Research Article

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Outcomes of the First 1,000 Total Hip and Total Knee Arthroplasties at a Same-day Surgery Center Using a Rapid-recovery Protocol

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JAAOS Glob Res Rev 2019;3:e022

DOI: 10.5435/JAAOSGlobal-D-19-00022

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Abstract

Background: Outpatient (<24 hour stay) total joint arthroplasty (TJA) has emerged as an alternative to traditional inpatient TJA. Patient-reported outcomes in the past have revealed favorable comparisons with inpatient controls. However, a higher outpatient TJA readmission rate has been reported. The goal of our study is to report outcomes, readmissions, and unplanned access to care data on the first 1,000 TJAs performed at a de novo ambulatory surgery center (ASC).

Methods: From March 2014 to May 2016, a consecutive series of 1,000 primary, total hip, and total knee arthroplasties (TKAs) were performed at a same-day surgical center. All patients were ≤66 years old, met the ASC inclusion criteria, and received preoperative training. All patients were discharged <24 hours after surgery to postoperative care suites. Oxford scores, visual analog scale for pain, patient satisfaction, ambulation, complication, and adverse events data were collected.

Results: A consecutive series of 543 TKAs and 457 total hip arthroplasties (THAs) were performed. Mean age was 57.2 years (range 28 to 66 years). The TKA patients consisted of 55.2% women, whereas THA patients consisted of 45.3% women. Overall infection rate was 0.8%. Hospital readmission rate was 1.5%, and early/unplanned access to care was 11.7%. Oxford Knee and Oxford Hip scores showed 15.7 and 21.1 point improvements, respectively, whereas pain scores improved 71% for TKA and 81% for THA at 6 months postoperatively ($P < 0.01$).

Conclusions: Our immediate and short-term complications, readmissions, and outcomes for all patients compared favorably with published inpatient data. This study provides baseline data for quality metrics and functional outcomes for ASC-based total joint procedures.

Outpatient (<24 hour stay) total joint arthroplasty (TJA) has emerged as a safe and cost-effective alternative to traditional inpatient TJA.[1-6] Advances in anesthesia, perioperative analgesia, postoperative rehabilitation, and surgical techniques have contributed to decreased length of stay and early postoperative mobilization.[7-9] The demand for total hip arthroplasty (THA) and total knee arthroplasty (TKA) is projected to increase markedly over the next 20 years.[10]

Although outpatient TJA has been successful in select patient populations when performed in a hospital setting, increasing numbers of orthopaedic practitioners are performing TJAs in free-standing ambulatory surgery centers (ASCs).[1-6] However, few studies report results and experience of TJA in the ambulatory setting. One such example is from Parcells et al [11] in 2016, who reported on their short-term TJA experience in an ASC. This study identified strict patient eligibility criteria as a primary reason for success, thus resulting in no major adverse outcomes reported. Ambulatory TJA concerns include the possibility for increased readmission rates, early and unplanned follow-up, and transfer to an inpatient facility for complications.[2,12-16] Patient-reported outcomes in the past have revealed favorable comparisons with inpatient controls at follow-up of 24 months.[2] Specifically, the Oxford Hip and Knee scores for inpatients have been shown to increase postoperatively by a range of 15 to 20 points, depending on the follow-up period.[17,18] Overall, very little data on outpatient TJA outcomes have been presented thus far in the literature.

In March 2014, a de novo orthopaedic-only ASC was opened in Vadnais Heights, Minnesota. Thirteen orthopaedic surgeons perform THA and TKA at the ASC on a regular basis. The center was created to perform same-day TJA in addition to traditional outpatient orthopaedic surgeries. Perioperative pathways were developed to standardize THA and TKA care throughout the center. Through standardization of care, implementation of perioperative analgesia protocols, and early rehabilitation, we believed that ASC-based TJA would be a safe and preferred alternative with favorable clinical and patient-reported outcomes. The purpose of our study is to analyze and report on the outcomes, complication rate, and unplanned access to care rate of the first 1,000 TJAs performed at a community-based, private ASC.

