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Comparative Analysis of Short-Term Postoperative Complications in Outpatient Versus Inpatient Total Ankle Arthroplasty: A Database Study

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ABSTRACT

Ankle arthritis is a potentially debilitating disease, with approximately 50,000 cases diagnosed annually. One treatment option for these patients is total ankle arthroplasty (TAA). This procedure has historically been performed in the inpatient setting with a 1–2-night postoperative hospital stay. Outpatient surgeries are gaining popularity due to their cost effectiveness, decreased length of hospital stay, and convenience. Therefore it is important to evaluate the safety of specific procedures in the outpatient setting compared with the inpatient setting. This study evaluated the complication rates in inpatient versus outpatient TAA. It analyzed data from the National Surgical Quality Improvement Program for 591 patients who received TAA. Postoperative complication rates were compared between 66 outpatients and 535 inpatients. Frequencies of the following complications were analyzed: wound complications, pneumonia, hematologic complications (pulmonary embolism and deep vein thrombosis), renal failure, stroke, and return to the operating room within 30 days. Unadjusted direct comparisons of the cohorts revealed higher complication rates in the inpatient cohort. Inpatients had higher rates of superficial surgical site infections, deep surgical site infections, number of organ/space surgical site infections, pneumonia occurrences, and return to the operating room, but these differences were not significant. These results showed no significant increase in complication rates in outpatients compared to inpatients. Our results suggest that inpatient and outpatient TAA show similar complication rates. This suggests that outpatient TAA is safe and may be a superior option for certain populations. Further investigation is warranted to verify these conclusions.

Ankle arthritis is a potentially debilitating disease, with approximately 50,000 cases diagnosed each year (1). Patients typically undergo conservative treatment measures such as bracing, analgesic medications, and steroid injections before surgery is considered (2). However, patients who do not respond to these treatments may opt for surgery in an attempt to improve their quality of life. The 2 operations typically offered are total ankle arthroplasty (TAA) and ankle arthrodesis. Historically, TAA has been associated with poorer outcomes, and patients more commonly undergo ankle arthrodesis (1–4). However, ankle arthrodesis is usually associated with limitations in physical mobility and can lead to development of arthritis in surrounding joints (5). Conversely, recent advancements in implant technology and a better understanding of ankle physiology have made TAA a viable option for patients with end-stage ankle arthritis (3,6). Patients undergoing ankle reconstruction, TAA, or ankle arthrodesis are often admitted for several days postoperatively for wound care, pain control, and physical therapy for rehabilitation (7). With advances in operative techniques and an increased emphasis on minimizing the costs of healthcare, outpatient same-day surgery for TAA is an emerging alternative. Reductions in cost are possible by performing TAA in an outpatient setting, and convenience can lead to increased levels of patient satisfaction (7,8).

Several studies have been conducted evaluating complication rates in the inpatient versus outpatient setting for other orthopedic surgeries, such as knee, shoulder, and hip arthroplasties, and lumbar discectomies (5,9–11). These studies discussed the safety, satisfaction, and results of outpatients who underwent these types of operations. Based on these studies, outpatient care can be appropriately considered due to the lack of difference in complication rates. However, no large study has

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compared the incidence of complications between inpatient and outpatient TAA. The purpose of this study was to evaluate differences in operative outcomes of TAA performed in an outpatient versus an inpatient setting using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database. We hypothesized that patients who underwent TAA in an outpatient setting would have lower rates of complications than those who underwent TAA in an inpatient setting.

Patients and Methods

Our team comprised members recruited by the 2 senior authors (A.S. and S.N.). We conducted a data analysis using the ACS NSQIP database (A.S., S.N., G.M., C.T., H.D., and D.D.) and compared outcomes between the 2 cohorts (A.S., S.N., G.M., C.T., H.D., D.D., and W.S.). The manuscript was then written and edited (A.S., S.N., C.T., H.D., and D.D.).

The NSQIP produces an annual report for each calendar year, from January to December; we obtained the records from 2006 to 2015. Our aim was to compare complication rates between the inpatient and outpatient cohorts in the database. This database measures operative outcomes up to 30 days postoperatively and contains de-identified patient data, thereby exempting this study from institutional review board review (12). The NSQIP database is unique in that trained clinical reviewers prospectively collect preoperative, intraoperative, and postoperative patient data for inclusion in the database through a standardized methodology. The database includes information from over 400 hospitals across the United States. Our patient cohort was identified using the current procedural terminology code for TAA (i.e., 27,702).

Demographic information included age, sex, weight, height, and race. Operative variables and comorbidities included preoperative hematocrit, length of operation, previous diabetes mellitus diagnosis, smoking status, and chronic steroid use. The complications of interest included wound complications (superficial wound infection, deep wound infection, wound dehiscence, deep organ space infection), pneumonia, hematologic complications (pulmonary embolism and deep vein thrombosis), renal failure, stroke, and return to the operating room within 30 days. Renal failure was defined as a patient who did not require dialysis before surgery but whose renal dysfunction worsened afterward, thus requiring the patient to undergo hemodialysis, peritoneal dialysis, hemofiltration, hemodiafiltration, or ultrafiltration.

