rahman Z, Bruce B, Romeo AA, Nicholson GP. Predictors of early complications of total shoulder arthroplasty. J Arthroplasty 2014;29:856-60. http://dx.doi.org/10.1016/j.arth.2013.07.002

9. Chin PYK, Sperling JW, Cofield RH, Schleck C. Complications of total shoulder arthroplasty: are they fewer or different? J Shoulder Elbow Surg 2006;15:19-22. http://dx.doi.org/10.1016/j.jse.2005.05.005

10. Courtney PM, Rozell JC, Melnic CM, Lee GC. Who should not undergo short stay hip and knee arthroplasty? Risk factors associated with major medical complications following primary total joint arthroplasty. J Arthroplasty 2015;30(Suppl):1-4. http://dx.doi.org10.1016/j.arth.2015.01.056

11. Cross MB, Berger R. Feasibility and safety of performing outpatient unicompartmental knee arthroplasty. Int Orthop 2014;38:443-7. http://dx.doi.org/10.1007/s00264-013-2214-9

12. Day JS, Lau E, Ong KL, Williams GR, Ramsey ML, Kurtz SM. Prevalence and projections of total shoulder and elbow arthroplasty in the United States to 2015. J Shoulder Elbow Surg 2010;19:1115-20. http://dx.doi.org/10.1016/j.jse.2010.02.009

13. Dorr LD, Thomas DJ, Zhu J, Dastane M, Chao L, Long WT. Outpatient total hip arthroplasty. J Arthroplasty 2010;25:501-6. http://dx.doi.org/10.1016/j.arth.2009.06.005

14. Dunn JC, Lanzi J, Kusnezov N, Bader J, Waterman BR, Belmont PJ Jr. Predictors of length of stay after elective total shoulder arthroplasty in the United States. J Shoulder Elbow Surg 2015;24:754-9. http://dx.doi.org/10.1016/j.jse.2014.11.042

15. Farmer KW, Hammond JW, Queale WS, Keyurapan E, McFarland EG. Shoulder arthroplasty versus hip and knee arthroplasties: a comparison of outcomes. Clin Orthop Relat Res 2006;455:183-9.

16. Farng E, Zingmond D, Krenek L, SooHoo NF. Factors predicting complication rates after primary shoulder arthroplasty. J Shoulder Elbow Surg 2011;20:557-63. http://dx.doi.org/10.1016/j.jse.2010.11.005

17. Fehringer EV, Mikuls TR, Michaud KD, Henderson WG, O'Dell JR. Shoulder arthroplasties have fewer complications than hip or knee arthroplasties in US veterans. Clin Orthop Relat Res 2010;468:717-22. http://dx.doi.org/10.1007/s11999-009-0996-2

18. Gallay SH, Lobo JAA, Baker J, Smith K, Patel K. Development of a regional model of care for ambulatory total shoulder arthroplasty. Clin Orthop Relat Res 2008;466:563-72. http://dx.doi.org/10.1007/s11999-007-0083-5

19. Gruson KI, Accousti KJ, Parsons BO, Pillai G, Flatow EL. Transfusion after shoulder arthroplasty: an analysis of rates and risk factors. J Shoulder Elbow Surg 2009;18:225-30. http://dx.doi.org/10.1016/j.jse.2008.08.005

20. Ilfeld BM, Wright TW, Enneking FK, Mace JA, Shuster JJ, Spadoni EH, et al. Total shoulder arthroplasty as an outpatient procedure using ambulatory perineural local anesthetic infusion: a pilot feasibility study. Anesth Analg 2005;101:1319-22. http://dx.doi.org/10.1213/01.ANE.0000180199.52383.CE

21. Kolisek FR, McGrath MS, Jessup NM, Monesmith EA, Mont MA. Comparison of outpatient versus inpatient total knee arthroplasty. Clin Orthop Relat Res 2009;467:1438-42. http://dx.doi.org/10.1007/s11999-009-0730-0

22. Lovald S, Ong K, Lau E, Joshi G, Kurtz S, Malkani A. Patient selection in outpatient and short-stay total knee arthroplasty. J Surg Orthop Adv 2014;23:2-8.

23. Lovald ST, Ong KL, Malkani AL, Lau EC, Schmier JK, Kurtz SM, et al. Complications, mortality, and costs for outpatient and short-stay total knee arthroplasty patients in comparison to standard-stay patients. J Arthroplasty 2014;29:510-5. http://dx.doi.org/10.1016/j.arth.2013.07.020

24. Ryan DJ, Yoshihara H, Yoneoka D, Zuckerman JD. Blood transfusion in primary total shoulder arthroplasty: incidence, trends, and risk factors in the United States from 2000 to 2009. J Shoulder Elbow Surg 2015;24:760-5. http://dx.doi.org/10.1016/j.jse.2014.12.016

25. Schairer WW, Vail TP, Bozic KJ. What are the rates and causes of hospital readmission after total knee arthroplasty? Clin Orthop Relat Res 2014;472:181-7. http://dx.doi.org/10.1007/s11999-013-3030-7

26. Singh JA, Sperling JW, Cofield RH. Cardiopulmonary complications after primary shoulder arthroplasty: a cohort study. Semin Arthritis Rheum 2014;41:689-97. http://dx.doi.org/10.1016/j.semarthrit.2011.09.003

27. Waterman BR, Dunn JC, Bader J, Urrea L, Schoenfeld AJ, Belmont PJ Jr. Thirty-day morbidity and mortality after elective total shoulder arthroplasty: patient-based and surgical risk factors. J Shoulder Elbow Surg 2015;24:24-30. http://dx.doi.org/10.1016/j.jse.2014.05.016