

## Guidelines

# Evidence-Based Orthopaedic Post-Operative Opioid Prescribing Recommendations Following Hip and Knee Arthroplasty

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Total knee arthroplasty (TKA) and total hip arthroplasty (THA) are frequently performed surgeries to relieve joint pain, with TKA known for its high postoperative pain rates. However, the rise in opioid prescriptions for managing pain, including chronic pain, has led to concerns among healthcare professionals and researchers due to the significant number of opioid-related deaths and nonfatal overdoses, emphasizing the need for alternative pain management strategies. The current guidelines established by the American Association of Hip and Knee Surgeons (AAHKS) recommend non-opioid multimodal anesthesia strategies and cautious opioid use for primary total joint arthroplasty. A multimodal anesthesia approach is recommended for all hip and knee arthroplasty procedures, with a preference for surgeon-administered intraoperative intra-articular adductor canal blocks and pericapsular injections for TKAs. For THAs, a local soft tissue injection is administered, and a fascia iliac block is recommended if a block is necessary.

## INTRODUCTION

Two of the most frequent and effective surgical procedures to alleviate pain in the affected joint are total knee arthroplasty (TKA) and total hip arthroplasty (THA).<sup>1,2</sup> The number of arthroplasty surgeries performed annually is estimated to rise remarkably.<sup>3</sup> TKA is widely acknowledged as one of the most painful orthopedic surgeries, with 60% of patients experiencing intense pain following the procedure.<sup>4</sup> Post-surgical pain hinders early movement, delays the start of physical therapy, and extends the rehabilitation period.<sup>5</sup>

In the US, between 1999 and 2020, over 564,000 individuals lost their lives due to an overdose that involved any form of opioid, including both prescription and illegal opioids.<sup>6</sup> The number of nonfatal drug overdoses far exceeds the number of overdose-related deaths; each nonfatal overdose carries its own emotional and economic burden.<sup>6</sup> Opioid drugs are now commonly prescribed as the first or second option for primary care providers to manage pain associated with osteoarthritis.<sup>7</sup> From 2003-2009, there was a significant rise in the prescription of opioids for knee osteoarthritis symptoms, with an increase from 31% to 40%.<sup>8</sup>

While opioids are the primary approach to pain management after discharge following TKA and THA, there is increasing scrutiny among clinicians and researchers regarding their prolonged use for treating chronic pain.<sup>9</sup>

Opioid medications are frequently prescribed by surgeons specializing in total hip and knee surgeries to manage post-operative pain. However, it has been observed within this field that when more significant amounts of opioids are prescribed, patients tend to consume more of these medications, which increases their risk of dependence and addiction.<sup>10,11</sup> Arthroplasty surgeons and other healthcare providers who prescribe pain medications must prioritize the improvement of opioid prescribing practices through opioid stewardship while also ensuring that their patients' pain management needs are met.

## PROBLEM STATEMENT

Following primary hip and knee arthroplasty surgeries, there is a risk that postoperative opioid prescribing may lead to unintended consequences such as dependency, abuse, diversion, and even death. However, there is a lack

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of clear guidelines regarding appropriate opioid dosing and pain management strategies in this context.

## PROPOSED SOLUTION

Comprehensive, evidence-based guidelines for postoperative pain management regimens following primary hip and knee arthroplasty are available. These guidelines can be found on the website of the American Association of Hip and Knee Surgeons (AAHKS) (<https://www.aahks.org/clinical-practice-guidelines/>), which are grounded in evidence published in both the arthroplasty literature and the broader medical and surgical literature. We aim to offer evidence-based recommendations for prescribing pain medication based on our institution's specific practices.

## STRATEGIES

Individual pain management needs can vary depending on a variety of factors. Pain management principles are generally categorized according to the type of pain, including acute, post-operative, chronic, and palliative pain management. This review will focus on acute and post-operative pain management principles and present the most up-to-date evidence-based recommendations for defining these principles.<sup>12</sup> In this section, you will find the principles that define postoperative analgesia regimens, whereas specific recommendations for evidence-based regimens will be provided later.

