Outpatient Hip and Knee Replacement

Implementation and Essential Techniques

R. Michael Meneghini
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Preface

We are in the midst of an outpatient revolution! Ten years ago, most orthopaedic surgeons and healthcare providers would not have dreamed that the majority of total hip and knee arthroplasty procedures would be performed in the outpatient setting discharged to home within hours of their surgeries. Accelerated by the COVID-19 global pandemic which constrained hospital beds and resources, we are on a trajectory to where the majority of patients undergoing primary total hip and knee arthroplasty are discharged to home the same day. However, due to the medical and surgical complexity of these procedures and patients who they are performed on, sophisticated programmes composed of high-functioning healthcare providers with highly coordinated care pathways and protocols must be developed and maintained.

This book provides real-world and practical content from nationally and internationally recognized experts in outpatient hip and knee arthroplasty. They share their insights on all the essential elements needed to develop a robust and successful outpatient same-day-discharge hip and knee arthroplasty program. All the critical issues are covered in the following text and include patient selection, perioperative medical optimization and management, perioperative pain control and anaesthetic techniques, common threats to patient discharge, patient connectivity and monitoring outside the hospital as well as financial considerations. The reader will find all the essential elements to develop and implement their own same day discharge outpatient hip and knee program in either a hospital or ambulatory surgery centre setting.

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Contents

Chapter 1
Patient Selection for Same-day Discharge: Medical and Surgical Risk Assessment

Peter Caccavallo and R. Michael Meneghini

Introduction

Total hip and knee arthroplasty (THA, TKA) performed in the outpatient setting has become increasingly utilized due to multiple factors and there are multiple studies that demonstrate efficacy for primaries [1, 2] and carefully selected revision cases [3–6]. The factors driving utilization of outpatient hip and knee arthroplasty surgeons include investment in ambulatory surgery centers (ASCs); repercussions of the COVID-19 pandemic such as constrained hospital resources and increased patient demand; and Centers for Medicare and Medicaid Services (CMS) decisions with the removal of these procedures from the inpatient-only list. Furthermore, case volume projections for primary THA and TKA being performed in ASCs are projected to increase by 457% and 633%, respectively over the next decade [7]. Nevertheless, as more arthroplasties are performed in the outpatient setting, thorough medical evaluation and proper patient selection and optimization will become more critical for safe and effective rapid discharge. This chapter will highlight key elements related to medical evaluation and patient selection and optimization for outpatient total joint replacement.

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Medical Evaluation and Patient Selection

Many joint replacement surgeons limit their outpatient surgical practice to the healthiest of patients. However, the vast majority of patients with end-stage arthritis fail to fall into this category which greatly limits the number of patients eligible for outpatient surgery. The key to *outpatient* surgical selection is to identify the patient who will safely discharge on the same day and is at a low risk for readmission, especially within the first 2 days. This is different than just identifying those who have increased risk for a postoperative medical *complication* within 90 days of surgery, which is the basis for most risk calculators. For example, a patient with *stable* coronary artery disease who has reasonable exercise tolerance will be more likely to discharge the same day after a total hip or knee arthroplasty. On the contrary, a healthy patient with a history of poor postoperative pain tolerance would be a low medical risk, but a high risk of failure for same-day discharge due to poor pain control. Further, an otherwise healthy patient with a history of postoperative urinary retention would be problematic in terms of discharging the same day. Simply put, increased medical complication risk does not necessarily equal the risk of outpatient failure. There are many variables including psychological, social, and medical risks that will allow one to effectively screen for appropriate outpatient candidates.

There are many *medical* risk assessment tools available (i.e., ASA, CCI, RAPT) [8–10] but they were never intended to be used as an outpatient screening tool. The most common classification system is the American Society of Anesthesiologists (ASA) Physical Status Classification originally described in 1976 [8]. The ASA score is based on a survey of 255 anesthesiologists used to determine the health status of a patient based on a 1–5 scale. A score of 1 represents a "normal healthy patient," 5 indicates a patient that is about to die, and 4 is a patient with a medical condition that is "a constant threat to life." This leaves most patients with a score of 1, 2, or 3 for elective TJA. Separating patients into three categories is a poor screening tool for outpatient surgical selection as the score is not particularly discerning. The authors of the original ASA publication even admit the classification system "suffers from a lack of scientific precision" [8].