Methods

From March 5, 2014, to May 31, 2016, a consecutive series of 1,000 total hip and TKAs were performed at a privately owned, same-day surgical center. All patients were 66 years old or younger, deemed to be in overall good health, and put through a preoperative training class to understand their requirements and expectations before, during, and after their stay. Being of a certain age was not an inclusion criteria in and of itself, although being eligible for insurance coverage was (so as not to financially distress the patient), thus all patients were 66 years old or younger.

Recovery Suite Concept

One unique aspect of the facility is the utilization of a recovery suite concept. Surgery is performed in the fully and appropriately licensed ASC. This is then followed by appropriate phase 1 and phase 2 recovery protocols. Once the discharge criteria are met, as outlined below, the patient is discharged from the ASC. The patient is physically discharged to a colocated and separately licensed recovery suite area. Staff members are not shared between the two areas. The recovery suite functions under a separate homecare license. Patients stay overnight in the recovery suite portion of the facility and are discharged home the following morning. They receive physical therapy, meals, and basic nursing services and assistance in the recovery suites.

Care Pathway

After meeting all the appropriate classifications for joint arthroplasty, including the failure of nonsurgical measures, patients were screened for any factors that would preclude enrollment in the TJA pathway. The TJA pathway includes preoperative elements, day of surgery perioperative elements, intraoperative elements, and postoperative elements.

Preoperative exclusion criteria were applied to minimize the risk of perioperative complication. Exclusion criteria were included but were not limited to the following: body mass index greater than 45, uncontrolled diabetes mellitus, uncontrolled hypertension, the presence of inadequately treated cardiovascular disease, the presence of an internal cardiac defibrillator, anemia with hemoglobin less than 12.0, and ASA greater than two. If the inclusion criteria are met for total joint consideration, a phone assessment is performed in which a medical health history is obtained and plans are made for postoperative pain control and appropriate postoperative anticoagulation. Home assessment is also performed through phone so as to create as safe a home environment as possible. This is performed by a clinical nurse specialist or nurse practitioner and included topics like who is helping at home, number of stairs inside/outside, railings, bathroom setup, equipment/supplies needed at home, etc. If not already performed, plans are made for history and physical assessments to be performed by their primary care physician. Preoperative laboratory evaluation includes hemogram with platelet count, protime/INR, blood type and antibody screen to identify patients with possible antibodies (the presence of

antibodies serves as an exclusion for outpatient total joint consideration), and urinalysis.

Patients meeting these criteria are then instructed on appropriate perioperative preparation. Whole-body Hibiclens scrub is performed once per day for 2 days before surgery. Mupirocin ointment is prescribed and instructions given that it be placed in the nasal cavities for 5 days before surgery. An in-depth tour of the facility is then performed, and questions are answered regarding physical therapy and nursing care to be delivered. Home knee-high sequential compression devices are fit and the patient instructed on their use. Two days before the scheduled surgery, the preoperative nursing call is made to perform the intake for the facility and provide final patient instructions.

Date of Surgery

In the preoperative area, routine preoperative orders such as the placement of intravenous catheter and nasal Betadine swab and surgical site cleansing with chlorhexidine are performed. Sequential compression devices are applied to the nonoperative extremity. Unless contraindicated by allergy or age, Celebrex 400 mg PO, gabapentin 300 to 600 mg PO, and aprepitant 40 mg PO are administered. In addition, Tylenol 1 g IV, tranexamic acid 1 g IV, and appropriate IV antibiotic are administered. For TKA patients, ultrasonography guidance is used to administer an adductor canal and saphenous regional block.

Intraoperatively, all patients received a general anesthetic. The total hip patients also received a short-acting spinal block to assist with pain blockade. Decadron 10 or 4 mg IV for diabetic patients is also administered. Appropriate replacement is undertaken. The overall goal is to minimize the chronic administration intraoperatively, unless actually necessary for pain control. At the surgical site, liposomal bupivacaine is injected in a sequential, deliberate fashion consistent with current articular injection recommendations.

