Is There Benefit in Keeping Early Discharge Patients Overnight After Total Joint Arthroplasty?

Running Title: Hospital Interventions Among Next Day Discharge Total Joint Arthroplasty Patients

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Abstract:

Introduction: In recent years, cost containment relative to patent safety and quality of care for total joint arthroplasty (TJA) has been a key focus for the Centers for Medicare and Medicaid Services (CMS) spawning significant research and programmatic change, including a move toward early discharge and outpatient TJA. TJA outpatients receive few, if any, medical interventions prior to discharge, but the type and quantity of medical interventions provided for TJA patients who stay overnight in the hospital is unknown. This study quantified the nature, frequency, and outcome of interventions occurring overnight after primary TJA.

Methods: 1,725 consecutive primary unilateral TJAs performed between 2012 and 2017 by a single surgeon in a rapid-discharge program, managed by a perioperative internal medicine specialist, were reviewed. Medical records were examined for diagnostic tests, treatments, and procedures performed, results of interventions, and all-cause readmissions. Recorded interventions included any that varied from the preoperative treatment plan, were beyond standard-of-care, and could not be completed at home.

Results: 759 patients were discharged on postoperative day one. 84% (641/759) received no medical interventions during their overnight hospital stay. Twelve (1.6%) received diagnostic tests, 90 (11.9%) received treatments, and 29 (3.8%) received procedures. 92% (11/12) of diagnostic tests were negative, 66% of 100 treatments in 90 patients were intravenous fluids for oliguria or hypotension, and all procedures were in/out catheterizations for urinary retention. **90-day all cause readmission rates were similar in patients who received (2.5%) and did not receive (3.3%) a clinical intervention.**

Conclusion: The majority of patients received no overnight interventions, suggesting unnecessary costly hospitalization. The most common issues addressed were oliguria, urinary retention, and hypotension. Protocols to prevent these conditions would facilitate outpatient TJA, improve patient safety, and reduce costs.

Keywords: Total joint arthroplasty, Outpatient, Complications, Interventions

Introduction:

Since its original description, the primary goals of total joint arthroplasty (TJA) have remained consistent: to safely perform a durable reconstruction that reduces pain, restores function, and improves quality of life [1]. Refinements in surgical technique, pain management, blood conservation, and rehabilitation have resulted in quicker recovery [2–4], providing a foundation for early discharge after TJA. These developments have become part of CMS efforts to contain costs while maintaining the safety and quality of TJA. Evidence has demonstrated early discharge TJA to be safe [5–12] and cost saving [13,14], without increasing readmission rates [15–17]. In fact, the paradigm has shifted and in the modern context prolonged inpatient lengths of stay have been associated with higher unplanned 90-day readmission rates [18]. However, discharge the same day of surgery has been criticized as potentially hazardous, with surgeons advocating an overnight stay to observe patients for life-threatening complications and those that will trigger a readmission [19–21].

A goal for better healthcare is to reduce unnecessary care, waste, and harm to patients by improving clinical practices and deterring patients and providers from the belief that ‘more is better’ [22,23]. Prior efforts to decrease expenditure by eliminating unnecessary healthcare modalities have proven to be effective in a variety of settings [24,25]. Whether TJA patients discharged on postoperative day one (POD 1) receive beneficial medical interventions the night of surgery, necessitating their stay in the hospital, remains unknown. The purpose of this study was to determine what interventions patients discharged the day after surgery receive overnight in the hospital following TJA, and if these interventions warrant inpatient level care for all patients. Our primary aim was to quantify the nature, frequency, and outcome of diagnostic tests, treatments, and procedures among patients staying one night in the hospital. A secondary aim

was to compare 90-day readmission rates between patients discharged on POD 1 who received an overnight intervention to those who did not receive an intervention. **We hypothesized that there would be no difference in 90-day readmissions between patients discharged on POD1 who underwent an overnight intervention (diagnostic test, treatment and/or procedure) and patients who underwent no intervention.**

