Rapid Recovery Anesthesia in Total Joint Arthroplasty

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Abstract

Major total joint arthroplasty (TJA) is an effective method of alleviating pain and restoring function performed in a growing number of patients with debilitating arthritis. These procedures, while relatively safe, are associated with a number of complications which can prevent rapid recovery. These complications can be minimized and recovery expedited with careful consideration and collaboration between the orthopaedic and anesthesia providers. The following review will outline some evolving areas in the field and literature that may influence decisions made by anesthesia providers while caring for these patients with an emphasis placed on rapid recovery.

Introduction

The prevalence of osteoarthritis along with the changing expectations of the aging population has made total joint arthroplasty (TJA) one of the most commonly performed orthopaedic procedures with projected increases in the coming decades [1]. In an effort to improve outcomes and reduce associated cost, rapid rehabilitation protocols have gained popularity. These protocols, which emphasize early mobilization and multimodal pain control, have proven effective at decreasing hospital length of stay and accelerating return to independence without increases in readmission and complications [2-4]. As a result, optimizing outcomes following total knee (TKA) and total hip arthroplasty (THA) requires multidisciplinary cooperation including preoperative planning, perioperative care, and postoperative rehabilitation with emphasis on minimizing perioperative complications, improving pain control while minimizing narcotic requirements, and achieving independent mobility effectively producing an ideal environment for rapid recovery. The events that transpire in the perioperative setting are of paramount importance and can have profound effects on the long-term outcomes of patients with anesthesia providers playing a critical role in the team. Rapid Recovery Anesthesia (RRA) can be thought of as not a single definable goal, but rather a multifaceted approach to caring for the patient during the preoperative, perioperative, and postoperative period of time. Goals of RRA include focus on volume repletion, multimodal pain control, minimizing blood loss, and controlling for adverse effects of anesthetics [5]. The purpose of RRA is to enable patient’s to recover from anesthetic and surgery and contribute to an ideal environment for rapid recovery. In light of this critical role, the goal should be to provide safe and effective anesthesia and analgesia while minimizing complications. A secondary goal of efficiency should also be emphasized given the rising costs of medicine and the benefits seen with rapid recovery. The following article will review the available literature to help guide decisions and considerations to optimize patient outcomes after major joint arthroplasty in regards to their anesthesia care.

Choosing the appropriate type of anesthesia to administer requires a unique approach with every patient dependent on many factors to include comorbidities, patient preferences, provider and surgeon preferences, and institutional culture. Ideal anesthesia provides adequate pain control, minimal complications, and allows immediate participation in postoperative rehabilitation. Choices available include general anesthesia, spinal or epidural anesthesia, and possible addition of peripheral nerve blocks. Collaboration between the patient, anesthesia, and surgeon should drive these decisions preoperatively.

Regional anesthesia, which includes both spinal and epidural blocks, has proven to offer several potential benefits when compared to general anesthesia to include decreasing complications and improving postoperative rehabilitation. Likely related to the advanced age of most patients undergoing arthroplasty, complications can occur following TKA and THA with rates averaging around 4% and overall mortality of 0.09-0.19% [6]. These complications can delay recovery and obviously impact overall outcome following TJA. Most studies have shown that the type of anesthesia can influence both the morbidity and mortality following arthroplasty. Rodgers et al [7] performed a meta-analysis of 141 studies performed before 1997 finding a significant reduction in mortality (OR 0.70, 95% CI 0.54-0.90, P=0.006) when regional blocks were compared with general anesthesia. Additionally, odds of complications were decreased to include reductions of 44% for deep venous thrombus (DVT), 55% for pulmonary embolism (PE), 39% for pneumonia, and 59% for respiratory depression Rodgers. This benefit was later confirmed by additional meta-analyses including only randomized trials, again with decreased odds of DVT and PE and additional benefits of decreased operative time, bleeding, and need for transfusion following TJA [8, 9]. Economic benefits also support the use of spinal anesthesia with total anesthesia cost shown to be almost half the cost of general anesthesia with similar outcomes in terms of time and pain scores [10]. These advantages come with minimal associated risk with incidence of neurologic injuries following central nerve blockade found to be less than 0.04% and rates of permanent injury estimated...
Tranexamic acid (TXA) has been identified as another important adjunct to decrease intraoperative blood loss and need for transfusion following THA and TKA. TXA promotes hemostasis through inhibition of fibrinolysis by reversibly binding plasmin effectively maintaining the fibrin matrix produced during coagulation. Protocols vary with common dosages ranging from 10 to 15 milligram per kilogram given preoperatively and postoperatively. Level 1 evidence supporting the use of TXA exists for patients undergoing elective TKA and THA that have shown significant decrease in intraoperative blood loss, postoperative blood loss, and need for transfusion. These benefits are observed without any increased incidence of thromboembolism. Perhaps the greatest reduction of infection and therefore decreased need for reoperation following TJA has been achieved with the implementation of prophylactic preoperative antibiotics. Infusion of antibiotics within 1 hour of incision has been shown to decrease postoperative infections in THA from 3.3% to 0.9% [38]. As a result, the importance of preoperative antibiotics should be stressed and appreciated by all members of the surgical team but especially anesthesia as they are typically the team member administering the medication. Additionally, there should again be active participation in the surgical timeout verifying that the antibiotics have in fact been completed. Although most primary and even revision arthroplasty cases are not excessively long, recommendations include re-dosing antibiotics at intervals of two times the half-life of the drug [39], which provides yet another opportunity for anesthesia to reduce infection risks as the surgeon may be preoccupied with a difficult case and unaware that another dose is indicated.

While antibiotics are effective at decreasing infections caused by the patient’s own micro flora, the bacterial burden of the operating room staff presents another source of potential contamination [40]. Laminar airflow has the theoretical benefit of decreasing infection by minimizing the number of colonized airborne particles from settling into the surgical field[41, 42] . This benefit though is lost when the unidirectional air flow is disrupted. A common cause of disruption is door openings and foot traffic through the operating room. Increased foot traffic and frequent door opening have been shown to increase airborne bacterial counts [42, 43] with nursing and anesthesia personnel being the most common perpetrators [44, 45]. These events represent an unnecessary infection risk that could compromise patient outcomes. Considering the relative short duration of most primary arthroplasties, this may be an indication to avoid anesthesia change over intraoperatively.

**Conclusions**

Total joint arthroplasty is a frequently and increasingly performed procedure which reliably improves pain and restores function in patients with debilitating arthritis of the hip and knee. Optimal outcomes rely on cooperation of multiple disciplines with anesthesia and orthopaedics working in close coordination. To minimize complications and expedite recovery anesthesia, providers need to individually evaluate patients and when possible consider spinal anesthesia, avoid of peripheral nerve blocks, ensure administration of indicated preoperative medications (antibiotics and tranexamic acid), and minimize foot traffic. Adoption of these practices also provide added benefits of improved cost and efficiency as a result of decreased complications.

**References**


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