15 Outpatient Unicompartmental Knee Arthroplasty

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Introduction

Surgeon and patient interest in outpatient joint replacement has grown in recent years [1–3]. This paradigm shift can largely be attributed to advancements in perioperative management and growing efforts to increase value provided by joint arthroplasty through diminishing the economic burden [3–5]. With the Centers for Medicare and Medicaid Services' decision to remove total knee arthroplasty from the Medicare inpatient-only list, a growing demand for outpatient arthroplasty is anticipated. This is especially true in the setting of unicompartmental knee arthroplasty (UKA), which has been on the outpatient list for many years.

Multiple investigations have reported outpatient hip and knee arthroplasty as a safe, reproducible, and cost-effective means of delivering patient care in appropriately selected patients [3–22]. With over five million individuals projected to undergo a hip or knee replacement on a yearly basis by 2050, further investigation of appropriate patient selection, prevention of complications, and economic benefits associated with outpatient joint arthroplasty are imperative [4, 17, 18, 23–27].

Unicompartmental knee arthroplasty has grown in the outpatient setting due to its joint-preserving nature, relatively low morbidity, and recent pressures to curtail hospital stays and associated costs [28–30]. In this chapter, we will discuss essential elements of outpatient UKA, including: patient selection and safety, preoperative education, unique elements of preoperative planning, surgical technique, perioperative management, and prevention of complications.

Institutional Readiness

Prior to launching an outpatient joint replacement program, an established system for quality and performance measurement must be in place. Quality metrics, such as length of stay, surgical time, blood loss, readmission rates, and complication rates, should be readily available for a comparative analysis following the introduction of outpatient UKA.

We support the position statement released by the American Association of Hip and Knee Surgeons (AAHKS) requiring optimization of the following elements prior to participation in outpatient program [31]:

- Appropriate patient selection (on medical grounds)
- Patient education and expectation management (e.g., preoperative "joint school")

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- Social support and environmental factors (family or professional outpatient support)
- Clinical and surgical team expertise
- Institution facility or surgery center factors (history of successful teamwork and an environment conducive to optimizing surgical outcomes)
- Evidence-based protocols and pathways for pain management, blood conservation, wound management, mobilization, and VTE prophylaxis.

Patient Selection

Patient Selection

Appropriate patient selection is a key element in outpatient joint replacement. Multiple authors have shown that outpatient UKA results in high satisfaction with no clinically significant increased risk of complications when patient selection is appropriately performed [1, 7, 14, 15]. Because UKA has been on the outpatient list for many years, many surgeons plan for the majority of patients undergoing UKA to be discharged the same day or within 24 hours.

Following surgical indication for a partial knee replacement, each individual must be effectively counseled to ascertain the feasibility of undergoing an outpatient procedure. It is essential to have a strong social support system in place, regardless of a patient's physical capability to undergo the intervention. Those without a reliable support system are best treated with an overnight hospital stay.

Traditionally, candidates for outpatient surgery have been identified as younger, healthier individuals with low American Society of Anesthesiologists (ASA) and Charlson Comorbidity Index (CCI) scores [3, 8–12, 32]. This method of patient selection is subject to significant physician discretion, and literature regarding patient safety is largely limited to single-physician retrospective case series [3, 8–12, 20, 22, 33].

Recent attempts have been made to objectively identify candidates for outpatient joint replacement surgery [17, 24, 25, 34–36]. Courtney et al. demonstrated higher risk for readmission and complications following outpatient joint replacement in patients aged more than 70 years and those with malnutrition, cardiac history, COPD, smoking history, cirrhosis, or diabetes mellitus [24, 25]. In an attempt to appropriately risk-stratify patients for successful outpatient surgery, Meneghini et al. generated the Outpatient Arthroplasty Risk Assessment (OARA) score. [17] The algorithm is based on the presence of nine comorbidity categories, namely, general medical, hematological, cardiac, endocrine, gastrointestinal, neurological and/or psychological, renal and/or urology, pulmonary, and infectious disease. In a review of over 1100 early discharge patients, the authors report the OARA score to be more predictive of successful same-day or next-day discharge for primary joint arthroplasty than ASA and CCI scores. Although early results are promising, further prospective investigations to validate the utility of the OARA are needed before widespread acceptance of the scoring tool is adopted [17, 36].

