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Safety and Effectiveness of Outpatient Total Ankle Arthroplasty

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Abstract

Background: Total ankle arthroplasty (TAA) is a surgical procedure commonly reserved for patients suffering from symptomatic end-stage ankle arthritis. As the number of TAAs increases, so does the associated economic burden. Given these economic constraints, there has been interest in the feasibility of outpatient TAA. The purpose of this study is to evaluate the safety, efficacy, and satisfaction of patients undergoing outpatient TAA.

Methods: This is a retrospective case series of consecutive patients who underwent outpatient TAA from July 2018 to June 2019. Inclusion criteria included any patient undergoing a primary TAA in the outpatient setting. This was defined as discharge on the same day of surgery or within 12 hours of surgery. All surgeries were completed by a single experienced surgeon through an anterior approach using the Cadence Total Ankle System. Prior to surgery, all patients received a popliteal nerve block. Patients were then discharged home with oral analgesic and a popliteal nerve catheter, which they removed after 48 hours. The primary outcome of interest was postoperative pain control, which was measured using a numeric scale. Secondary outcomes included complication rate, readmission rate, and patient satisfaction. A review of the current literature was then completed to supplement our results.

Results: In total, 41 patients were included in our analysis. In terms of the primary outcome, the average numeric scale score was 1.98, indicating excellent pain control. Additionally, nearly all 41 patients stated they were very satisfied with their postoperative pain control regimen. In terms of secondary outcomes, the majority of patients stated they were satisfied with discharge on the same day as surgery. There were no readmissions or major complications in our outpatient TAA cohort. When asked if they would recommend the care they experienced to a friend with the same condition, 95% of patients said that they would recommend this care pathway. Our literature review included 5 original studies, which were all retrospective level IV studies. These studies uniformly demonstrated the safety and efficacy of outpatient TAA.

Conclusions: The results of our study demonstrate the outpatient TAA is associated with excellent pain control using a multidisciplinary pain approach. The use of standardized outpatient postoperative pathways was effective in preventing readmissions and complications, while still resulting in high patient satisfaction scores. A review of the literature complemented our results, as there are largely no significant differences between outpatient and inpatient TAA.

Level of Evidence: Level IV, case series.

Keywords: ankle arthritis, total ankle arthroplasty, outpatient TAA, pain control, case series orthopaedic surgery, total ankle replacement

Introduction

In recent years, there has been an international drive for the development of care pathways to improve patient outcomes using a comprehensive multimodal, evidence-based approach.[17] This has resulted in the formation of the Enhanced Recovery After Surgery (ERAS) initiative in Europe, as well as similar programs across the world, including Early Recovery Canada (ERC).[17] These programs have been successful in reducing complications and readmissions in a number of common orthopedic procedures, most notably hip and knee arthroplasty.[1,9,10,15] In addition to

improved patient outcomes, these practices have also demonstrated efficacy in reducing patient length of stay, thus reducing unnecessary inpatient admission costs. Nonetheless, implementation of these pathways varies widely between regions, subspecialties, and surgeons.[17]

Total ankle arthroplasty has generally been considered an inpatient procedure given its complexity and need for postoperative analgesia.[4] Third- and fourth-generation designs have improved implant longevity, gait kinematics, and patient outcomes.[5] From 2000 to 2010, the use of TAA increased almost 10-fold, and that rate of growth has accelerated further over the last decade.[8,12] As this procedure becomes more common with technological advances, the economic burden of TAA will continue to increase proportionally. The hip and knee arthroplasty literature has consistently demonstrated that appropriate patient selection for outpatient surgery can reduce costs and improve early outcomes.[18] Despite the increase in the use of TAA globally, there is limited evidence on the safety of TAA in an outpatient setting.