Postoperative

Patients are cared for in recovery suites until they meet the appropriate discharge criteria to phase 2 recovery (according to the modified Aldrete Scale). There, Tylenol 1 g IV is administered 4 hours after the initial dose, as is tranexamic acid 1 g IV. Appropriate IV and PO medications are administered for pain control. Ambulation is initiated as soon as the patient is awake, alert, and shows sufficient balance and return of extremity strength. Once the discharge criteria have been met, patients are discharged from the ASC to the separately licensed recovery suites.

Oxford Hip/Knee (in accordance with AJRR recommendations) and visual analog scale pain data were recorded preoperatively and postoperatively (3 months, 6 months, and yearly), as was a series of questions pertaining to surgical satisfaction. Furthermore, patients were instructed as to the parameters of the pain scale and asked to then rate their pain every 4 hours for the first 24 hours postoperatively as well as at 48 hours and 7 days. This satisfaction questionnaire included the following five questions:

(1) How well did the surgery on your joint relieve the pain?
(2) How well did the surgery on your joint increase your ability to perform regular activities?
(3) How well did the surgery on your joint allow you to perform heavy work or sport activities?
(4) How well did the surgery on your joint meet your expectations?

*Options for each of the above questions: Poor, Fair, Good, Very Good, Excellent

(5) Would you have the operation again if needed, on another joint?

*Options: Definitely Not, Possibly Not, Probably Yes, Definitely Yes.

Ambulation data were also collected postoperatively, as were complications, adverse events, early access to care, pain, and narcotic use for the first 30 days. Patients who were not seen at the standard of care 4 to 6 weeks postoperative time point were contacted by the staff to ask for specific details pertaining to the aforementioned variables.

This study was approved as an exempt medical chart review by the HealthEast Institutional Review Board.

Statistical Analysis

Repeated measures analysis of variances and post hoc Student *t*-tests were used to determine differences in scores over time, with chi-square tests being used for differences in percentages. Statistical analyses were performed using IBM SPSS Statistics for Windows, v23 (IBM). Significance was set at $P < 0.05$.

Results

A consecutive series of 543 ASC-based TKAs and 457 THAs were performed, with a mean age of 57.2 years (range 28 to 66 years). A total of 507 women and 493 men were included. The TKA patients consisted of 300 women and 243 men (mean age = 58.0 years), whereas the THA patients consisted of 207 women and 250 men (mean age = 56.3 years).

Overall infection rate was 0.2% (1/462) for TKA and 0.3% (1/395) for THA. Hospital admission rate was 1.5% (7/462) for TKA and 2.5% (10/395) for THA, and early or unplanned access to care (defined as emergency department, orthopaedic urgent care or unplanned primary care/surgeon visit) was 10.4% (48/462) for TKA and 13.2% (52/395) for THA (Table 1). It should be noted that

Table 1

Percentage of Patients Receiving Each Type of Unplanned Access to Care

Variable	Emergency Department	Orthopaedic Urgent Care	Primary Care Visit	Surgeon Visit	Total Patients[a]
All patients	2.6% (22/848)	5.4% (47/801)	2.0% (16/755)	3.2% (32/1000)	11.7% (100)
TKA	3.1% (14/458)	4.8% (23/436)	1.0% (4/407)	2.9% (16/543)	10.4% (48)
THA	2.1% (8/390)	6.0% (24/365)	3.2% (12/348)	3.5% (16/457)	13.2% (52)

THA = total hip arthroplasty, TKA = total knee arthroplasty
[a] Some patients had multiple unplanned access to care visits.
( ) = N.

Table 2

Adverse Events Breakdown by Type

Adverse Events	TKA	THA
Infection	1	1
Dislocation	0	1
Need for blood transfusion	1	0
Admitted to the hospital for bleeding	1	0
Hematoma	1	1
Emergency department for postoperative bleeding	0	1
Deep vein thrombosis	2	1
Intraoperative fracture	0	1
Patella fracture after fall	1	0
Quadriceps tear after fall	1	0
Unknown emergency department visit	0	1
Incisional drainage	1	0

THA = total hip arthroplasty, TKA = total knee arthroplasty

unconfirmed data points were not included in the descriptive analysis.