Methods:

Study Sample:

We identified 1,725 primary unilateral TJAs consecutively performed during a five-year period from 2012 to 2017 with institutional review board approval. All cases were performed by a single, high-volume surgeon at a tertiary care referral center. Seven-hundred and sixty-two (44%) of the cases discharged from the hospital on POD1 formed the study sample (**Figure 1**). Three patients were excluded from analysis. For two of these patients, interventions were for chest x-rays prior to Medicare approved discharge to extended care facilities on POD 1. One patient expired on POD 1 after acute onset of chest pain upon awakening from total hip arthroplasty in the recovery room. The patient underwent EKG positive for acute myocardial infarction followed by cardiac catheterization with percutaneous coronary intervention for coronary artery blockage. Unfortunately, the patient suffered an acute occlusion of their drug-eluting stent the next morning and expired despite repeat cardiac catheterization. This patient was excluded because there is no way to know when he would have been discharged absent this unexpected event.

Patient Care Protocols:

As part of our standardized perioperative care program, all patients underwent preoperative risk assessment and medical clearance and optimization within four weeks of

surgery by a perioperative internal medical specialist whose practice focuses exclusively on hip and knee arthroplasty patients. Each patient's surgery was discussed at a coordinated care conference attended by key members of the multidisciplinary team the week prior to their scheduled surgery. The goal of the meeting is to share information across disciplines and proactively develop patient care plans, shared with everyone who provides direct care or services to the patient. Preoperatively, patients and family members received comprehensive clinic-based joint replacement education and attended a hospital-based joint replacement class. Postoperatively, all patients were encouraged to ambulate by the afternoon on the day of surgery and received the same standardized rehabilitation protocol. Postoperative care was assumed by the operative surgeon, the internal medicine specialist, clinic staff, and a multidisciplinary inpatient care team. The same modern perioperative pain control, clinical, and rehabilitation protocols were used for all patients.

Perioperative and Postoperative Pain Control and Anesthesia Protocols:

A standardized multimodal preoperative pain protocol was used in all cases. Unless allergic or contraindicated, patients were given acetaminophen (1000 mg PO) 24 hours before surgery and oxycodone (10 to 20 mg PO), celecoxib (200 mg PO), and pregabalin (75 mg PO) immediately before surgery. Intraoperatively, surgeries were performed with standardized light general anesthesia (desflurane or sevoflurane) and a low-dose intrathecal, single-shot spinal injection of either 0.40 mg of morphine with a median of 10.5 mg bupivacaine local anesthetic or 25 mcg of fentanyl with a median of 7.5 mg bupivacaine. Beginning January 1, 2015, the spinal anesthesia medication cocktail was changed from morphine to fentanyl. Between September 01, 2012 and May 31, 2016, patients were instructed not to consume liquids after 12 AM on the day of surgery. Beginning on June 01, 2016, patients were allowed to drink liquids up to two hours

before surgery. Patient-specific, goal-directed fluid therapy involving preoperative, intraoperative, and postoperative administration of approximately 2000 mL total of crystalloid sodium lactate unless patients had significant renal diseases in which case normal saline was used. Postoperatively, patient's ability to void was observed. In and out catheterization was performed in patients that failed to spontaneously urinate after 8 hours from the time of their preoperative void. Additionally, if the patient is able to urinate within those 8 hours but makes less than 300cc of urine on their own, we perform an in and out catheterization and restart the clock. Patients that are unsuccessful in spontaneously voiding after three catheterizations get a consultation with Urology and are taught either self-catheterization or have a Foley docked to be managed by Urology.