Improvements in surgical technique, the creation of standardized perioperative care pathways, and the use of multimodal pain regimens have made outpatient procedures a viable option for appropriate patients undergoing TAA. However, the outcomes after outpatient TAA are yet to be fully elucidated. As such, the purpose of this study is to evaluate patient outcomes, complications, and satisfaction after outpatient TAA.[11] We hypothesize that outpatient TAA will be safe and effective, resulting in greater patient satisfaction.

Methods

Following institutional review board approval, a retrospective case series design study was completed on 81 consecutive patients who underwent TAA from July 2018 to June 2019. Forty-one patients were included the study. Inclusion criteria included patients undergoing a primary TAA in the outpatient setting, which was defined as discharge on the same day of surgery or within 12 hours of surgery. All surgeries were completed by a single surgeon at a single center with greater than 10 years of experience with TAA. All surgeries were performed in a standardized fashion using the Integra Cadence Total Ankle System using an anterior or anteromedial approach. Ancillary procedures (tendon transfers, soft tissue releases, and osteotomies) were completed at the discretion of the treating surgeon based on optimal balancing of the foot deformity. This was determined intraoperatively.

The outpatient protocol was developed by the senior author over a 10-year period with the help of a multidisciplinary team. Key elements of this protocol included early holistic patient education and discussion of realistic expectations. These were undertaken preoperatively by the senior surgeon at both the initial and presurgical consultations. An opioid-sparing multimodal analgesic regimen was individualized to each patient after discussion with the anesthetist. Application of a below-knee metal stirrup cast with instructions to partially weightbear allowed for early mobilization in the postoperative period. All patients received a popliteal nerve block and were sent home with an indwelling peripheral nerve catheter for continued pain relief. The Baxter LV10 Elastometric Infuser with 0.2% ropivicaine was inserted by our dedicated team of anesthetists for each patient as previously described. It was our hospital's protocol for the patient to remove the catheter themselves after 48 hours. Patients were also discharged home with a prescription for regularly scheduled nonsteroidal anti-inflammatory drugs and low-dose narcotics. The latter was prescribed "as required," to be commenced just prior to nerve catheter removal. Appropriateness for discharge was determined jointly by the multidisciplinary team consisting of the treating surgeon, anesthetist, and physiotherapist. Checkpoints included satisfactory postoperative radiographs, adequate pain control, and the ability for the patient to mobilize safely in her or his stirrup cast using crutches.

Stirrup casts were changed to a weightbearing aircast at 2 weeks if an isolated TAA was completed. They were transitioned to an aircast at 5-6 weeks if any ancillary tendon transfers or bony procedures were performed, and their prescribed oral analgesics were extended to cover this period.

The primary outcome was postoperative pain control. This was measured using the visual analog scale (VAS) and was conducted in the outpatient clinic by a clinical researcher not related to the surgical team. Secondary outcomes of interest included the 30-day readmission rate, major complications within 30 days, and patient satisfaction. The latter was determined using a validated questionnaire administered by a research assistant (Appendix A). Significant complications included myocardial infarction,

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deep venous thrombosis, pulmonary embolus, cerebrovascular accident, surgical site infection, and death. Patients were reassessed at 2 weeks for a wound check and reapplication of stirrup cast or aircast, and then at 4 weeks for clinical reassessment using the satisfaction questionnaire. The following data for each patient were then collected through a thorough chart review: demographics, comorbidities, and perioperative complications, including wound breakdown, infection, revision, and nonrevision surgeries. All patient chart data were collected prospectively by a research assistant and compiled in a local database.