Adverse events were recorded over the first 30 days based on patient interview, in addition to chart and electronic health record review. These were defined as any event directly related to the operation that required intervention by a medical professional. Overall, the adverse event rate was 1.9%. Nine TKA patients experienced an adverse event (1.9%), and seven THA patients experienced an adverse event (1.8%) (Table 2).

To assess technical and procedural learning curves, we looked at early access to care and adverse events both before (early phase) and after (late phase) January 1, 2015. For early access to care, we found a rate of 20.5% in the early phase and a rate of 8.3% in the late phase ($P < 0.001$). For adverse events, we found a rate of 2.6% in the early phase and a rate of 1.6% in the late phase ($P = 0.396$).

Opioid analgesia was recorded within the postoperative care suites before full discharge. TKA patients (64.3%) and THA patients (64.3%) were given at least one oral administration of opioid analgesia. Two percent and 0.6%, respectively, were administered at least two doses, with only 0.2% of THA patients (zero percent TKA) receiving at least three doses. At 30 days postoperatively, 31.1% of TKA patients and 19.4% of THA patients self-reported that they were currently taking opioid analgesia.

Oxford Knee scores improved 15.7 points from both preoperatively to 6 months and preoperatively to 12 months postoperatively ($P < 0.01$). Oxford Knee scores increased significantly from preoperatively to 3 months (11.4 points; $P < 0.01$) and also from 3 months to 6 months (4.3 points; $P < 0.01$). No change was observed in the score from 6 months to 12 months ($P = 0.999$).

Oxford Hip scores improved 21.4 points from preoperatively to 6 months and 21.1 points from preoperatively to 12 months ($P < 0.01$). Oxford Hip scores increased significantly from preoperatively to 3 months (19.6 points; $P < 0.01$) and also from 3 months to 6 months (1.8 points; $P < 0.01$). No significant difference was seen from 6 months to 12 months ($P = 0.977$) (Table 3).

Visual analog scale pain scores (on a 100-mm scale) improved 68% for TKA patients from preoperatively to 6 months and 64% from preoperatively to 12 months. THA patients showed improvements of 82.3% and 81.8%, respectively, over those same time periods. For both TKAs and THAs, significant improvements were seen from preoperatively to 3 months and 3 months to 6 months postoperatively, with no difference from 6 to 12 months ($P < 0.01$) (Table 4).

Pain data recorded immediately after surgery revealed a consistently low level of pain throughout the first 24 hours postoperatively. Pain then significantly increased at 48 hours

Table 3

Mean Oxford Scores at Each Time Point for Both Total Knee Arthroplasty and Total Hip Arthroplasty Patients

Variable	Preoperatively	3 mo	*P* Value (Preoperatively to 3 mo)	6 mo	*P* Value (3 mo to 6 mo)	12 mo	*P* Value (6 mo to 12 mo)
Oxford Knee	23.2	34.6	<0.01	38.9	<0.01	38.9	0.999
Oxford Hip	21.2	40.8	<0.01	42.6	<0.01	42.3	0.977

Table 4

VAS Pain (100 mm Scale) Over Time

Variable	Preoperatively	3 mo	*P* Value (Preoperatively to 3 mo)	6 mo	*P* Value (3 mo to 6 mo)	12 mo	*P* Value (6 mo to 12 mo)
TKA VAS pain	62.4	24.5 (61%)	<0.001	20.0 (68%)	<0.001	22.2 (64%)	0.604
THA VAS pain	67.1	14.3 (79%)	<0.001	11.9 (82%)	0.005	12.2 (82%)	0.890

THA = total hip arthroplasty, TKA = total knee arthroplasty, VAS = visual analog scale
( ) = % improvement from preoperatively.

postoperatively ($P < 0.01$), only to significantly decrease again by 7 days postoperatively ($P < 0.01$) (Figure 1).

For ambulation, TKA patients on average took their first steps at 3 hours and 24 minutes postoperatively and covered an average distance of 71 feet. At 5 hours and 56 minutes postoperatively, patients covered an average distance of 340 feet. This ambulation used a combination of both SecureTrack and a handheld walker.