The inpatient and outpatient groups were compared using chi-square tests for categorical variables and Wilcoxon rank-sum tests for continuous variables. The p values $< .05$ were considered statistically significant.

Results

A total of 591 patients were identified as having undergone inpatient or outpatient TAA. Sixty-six (11.17%) patients were treated as outpatients, and 525 (88.83%) were hospitalized as inpatients for at least 24 hours. The mean age of outpatients was 58.9 ± 11.1 years compared with 65.4 ± 10.2 years for inpatients (Table 1). Inpatient TAA had a significantly higher mean operation time (161 min vs 148 min, $p = .049$) and a significant difference in length of total hospital stay (2.3 days vs. 1.1 days, $p < .001$). Sixty-five (12.38%) patients who underwent inpatient TAA had a previous diagnosis of diabetes, whereas only 6 (9.09%) outpatients had been previously diagnosed ($p = .005$). No other demographics or comorbidities were found to have significant differences between inpatient and outpatient groups.

Of the 525 patients who underwent inpatient TAA, 3 (0.57%) had superficial incisional surgical site infection (SSI), 1 (0.19%) had deep SSI, 1 (0.19%) had organ/space SSI, 2 (0.38%) had pneumonia, and 4 (0.76%) returned to the operating room. No incidences of these complications occurred in patients who underwent outpatient TAA (Table 2). None of the differences found in complication rates between inpatient and outpatient groups was statistically significant. No occurrences were reported of acute renal failure, wound disruption, pulmonary embolism, stroke, or deep vein thrombosis/thrombophlebitis for inpatients or outpatients.

Discussion

When comparing inpatient versus outpatient surgery, outpatient surgery obviously reduces cost and length of hospital stay and increases patient satisfaction (8). Because of this, same-day outpatient operations are gaining popularity. With this shift in preference, it is important to evaluate what operations are safe to perform in the outpatient setting. Although the results of the current study do suggest increased complication rates in the inpatient setting, the differences were not statistically significant.

The safety of other outpatient joint operations has been extensively studied, and it has been determined that outpatient total knee, hip, and shoulder arthroplasties can be performed safely in the outpatient setting (5,9–11,13). To our knowledge, our study is the first of its size to compare the complication rates of TAA in the inpatient and outpatient setting. Mulligan and Parekh (13) found that outpatient TAA was a safe and viable operation. Their study reviewed 81 patients who underwent TAA by a single fellowship-trained foot and ankle orthopedic surgeon and compared complication rates with patient length of stay, same-day discharge (outpatient), single-night stay (overnight), and 2-or-more-night stay (inpatient). The complications in review were 90-day global period medical and operative complications, reoperations, readmissions, emergency room visits, and pain control. Of the 81 patients, 13 (16.05%) were discharged on the same day as surgery, 52 (64.20%) were admitted overnight, and 16 (19.75%) were admitted for 2 or more nights. Of the 16 patients admitted for 2 or more nights, 5 (31.25%) had a complication within 90 days of the surgery. All of these complications were superficial wound breakdowns with delayed healing. This complication rate was higher when compared to the patients who were discharged the same day and with those who were admitted overnight. One (7.69%) patient of the 13 outpatients had a complication within 90 days, and 2 (3.84%) of the 52 overnight patients reported a complication (13).

Gonzalez et al (7) compared the cost and complication rates of inpatient and outpatient TAA and attempted to identify a patient population that would benefit from outpatient TAA. An analysis was performed on data from 36 patients who underwent TAA between 2010 and 2015.

Table 1
General patient information, demographics, and comorbidities (N = 591)

	Inpatient	Outpatient	p Value
Avg. age (year)	65.4 ± 10.2	58.88 ± 11.1	<.001
Avg. operative time (min)	161.6 ± 54.1	148.68 ± 54.3	.05
Avg. preoperative hematocrit (%)	41.4 ± 4.0	41.2 ± 4.2	.77
Avg. height (cm)	169.37 ± 10.16	169.39 ± 10.41	.86
Avg. weight (kg)	87.77 ± 17.19	86.6 ± 18.1	.79
Avg. length of hospital stay (d)	2.3 ± 1.4	1.1 ± 1.1	< .001
Sex (n)			.24
Men	267 (50.86%)	28 (42.42%)	
Women	258 (49.14%)	38 (57.58%)	
Race (n)			.72
White	434 (83.14%)	59 (90.77%)	
Black	12 (2.30%)	2 (3.08%)	
Other	66 (14.56%)	4 (6.15%)	
Comorbidities (n)			
Diabetes	65 (12.38%)	6 (9.09%)	.005
Smoker	38 (7.24%)	6 (9.09%)	.62
Steroid use	25 (4.76%)	4 (6.06%)	.55

Avg., average.