Furthermore, all patients should undergo a complete history and physical medical exam for identification of modifiable risk factors as well as appropriateness for elective surgery from a cardiac standpoint using the most recent American College of Cardiology and American Heart Association guidelines. Laboratory and cardiac testing should be obtained for all patients based on current perioperative guidelines including hemoglobin, creatinine, and HgA1c values. A physical exam is performed with special attention to cardiac, pulmonary, and neurological baseline abnormalities that delineate a clear physical baseline and avoidance of postoperative misunderstandings. In our outpatient program, patients are stratified using the Outpatient Arthroplasty Risk Assessment (OARA) Score [11] which consists of nine categories including General, Hematological, Cardiac, Endocrine, Gastrointestinal, Neurological/Psychological, Renal/Urology, Pulmonary, and Infectious disease. The OARA Score has demonstrated near-perfect positive predictive values (PPV) of

91.5 and 98.8; and very low false positive rate values of 3.0 and 0.7 using cut-off values of 59 and 79, respectively for determining which arthroplasty patients are safe for early discharge in the outpatient setting [11, 12]. This score has also been externally validated outside the original institution with a PPV of 86.1 for both same-day and next-day discharge of THA patients in a rapid discharge program [13]. The OARA Score, compared to other *medical* risk stratification tools, provides a higher level of scientific precision as the score ranges from 0 to 100 on a continuous scale compared to the ASA classification ranging from 1 to 5 on a categorical scale. It is also important to note the OARA Score was not designed to be a measure of physical status, medical complexity, or mortality. Key aspects of the OARA Score are briefly summarized below:

General Medical

A patient's general overall health and functional status are assessed. It is intuitive that a patient with no home support and severe deconditioning is a poor outpatient candidate. Obesity and morbid obesity, while not prohibitive to outpatient surgery, tend to predict patients with poorer states of health and decreased medical compliance. Screening for high narcotic and benzodiazepine tolerance or simply a history of chronic pain control difficulties are barriers to physical and mental readiness for same-day discharge. The General Medical category accounts for 180 possible points contributing to the overall original OARA Score.

Hematological

Patients with anemia, especially significant or unevaluated anemia, can potentially have a wide variety of known and unknown medical problems which can be exacerbated in the immediate postoperative period. With large expected blood loss, patients with likely postoperative transfusion necessity should be avoided. Those with difficulty managing anticoagulation/antiplatelet medications will require more attention and sometimes increase the risk of outpatient failure. The Hematological category accounts for 325 possible points contributing to the overall original OARA Score.

Cardiac

While patients with stable coronary artery disease can make great outpatient candidates, identifying those with tenuous conditions despite appropriate management can be a challenge. With large fluid shifts, as well as intentional and unintentional

intraoperative hypotension, this may exclude patients with severe aortic stenosis or a history of pulmonary edema. These patients frequently require longer periods of postoperative monitoring as an inpatient. The Cardiac category accounts for 385 possible points contributing to the overall original OARA Score.

Endocrine

Uncontrolled diabetes is not only a marker for perioperative complications but also noncompliance. Outpatient surgery requires increased responsibility on the side of the patient. Those that show poor long-term compliance often will show poor short-term compliance and an increased risk of readmission. Adrenal suppression can make the aforementioned expected hypotension difficult to manage within the first 24 h. The Endocrine category accounts for 165 possible points contributing to the overall original OARA Score.

Gastrointestinal

Patients with cirrhosis are high-risk patients in general. However, healthy patients with a history of postoperative ileus and difficulty swallowing can be at high risk for postoperative complications and readmissions. The Gastrointestinal category accounts for 185 possible points contributing to the overall original OARA Score.

Neurological/Psychological

Patients with dementia are a challenge, even on the inpatient side. Postoperative rehabilitation, expected pain, and detailed medicine directions can be quite intimidating. It is often unpredictable who will tolerate anesthesia and postoperative sedating medications or who will have prolonged postoperative delirium. Even patients suffering from depression alone can find simple instructions challenging to follow and are better treated as inpatients. The Neurological/Psychological category accounts for 185 possible points contributing to the overall original OARA Score.

Renal/Urology

Chronic renal disease is also very sensitive to fluid shifts and hypotension and frequently will require specific fluid and medicinal adjustments beyond the day of surgery. With a significant incidence of anesthetic-induced postoperative urinary

retention (POUR), patients with a history of POUR, or uncontrolled benign prostatic hyperplasia (BPH) can be a challenge unless protocols are in place to manage this common issue. The Renal/Urology category accounts for 220 possible points contributing to the overall original OARA Score.

Pulmonary

Patient with tenuous asthma or chronic obstructive pulmonary disease (COPD) need special consideration of its predicted stability postoperatively. Untreated sleep apnea can be especially dangerous when postoperative pain and narcotic requirement are at their peak on postoperative day zero. The Pulmonary category accounts for 250 possible points contributing to the overall original OARA Score.