THA patients on average took their first steps at 3 hours and 8 minutes postoperatively and covered an average distance of 87 feet. At 5 hours and 43 minutes postoperatively, patients covered an average distance of 385 feet.

For each of the satisfaction questions, our results are depicted as the combined percentage of patients reporting "very good" or "excellent" satisfaction.

For TKA patients, a significant improvement was seen for satisfaction with "Pain Relief" from 3 months to 6 months postoperatively (68.3% versus 83.2%; $P = 0.001$), with a nonsignificant decrease from 6 months to 1 year postoperatively (83.2% versus 73.0%; $P = 0.086$). For "Daily Activities," a significant improvement was seen from 3 months to 6 months (58.1% versus 73.7%; $P = 0.003$), with a nonsignificant decrease seen from 6 months to 1 year (73.7% versus 72.6%; $P = 0.862$). For "Heavy Work and Sport," a significant improvement was seen from 3 months to 6 months (36.8% versus 60.7%; $P < 0.001$), with a nonsignificant decrease seen from 6 months to 1 year (60.7% versus 50.9%; $P = 0.190$). For "Expectations Being Met," a nonsignificant improvement was seen from 3 months to 6 months (65.8% versus 74.9%; $P = 0.069$), with a nonsignificant decrease then seen from 6 months to 1 year (74.9% versus 71.4%; $P = 0.603$) (Table 5).

Figure 1

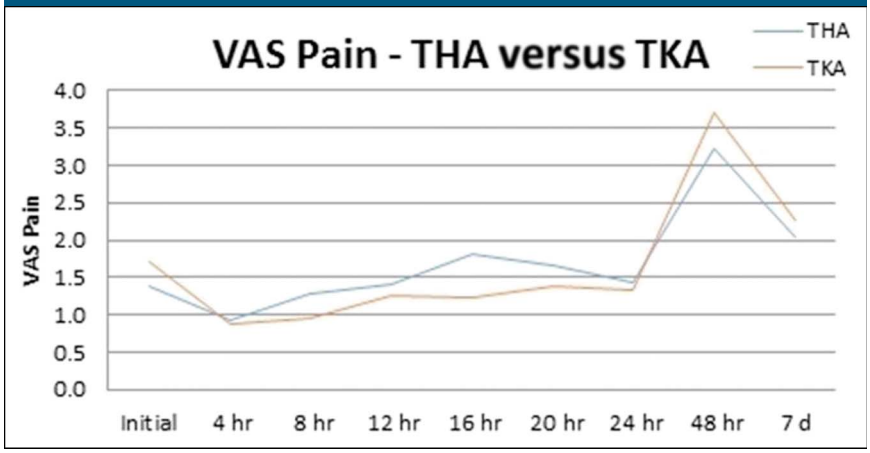

Chart showing visual analog scale pain (10 cm scale) breakdown immediately postoperatively through 7 days.

Table 5

Percentages Represent "Very Good-To-Excellent" or "Probably-To-Definitely Yes" Responses

Total Knee	Pain	Daily Activities	Heavy Work/ Sport	Meet Expectations	Have Surgery Again?
3 mo	68.3%	58.1%	36.8%	65.8%	90.9%
6 mo	83.2%	73.7%	60.7%	74.9%	92.3%
12 mo	73.0%	72.6%	50.9%	71.4%	87.3%

Table 6

Percentages Represent "Very Good-To-Excellent" or "Probably-To-Definitely Yes" Responses

Total Hip	Pain	Daily Activities	Heavy Work/ Sport	Meet Expectations	Have Surgery Again?
3 mo	88.0%	81.9%	60.3%	82.4%	97.0%
6 mo	87.7%	80.9%	70.9%	84.6%	98.0%
12 mo	88.7%	87.6%	72.4%	86.5%	96.6%

Table 7

Average Recovery Time and Percentage Breakdown by Duration

Variable	Avg. Recovery Time (min)	<120 min	2-4 hr	4-6 hr	6+ hr
TKA	225.1	3.8%	65.3%	24.6%	6.4%
THA	221.8	5.5%	66.4%	18.9%	9.1%

