



# Institution of same-day total joint replacement at an urban safety net hospital during the COVID-19 pandemic

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## ABSTRACT

**Background:** Increasingly, total hip and total knee replacements are being performed at outpatient ambulatory surgery centers. The purpose of this study was to investigate the feasibility and safety of instituting a same-day surgery program for hip and knee replacement at an urban, safety net hospital.

**Methods:** Retrospective review of a prospectively collected registry for all patients scheduled for same-day total joint replacement at a safety net hospital was performed. Medical records were reviewed for patient demographics, same-day hospital admissions, and 30-day emergency room/hospital admissions.

**Results:** 131 same-day total joint replacements were identified, including 76 knees and 55 hips. Median ASA was 3, and median Charlson comorbidity score was 2. Rate of same-day surgery for total joint replacements increased from 4.5% in September 2020 to 100% in September 2021. On major patient outcomes, 3.8% of patients (n = 5) required conversion to inpatient admission. Rate of 30-Day Emergency Department (ED) visits was 13.0% (n = 17). Most common complaints included postoperative pain (n = 10), incision drainage/edema/hematoma (n = 9), and cellulitis (n = 2). 30-Day Hospital Readmissions occurred in 1.5% of patients (n = 2).

**Conclusion:** Same-day hip and knee replacement can be performed safely at a safety net hospital. Unlike dedicated high-volume orthopedic hospitals or outpatient surgery centers, urban safety net hospitals face a different set of challenges and must care for a wide variety of patients who do not plan for their illness and/or may not be able to pay for their care. Outpatient total joint replacement may extend total joint replacement to patients who might not have access otherwise.

## 1. Introduction

Increasingly, total hip and total knee replacements are being performed as outpatient surgery. This has been proven to be cost-effective and safe in a variety of settings.<sup>1–11</sup> When performed safely, total joint replacement with same-day discharge is associated with positive patient satisfaction and functional outcome scores.<sup>3</sup> In order to stratify medical risk and select appropriate patients for safe same-day discharge, a scoring system has been described.<sup>12–14</sup> Rapid recovery protocols, emphasizing regional anesthesia and opioid-sparing pain management, have been described with the purpose of making same-day discharge more feasible for these patients.<sup>15,16</sup> By now, an increasing number of total hip and total knee replacements are performed at outpatient

ambulatory surgery centers. This represents a significant opportunity for decreasing the cost of care for insurance carriers and the CMS, and it is a viable source of revenue for physician-owned surgery centers.

For urban safety net hospitals, same-day total joint replacement may have additional relevance. Hospitals serving the Medicaid population and the uninsured operate on low margins at baseline, and the provision of elective surgery for these patients is a particular challenge. For a safety net hospital struggling with shrinking resources, staffing shortages, and limited bed availability, the idea of running a viable total joint replacement program may seem impractical. However, if a safety net hospital can adopt a safe same-day discharge program for hip and knee replacements, it may be possible to continue to provide these services at reduced cost with fewer resources and fewer inpatient beds.

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In order to investigate the feasibility and safety of instituting a same-day surgery program for hip and knee replacement at a safety net hospital, we have conducted a review of our same-day total joint program. In the height of the COVID epidemic, our safety net hospital experienced an expected shortage of available inpatient beds. As elsewhere in the country, all elective surgeries were postponed for a time. However, as we planned resumption of elective surgery, we found that the shortage of inpatient beds persisted, and our total joint program could not continue if all patients required hospital admission. Therefore, in September 2020, we began our same-day total joint replacement program. The present study is a review of the results for our first year.

## 2. Methods

In September 2020, we started to offer same-day total joint replacement surgeries at our institution. In collaboration with our anesthesiology department, we determined criteria for selecting appropriate same-day surgery candidates (Table 1). On the day of surgery, same day surgery candidates were scheduled as first cases to maximize chances of same-day discharge. All patients received spinal anesthesia. Knee replacement patients received additional regional anesthesia in the form of adductor canal blocks and infiltration between the popliteal artery and capsule of the knee (IPACK) blocks. All knee replacements were performed with a medial parapatellar quadriceps splitting approach. Hip replacements were performed using either a direct anterior approach or a posterior approach, according to the surgeon's preference. Following surgery, same day discharge was