It is the authors' belief that the vast majority of patients undergoing UKA can be safely treated as outpatients. At our institution, over 95% of partial knee replacement are done as outpatient surgery. In our series comparing 569 UKAs performed in the hospital setting versus the surgery center setting, the only patients excluded were those with a significant cardiac history or a lack of social support. Currently, it is the senior author's policy to plan all UKAs as outpatient surgery.

Preoperative Education and Support System

Preoperative counseling and the presence of a reliable support system are pillars of outpatient arthroplasty surgery. Despite the growing popularity of outpatient surgery among surgeons, less than 50% of patients are aware that same-day discharge is an option and over 50% of patients expect a minimum 2-day stay following a joint replacement [37]. Further barriers to rapid recovery protocols are present when patients or

their relatives have previously experienced an extended hospital or rehabilitation stay, making such practice their standard of care. Nevertheless, thorough preoperative education regarding the safety, patient satisfaction, and benefits associated with outpatient UKA can aid in eliminating fears or preconceived notions about same-day discharge.

The surgeon and team members should present a detailed and easily understandable program focusing on the perioperative period, setting clear expectations for both patient and support system. All members of the surgical team and clinical staff should convey the same message to each patient. Details of the operation, preferred mode of anesthesia, multimodal pain management protocol, physical therapy requirements for discharge, common barriers to discharge, and home care following surgery should be highlighted. The preferred method of postoperative communication with the surgeon's office should be clearly delineated. A comprehensive preoperative teaching class is an option, but not mandatory. In our institution's experience, confident detailing of the postoperative recovery plan and a concise handout highlighting the aforementioned points by the surgeon and perioperative team have proven invaluable in educating our patients.

Perioperative Management

Multimodal pain protocols reduce the total opioid consumption with the goals of decreasing the incidence of postoperative delirium, respiratory depression, ileus, urinary retention, and nausea.

Preoperative analgesia protocols are essential elements to multimodal pain pathways [15, 33, 38]. Administration of select medications prior to incision aids in decreasing the local inflammatory response and reducing the pain signaling to the central nervous system [15, 33, 38]. Nonsteroidal anti-inflammatory drugs (NSAIDs), including cyclooxygenase (COX)-2 inhibitors, gabapentinoids, and acetaminophen, have gained popularity for their narcotic-sparing effect. The use of narcotics can be further diminished through the utilization of preoperative motor–sparing peripheral nerve blocks, non-narcotic spinal anesthesia, intravenous ketorolac, perioperative glucocorticoids, and intraoperative wound infiltration with long-acting local anesthetics.

In this section, we will highlight evidenced-based protocols for preoperative anesthesia, multimodal analgesia, blood management, surgical techniques, and postoperative management.

Preoperative Medication

Pre-emptive pain and nausea management should begin in the preoperative holding area. Our current regimen is as follows: oral acetaminophen 1 g, oxycodone hydrochloride 10 mg, celecoxib 400 mg, pregabalin 75 mg, and a scopolamine patch placed behind the ear. Selective withholding of medications may be considered in cases of advanced age, allergies, or a documented history of prior drug intolerance.

Neuraxial Anesthesia

In the rapid recovery setting, spinal-epidural anesthesia with an additional motor-sparing regional block is preferred over general anesthesia. This bias is due to higher rates of pulmonary complications, infections, acute renal failure, 30-day mortality, and prolonged hospital stay associated with general anesthesia in the setting of knee arthroplasty [39, 40].

Spinal anesthesia utilizing sodium-channel blocking local anesthetics (e.g., lidocaine or mepivicaine) with elimination or minimization of opioids has dual benefits. Minimizing narcotic medication in the spinal injection reduces opioid-related side effects, while the short-acting local anesthetic agents allow patients to more rapidly participate in postoperative physical therapy. We prefer the use of 2% lidocaine for neuraxial anesthesia due to lidocaine's significantly shorter onset of action and overall duration (2 hours) when compared to bupivacaine (4–8 hours) [15, 38]. Recent literature has shown lidocaine spinals are safe and effective in the outpatient joint replacement setting, with low urinary retention rates and no episodes

of transient radiculitis, possible rare side effect of lidocaine [41]. Recent literature has also shown clinically significant benefits of utilizing mepivicaine over bupivacaine spinals, demonstrating fewer urologic complications and shorter length of stay in patients receiving mepivicaine [42]. Our recommended regimen for planned outpatient partial knee replacement is a single-shot spinal consisting of 2% lidocaine or 2% mepivicaine.

