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Research Article

Pain Management Associated with Total Joint Arthroplasty: Current Concepts

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Total Joint Arthroplasty (TJA) is one of the most commonly performed procedures in orthopaedic surgery with the prevalence in the United States (U.S.) exceeding 1 million per year [1,2]. On the basis of 2000-to-2014 data, primary Total Hip Arthroplasty (THA) is projected to grow 71%, to 635,000 procedures, by 2030 and primary Total Knee Arthroplasty (TKA) is projected to grow 85%, to 1.26 million procedures, by 2030 [3]. With a projected increased age expectancy of the American population, the demand for TJA is also predicted to increase over time, as will the accompanying demand for opioid pain management; thus, keeping pain management associated with TJA in the forefront of the lingering American opioid crisis. TJA is a surgical option performed to provide effective relief of joint pain and dysfunction in patients with advanced end-stage Osteoarthritis (OA) or inflammatory arthritis of a large joint when nonsurgical or conservative treatment has failed. For the purposes of this review, TJA includes both Total Knee Arthroplasty (TKA) and total hip arthroplasty (THA).

Opioid medications have been used for many years as the mainstay of treatment for patients undergoing TJA. These medications, however, are associated with an array of adverse effects and complications that may elicit chronic use, tolerance and addiction, potentially leading to postoperative infection, increased lengths of hospital stays and early revision surgery [4,5]. As noted in the article Pain Management Associated with Total Joint Arthroplasty: A Primer [6], opioid prescription is recommended for short-term use only in patients with severe joint pain awaiting TJA [6]. Prescription opioids (e.g. morphine, codeine and oxycodone) for patients with chronic joint pain related to end-stage (OA) who are awaiting TJA surgery is generally discouraged by the orthopaedic community [7]. Similarly, prescribing significant doses of opioids in the acute postoperative period in TJA is discouraged as higher doses of opioids do not correspond to a reduction in pain control and may be associated with a greater likelihood of long-term opioid use [8-10].

In response to the opioid crisis, at the annual conference of the American Academy of Orthopaedic Surgeons (AAOS) in 2019, the concept of a "deliberate and well-coordinated" multimodal approach to pain management in patients undergoing TJA was introduced [11]. Strategies for pain management before, during and after surgery to minimize opioid use in patients undergoing TJA identified a "contemporary, multimodal approach" under the concept of "opioid stewardship [12]." As presented, the multimodal approach shifts the paradigm from the "sick patient model" to a "well-patient concept." Utilizing a multidisciplinary process, the aim of the contemporary multimodal approach is to keep narcotic use below the threshold for side effects from any medication used and preemptively focus on limiting the total analgesic requirement for patients [12]. The newer concept assumes patients undergoing TJA are optimized for surgery and not expected to be thrown off baseline by the surgery. Consequently, optimized patients will not need to utilize additional unnecessary hospital resources or incur extended lengths of hospital stays following TJA surgery [12].

At the outset when considering use of narcotics for a patient, performing a careful assessment to evaluate risk of overuse and overdose is essential for any health care practitioner prescribing opioids. Patients in the 18-25 or > 50 year old age group, women and those with a history of chronic use are at higher risk of persistent opioid use in the general surgical population [13]. Regular use of opioids for 4 months or longer before TJA is a strong predictor of persistent use of opioids after surgery [14]. Use of the of statewide electronic prescription drug monitoring programs (PDMP) is now generally mandated in many states for prescribers to review an individual's prescriptions prior to prescribing opiates. Best practices for prescribing opioids include prescribing opioids at their lowest dose and for the shortest duration necessary to control symptoms with close monitoring of common side effects [11]. Referral to a specialist in pain management with expertise in opiate use risk assessment and prescription may provide a safe option for prescribers who are hesitant to prescribe on their own.