1. Whenever feasible, non-pharmacological treatment approaches should be utilized.
2. Non-opioid analgesics, combined with periarticular injections and regional blocks, should be regarded as the initial option for pain management prescription and are preferably prescribed as a standing regimen rather than on an as-needed basis.
3. Opioids should only be administered as needed for breakthrough pain and at the lowest feasible dose, duration, and quantity.
4. Before prescribing an opioid, risk factors for opioid abuse should be considered.
5. When prescribing opioids, education on their use should be provided.

It is advisable to integrate non-pharmacological approaches into the treatment plan whenever feasible. Such policies may involve but are not restricted to, rest, ice, elevating the affected area, and utilizing surgical dressings that are securely fastened but not excessively tight.<sup>13</sup>

Non-opioid analgesics should be considered a first-line pharmacologic treatment for pain and the foundational agent in a multi-modal pain management strategy of pain. Moreover, non-opioid analgesics are best utilized on standing rather than on an as-needed (PRN) basis. Specifically, acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids, gabapentinoids, and local anesthetics have shown remarkable effectiveness in multimodal analgesia studies.<sup>14-16</sup> Regimens are further detailed below. However, opioid-acetaminophen combination medica-

tions (i.e., Percocet, Roxicet, Vicodin, etc.) should be avoided to prevent accidental overdosing on acetaminophen.

To assist with decreasing post-operative pain and opioid consumption, regional blocks and/or periarticular injections are recommended.<sup>17</sup> The advantage of a periarticular injection over a regional block is that it produces no motor blockade, in turn allowing for faster and safer patient mobilization post-operatively.<sup>18</sup> While no consensus periarticular injection combination exists, our preferred injection combination and surgeon-administered adductor canal block are included in [Table 1](#).

Risk factors for opioid abuse and dependence should be considered prior to providing opioid prescriptions. These include preoperative opioid use, psychiatric conditions, chronic pain syndrome, and longstanding back pain.<sup>19,20</sup> Providers should utilize their state's Prescription Drug Monitoring Program (PDMP) to review the patient's prescription drug history before prescribing opioids and periodically throughout their course of therapy beyond the acute period.

Before prescribing an opioid, counseling on safe opioid use should be performed with the patient. Counseling has been shown to decrease voluntary opioid use while maintaining high pain management satisfaction.<sup>21-24</sup> Counseling should establish the duration of therapy and goals of opioid use (patients are recommended to start weaning medications by three weeks postoperative with a maximum time of opioid use set at eight weeks) and may include the use of a physician-patient opioid agreement. Lastly, patients should be advised on safely storing prescribed opioids to avoid diversion and abuse.<sup>25</sup>

If an opioid is prescribed, the lowest dose and shortest duration possible should be prescribed.<sup>26</sup> The CDC recommends a maximum of 50 morphine milligram equivalents (approximately six doses of 5mg of Oxycodone) for no more than 3-7 days in most acute musculoskeletal injuries. There is no clear recommendation from the CDC for postoperative prescribing. However, surgeons should work to keep the use of opioid pain medications as short as possible while still providing adequate pain control. Tramadol may be considered an alternative first-line opioid agent as it is equally effective as other more potent opioids but with a lower risk of dependency.<sup>27</sup> Medication interactions with tramadol must be considered on an individual basis.

Surgeon prescribers should engage other providers in the patient's healthcare delivery team during the perioperative period (i.e., primary care provider or pain management specialist). This communication can avoid double-prescribing and discrepancies in prescribing assumptions.<sup>28</sup> If patients with prior opioid use history proceed to surgery, baseline opioid prescription doses should be continued, and postoperative analgesia is best managed by their pain management provider, if applicable.