THA = total hip arthroplasty, TKA = total knee arthroplasty

For THA patients, 88.0% of patients reported "very good or excellent" satisfaction at 3 months postoperatively for "Pain Relief," 81.9% for "Daily Activities," and 82.4% for "Expectations Being Met," with these levels staying statistically the same at 6 months and 1 year postoperatively ($P > 0.05$). For "Heavy Work and Sport," a nonsignificant improvement was seen from 3 months to 6 months (60.3% versus 70.9%; $P = 0.074$), while remaining statistically the same from 6 months to 1 year (70.9% versus 72.4%; $P = 0.823$) (Table 6).

At 12 months postoperatively, when asked whether they would have surgery again, 87.3% of TKA and 96.6% of THA patients responded with "probably yes" or "definitely yes."

For TKA patients, the average recovery time (calculated from the time the patient enters the postanesthesia care unit until the official discharge time) was 225.1 minutes (range 87 to 1250). In addition, 6.4% of TKA patients had a recovery time of greater than 6 hours, 24.6% with 4 to 6 hours, 65.3% with 2 to 4 hours, and 3.8% with less than 120 minutes.

For THA patients, the average recovery time was 221.8 minutes (range 84 to 1211). In addition, 9.1% of THA patients had a recovery time of greater than 6 hours, 18.9% with 4 to 6 hours, 66.4% with 2 to 4 hours, and 5.5% with less than 120 minutes (Table 7).

Discussion

The past 5 years has seen an increased migration of total joint replacement from the inpatient hospital setting to an outpatient procedure performed in a hospital or an ASC.[19,20] This migration hopes to achieve the triple aim goals of improving the patient experience of care, improving the health of populations, and reducing the per capita cost of health care.[21] There have been several reports in the literature regarding the efficacy of outpatient TJA performed in an ASC. To date, this current study is the largest series of total joint arthroplasties performed in an ASC.

One concern within the orthopaedic community when performing total joint arthroplasties in an ambulatory surgical center setting is the perceived higher risk of complication and readmission. Complication rates for outpatients have been reported between 5.1% and 13.3%.[13,14,16] Our observed adverse event rate compares favorably with previous reports (adverse event rate: THA = 1.8%, TKA = 1.9%). Having a well-defined, standardized protocol that addresses the inclusion criteria, patient education and expectations, preoperative preparation, day of surgery and intraoperative guidelines, and postoperative care and rehabilitation protocols creates a consistency in the care delivery that minimizes complication rates.

For same-day discharge patients, readmission/revision surgery rates have ranged from 0.6% to 3.6%.[2,12-16] Our observed hospital admission rates of 1.5% for TKA and 2.5% for THA are well within this reported range. We think that these relatively low rates of admission can be attributed to in-depth preoperative patient education. Patients are instructed to contact the care team regarding any questions in the postoperative period, especially if they think they are developing a

complication related to surgery. In these instances, the situation is triaged and appropriate instruction is given through phone, where the patient is instructed to seek care at the facility with the appropriate level of acuity. Most patients who require a clinical visit are seen by the surgical team or in an orthopaedic urgent care setting. This minimizes the number of emergency department visits and maintains care delivery by the most appropriate providers who have the greatest knowledge regarding the patient's current medical and surgical condition.

Overall, early access to care was noted in 10.4% of TKA patients and 13.2% of THA patients, which is in line with previously reported data on outpatient TJA.[15] Furthermore, a notable reduction in early access to care was noted as experience was gained with the education and treatment protocols (20.5% early phase, 8.3% late phase).

In assessing total joint function, the Oxford outcome scores have been an accepted and validated measure for two decades. Our data revealed notable improvements at 1 year for both TKA patients (15.7 points) and THA patients (21.1 points). These findings are similar, if not slightly higher than previously published papers, all of which included data on surgeries performed in an inpatient hospital setting.[17,18] Although our patients were predominantly chosen from a healthy, younger population, it is important to note that they were still able to achieve the expected results, if not surpass them, while undergoing surgery in an ambulatory surgical center.

