



Guidelines

Evidence-Based Orthopaedic Post-Operative Opioid Prescribing Recommendations Following Sports Medicine Knee Surgery

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Over the last two decades, the opioid epidemic in the United States has caused significant harm in terms of illnesses, deaths, and economic costs. To address this public health crisis, healthcare providers must take responsibility for appropriately using and managing these drugs. They should adhere to evidence-based guidelines for prescribing opioids. Several measures have been implemented to reduce excessive opioid use, including Prescription Drug Monitoring Programs, educational campaigns, and multiple pain relief methods. Surgeons, especially those who perform orthopedic and musculoskeletal procedures, have been identified as high-volume opioid prescribers. However, there is a lack of clear guidelines for appropriate opioid dosages and pain management strategies for common sports medicine knee surgeries. Therefore, the aim is to create comprehensive, evidence-based guidelines for postoperative pain relief for such procedures.

INTRODUCTION

The United States is going through an opioid epidemic characterized by a rising number of deaths caused by opioid misuse and overdose.¹ Even though the United States makes up only 5% of the world's population, it was responsible for using 80% of all opioids and 99% of hydrocodone.² Over 50% of people who use opioids for non-medical reasons get them from their friends or family members, and prescription drugs may be a primary source.^{3,4} Orthopedic surgeons rank fourth among the highest prescribers of opioids at a rate of 7.7%.⁵

Roughly 2 million surgeries on the knee using arthroscopic techniques are carried out annually in the United States.⁶ Arthroscopic procedures have been experiencing a sharp rise in numbers in the United States, and they now constitute a considerable proportion of typical orthopedic procedures.⁷ The number of knee arthroscopy procedures and related treatments, such as meniscal repair and partial meniscectomy, has also increased.^{8,9} According to a report, around 3 to 6 million unused opioid pills would be left over after the surgical treatment of meniscal tears. Most of these pills would not be kept in a secure place, as reported by 66% to 75% of patients.^{3,10}

To address the issue of prescription opioid abuse, several effective measures have been implemented, such as Prescription Drug Monitoring Programs (PDMPs),¹¹⁻¹⁴ and government initiatives aimed at reducing the amount of opioids prescribed following surgical procedures,¹⁵ and multimodal analgesia strategies.¹⁶ As a result, there has been a notable reduction in the annual opioid prescribing rates in the United States, with an overall decrease of 19% between 2006 and 2017. Additionally, the rates of prescription opioid-involved deaths in the United States decreased by 7% from 2018 to 2019.¹¹ Despite the progress made in addressing the issue of prescription opioid abuse, the total amount of opioids prescribed per person in morphine milligram equivalents (MME) is still more than three times higher than it was in 1999.¹¹ According to data from 2019, approximately 10.1 million individuals in the US misused prescription opioids, and 1.6 million individuals had an opioid use disorder and also misused prescription pain relievers for the first time.¹⁷ According to a report in 2017, over 17% of Americans had at least one opioid prescription filled. On average, each patient has been dispensed 3.4 opioid prescriptions, with a mean daily dose of 45.3 morphine milligram equivalents (MME) over 18 days.¹⁸

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Surgeons in sports medicine, who perform many surgeries and typically prescribe opioids as part of post-operative care, may be at risk of unintentionally prescribing excessive opioids.^{19–21} It is crucial that sports medicine surgeons, as well as other healthcare professionals who prescribe opioids, prioritize responsible and appropriate opioid prescribing practices by implementing opioid stewardship programs. This should be done while ensuring their patients receive adequate pain management.

PROBLEM STATEMENT

There is a risk of unintentionally over-prescribing opioids following common knee surgeries such as arthroscopic meniscectomy, anterior cruciate ligament (ACL) reconstruction, and patellar stabilization surgery in sports medicine, which could lead to patients becoming dependent on, abusing, or misusing these medications, potentially leading to fatal consequences. However, there is a lack of clear guidelines for healthcare professionals regarding appropriate opioid dosing and pain management strategies in these situations.