## MEDICATIONS

### 1. NON-STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDS)

The AAHKS Clinical Practice Guideline (CPG) for NSAIDs recommends oral NSAID use in the immediate preoperative and/or early postoperative period. There is strong evidence for administering oral NSAIDs at this time to reduce pain and opioid consumption following primary TJA.<sup>29</sup> Based on one high-quality study, moderate evidence supports preoperative administration of an oral selective cyclooxygenase inhibitor (COX-2) NSAID. A perioperative oral selective COX-2 NSAID dose led to better pain control. It reduced opioid consumption following primary TJA compared to giving the first NSAID dose in the early postoperative period.<sup>29,30</sup> There has been no significant difference shown in the outcomes of postoperative opioid consumption or pain scale when comparing selective and non-selective oral NSAIDs.<sup>31–33</sup>

Intravenous (IV) ketorolac given preoperatively, intraoperatively, or within 24 hours postoperatively was strongly recommended for reduction in pain and opioid consumption postoperatively following primary TJA. Regarding low-dose (15 mg) versus high-dose (30 mg) administration of IV ketorolac immediately postoperatively, there was a moderate recommendation that they are equivalent to reducing pain and opioid consumption within the first six-hour postoperative period.<sup>29</sup>

Following discharge, the CPG has a moderate recommendation for administering oral selective COX-2 NSAID to reduce pain and opioid consumption during the six weeks following a primary TKA.<sup>29</sup> There is also a consensus recommendation for using COX-2 NSAIDs after discharge as part of a multimodal pain regimen to reduce postoperative pain and opioid consumption in patients undergoing primary THA.<sup>29</sup> It is important to note that this recommendation only exists for an oral COX-2 NSAID because no studies on non-selective NSAIDs could likely be used similarly.

Regarding the risk of postoperative medical complications from NSAIDs given preoperatively, intraoperatively, or postoperatively, there is a limited recommendation that oral and IV NSAIDs administered in this period do not appear to increase the risk of medical complications following primary TJA. Still, patient factors and length of administration must be taken into consideration.<sup>29</sup>

Standard precautions and contraindications of NSAIDs should be considered, and pharmacy or medical specialists should be consulted for assistance in unclear cases. NSAIDs should be used cautiously in patients with renal insufficiency, cardiovascular disease, GI bleeding, and anticoagulation/antiplatelet therapy. A concomitant proton pump inhibitor, such as omeprazole 20 mg BID or pantoprazole 40 mg daily, can be used in patients over 50 years old and/or with gastric ulcer risk factors while taking NSAIDs, particularly since many patients will also be taking aspirin concurrently for venous thromboembolism prophylaxis. Daily ibuprofen dose should not exceed 2400 mg, and daily naproxen dose should not exceed 1100 mg (initial day can be up to 1375 mg).<sup>25</sup>

### 2. ACETAMINOPHEN

The AAHKS CPG for Tylenol use in primary TJA gives a moderate recommendation for perioperative administration of IV or oral acetaminophen to reduce pain and opioid consumption during the perioperative period of primary TJA.<sup>34</sup> This moderate recommendation may change soon as the reason for IV acetaminophen being given a moderate recommendation instead of a strong recommendation was related to its high cost compared to oral acetaminophen. In December 2020, the US Food and Drug Administration (FDA) approved generic versions of IV acetaminophen, which may lower the current cost. The moderate recommendation for oral acetaminophen over a strong recommendation is secondary to inconsistencies in the data comparing it to a placebo.<sup>34</sup> Following discharge, a consensus is that oral acetaminophen may be part of a multimodal pain regimen. This recommendation is based on the low cost and low risk of acetaminophen in treating pain following primary TJA.<sup>34</sup>

The FDA recommendation remains a maximum of 4000 mg daily for less than ten days in healthy adults with normal liver function, no other acetaminophen sources, and less than two alcoholic drinks daily. Recently, recommendations have been made to limit acetaminophen dosing to 3000–3250 mg daily due to reports of overdose in patients taking standard doses up to 4000 mg daily.<sup>25</sup> However, these reports have been due to patients unintentionally ingesting acetaminophen through additional sources (sleep medications, cough medications, etc.). Patients with abnormal liver function tests, active hepatitis, cirrhosis, or another active hepatic disease should consider a maximum of 2000 mg daily or less. Standard precautions and contraindications to acetaminophen use should be regarded, and pharmacy or medical specialists should be consulted for assistance in unclear cases.