**Table 1**  
Criteria for same-day arthroplasty.

<p>Patients considered for outpatient knee and hip replacements should have no conditions or circumstances that would preclude rapid discharge after surgery and must meet the following criteria:</p> <ul style="list-style-type: none"> <li>• ASA 1 or 2. ASA 3 patients <i>may be</i> considered but <i>must</i> be approved by the anesthesiology department at least one week in advance and may necessitate a medicine consult prior to discharge.</li> <li>• Unilateral, uncomplicated, primary hip or knee arthroplasty</li> <li>• Pre-operative BMI <math>\leq 40</math> kg/m<sup>2</sup></li> <li>• Age <math>&lt; 70</math> years at time of surgery</li> <li>• Pre-operative hemoglobin <math>&gt; 12</math> g/dL</li> <li>• No history of seizure disorder, active liver disease, or active kidney disease (preoperative GFR <math>&gt; 60</math>)</li> <li>• Diabetics with HgA1c <math>&lt; 8</math> (glucose <math>\sim 150</math> mg/dL)</li> <li>• Drinks less than 14 alcoholic beverages per week and no history of alcohol withdrawal</li> <li>• No history of cardiopulmonary disease that would necessitate inpatient monitoring after surgery. Hypertensive patients with values SBP <math>&lt; 160</math> and DBP <math>&lt; 100</math> taken as outpatient are eligible for outpatient surgery. Also, patients with COPD who have normal exercise capacity and do not require oxygen <i>may</i> be eligible for outpatient arthroplasty pending anesthesiology review.</li> <li>• No history of DVT, PE, TIA/stroke, MI, or other thromboembolic event</li> <li>• Preoperative ambulatory status does not require the use of a walker or wheelchair</li> <li>• Ideally, no chronic pre-operative opioid medication use or history of opioid addiction; <i>however</i>, opioid use due to pain from the arthritic joint that will undergo surgery is permissible as long as it is <math>\leq 10</math> mg oxycodone per day (or equivalent)</li> <li>• No history of significant nausea with opiate use (exception: patients who have nausea with one type of opiate but have proven to tolerate others are permissible)</li> <li>• Not immunocompromised or taking immunomodulatory medications (i.e. RA patients)</li> <li>• Assistance available at home after discharge on a 24-h basis for at least the first 2 postoperative days</li> <li>• Patient must be willing to have a spinal anesthetic. Patients with lumbar spine pathology (i.e. surgery, scoliosis, sciatica), CSF disorders (i.e. normal pressure hydrocephalus, pseudotumor cerebri), or blood thinners (not including aspirin) require review by the anesthesiology department at least one week in advance.</li> </ul>
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(ASA: American Society of Anesthesiologists score, BMI: body mass index, COPD: chronic obstructive pulmonary disease, CSF: cerebral spinal fluid, DBP: diastolic blood pressure, DVT: deep venous thrombosis, GFR: glomerular filtration rate, HgA1c: hemoglobin A1c, MI: myocardial infarction, PE: pulmonary embolism, RA: rheumatoid arthritis, SBP: systolic blood pressure, TIA: transient ischemic attack).

accomplished if all discharge criteria could be met (Table 2). Patients received up to one dose of postoperative IV antibiotics, and they were provided with a prescription for oral opioid medication to be used as needed.

We performed a review of all patients scheduled for same day total joint replacement at our institution, from September 28, 2020 through October 7, 2021. Patients were identified from our same-day total joint replacement registry. Charts were reviewed to determine patient demographics including age, sex, ASA score, and Charlson Comorbidity Index. We recorded complications, including emergency room visits and hospital admissions within 30 days after surgery. In addition, we recorded the rate of hospital admission resulting when patients could not be discharged on the day of surgery.

Data reporting and statistical analysis were performed in a standardized manner according to Strage et al.<sup>17</sup> Utilizing the Shapiro-Wilk W test to test for normality, all continuous data were found to be nonparametric and are accordingly presented with the median and interquartile range (IQR). Categorical data is presented as count (n) and percentage. All analyses were performed using JMP Pro version 16 statistical software (SAS; Cary, NC).