In knees only, a periarticular injection of 0.2% (200 mg) ropivacaine, 0.5 mg epinephrine, 80 mcg clonidine, and 30 mcg ketorolac (removed for patients with renal insufficiency) to equal 101.3 mL total volume was used immediately following final implant fixation. Postoperatively, unless allergic or contraindicated, patients received acetaminophen (1000 mg PO tid), OxyContin (10 to 20 mg PO q12 hours), celecoxib (200 mg PO bid), oxycodone (5-10 mg hourly prn for mild pain and 10-20 mg hourly prn for moderate pain), or hydromorphone (0.5 mg IV q20 minutes prn for severe pain).

Surgical Procedures:

For all TKAs, a medial parapatellar approach was used. Standard coronal plane femoral bone cuts were made with computer-aided navigation (Stryker Navigation, Kalamazoo, MI), and tibial cuts performed with an extramedullary alignment. Prior to closure, a medium Hemovac drain was placed in all knees. The posterolateral approach was used in all hip surgeries with the

patient in a lateral decubitus position. Acetabular and femoral components were implanted with consistent surgical technique, and a postoperative drain was not used.

Rapid Recovery Protocols:

As the joint replacement program care-coordination and experience evolved and matured, the expectations for early discharge subsequently progressed. Between 2011 and 2013, patients were educated with the expectation of being discharged to home no later than postoperative day two if medically appropriate per the perioperative medicine specialist and physically safe per the physical therapist. During that time, however, patients were allowed to discharge the morning after surgery, if so motivated. Beginning in 2014, patients were routinely informed to anticipate discharge home the morning after surgery. In 2015 appropriate patients (as identified by the Outpatient Arthroplasty Risk Assessment (OARA) score) were offered outpatient surgery with same day discharge in the ambulatory surgery center or the hospital [26].

Data Collection:

Data for this study were prospectively recorded in and retrieved from the electronic medical record (EMR) and verified for accuracy. A retrospective review of the EMR was completed for each patient. Demographic data including patient age in years, sex, body mass index (BMI) in kg/m^2, American Society of Anesthesiologists Physical Status classification (ASA-PS; 1, 2, 3 or 4) and type of procedure (THA or TKA) were recorded. All-cause inpatient readmissions within 90 days of discharge were recorded for each patient. Medical records were sorted by type, and the Laboratory/Blood Bank, Radiology Reports, and Diagnostic Tests/Treatments/Procedures sections were searched for records dated either the day of or the day after patients' surgeries. Internal medicine staff progress notes were reviewed for additional test results, treatments, and overall status of the patient. The results review section of the EMR

was also evaluated for data on additional tests and results. For each intervention, the date, time, results, and cause for the intervention were recorded. The study outcome variables were medical interventions, separated into three categories: diagnostic tests, treatments, and procedures. Interventions utilized to look for pathology in a patient were defined as diagnostic tests, including cardiac enzymes, EKGs, ultrasounds, urinalysis, and x-rays. Treatments were all interventions administered orally or intravenously to improve a patients' condition. Procedures were defined as invasive interventions, such as cardiac or urinary catheterization. We recorded all medical interventions that varied from the preoperative treatment plan, were beyond standard-of-care or routine interventions, and that patients could not complete at home. Therefore, routine basic metabolic panels, hemoglobin and iron levels, blood sugar control, over-the-counter treatments, and patient comfort measures were not recorded. If an intervention was performed prior to 4 PM on the day of surgery, we did not include it in our counts because the same intervention (for example, in/out catheterization) could have been performed for same day discharge patients. This permitted us to more accurately answer the question "what beneficial medical interventions are provided for TJA patients who stay overnight in the hospital."

Medical interventions were reviewed by the perioperative internal medicine specialist to confirm medical necessity and inclusion in the study.