Regional Blocks

Regional nerve blocks have become an increasingly important element of rapid recovery programs. Femoral nerve blocks have traditionally been the gold standard. However, due to mixed motor and sensory involvement, persistent quadriceps weakness can result and lead to delayed discharge due to a prolonged time until ambulation. Additionally, motor blocks serve as a potential fall risk during the early recovery period [26, 43, 44]. Because of its motor-sparing capabilities, the adductor canal block has gained popularity over femoral blocks and continuous spinal anesthesia in recent years [4, 7, 15, 26, 45, 46]. The adductor canal block provides a selective sensory blockade with minimal decrease in quadriceps strength, enabling early ambulation and decreasing early fall risk [26, 45, 46]. Recent literature has shown a single-shot adductor canal block with bupivacaine and multiple adjuvants provide equivalent analgesic benefit for up to 30 hours when compared to a continuous adductor canal block [46]. At our institution, we routinely utilize ultrasound-guided single-shot adductor canal blocks (0.5% ropivacaine, 25 mL).

Intraoperative Medication

Multimodal pain and nausea control continue intraoperatively with the administration of ondansetron 4–8 mg for nausea, dexamethasone 4–10 mg for nausea and anti-inflammatory purposes, and propofol for procedural sedation. The authors find propofol particularly useful in the rapid recovery setting due to its quick onset of action, short half-life, and hypotensive effects. However, diligent and continuous airway monitoring is required, as propofol is a known respiratory depressant. Ketamine (0.5 mg/kg) has also proven effective and provides additional pain control [26]. Standard preoperative antibiotics should always be administered.

Blood Management

Blood transfusion in the setting of partial knee arthroplasty is rare; however, blood conservation remains a critical element of outpatient UKA. The process beings with maintaining normothermia preoperatively and employing appropriate fluid hydration during the perioperative period. Meticulous hemostasis with the use of electrocautery is recommended during surgery. Extensive data and AAOS recommendations now support the routine use of tranexamic acid (TXA) to decrease transfusions in hip and knee arthroplasty [47, 48]. The dosage and route of administration do not appear to substantially differ in their effectiveness, leaving these elements up to surgeon's discretion [47, 48]. Our current regimen includes 1 g IV TXA prior to tourniquet inflation and 1 g IV TXA in the recovery room. Placement of a tourniquet is recommended, although recent literature has questioned its efficacy in the era of tranexamic acid [49]. Watertight arthrotomy closure and tissue glue have been reported to reduce external drainage when combined with the current generation of dressing materials [4].

Surgical Technique

Surgeons should employ their preferred surgical technique in the outpatient setting. Although the current authors employ a minimally invasive surgical (MIS) midvastus or lateral arthrotomy technique in an effort to minimize soft tissue trauma at the time of surgery, debate continues to exist over clinically meaningful differences in early recovery for MIS vs. traditional techniques [50–52]. Similarly, no universally accepted clinically important differences have been reported

between traditional instrumentation versus patient-specific instrumentation or traditional operative technique versus computer-assisted [53–55].

Local tissue infiltration with a periarticular injection (PAI) "cocktail" has gained traction over the past decade [26, 33, 38]. Various combinations of a long-acting anesthetic, NSAID, steroid, and epinephrine introduced into the soft tissues surrounding the knee have been described [26, 33, 38]. Substantial debate exists over the efficacy of liposomal bupivacaine, with a recent randomized controlled trial showing no superiority over standard bupivacaine [56]. It is the author's opinion that the method in which the cocktail is administered is more important than the medications contained with the cocktail itself. We recommend targeted infiltration of a bupivacaine-only injection into the posterior capsule, proceeding anteriorly, and always aspirating to ensure no vascular structure is injected. Following diffuse capsular infiltration, 20 mL is injected into the periosteum of the femur and tibia, followed by 10 mL into the anterior suprapatellar synovium and extensor mechanism. Residual bupivacaine is infused in the subcutaneous tissues [38].

Postoperative Management

Two clearly defined phases of care comprise the immediate postoperative period: acute phase and step-down phase. During these phases, attention should focus on medical optimization and the prevention of complications that can occur in the first 24 hours after a procedure, such as: falls, over-sedation, urinary retention, nausea, pain, dehydration, and hypotension [3, 23, 26, 57].