Once patients are optimized by a multidisciplinary team for TJA surgery, the multimodal approach to pain management consists of several phases: a preoperative phase, an intraoperative phase and a postoperative phase. Preoperative pain management on the day of surgery may involve use of acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs) (e.g. celecoxib, aspirin) may be used as analgesics in the holding area prior to entering the operating room. Pregabalin (Lyrica), opioids

(e.g., morphine, oxycodone) and gabapentin may also be used for analgesia but these agents tend to be avoided in elderly patients due to the adverse sedative effects they may experience postoperatively. Effective perioperative management of fluids and nausea is an important component of surgical pain management. Administration of dexamethasone in moderate doses (more than 0.1 mg/kg) appears to produce a consistent analgesic effect postoperatively if given preoperatively compared with intraoperative administration. In addition, dexamethasone has been shown to be an effective adjunct in multimodal strategies to reduce postoperative emesis and opioid consumption [15].

In patients undergoing TJA, spinal anesthesia is often preferred for use over General Anesthesia (GA). Administered intraoperatively, spinal anesthesia balances pain control with timely resolution of motor block, provides less nausea and pain in the immediate postoperative period, requires less sedation and eliminates the side effects of hoarseness and sore throat that can present after GA. Certain types of spinal anesthesia, however, can delay postoperative ambulation in THA, which is a predictor of early hospital discharge. A randomized control study compared mepivacaine versus bupivacaine spinal anesthesia for early postoperative ambulation in patients undergoing THA [16]. The researchers concluded that patients who received mepivacaine ambulated earlier than patients who received bupivacaine and were more likely to be discharged earlier, thus making mepivacaine a better option for THA patients who could be discharged the same day of surgery [16]. Mepivacaine offers a shorter and more predictable half-life, allowing the dose to be tailored to predicted surgery time. If GA is used, total Intravenous (IV) anesthesia may be better tolerated than inhalation agents and has a shorter half-life.

Postoperatively, peripheral nerve blocks can provide significant relief from pain in TJA surgery. A significant limitation in the use of peripheral nerve blocks, however, is their tendency to cause a motor block that may slow the process of rehabilitation. Periarticular injections (i.e., a regional analgesic injections administered into surrounding tissue of the joint in the surgical field), on the other hand, provide an additional simpler option that is surgeon-directed, addresses pain directly at the source, and do not interfere with motor function. Hospital discharge medications may include acetaminophen, NSAIDs, and an opioid prescribed based on written opioid taper guidelines. An opiate pain control plan is based on a calculated amount of narcotic medication that the patient is taking at the time of discharge from the hospital generally with a limit of 400 Oral Morphine Equivalents (OMEs) for opioid naïve TKA or THA patients [7,11]. Best practice is defined as prescribing less than 90 morphine milligram equivalents per day, to specify the total number of days of the prescription, and not to exceed 7 days unless there is clinical justification for an extended course within the patient's medical chart [17]. An example of an opioid taper plan after TJA is provided in the article Pain Management Associated with Total Joint Arthroplasty: A Primer [7]. Implementation of the guidelines has demonstrated to result in fewer opioids prescribed with no increase in refills [11].

In summary, an optimal strategy for pain management associated with TJA consists of multimodal therapy implemented by a multidisciplinary team individualized to each patient (Table 1). Targeting key mechanisms involved in pain perception in the preoperative, intraoperative and postoperative phases of TJA surgery is important to achieve desired surgical outcomes. Reducing dependence on a single opioid medication and adopting an opiate pain control plan with preoperative and postoperative prescription opioid schedules utilizing best practice criteria results in minimal use of opioids throughout the surgical process. Coordinating opioid prescriptions with open communication among health care practitioners and use of statewide electronic PDMP are strategies shown to be effective in tackling the ongoing opioid crisis within the American health care system.

1. Target Key mechanisms in pain perception	Preoperatively, intraoperatively and postoperatively	Objective: Achieve desired surgical outcomes
2. Reduce dependence on single opioid medication	Consider use of acetaminophen, NSAIDs, peripheral nerve blocks and periarticular injections	Objective: Minimize use of opioids throughout surgical process
3. Adopt opiate pain control plan	Preoperatively and postoperatively	Objective: Utilize best practice criteria
4. Coordinate opioid prescriptions	Maintain open communication among health care providers	Objective: Use electronic prescription drug monitoring programs (PDMP)

Table 1: Optimal strategy for pain management associated with TJA.

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