For "heavy work and sport" activities, these are often restricted to minimal exposure in the first 90 days, with gradual lessening of these restrictions over the subsequent months, based on the progress of their motion and pain. Even so, approximately two of three patients achieved very good to excellent satisfaction with their recovery at 6 months postoperatively and beyond.

The American Academy of Orthopaedic Surgeons recommends mobilization as soon as possible postoperatively for THA and TKA patients.[22] Although conflicting reports in the literature on range of motion outcomes exist, early ambulation and mobilization have been shown to reduce the incidence of deep vein thrombosis and decrease the length of stay for inpatients.[23-25] Successful perioperative analgesia is vital to initiating physical therapy protocols on day zero postoperatively.[26,27] In our study, THA patients ambulated at 3 hours 8 minutes postoperatively, whereas TKA patients ambulated at 3 hours 24 minutes postoperatively. Peters et al[28] reported their accelerated clinical pathway results which showed THA patients ambulating an average of 104 feet and TKA patients ambulating an average of 94 feet on postoperative day (POD)1. The patients in our study ambulated 3 times that distance 1 day earlier, on POD0, with THA patients ambulating 385 feet in 5 hours 43 minutes postoperatively and TKA patients ambulating 340 feet in 5 hours 56 minutes postoperatively. Further studies will be directed to examine the specific impact of our accelerated mobilization protocol on ROM, strength, and functional outcomes.

The limitations of this study include the fact that our ASC protocol only included patients who were deemed to be overall healthy individuals with no notable comorbidities. Approximately 15% attrition (missing data) rate existed, although one could argue that this may be better than expected for a study following 1,000 consecutive patients. In many instances, we relied completely on patient responses at 30 days postoperatively to determine what type of postoperative care, whether any, was sought by the patient, whether done outside of our institution.

Conclusions

Our immediate and short-term complications and readmissions for all patients compared favorably, if not superiorly, with benchmark data. These included infection rate, readmission rate, early/unplanned access to care, adverse events, opioid analgesia, functional outcomes, pain outcomes, ambulation, satisfaction levels, and recovery time. This was true for both TKA patients and THA patients.

These results serve as an internal and external benchmark for both inpatient and ASC-based THA/TKA programs. Quantitative outcome measures and baseline PROMs have been established, so as to advance toward best practices in ASC-based TJA.

References

1. Berger RA, Sander S, Gerlinger T, Della Valle C, Jacobs JJ, Rosenberg AG: Outpatient total knee arthroplasty with a minimally invasive technique. *J Arthroplasty* 2005;20(7 suppl 3):33-38.
2. Kolisek FR, McGrath MS, Jessup NM, Monesmith EA, Mont MA: Comparison of outpatient versus inpatient total knee arthroplasty. *Clin Orthop Relat Res* 2009; 467:1438-1442.
3. Dorr LD: Regional anesthesia improves perioperative events in patients having total hip or knee replacement. *J Bone Joint Surg Am* 2010;92:1264.
4. 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: 252-2555.
5. Hartog YM, Mathijssen NM, Vehmeijer SB: Total hip arthroplasty in an outpatient setting in 27 selected patients. *Acta Orthop* 2015;86:667-670.
6. Goyal N, Chen AF, Padgett SE, et al: Otto aufranc award: A multicenter, randomized study of outpatient versus inpatient total hip arthroplasty. *Clin Orthop Relat Res* 2017;475:364-372.
7. Taunt CJ Jr, Finn H, Baumann P: Immediate weight bearing after cementless total hip arthroplasty. *Orthopedics* 2008; 31:223.
8. Berger RA, Jacobs JJ, Meneghini RM, Della Valle C, Paprosky W, Rosenberg AG: Rapid rehabilitation and recovery

with minimally invasive total hip arthroplasty. *Clin Orthop Relat Res* 2004: 239-247.

9. 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;467:1424-1430.