## 3. Results

A total of 131 same-day total joint replacements were identified through a prospectively collected registry. No patients were excluded. Replacement procedures consisted of 58.0% knees (TKA, n = 76) and 42.0% hips (THA, n = 55). The rate of same-day total joint procedures compared to procedures requiring overnight admission during the study period was 50.0% (n = 126/252), growing from 4.5% of total joints performed in September 2020 (n = 1/22) to 100.0% of total joints performed in September 2021 (n = 24/24).

Patient demographics are presented in Table 3. Median patient age was 59 (IQR: 53 to 64), and 49.6% of the cohort were female. Median ASA was 3 (IQR: 2 to 3), and median Charlson comorbidity score was 2 (IQR: 1 to 3). Patient payer types in order of frequency included Medicaid (58.0%, n = 76), Medicare (19.8%, n = 26), private insurance (13.7%, n = 18), and financial assistance programs for the uninsured (8.4%, n = 11).

On major patient outcomes, 3.8% of patients (n = 5) required conversion to inpatient admission. Reasons for admission included delayed physical therapy clearance (n = 4) and a medical complication (n = 1), which consisted of a patient experiencing a chronic obstructive pulmonary disease (COPD) exacerbation and inadequate oral pain control. The rate of 30-Day Emergency Department (ED) visits was 13.0% (n = 17). Most common chief complaints included postoperative pain (n = 10), incision drainage/edema/hematoma (n = 9), and cellulitis (n = 2). 30-Day Hospital Readmissions occurred in 1.5% of patients (n = 2), consisting of one periprosthetic fracture requiring revision and one hematoma requiring evacuation/irrigation and debridement (I&D). A summary of these primary outcomes is presented in Table 4.

## 4. Discussion

We found that same-day hip and knee replacement could be

**Table 2**  
Criteria for safe same-day discharge.

<ul style="list-style-type: none"> <li>• Resolution of neuraxial anesthesia</li> <li>• Patient demonstrates ability to get into and out of bed safely and independently.</li> <li>• Patient demonstrates ability to ambulate independently with assistive device or crutches.</li> <li>• Patient is cleared for discharge to home by physical therapist.</li> <li>• Patient is tolerating an oral diet.</li> <li>• Pain is controlled with oral pain medication.</li> <li>• Patient has demonstrated the ability to void independently.</li> <li>• Patient desires a discharge to home care.</li> </ul>
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**Table 3**  
Patient demographics.

	Patients (n = 131)
<b>Age</b>	59 (53–64)
<b>Female</b>	65 (49.6%)
<b>ASA Score</b>	
I	2 (1.5%)
II	55 (42.0%)
III	74 (56.5%)
IV	0 (0%)
<b>Charlson Comorbidity Index</b>	
0	14 (10.7%)
1	31 (23.7%)
2	31 (23.7%)
3	32 (24.4%)
4	18 (13.7%)
5	4 (3.1%)
6	0 (0%)
7	1 (0.8%)
<b>Total Knee Arthroplasty</b>	76 (58.0%)
<b>Total Hip Arthroplasty</b>	55 (42.0%)
<b>Insurance Type</b>	
FAP	11 (8.4%)
Medicaid	76 (58.0%)
Medicare	26 (19.8%)
Private	18 (13.7%)

(ASA: American Society of Anesthesiologists score, FAP: Financial Assistance Programs for the uninsured).

- All continuous variables were nonparametric and are presented as median (interquartile range).

**Table 4**  
Patient outcomes.

	Patients (n = 131)
<b>Conversion to Inpatient</b>	5 Patients (3.8%)
Physical Therapy Clearance	4 (3.1%)
Medical Complication <sup>a</sup>	1 (0.8%)
<b>30-Day Emergency Department Visits</b>	17 Patients (13.0%)
Cellulitis	2 (1.5%)
Drainage/Edema/Hematoma	9 (6.9%)
Fatigue	1 (0.8%)
Pain	10 (7.6%)
Skin Irritation/Rash	1 (0.8%)
<b>30-Day Hospital Readmissions</b>	2 Patients (1.5%)
Periprosthetic Fracture Revision	1 (0.8%)
I&D (Hematoma)	1 (0.8%)

(I&D: irrigation and debridement).