The acute phase begins with transfer of the patient from the operating room to the post-anesthesia recovery unit. Continued monitoring and medical stabilization by anesthesia and nursing are performed, while pain, nausea, and dehydration are concurrently managed [15, 26, 38]. The multimodal regimen continues with IV ketorolac 15–30 mg (once), tramadol 50 mg (q 6 scheduled), and hydrocodone-acetaminophen 10–325 mg (q4 PRN). Intravenous rehydration is performed to diminish nausea and optimize a steady-state fluid balance. Overzealous rehydration must be avoided to mitigate the risk of iatrogenic urinary retention, with a goal of less than 1500 mL total fluids administered [58, 59]. Routine laboratory draws are not necessary following routine partial knee arthroplasty, and we do not routinely employ this practice at our institution [60]. Early straight leg raise is encouraged as soon as the patient gets to the recovery room to instill confidence and alleviate fears of early mobilization.

The step-down phase begins after the patient is medically stable, weaned from oxygen, pain is controlled, and transfer to a private recovery area is deemed appropriate by experienced nursing and anesthesia staff. The patient is encouraged to sit up in bed and is given oral liquids and a light snack. With the assist of a nurse or physical therapist, the patient is directed to sit on the side of the bed with feet dangling and is then allowed to stand. The physical therapy staff subsequently coaches the patient on how to properly utilize an ambulatory aid, followed by a short walk to the restroom for a voiding trial.

Postoperative urinary retention (POUR) is a common barrier to discharge and has been reported to occur in up to 46% of arthroplasty patients scheduled to undergo a rapid-recovery joint replacement [58, 61]. Patients over 60 years with a history of urinary retention, those receiving high volumes of perioperative intravenous fluids, and patients receiving opioid-containing spinals are at higher risk for POUR [58, 59, 61, 62]. To mitigate the risk of POUR, we advocate opioid-free spinal analgesic consisting of lidocaine or mepivicaine only, total fluid administration goal of less than 1500 mL, minimization of narcotic medication where feasible, and early ambulation.

Physical therapy goals for discharge include safe ambulation with either crutches or a walker and management of activities of daily living following discharge. Specific protocols may be individualized to each institution and should be developed with the input of the physical therapy department [3, 10]. At our institution, we require patients to independently stand from a chair,

ambulate with the use of crutches or a walker, and void prior to discharge.

Once the goals of discharge have been met, the previously provided discharge materials are again reviewed with the patient and family members. The nursing staff will highlight the medication regimen, local wound care, contact information for the surgeon's office, how to schedule outpatient physical therapy, and when to return to the office for a follow-up appointment. Following discharge, patients are contacted within 24 hours to assess their progress and to answer questions. In our experience, the use of a mobile application that provides daily surgeon-specific updates, permits two-way communication, and provides home-directed exercises has proven beneficial in guiding patients through their postoperative recovery.

Thromboprophylaxis

Deep vein thrombosis (DVT) prophylaxis is required for all patients undergoing joint arthroplasty, and the appropriate regimen should be based on a patient's risk [23, 63]. In our experience, most patients undergoing rapid recovery UKA are lower risk for thromboembolic events and can be safely treated with compression stockings and aspirin [15, 64, 65]. In higher risk patients, we prefer the use of oral factor Xa inhibitors, which do not have to be monitored [63].

Results of Outpatient Surgery

Rapid recovery protocols and tools for safe selection of outpatient joint replacement surgery patients continue to evolve. Multiple authors have shown outpatient joint replacement surgery is safe, cost-effective, and leads to higher patient satisfaction scores [1, 3, 5, 7–17, 20, 21, 36, 37]. Excellent outcomes with low complication rates have been achieved in both hospital and outpatient ambulatory surgery center settings [8, 15, 21, 66]. Further, AAHKS has released a position statement supporting outpatient joint arthroplasty in appropriately selected patients at aptly prepared centers, highlighting specific, critical areas for continued focus and development [31].

Summary

The success of an outpatient joint replacement surgery program relies on the development, integration, and implementation of multiple elements, including: well-defined criteria for patient selection, patient education, social support system, perioperative medical optimization and management, multimodal pain control, consistent and dependable perioperative teams, and coordinated postoperative care by surgeons and other providers. If the above recommendations are implemented, it is our opinion that UKA can be appropriately performed in the outpatient setting on most patients (> 95%) in a safe, effective manner with high patient satisfaction.

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