Infectious Disease

The overall stress and physical demand for joint replacement is significant. Patients with significant acute infections regardless of potential prosthetic joint infection risk are a risk for same-day discharge failure. The Infectious Disease category accounts for 65 possible points contributing to the overall original OARA Score.

In addition to a medical risk stratification tool, program, or methodology such as OARA, appropriate medical evaluation should include thorough medical history and physical examination directed toward the psychological, social, and medical issues that will predict the likelihood of outpatient safety and success. It is sometimes difficult to determine if a *medical* risk factor confers a higher likelihood of delay in outpatient discharge. An appropriate medical evaluation that includes a validated tool to identify risks for outpatient failure will open outpatient surgery to a much larger population of patients that may have increased medical risks but would still be appropriate for outpatient surgery. It not only provides patient assurance and a guide for appropriate screening, but it provides an appropriate defense for unforeseen and unavoidable complications that still rarely occur in all settings.

Perioperative Optimization

In addition to patient selection, perioperative patient optimization is also critical to successful early discharge of outpatient arthroplasty patients. This involves multidisciplinary perioperative protocols developed in conjunction with anesthesia and a dedicated internal medicine specialist [14]. Protocols prioritize intraoperative fluid management and resuscitation, multimodal pain control, and overall consistent surgical care (i.e., approach and operative time). Intraoperative fluid management

should emphasize euvolemia via protocols designed to allow/encourage patients to drink clear liquids up to 2 h before surgery. We emphasize euvolemia rather than hypovolemia or overhydration with excessive fluid loading, both of which can exacerbate postoperative urinary retention. Then, approximately 2 L of fluid is given intraoperatively to maintain adequate tissue perfusion and oxygen delivery [15]. Pain control protocols should highlight multimodal medications given preoperatively and postoperatively [16]. Intraoperative pain control can be managed effectively with nerve blocks and peri-articular injections, particularly for knees [17, 18]. Further, protocols should prioritize conserving intraoperative blood loss with the use of tranexamic acid (TXA) [19, 20] and potentially advanced technology such as abbreviated navigation of the femur which has shown to reduce blood loss during joint replacement [21]. Postoperatively, an extended antibiotic prophylaxis protocol has shown to reduce infection rates associated with primary and revision TJA [22–24]. While some physicians have concerns about antibiotic resistance with this protocol, the rationale for extended antibiotic prophylaxis centers around extending the "golden period" for maintaining low microbe levels and therefore preventing periprosthetic joint infection in TJA [23, 25]. Further, the choice of wound dressing should be considered as the use of closed incision negative pressure wound therapy may be beneficial in reducing the incidence of incisional wound complications in high-risk patients [26].

Barriers to Early Discharge in TJA

After successful patient selection and optimization, identifying the barriers to rapid discharge for outpatient TJA patients are of utmost importance for continual protocol improvements. Recent studies suggest the main predictors for patients not discharging same-day or next-day are postoperative urinary retention (POUR) [27]; hypotension, intractable pain, and nausea [28, 29]; general motor weakness [29]; and hypoxemia [3] among others. Further study is necessary to elucidate these predictors and other barriers to early discharge in TJA.

Conclusion

In summary, outpatient TJA is expected to increase exponentially over the next decade which makes medical evaluation and patient selection paramount for its continued success. Several medical risk stratification tools exist but are limited by low scientific precision and were designed to evaluate medical risk rather than surgical risk to rapid discharge following TJA. The OARA Score was specifically designed to screen for patients who are surgically appropriate for outpatient TJA and accounts for comorbidities in nine medical categories. Furthermore, perioperative patient

optimization with multidisciplinary team protocols, proper intraoperative fluid management, and multimodal pain control is also critical to a successful outpatient TJA program.

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Chapter 2
Medical Optimization and Risk Mitigation for Readmission

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Introduction

Primary total joint arthroplasty (TJA) represents one of the most commonly performed surgeries in the United States. Rates of outpatient TJA have dramatically increased [1] and while studies have shown that appropriately selected patients undergoing outpatient TJA have similar outcomes to standard-stay inpatients, it is crucial that these patients are optimized prior to their surgical intervention to ensure safe and timely discharge [2, 3].

Modifiable Versus Non-modifiable Risk Factors

Risk factors can be differentiated between modifiable and non-modifiable. A modifiable risk factor is one that can be changed, and such change can result in a different outcome for that patient. A non-modifiable risk factor is one that cannot be changed and, although important to recognize and counsel the patient on, is unfortunately beyond the control of the surgeon and their patients. This chapter will focus on identifying and acting on modifiable risk factors.