### 3. GABAPENTINOIDS

The AAHKS CPG strongly recommends the perioperative use of pregabalin but not gabapentinoids to reduce opioid consumption after primary TJA.<sup>35</sup> A moderate strength recommendation was given that there is no difference in postoperative pain, opioid consumption, or complications between low-dose and high-dose gabapentinoids. This recommendation included a strong warning that gabapentinoids may lead to an increased risk of confusion among elderly patients and respiratory depression when used with opioids.<sup>35</sup> Following discharge, pregabalin is strongly recommended to reduce postoperative pain, neuropathic pain, and opioid consumption after TJA, but gabapentin does not appreciably reduce pain or opioid consumption.<sup>35</sup>

### 4. CURRENT EVIDENCE FOR POSTOPERATIVE OPIOID REQUIREMENTS

AAHKS, AAOS, Hip Society, Knee Society, and The American Society of Regional Anesthesia and Pain Medicine have

collaborated to develop evidence-based guidelines on the use of opioids in TJA as outlined in the CPG.

Patients undergoing TJA with a history of opioid consumption before surgery have inferior patient-reported outcomes and increased complications.<sup>36–40</sup> Additionally, there is a correlation between a higher dose of opioids pre-operatively and the associated risk of infection and revision surgery.<sup>41</sup> Various studies have demonstrated an increase in opioid consumption among those that had taken opioids before surgery.<sup>42–44</sup> Due to heterogeneity in endpoints while examining this evidence, the AAHKS CPG provides a moderate strength recommendation on the association of increased risks and complications, as well as more significant opioid use, in these patients compared to those that are opioid naïve. Therefore, efforts should be made to wean patients off opioids, in coordination with pain management specialists, before TJA if feasible. Although of lower quality, one retrospective study by Ngyuen et al. demonstrated that a reduction in 50% of opioids before surgery resulted in significantly better patient-reported outcomes.<sup>45</sup>

Perioperative administration of opioids is vital in pain management following TJA. Pre-emptive administration of opioids has been shown to lower VAS pain scores and lower morphine consumption post-operatively.<sup>46</sup> While additional pre-operative opioids may pose an added risk, the AAHKS CPG strongly endorsed its preoperative administration. Furthermore, intraoperative opioid administration received a moderate strength recommendation due to its ability to decrease opioid consumption within the immediate postoperative period.<sup>47,48</sup>

While scheduled opioid administration during the immediate 72-hour post-operative period decreases pain and the need for breakthrough medication, the AAHKS CPG provides a moderate-strength recommendation discouraging this practice due to the associated risks.<sup>49</sup> While the evidence demonstrates that opioids can reduce post-operative pain, the evidence is not definitive.<sup>50–52</sup> The work group acknowledges risks related to opioid consumption, such as respiratory depression and constipation. Given these risks, it is also essential to be cautious with the use of extended-release formulations.<sup>53,54</sup>

Post-operatively, patients often require opioids upon discharge. Regarding the number of pills a patient should receive, Hannon et al. performed a randomized control trial which demonstrated that when patients were sent home with 30 pills of immediate-release oxycodone as opposed to 90, they had identical pain scores and patient-reported outcomes with no difference in morphine equivalents consumed.<sup>55</sup>

Tramadol is a partial agonist with a milder side-effect profile often utilized in multi-modal regimens. When compared to placebos and alternate opioid medications, Stiller et al. found that 100mg/mL administered every 6 hours for 24 hours after surgery leads to a 31% lower morphine consumption; however, evidence cumulatively demonstrates mixed efficacy on pain, patient-reported outcome scores, opioid consumption, or adverse events.<sup>56–58</sup>