A literature search was then completed by a single reviewer and is up-to-date as of February 17, 2020. The databases MEDLINE and EMBASE were searched using engine-specific strategies to maximize sensitivity (Appendix B). All search results were then compiled in a reference manager program. After screening for duplicates using Endnote library (ENDNOTE X3, Thomson Reuters, USA), studies were then filtered based on title and abstract for eligibility. Studies that were considered eligible then underwent full-text review. Only primary articles, which met all of the inclusion and exclusion criteria, were included in the final literature review. Two reviewers then independently selected the studies included in this article from the compiled literature search (S.K., S.M.). A third independent reviewer decided any disagreement. Eligibility included any studies that assessed TAA in the outpatient setting with both patient-reported outcomes and data pertaining to the safety/complication profile. Exclusion criteria included case reports, reviews, commentary pieces, rebuttals, and studies/abstracts not available in English. We assessed the quality of the evidence of the included studies with the Grading of Recommendations, Assessment, Development, and Evaluations pro-Guideline Development Tool online application using Grading of Recommendations, Assessment, Development, and Evaluations criteria. This is an explicit framework for developing and presenting summaries of evidence. A predeveloped data extraction form was then used to collect all information regarding outcomes of interest. Descriptive statistics using mean and standard deviation were completed for all outcomes of interest when applicable.

Results

In total, 41 patients were included in our study during this 1-year period from July 2018 to June 2019. No patients were lost to follow-up during the 1-month postoperative period during which data collection was completed. The average age of our cohort was 66.4 years, with 18 males and 23 females (Table 1). The majority of patients had an American Society of Anaesthesiologists (ASA) class 2 or 3 grading (14 and 23 patients, respectively). In total, 76% (32/41) of patients required an ancillary procedure.

Table 1. Patient Baseline Demographics.

Characteristic	No. of Patients/Ankles
	41/81
Mean age	66.41
Sex (M:F)	18:23
ASA score	
1	1
2	14
3	23
4	3
Operative side (R:L)	26:15
Total ancillary procedures	32
TAL	14
Lateral ligament reconstruction	1
Talonavicular capsule release	7
Metatarsal osteotomy	6
Tendon transfers	6
Posterior tibial tendon release	5
Calcaneus osteotomy	3
Plantar fascia release	3
Talonavicular fusion	3
Hardware removal	2
Deltoid reconstruction	1
Subtalar fusion	1
Medial malleolar osteotomy	2
Lateral malleolar osteotomy	1
Syndesmosis reconstruction	1
Forefoot reconstruction	1
No ancillary procedures	9

Abbreviation: ASA, American Society of Anaesthesiologists; TAL, tendoachilles lengthening.

Sixty-one ancillary procedures were performed in total, with the most common procedure being tendoachilles lengthening (14 TAL), lateral ligament reconstruction (1), talonavicular capsule release (7), metatarsal osteotomy (6), and tendon transfers (6).

In terms of postoperative analgesia's primary outcome, the mean VAS was 1.99 (SD = 2.44), indicating excellent pain control (Table 2). In terms of secondary outcomes, there were no readmissions for any reason during the 30-day postoperative period. Additionally, there were no major complications among all 41 outpatients, with the majority of patients reporting feeling satisfied with being discharged home on the same day of surgery. Nearly all patients reported being very satisfied with the surgical procedure and the recommended methods of pain control, with 95% of patients saying that they would all recommend the same care to a friend with a similar condition.

Our extensive literature search produced a total of 26 studies. Exclusions were then applied as stated above. From this, 6 studies were chosen for full-text review, after which 1 was further excluded for not having any primary data for outpatient TAA.[2,3,6,11,14,16] All 4 studies included in the

Table 2. Primary and Secondary Outcomes

Outcome	Mean
Mean VAS score	1.99
Complications	0
Readmissions	0
Satisfaction questionnaire	
Treatment[a]	1.13
Pain control[a]	1.26
Same-day discharge[a]	1.65
Would recommend to friend	1.29

Abbreviation: VAS, visual analog scale.
[a]Graded on survey using the following scale: 1 = very satisfied; 2 = somewhat satisfied; 3 = somewhat dissatisfied; 4 = very dissatisfied.