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Patient Modifiable Risk Factors and Current Evidence

Diabetes

Diabetes and poor glycemic control have not only been associated with an increased risk of surgical site infection but it is also implicated as a major contributor to PJI in multiple studies. Analysis of these studies has shown a diagnosis of diabetes increases the odds of PJI by more than double [4]. Hemoglobin A1c (Hgb A1c) has been used as a marker of glycemic control in TJA candidates. A simple blood test, Hgb A1c, provides insight into a patient's glycemic control over the past 3 months [5]. Patients with good glycemic control have a Hgb A1C level of less than 7.0%. Other markers of glycemic control include perioperative glucose levels, which some feel better predict PJI when compared to Hgb A1c alone [6]. Additionally, serum fructosamine has been suggested as an adjunct measure of glycemic control over a shorter duration of time when compared to Hgb A1c [7, 8].

Physiologically, the stress from surgery results in an increased production of hormones that antagonize insulin and predispose patients to a relative hyperglycemic state. Thus, in patients with already impaired glycemic control, it is crucial that perioperative control be strictly enforced. Postoperative hyperglycemia, even in patients without a diagnosis of diabetes, can increase the risk of developing a surgical site infection in a dose-related manner. Thus, it is the recommendation of the authors that blood glucose levels be maintained between 110 and180 mg/dL (optimal cutoff of around137 mg/dL) [9] in the perioperative period through frequent blood sugar checks and initiation of diabetic management protocols postoperatively following primary TJA [9]. We also recommend postponing surgery in patients with uncontrolled diabetes and encouraging them to work with their primary care provider, a nutritionist, and/or an endocrinologist on better glycemic control.

Obesity

Obesity is when a person is too heavy for their height. Obesity is a global pandemic thought to be caused by people consuming foods and drinks that are more energy-dense (high in sugars and fats), and engaging in less physical activity. Body mass index (BMI) is an index of weight-for-height used to classify obesity. It is defined as a person's weight in kilograms divided by the square of their height in meters (kg/m^2). In adults, overweight is defined as a BMI of 25 or more, whereas obesity is a BMI of 30 or more.

Obesity has been correlated with higher rates of osteoarthritis and eventually increased utilization of TJA [10]. Studies have shown that patient satisfaction and functional improvement among the obese patient population is similar to the non-obese group following TJA. However, obese patients are at a higher risk of postoperative complications [11]. Obesity predisposes patients to an increased surgical

dissection during exposure of the arthritic joint being replaced. This, in turn, can lead to longer surgical times, which is associated with a higher risk of PJI [12]. The poor vascularity of adipose tissue further compounds this problem, leading to poor wound healing and a higher risk of persistent wound drainage. A consensus opinion from the American Association of Hip and Knee Surgeons (AAHKS) evidence-based committee emphasized considering delaying elective TJA in patients with a BMI > 40 kg/m^2, especially when associated with other comorbid conditions [10]. Additionally, some obese patients have metabolic syndrome, which is a cluster of conditions arising from insulin resistance that impairs normal leukocyte function. It is defined as having a BMI > 30 kg/m^2 with central obesity, as well as two of the following: hyperlipidemia, hyperglyceridemia, hypertension, or diabetes [13]. Zmistowski et al. demonstrated an increased risk of PJI (14.3% vs 0.8%) in those with uncontrolled metabolic syndrome when compared to a healthy cohort [14]. Thus, patients with obesity should be screened for other characteristics that may define metabolic syndrome and consideration should be made to counsel these patients on the importance of modification of some or all of these risk factors.

Malnutrition

Malnutrition is often an unrecognized aspect of obesity, associated with the consumption of high caloric but nutritionally poor diets. Malnutrition was found to be present in 42.9% of obese patients in a prospective study evaluating the role of malnutrition in TJA patients [15]. Laboratory tests can help to identify patients at risk for malnutrition. These include a total lymphocyte count of less than 1500 cells/mm^3, a serum albumin of less than 3.5 g/dL, or a transferrin level of less than 200 mg/ dL. Patients with preoperative malnutrition should be encouraged to work with a dietician to help improve their nutritional intake and help prepare them for the catabolic demands required in the postsurgical period.

Smoking

Smoking, and its principal ingredient nicotine, has been associated with decreased oxygen delivery to tissues secondary to microvascular constriction. Duchman et al. reported an increased risk of wound complications with current more so than former smokers in a large national database study [16]. The deleterious effects, in particular PJI, seen with smoking have been confirmed by other studies [17].

Studies have shown smoking cessation programs may decrease complications associated with the use of nicotine, even as late as 4 weeks preoperatively [18]. Thus, we recommend patients considering elective primary TJA have a minimum period of 4 weeks of smoking cessation prior to their surgery. Smoking cessation