## RECOMMENDATIONS

The existing guidelines, as established by AAHKS on non-opioid multimodal anesthesia strategies and opioid use for primary TJA, have been presented thus far. We recommend a multimodal anesthesia strategy for all hip and knee arthroplasty procedures. For TKAs, we prefer a surgeon-administered intraoperative intra-articular adductor canal block, as previously described by Pepper et al., in addition to a pericapsular injection.<sup>59,60</sup> If regional blocks are used for TKAs, adductor canal blocks are recommended over femoral blocks to decrease the risk of delayed return of motor function post-operatively.<sup>61,62</sup> For THAs, a local soft tissue injection is given. A fascia iliaca block is recommended if a block is needed.<sup>63</sup> Our preferred combination for the local infiltration injection is included in [Table 1](#). As published by Karam et al., [Table 2](#) displays a suggested immediate postoperative analgesia regimen. Variations on this protocol are effective. [Table 3](#) shows a recommended discharge analgesia regimen that should be continued for two weeks.<sup>16</sup>

## CONCLUSIONS

Opioid stewardship by arthroplasty surgeons is more imperative than ever and can substantively help combat the opioid epidemic. Non-opioid analgesics should be the first-line treatment for pain and the foundation of a multi-modal pain management strategy.

Risk factors for opioid abuse and dependence should be considered prior to prescribing opioids. And counseling on safe opioid use should be performed with the patient before prescribing an opioid. The lowest dose and shortest duration possible should be prescribed for opioids, and other medications should be considered as alternatives.

## DECLARATION OF CONFLICT OF INTEREST

The authors do not have any potential conflicts of interest in the information and production of this manuscript.

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Not applicable.

**TABLE 1. RECOMMENDED PERIARTICULAR INJECTION**

<b>Surgery Type</b>	<b>Medication</b>
Primary THA	Ropivacaine 0.5% Dexamethasone Ketorolac
Primary TKA	Ropivacaine 0.5% Dexamethasone Ketorolac

THA: Total hip arthroplasty; TKA: Total knee arthroplasty

**TABLE 2. RECOMMENDED POSTOPERATIVE ANALGESIA, AS ADOPTED FROM KARAM ET AL.<sup>16</sup>**

<b>Surgery Type</b>	<b>Medication</b>	<b>Dosing</b>
Primary THA	Cryotherapy	Ice packs
	Acetaminophen	650 mg PO every 6 hours
	Pregabalin (or gabapentin)	75 mg PO BID (or 300 mg PO BID)
	Celecoxib	200 mg PO BID
	Tramadol	50 mg PO every 6 hours PRN for moderate pain
	Oxycodone	5-10 mg PO every 4 hours PRN for severe pain
Primary TKA	Cryotherapy	Ice packs
	Acetaminophen	650 mg PO every 6 hours
	Pregabalin (or gabapentin)	75 mg PO BID (or 300 mg PO BID)
	Ketorolac	30 mg IV every 6 hours*
	Tramadol	50 mg PO every 6 hours PRN for moderate pain
	Oxycodone	5-10 mg PO every 4 hours PRN for severe pain

\*if > 65, 15 mg instead of 30 mg ketorolac is used. Ketorolac is not given to patients with chronic kidney disease

THA: Total hip arthroplasty; TKA: Total knee arthroplasty; PO: Per os; BID: Bis in die (twice daily); PRN: Pro re nata (Per needed)

**TABLE 3. RECOMMENDED DISCHARGE ANALGESIA, AS ADOPTED FROM KARAM ET AL.<sup>16</sup>**

<b>Surgery Type</b>	<b>Medication</b>	<b>Dosing</b>	<b>Pills Prescribed</b>
Primary THA	Acetaminophen	1 g PO every 6 hours	#240
	Meloxicam (or celecoxib)	15 mg PO daily (or 200 mg PO BID)	#30
	Pregabalin (or gabapentin)	75 mg PO BID (or 300 mg PO BID)	#60
Primary TKA	Acetaminophen	1 g PO every 6 hours	#240
	Meloxicam (or celecoxib)	15 mg PO daily (or 200 mg PO BID)	#30
	Pregabalin (or gabapentin)	75 mg PO BID (or 300 mg PO BID)	#60
	Tramadol (for breakthrough pain)	50 mg PO every 8 hours PRN	#15
	Oxycodone (for breakthrough pain)	5-10 mg PO every 4 hours PRN	#15

THA: Total hip arthroplasty; TKA: Total knee arthroplasty; PO: Per os; BID: Bis in die (twice daily); PRN: Pro re nata (Per needed)

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