- <sup>a</sup> Patient who experienced COPD exacerbation and inadequate pain control for same day discharge.

performed safely at our safety net hospital. After implementation, the rate of same-day surgery for total joint replacements increased, from 4.5% of total joints performed in September 2020 to 100.0% performed in September 2021. That greater trend is a reflection of both an increased willingness of our surgeons, anesthesiologists, and therapists to support same-day discharge after the protocol's safety was demonstrated and the resurgence of COVID-19 cases due to the Delta variant. With no available inpatient beds during the latter months of the study period, elective surgeries were cancelled if hospital admission was anticipated, and same-day surgeries were scheduled in their place.

We found that 13.0% of our patients presented to the ED within the first 30 days after surgery for an orthopedic complaint. Usually, ED visits were related to postoperative pain or superficial skin complaints and did not require further intervention beyond education. Our 30-day hospital readmission rate was 1.5%, representing one periprosthetic femur fracture and one hematoma requiring evacuation/I&D following same-day anterior hip replacement. While surgical technique is likely implicated for the periprosthetic fracture, the same-day protocol per se is not necessarily related. No patient required hospital admission for deep vein

thrombosis (DVT), pulmonary embolism (PE), wound infection, or any other medical complication related to joint replacement surgery.

The safety of same-day total joint replacement has been investigated by a number of studies using the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) registry database. Nelson et al. compared patients undergoing outpatient versus inpatient hip replacement.<sup>18</sup> They found no increased risk of adverse events or readmissions associated with outpatient surgery, and the readmission rate following outpatient surgery was 1.43% compared to 2.97% for inpatient surgery.<sup>18</sup> Similarly, Mundi et al. compared same-day hip and knee replacement procedures to inpatient surgery.<sup>19</sup> These authors found a 1.5% readmission rate for same-day hip replacement and a 2.2% readmission rate for same-day knee replacement, demonstrating a decreased risk for readmission for same-day hip replacements, with no significant difference in re-admission risk for same-day knee replacements.<sup>19</sup> The readmission rate for our series of same-day joint replacement (1.5%) is consistent with the readmission rate reported for these larger cohorts found in the NSQIP database.

Basques et al. used the NSQIP database to perform a matched cohort study comparing same-day to inpatient total joint replacement.<sup>20</sup> They found no difference in the risk of adverse events or readmission associated with same-day surgery, but increased BMI  $\geq 35$ , diabetes, and age  $\geq 85$  were associated with increased risk of readmission following same-day surgery.<sup>20</sup> Courtney et al. queried the NSQIP database to compare the readmission and complication rates between outpatient and inpatient joint replacement procedures.<sup>21</sup> While they found no increased risk of complication or readmission associated with outpatient surgery, they identified several risk factors for increased complication and readmission following joint replacement, including age greater than 70, malnutrition, cardiac history, smoking, and diabetes.<sup>21</sup> Despite the fact outpatient surgery did not demonstrate additional risk for these patients, the authors argue that outpatient joint replacement should not be offered to patients with these comorbidities.<sup>21</sup> Compared to the patients treated with outpatient joint replacement in the above studies, our cohort of patients receiving same-day total joint replacement demonstrates a higher percentage of patients with ASA  $\geq 3$ .

The present study tends to corroborate the findings of Reddy et al., demonstrating that same-day total joint replacement can be performed safely, even for older patients, and even for ASA scores of 3 or more.<sup>11</sup> The median ASA score for our same-day total joint replacement patients was 3 (accounting for 56.5% of our patients), and the median Charlson co-morbidity score for our patients was 2. Only one patient in our series required an unanticipated hospital admission for management of a medical comorbidity (COPD exacerbation that resolved during the evening of admission).

It is important to note that the present study does not represent a series of unselected patients. As we introduced the practice of same-day joint replacement, we began with a selected population of younger and healthier patients. After demonstrating that same-day total joint replacement could be performed safely, we began to expand the practice to older patients with varying degrees of medical comorbidities. All patients received the same pre-operative education, suggesting that a same-day discharge may be anticipated. On the day of surgery, patients were evaluated postoperatively to see if same-day discharge would be feasible. If patients could meet discharge criteria (independent ambulation, appropriate pain control, ability to void, etc.), and if there was agreement between the orthopedic, anesthesia, and physical therapy services, then a same-day discharge would be completed. Even though we began with the notion of appropriate pre-operative patient selection, much of our same-day program has come to be characterized by this kind of post-operative patient selection.