literature review were graded as level IV studies, with 1 retrospective case series and 4 retrospective cohort studies. This had a total of 1347 inpatients with 373 outpatients. The average age of patients ranged from 58 to 62 years. Only 1 study assessed postoperative pain using VAS, with inpatients and outpatients demonstrating no significant difference between groups (3.6 vs 3.1, respectively). Among all studies, there was 1 readmission in the outpatient and inpatient cohort. Similarly, there was only 1 emergency department visit recorded in the outpatient cohort, with none in the inpatient group. The complication rate varied from 2% to 31% among inpatients, compared to 0% to 15% among outpatients. The infection rate showed a similar trend, with 1% to 6.7% of inpatients getting an infection, compared to 0% to 1.5% of outpatients. Two studies did not state their pain protocol. Three studies used a combination of popliteal nerve blocks and an oral narcotic analgesic regimen. Two of these studies additionally used a saphenous nerve block (without catheter). Blood loss and tourniquet times were comparable among both groups.

Discussion

In order to standardize and improve patient outcomes, many outpatient surgical programs rely on the use of these so-called "fast-track" perioperative pathways.[17] These programs commonly involve the use of a multimodal opioid-sparring pain protocol that can aid in early discharge. Previous studies have already demonstrated the success of such outpatient programs in hip, knee, elbow, and shoulder arthroplasty.[7,13,18] The purpose of this study was to evaluate the safety and efficacy of TAA as an outpatient procedure. Our study's results support our hypothesis, as outpatient TAA provided excellent pain control and patient satisfaction in the postoperative setting. Furthermore, outpatient TAA was not associated with an increased risk of complications or readmissions. Our literature search revealed 5 primary articles concerning outpatient TAA, and all compared favorably with our results.

Pain control after outpatient TAA was assessed by 2 previous studies.[3,11] Mulligan et al[11] previously published a comparative retrospective cohort study of 81 patients who had undergone TAA, 65 of whom were considered outpatients. The average VAS score of patients in this cohort was 3.2, and there were no significant differences in VAS score between the inpatient and outpatient cohorts (3.6 vs 3.1, $P = .72$, respectively). Additionally, there were no differences in narcotic prescription refills among either cohort as well. Gonzalez et al[3] also assessed pain control after outpatient TAA using a retrospective comparative cohort design, albeit indirectly using a phone questionnaire administered 3 weeks postoperatively. Pain control was similar among both groups, as 73% of inpatients and 76% of outpatients reported that postoperative pain was not a problem for them. These results compared favorably with our case series of outpatient TAA, which demonstrated a VAS score of 2, with nearly all patients reporting being satisfied with their postoperative pain protocol.

In terms of patient safety, several studies assessed for risk of readmission and complications after outpatient TAA.[2,3,14] Borenstein et al[2] reported on a case series of 65 consecutive outpatient TAAs. In this cohort, there were no readmissions, 1 wound infection, and an overall complication rate of 15.4%. Complications included wound breakdown (1), infection (1), revision surgery for component loosening (1), and nonrevision surgery (8). Gonzalez et al[3] similarly reported no difference in readmission or complication rates between inpatients and outpatients, with only 1 inpatient developing a deep infection and another outpatient being reassessed in the emergency department for urinary retention. In a large retrospective database study[14] of 66 outpatients and 535 inpatients, inpatients had higher rates of surgical site infection and reoperation, although there was no statistical difference between both groups. Mulligan et al[11] also demonstrated there was no difference in readmission rates between groups; however, this was the only study to show the superiority of outpatient surgery in terms of complications. In this cohort, 31% of inpatients had a complication compared with 5% of outpatients ($P = .01$). Again, the results of previous studies on this subject closely echoed this study's results, as we reported no readmissions or complications in our outpatient TAA cohort.