Data Analysis:

Minitab 19 (Minitab Inc, State College, PA) was used for data analysis. The number of patients receiving each type of diagnostic test, treatment, and/or procedure are reported along with the symptoms prompting each intervention and the results of each intervention. Continuous data are reported as means and standard deviations, and categorical data are reported as numbers and proportions. The proportions of hospital readmissions within 90 days of discharge in patients

who underwent an overnight intervention and those who did are presented. **Post-hoc calculation of statistical power using alpha 0.05 was too low to present the results of statistical tests.**

Results:

The final analysis sample of 759 cases was predominantly comprised of female (453, 59.7%) and TKA (459, 61%) patients **(Table 1).** Average age and BMI were 62.9 (±10.8) years and 32.7 (±6.8) kg/m^2, respectively. The majority of patients (58.9%) had an ASA-PS classification of three or four. **All patients were discharged home with either outpatient or in-home physical therapy.**

Fifteen percent (119/759) of TJA patients discharged on POD 1 experienced one or more overnight medical interventions. Table 2 shows the number of patients who received diagnostic tests, treatments, and procedures, and the total number of interventions collectively received. The average number of interventions per patient was 0.20 ± 0.50 (range 0 to 3).

Thirteen patients (13/759; 1.7%) underwent 13 diagnostic tests (Table 3), all of one of which were negative with none of these patients readmitted to the hospital within 90-days. **Table 1 presents the proportion of patients who received and did not receive diagnostic tests based on sex, age, BMI, ASA-PS classification, and procedure type.**

The majority (66/100; 66%) of 100 treatments in 90 patients were IV fluids for oliguria or hypotension (Table 4). Two patients who underwent a treatment (both IV fluids for oliguria) were readmitted to the hospital within 90-days, one for a gastrointestinal bleed and one for acute kidney injury and acute hypercapnic respiratory failure. **Table 1 shows the prevalence of treatments based on demographic characteristics.**

Thirty patients (30/759; 3.9%) underwent 31 procedures prior to discharge on POD 1. Twenty-nine of the procedures were in-out catheterizations for urinary retention. **As shown in**

Table 1, procedures were more common in male patients than female patients and in patients undergoing THA.

One patient who received an in-out catheterization was readmitted within 90-days for treatment of a periprosthetic joint infection.

Examination of all-cause readmissions indicated that equivalent proportions of patients who received an intervention prior to discharge on POD 1 (2.5%) and those who did not (3.3%) were readmitted to the hospital within 90-days.

Discussion:

In the United States, it has been estimated that $158-$226 billion of annual healthcare expenses are unnecessary and the result of overtreatment [27]. Overtreatment occurs when patients are subjected to care that is rooted in outdated habits and which sound science does not support. The exponentially increased demand for TJA [28] has imposed an enormous economic burden on the healthcare system, accounting for more Medicare expense than any other inpatient procedure [29]. Not surprisingly, cost containment has become a primary focus of policy and research on TJA. Multiple strategies have been adopted to improve the value of TJA, but like the overall healthcare system, the savings potentially achievable from a reduction in wasteful spending may be more significant than from direct cuts in care or coverage. As part of the effort to reduce cost, hospital lengths of stay have decreased following primary TJA [13]. However, there is disagreement regarding the optimal inpatient length of stay. Some surgeons cite early discharge TJA as safe [5–11] and without increased readmission rates [15–17]. Whereas others criticize early discharge TJA as risky, claiming inpatient stays allow for the recognition of life-threatening complications and those complications that prompt readmission [19–21]. With the removal of TKA from the inpatient-only list, hospitals and payers must now consider all

Medicare TKA patients as potential outpatients.[30] Further, with the current COVID-19 pandemic of 2020, patients must minimize their time in the inpatient setting where more medically ill and transmittable contagious diseases exist. Therefore, understanding the true value and necessity of an overnight, in-hospital stay is critical. This study sought to answer the question of whether there is a benefit for early discharge patients to stay in the hospital overnight? The results of this study describe the *small number and consistent nature* of hospital interventions among patients discharged on POD 1 following primary TJA and demonstrate that there is no difference in readmission rates between those patients who experienced an intervention and those who did not. The findings indicate that better identification of patients requiring an overnight stay, as well as prevention methods for urinary retention, oliguria, and hyponatremia are required to further enhance patient safety via elimination of unnecessary and costly hospital stays.