Our total joint program changed dramatically after institution of our same-day protocol. The success of our same-day program rests largely with our decision to pursue it. The major change took the form of education, not only for our patients, but for our providers.<sup>22,23</sup> Our surgeons had previously admitted all joint replacements for at least one night

postoperatively, and they had to be convinced that same-day surgery was not only safe but possible. Clinic staff had to learn that same-day surgery was not an exception to the rule. Rather, it was an expected outcome. Our anesthesiology partners had to become more comfortable with discharging patients from the PACU, our recovery nurses had to be comfortable sending patients home rather than to the ward, and our therapists had to become adept at seeing patients soon after surgery to ensure that they were safe to go home.

For a same-day total joint program to work, patient education is paramount.<sup>23</sup> Throughout the process, from the first visit in clinic, through the moment of discharge to home after surgery, all members of the health care team need to reiterate a common message: “Same day discharge is planned. Same day discharge will happen. And, same day discharge is safe.” Convincing patients to accept same day discharge may seem like a challenge, especially as this is a newer practice. Many patients may have friends who stayed in the hospital after joint replacement. Many patients may have been admitted to the hospital after their own previous joint replacement. Still, we found that patients accepted same-day discharge readily. Most seemed to have less reluctance than their providers.

Unlike dedicated high-volume orthopedic hospitals or outpatient surgery centers, urban safety net hospitals face a different set of challenges.<sup>24</sup> These hospitals must continue to care for a wide variety of patients who do not plan for their illness and who cannot pay for their care. The COVID epidemic has only exacerbated the difficulty of caring for a large population of under- and uninsured patients. While some private hospital systems earned record profits in 2020, multiple safety net hospitals were forced to care for a disproportionate share of the COVID burden, even while operating at a loss.<sup>25</sup> When healthcare resources are stretched thin, elective surgeries may be the first to be rationed or eliminated altogether, and those without the ability to pay are the most at risk. For patients who depend on a safety net hospital, access to elective surgery will depend on the hospital’s ability to provide it. Seen in this context, outpatient total joint replacement may offer the promise of extending total joint replacement to those patients who might not have access to it otherwise.

The limitations of the present study are characteristic of any retrospective cohort study. Specifically, we have no control group. As such, we cannot make any conclusions about the presence or absence of increased risk that may have been introduced to our patients as a result of inclusion in the same-day total joint replacement protocol. Even so, our re-admission rate is consistent with previous studies on same-day joint replacement. Also, our cohort was subject to bias as we selected only the most healthy candidates for same-day joint replacement when this program was initiated at our institution. Later in the series, as our institution became more familiar with the same-day joint replacement protocol, the criteria for inclusion changed somewhat, and same-day discharge was offered to more and more patients according to their progress postoperatively. Again, this introduces bias, as it can be argued that only healthier patients would demonstrate progress in the recovery room satisfying our criteria for same-day discharge. Nevertheless, the present study demonstrates that a same-day total joint replacement program can be successful at an urban safety net hospital, so long as appropriate criteria for safe discharge are met.

## 5. Conclusion

Same-day hip and knee replacement can be performed safely at a safety net hospital. Unlike dedicated high-volume orthopedic hospitals or outpatient surgery centers, urban safety net hospitals face a different set of challenges and must care for a wide variety of patients who do not plan for their illness and/or may not be able to pay for their care. Outpatient total joint replacement may extend total joint replacement to patients who might not have access otherwise.

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## Institutional ethical committee approval

Institutional Review Board approval was obtained prior to initiation of this study.

## Author contributions

**E. Mark Hammerberg:** Conceptualization, Methodology, Writing - Original Draft/Review and Editing. **Nicholas J Tucker:** Conceptualization, Methodology, Investigation, Formal Analysis, Visualization, Writing - Original Draft/Review and Editing. **Stephen C Stacey:** Conceptualization, Writing - Review and Editing. **Cyril Mauffrey:** Conceptualization, Writing - Review and Editing. **Austin Heare:** Conceptualization, Writing - Review and Editing. **Luis A. Verduzco:** Conceptualization, Writing - Review and Editing. **Joshua A Parry:** Conceptualization, Methodology, Formal Analysis, Writing - Review and Editing.

## Declaration of competing interest

None of the authors have financial conflicts of interest relevant to the content of this study.

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