A limitation of this study includes the small number of patients in our cohort because of the relative rarity of TAA compared to other lower extremity arthroplasties. We included all consecutive patients who required surgery for the failure of conservative management of ankle arthritis during a 1-year period from an experienced specialist who receives referrals from a large catchment area. Additionally, this was a retrospective noncomparative study, and as such,

we were unable to draw comparisons with an inpatient control group. Patient questionnaires used to determine satisfaction may also have been prone to recall bias. We also had a relatively short follow-up period of 30 days; however, the goal of the study was to assess the short-term safety, efficacy, and satisfaction of outpatient TAA, and as such, we did not require longer follow-up that is necessary for accurate assessment of functional outcomes. Future studies based on our results could focus on cost-benefit analysis to determine the economic advantages of outpatient surgery, as the potential financial savings in hip and knee outpatient surgery have been well demonstrated. Additionally, future studies would benefit from a comparative prospective design such as a randomized control trial. Nonetheless, one of the major strengths of this study includes the fact that it is one of the largest outpatient TAA cohorts in the literature.

Conclusion

The results of our study demonstrate that outpatient TAA is associated with excellent pain control using a multidisciplinary pain approach. The use of a standardized outpatient postoperative pathway is effective in preventing readmissions and complications while still resulting in high patient satisfaction scores. Our results compared favorably with other reports, documenting largely no significant differences between outpatient and inpatient TAA.

Appendix A: Postoperative Patient Satisfaction Survey

Postsurgery Patient Satisfaction Survey

1) How satisfied are you with your surgical treatment? (after surgery only)
   - ○ Very satisfied
   - ○ Somewhat satisfied
   - ○ Somewhat dissatisfied
   - ○ Very dissatisfied
2) How satisfied are you with pain control?
   - ○ Very satisfied
   - ○ Somewhat satisfied
   - ○ Somewhat dissatisfied
   - ○ Very dissatisfied
3) How satisfied are you with going home the same day of the surgery?
   - ○ Very satisfied
   - ○ Somewhat satisfied
   - ○ Somewhat dissatisfied
   - ○ Very dissatisfied
4) Would you recommend the same process to a friend with the same condition? (after surgery only)
   - ○ Definitely yes
   - ○ Probably yes
   - ○ Probably no
   - ○ Definitely no
5) Did you visit the Emergency Room during the first two weeks after your surgery?
   - ○ Yes
   - ○ No
6) Rate your pain from 0-10 (0 being *no pain*, 10 being the *worst pain imaginable*):

0	1	2	3	4	5	6	7	8	9	10

Appendix B: Search Strategy

Database: Embase Classic+Embase <1947 to 2020 February 14>
Search Strategy:

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1 exp outpatient care/ or outpatient.mp. or exp outpatient/ or exp outpatient department/ (315874)
2 same-day discharge*.mp. (1144)
3 ERAS.mp. (6944)
4 enhanced recovery after surgery.mp. (2930)
5 1 or 2 or 3 or 4 (324137)
6 exp ankle arthroplasty/ or total ankle arthroplasty.mp. (1601)
7 ankle replacement*.mp. (1216)
8 total ankle*.mp. (1680)
9 6 or 7 or 8 (2031)
10 5 and 9 (14)

Database: Ovid MEDLINE: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE Daily and Ovid MEDLINE <1946-Present>
Search Strategy:

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1 exp outpatient care/ or outpatient.mp. or exp outpatient/ or exp outpatient department/ (179406)
2 same-day discharge*.mp. (579)
3 ERAS.mp. (3961)
4 enhanced recovery after surgery.mp. (1778)
5 1 or 2 or 3 or 4 (184202)
6 exp ankle arthroplasty/ or total ankle arthroplasty.mp. (690)
7 ankle replacement*.mp. (848)

8 total ankle*.mp. (1314)
9 6 or 7 or 8 (1371)
10 5 and 9 (12)

Ethical Approval

Ethical Approval for this study was obtained from Unity Health Toronto Research Ethics Board (REB).

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Timothy R. Daniels, MD, reports grants and personal fees from Integra, grants and personal fees from Stryker, personal fees from *Journal of Bone and Joint Surgery (American Volume)*, and grants and personal fees from Wright Medical Technology, outside the submitted work. ICMJE forms for all authors are available online.

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