10. Kurtz S, Ong K, Lau E, Mowat F, Halpern M: Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007;89:780-785.

11. Parcells BW, Giacobbe D, Macknet D, et al: Total joint arthroplasty in a stand-alone ambulatory surgical center: Short-term outcomes. *Orthopedics* 2016;39:223-228.

12. Berger RA, Kusuma SK, Sanders SA, Thill ES, Sporer SM: The feasibility and perioperative complications of outpatient knee arthroplasty. *Clin Orthop Relat Res* 2009;467:1443-1449.

13. Lovald ST, Ong KL, Malkani AL, et al: Complications, mortality, and costs for outpatient and short-stay total knee arthroplasty patients in comparison to standard-stay patients. *J Arthroplasty* 2014;29:501-515.

14. Courtney PM, Boniello AJ, Berger RA: Complications following outpatient total joint arthroplasty: An analysis of a national database. *J Arthroplasty* 2017;32: 1426-1430.

15. Springer BD, Odum SM, Vegari DN, Mokris JG, Beaver WB Jr: Impact of inpatient versus outpatient total joint arthroplasty on 30-day hospital readmission rates and unplanned episodes of care. *Orthop Clin N Am* 2017;48:15-23.

16. Klein GR, Posner JM, Levine HB, Hartzband MA: Same day total hip arthroplasty performed at an ambulatory surgical center: 90-day complication rate on 549 patients. *J Arthroplasty* 2017;32: 1103-1106.

17. Williams DP, Blakey CM, Hadfield SG, Murray DW, Price AJ, Field RE: Long-term trends in the Oxford knee score following total knee replacement. *Bone Joint J* 2013; 95-B:45-51.

18. Pennington M, Grieve R, Black N, van der Meulen JH: Functional outcome, revision rates and mortality after primary total hip replacement—A national comparison of nine prosthesis brands in England. *PLoS One* 2013;8:e73228.

19. Bert JM, Hooper J, Moen S: Outpatient total joint arthroplasty. *Curr Rev Musculoskelet Med* 2017;10:567-574.

20. Impact of Change® v16.0; HCUP National Inpatient Sample (NIS). *Healthcare cost and utilization project (HCUP). 2013. Agency for Healthcare Research and Quality*, Rockville, MD, OptumInsight, 2014; The following 2014 CMS Limited Data Sets (LDS): Carrier, Denominator, Home Health Agency, Hospice, Outpatient, Skilled Nursing Facility; The Nielsen Company, LLC, 2016; Sg2 Analysis, 2016.

21. *IHI Triple Aim Initiative—The Best Care for the Whole Population at the Lowest Cost*. www.ihi.org/Engage/Initiatives/TripleAim/Pages/default.aspx. Accessed August 2016.

22. Foran JRH, Fischer SJ: orthoinfo.aaos.org/topic.cfm?topic=A00389. Accessed August 2015.

23. Harvey LA, Brosseau L, Herbert RD: Continuous passive motion following total knee arthroplasty in people with arthritis. *Cochrane Database Syst Rev* 2014;2: CD004260.

24. Chandrasekaran S, Ariaretnam SK, Tsung J, Dickison D: Early mobilization after total knee replacement reduces the incidence of deep venous thrombosis. *ANZ J Surg* 2009; 79:526-529.

25. Guerra ML, Singh PJ, Taylor NF: Early mobilization of patients who have had a hip or knee joint replacement reduces length of stay in hospital: A systematic review. *Clin Rehabil* 2015;29:844-854.

26. Ranawat CS, Ranawat AS, Mehta A: Total knee arthroplasty rehabilitation protocol: What makes the difference? *J Arthroplasty* 2003;18(3 suppl 1):27-30.

27. Ranawat AS, Ranawat CS: Pain management and accelerated rehabilitation for total hip and total knee arthroplasty. *J Arthroplasty* 2007;22(7 suppl 3):12-15.

28. Peters CL, Shirley B, Erickson J: The effect of a new multimodal perioperative anesthetic regimine on postoperative pain, side effects, rehabilitation, and length of hospital stay after total joint arthroplasty. *J Arthroplasty* 2006;21(6 suppl 1):132-138.