We observed that only 1.6% of patients discharged on POD 1 following primary TJA underwent a diagnostic test beyond routine standard-of-care. This is a novel finding, as the number of patients receiving a postoperative test after primary TJA has not been described. All but two of the diagnostic tests was negative, suggesting that a further reduction in testing may be possible without compromising patient safety. Similarly, these results may be interpreted to mean that not every early discharge patient requires diagnostic testing following TJA, as has recently been emphasized by Richardson et al [31], who suggested routine postoperative hemoglobin monitoring may be unnecessary. Future studies should seek to determine which patients require diagnostic tests and whether these tests are required to be performed as inpatient or whether they can be safely conducted at home and reported to healthcare providers who can respond in instances of an abnormal result.

In the present study, 3.6% of patients discharged on POD 1 following primary TJA required a procedure, and all of the procedures were in-out catheterizations for postoperative urinary retention (POUR). Future research should determine whether this procedure can be taught to patients and/or their caregivers to be performed safely at home. Coupled with the knowledge of which patients are at high risk and the recent report suggesting that avoiding certain anesthetic agents reduces the incidence of POUR [32], the elimination of catheterizations could lower the incidence of in-hospital procedures to nearly zero.

This study found a total of 84 patients required a postoperative treatment prior to discharge on POD 1. 68% of the postoperative treatments were intravenous fluids for hypotension, oliguria, or as part of a urinary retention treatment plan. Many early discharge protocols focus on keeping patients hydrated pre-, intra- and post-operatively [3,16]. The results of the present study were utilized by our multidisciplinary team to re-assess our perioperative hydration protocols and future research should be conducted on the ideal fluid optimization. Additionally, as previously suggested, research may be conducted to evaluate the necessity of receiving these treatments as an inpatient and to explore the feasibility of doing them at home under the direct or indirect supervision of a healthcare provider.

Perhaps the most notable finding of this study was that 84% of patient discharged on POD 1 did not require any intervention prior to discharge, suggesting these patients did not receive any benefit from an overnight stay and endured an unnecessary hospital stay. Our all-cause readmission rates were low and are similar to those previously reported in the literature [17]. Our finding that there was no significant difference in the readmission rates between patients requiring an intervention and those not requiring an intervention suggests that same day discharge may be safe and unlikely to result in increased complications for many patients.

Eliminating unnecessary overnight stays in the hospital for appropriate patients would reduce the cost of care by up to $1,625-2,025 [15] without increasing the risk, thereby improving the value of TJA.

This descriptive study is not without limitations, including its retrospective cohort design. Despite inherent bias of this study design, all of the data were prospectively collected on consecutive cases performed by a single surgeon with identical protocols, which may reduce selection and interpretation biases. It should be noted that this study was not designed to evaluate interventions received by unhealthy patients requiring prolonged inpatient care, but instead relatively healthier patients discharged on POD 1. Some patients in the cohort were eligible for but declined same day discharge. Thus, findings may add to the utility of the OARA score in safely identifying and educating patients eligible for outpatient TJA [26]. Future studies may seek to determine whether a predictive model, or even the OARA score, is capable of determining which same day discharge eligible patients require an intervention overnight. Additionally, it has been suggested that pain, muscle weakness, and dizziness are the main reasons why patients stay in the hospital longer than expected [33]. It is unknown if patients in this study felt they required an inpatient stay due to pain, weakness ,or dizziness. Therefore, it is possible that some of the patients receiving no medical interventions might not have been ready to leave the hospital the day of surgery. Additionally, it is possible patients requiring readmission did so at another institution, in which case the readmission rates may be underreported.