Table 2
Frequency of complications for patients who underwent total ankle arthroplasty (N = 591)

Complications	Inpatient (n)	Outpatient (n)	p Value
Superficial incisional surgical site infection	3 (0.57%)	0	.70
Deep incisional surgical site infection	1 (0.19%)	0	.89
Organ/space surgical site infection	1 (0.19%)	0	.89
Pneumonia	2 (0.38%)	0	.79
Return to the operating room	4 (0.76%)	0	.62

This study recorded a 13.4% cost reduction when TAA was performed as an outpatient procedure; this is equivalent to a reduction in cost of $2500 per case. The average length of stay for a group of 15 inpatients was 2.5 days (range 1 to 7 days). One (4.76%) patient returned to the emergency department from the outpatient group, and no 30-day readmissions were reported from either group. One (6.67%) deep wound infection was reported in the inpatient group due to wound dehiscence, and no other wound complications were reported. Patient satisfaction was also assessed, and 71% of outpatients and 93% of inpatients said that they were happy with their decision to undergo surgery in their respective setting (7).

A recent study by Borenstein et al (14) reviewed 65 patients who underwent outpatient TAA to identify and analyze complication rates. The primary outcomes of this study included emergency department visits, readmissions, wound breakdown, infection, revision, and nonrevision surgery. No emergency department visits or readmissions were reported, and the overall complication rate was 15.4%. These complications included 1 (1.5%) minor wound dehiscence, 1 (1.5%) wound infection, 2 (3%) revision surgeries, and 8 (12%) nonrevision surgeries. This study demonstrated the safety of outpatient TAA in appropriately selected patients (14).

In our study, 2 independent risk factors for postoperative complications in TAA showed significance between inpatients and outpatients: operative time and patient age. Post-traumatic arthritis is more common in the ankle than in the hip and knee. Because of this, ankle arthritis often affects relatively younger patients (15). Saltzman et al (15) performed an epidemiologic study on ankle arthritis. They evaluated 639 patients with ankle arthritis and divided them into subtypes. Four hundred forty-five (69.64%) of these patients had post-traumatic ankle arthritis, with a mean age of 51.5 ± 14.4 years. The overall mean age of these patients was 52.3 years. This is young relative to other types of lower extremity arthritis and is notable because it shows that younger patients may need TAA compared to other types of joint replacement (16). Our data showed significantly shorter operative time and age of outpatients compared to inpatients. This is worth noting because literature has shown that invasive procedures with long operative times and patients older than 65 years cause a substantial increase in risk for postoperative complications in outpatient procedures (17–19). With the patient population being younger in TAA, this may show an increased benefit for performing TAA in the outpatient setting.

Patients treated as outpatients in our study were significantly less likely to be diabetic. Although based on our data it is impossible to determine if diabetes contributed to inpatient complication, it is worth noting that a diabetes diagnosis predisposes a risk of complication, especially for patients with uncontrolled diabetes (20,21).

The strength of our study is that it is the first to analyze short-term postoperative complications of TAA for inpatients versus outpatients using data gathered from a national database (NSQIP). Since the NSQIP's inception, it has been widely used by hospitals and physicians alike to identify perioperative risk factors and develop safe operative practices, to further decrease frequency of complications and adverse events (22–27).

Certain limitations of our study must also be acknowledged. Although the NSQIP data are held to a high standard, the accuracy of the records could not be ensured. Furthermore, the sample size was limited because only a small number of patients undergo TAA procedures each year, specifically in the outpatient setting. It is also possible that the outpatients in this database were healthier than the inpatients; this was supported by the increased age and prevalence of diabetes in the inpatient cohort. However, given the lack of complications in the outpatient cohort, it was not possible to statistically adjust for these differences. Additionally, any complications that may have occurred after the surgery were limited to 30 postoperative days. Complications such as deep vein thrombosis, pulmonary embolism, or stoke could have occurred after this timeframe. Also, inpatients are generally subject to higher clinical scrutiny and more diagnostic testing, which could cause the complication rates to be higher. Although we appreciate the limitations of our investigation, we think that our results could be useful in the future development of prospective cohort studies and randomized controlled trials that compare operative outcomes of inpatient and outpatient TAA.

In our analysis of the NSQIP data, we found no significant increase in complications for TAA performed in the outpatient setting compared to the inpatient setting. We found the following incidental differences: inpatients were significantly more likely to be older in age, diagnosed with diabetes, and have an increased operative time. Our results suggest that inpatients were more likely, but not significantly more likely, to have a higher occurrence of complications and return to the operating room. Further investigation is warranted to verify these conclusions, and our results could be used in future studies on this subject.

Disclosures

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) and the hospitals participating in the ACS NSQIP are the source of the data used herein. They have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

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