In conclusion, the results of this study demonstrate that the majority of patients discharged on POD 1 following primary TJA did not require any medical interventions. Additionally, there was no difference in readmission rates between the patients that required an intervention and those that did not. These data suggest that overnight hospitalization following

TJA may be unnecessary for more patients than are currently identified. Adequate hydration and avoidance of POUR seem to be the greatest targets of perioperative optimization and should be the focus of additional research. The goals of transitioning to outpatient TJA include improving the patient experience and reducing per capita cost of healthcare, and the results of this study suggest eliminating the overnight stay in a large percentage of TJA patients may help achieve these goals.

Acknowledgements

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Table Legends:

Table 1. Patient demographics of included patients discharged on POD1 (n=759)

Table 2. Types of Medical interventions Performed with Patients Discharged on POD1 (N=759)

Table 3. Diagnostic Tests Ordered for Patients Discharged on POD 1

Table 4. Treatments Ordered for Patients Discharged on POD 1

Figure Legends:

Figure 1. Flow diagram of patient population during study period and patients included in study

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Figure Legends

Figure 1. Flow diagram of patient population during study period showing patients included and excluded from study.

Table 1: Demographic Characteristics Overall and By Intervention Type

	Overall	Diagnostic Tests		Treatments		Procedures	
		Yes	No	Yes	No	Yes	No
Sex							
% Female	59.7	96.7	1.3	13.7	86.3	2.4	97.6
% Male	40.3	98.0	2.0	9.2	90.8	5.9	94.1
Mean (SD) Age in Years	62.9 (10.8)	67.1 (5.7)	62.8 (10.8)	64.6 (8.0)	62.7 (11.1)	62.6 (6.9)	62.9 (10.9)
Mean (SD) BMI in kg/m^2	32.7 (6.8)	32.5 (6.2)	32.7 (6.8)	33.4 (7.0)	32.6 (6.8)	32.3 (6.3)	32.7 (6.8)
ASA-PS Classification							
1 or 2	41.1	2.3	97.7	9.7	90.3	3.3	96.7
3 or 4	58.9	1.1	98.9	13.4	86.6	4.3	95.7
Procedure							
THA	39.0	2.0	98.0	13.8	86.2	6.4	93.6
TKA	61.0	1.3	98.7	10.6	89.4	2.2	97.8

BMI, body mass index
ASA-PS, American Society of Anesthesiology Physical Status Classification; 1 = normal healthy patients, 2 = patients with mild systemic disease, 3 = patients with severe systemic disease, 4 = patients with a severe systemic disease that is a constant threat to life

Table 2. Types of Medical interventions Performed With Patients Discharged on POD1 (N=759)

Intervention	Number of Patients (%)	Number of Interventions
Diagnostic Tests	12 (1.6)	12
Treatments	90 (11.9)	100
Procedures	30 (3.8)	31

Table 3. Diagnostic Tests Ordered For Patients Discharged on POD 1

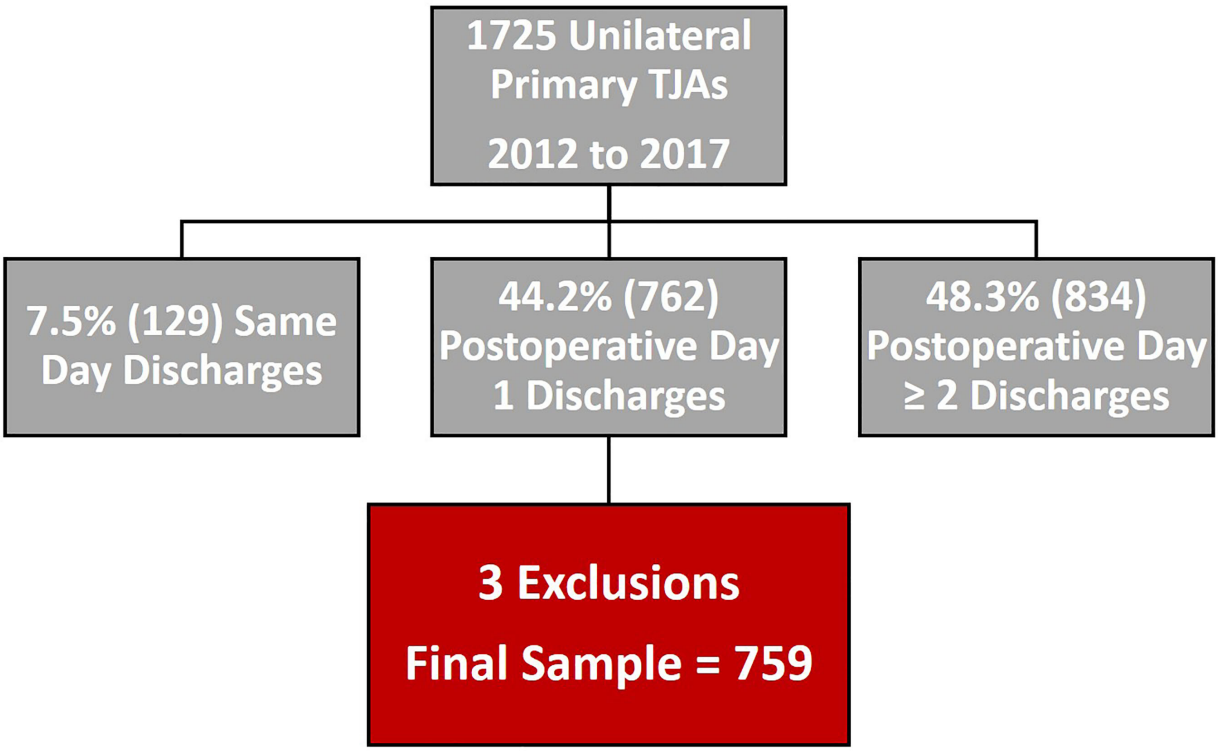
Diagnostic Test	Number of Patients	Symptoms	Test Result	90 Day All Cause Readmissions
Bladder Ultrasound	4	Urinary Retention	Negative	None
EKG	3	Chronic Intermittent Non-Cardiac Chest Pain	Negative	None
		Angina	Negative and Positive	None
Urinalysis	2	Acute Hyponatremia on BMP	Positive	None
		Asymptomatic (low sodium noted on BMP)	Negative	None
X-Ray Abdomen KUB	2	Abdominal Distension	Negative	None
RUE Venous Doppler Ultrasound	1	RUE Pain and Swelling	Negative	None
Hand X-ray	1	Hand Pain after Fall	Negative	None

EKG = electrocardiogram
BMP = basic metabolic panel
KUB = kidneys, ureters, bladder
RUE – right upper extremity

Table 4. Treatments Ordered For Patients Discharged on POD 1

Treatment	Number of Patients	Symptoms	90 Day All Cause Readmissions
Anti-Opioid	1	Over-sedation	None
Cholinergic Agonist and α-1 Blocker	10	Urinary Retention	None
Electrolyte supplementation	7	Hypokalemia	None
Fiorinal	1	Migraine headache	None
Intravenous Fluids	54	Oliguria	1 GI bleed; 1 AKI and acute hypercapnic respiratory failure
Intravenous Fluids	12	Hypotension	None
Intravenous Fluids	1	Chronic kidney disease	None
Intravenous Fluids	1	Acute hyponatremia	None
Intravenous Fluids	1	Near syncope	None
Intravenous Iron	5	Iron deficiency	None
Loop Diuretic	4	Oliguria	None
Loop Diuretic	2	Acute hyponatremia	None
Loop Diuretic	1	Chronic Hyponatremia/SIADH	None

GI = gastrointestinal
AKI = acute kidney injury
SIADH = syndrome of inappropriate antidiuretic hormone secretion


1725 Unilateral Primary TJAs
2012 to 2017
7.5% (129) Same Day Discharges
44.2% (762) Postoperative Day 1 Discharges
48.3% (834) Postoperative Day ≥ 2 Discharges
3 Exclusions
Final Sample = 759