PROPOSED SOLUTION

There is a need for thorough and evidence-based guidelines outlining appropriate postoperative pain management strategies to ensure effective pain relief while minimizing the risk of adverse effects for common knee procedures in sports medicine. Evidenced-based guidelines are required to ensure adequate pain management while minimizing the risk of over-prescribing opioids after knee surgeries in sports medicine.

STRATEGIES

Pain management should be individualized based on the patient's specific circumstances, including the type of pain, the severity of pain, medical history, and any underlying conditions or risk factors. This review uses current and evidence-based principles to focus on acute and post-operative pain management.²² The defining principles for post-operative pain management regimens are outlined in this section, while detailed recommendations based on the best available evidence will be presented later.

Non-pharmacologic treatment strategies should be incorporated whenever possible. These strategies include but are not limited to rest, ice, elevation, and compressive surgical dressings that are secure but not constrictive. Continuous cold-flow cryotherapy has additionally gained popularity in multimodal postoperative pain control. Current literature suggests a beneficial effect of decreased postoperative analgesia requirements^{23–25} in patients undergoing ACL reconstruction. However, the evidence is mixed when directly comparing traditional ice and compression with temperature-controlled continuous cold flow devices concerning postoperative opioid consumption. Ruffilli et al.²⁵ found that patients experienced less pain on a post-

operative day one after ACL reconstruction with the addition of continuous cryotherapy compared to those patients who solely utilized ice and compression; however, there was no difference in opioids consumed. This contrasts Waterman et al.²⁶ who reported a significantly more tremendous amount and duration of opioid consumption after ACL reconstruction in patients who used ice therapy compared to cryotherapy with compression. Either ice or cold flow cryotherapy should be considered in all patients for whom it is appropriate as an important non-pharmacologic analgesia strategy. However, given the cost associated with continuous cold flow devices and the lack of significant literature demonstrating superiority over traditional ice, additional research is necessary before recommending cold flow cryotherapy as a standard of care adjunct to multimodal pain control.

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 and non-steroidal anti-inflammatory drugs (NSAIDs) have shown great effectiveness in multimodal analgesia studies.^{27,28} Regimens are further detailed below.

Before prescribing opioids, it is vital to consider the risk factors for opioid abuse and dependence. These may include a history of substance abuse, psychiatric conditions, and a low educational level.^{29,30} The utilization of opioids before surgery has been identified as a predictive factor for increased postoperative opioid requirements.³¹ Healthcare providers are advised to use their state's Prescription Drug Monitoring Program (PDMP) to review a patient's prescription drug history before prescribing opioids and to periodically review the PDMP throughout therapy, even beyond the acute phase.

It is recommended to conduct counseling sessions with patients regarding safe opioid use before prescribing these medications. Evidence has demonstrated that such counseling can effectively reduce the amount of voluntary opioid use while maintaining high patient satisfaction with pain management.³² Counseling should establish the duration of therapy and goals of opioid use (2 weeks postoperatively is recommended, with a maximum of 6 weeks). It 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.³³

When prescribing opioids, it is recommended to prescribe the lowest effective dose and for the shortest duration possible.^{30,34} The CDC recommends ≤ 3 days of short-acting opioids for procedures with an expected rapid recovery and 3–7 days for operations with an expected medium-term recovery.³⁵ Their published guidelines, based on the Bree Collaborative and Washington State Agency Medical Directors' Group guidelines, also recommend combining postoperative opioids with either NSAIDs or acetaminophen.³⁶

During the perioperative period, surgeon prescribers are advised to collaborate with other healthcare providers involved in the patient's care, such as primary care providers

or pain management specialists. This communication can help prevent double-prescribing and discrepancies in prescribing assumptions. Patients on chronic opioid pain medication present a particularly challenging population to manage postoperatively. While it is recommended to utilize the aforementioned multimodal analgesia strategies, the patient's pain management provider, if available, is best equipped to handle their postoperative pain.

MEDICATIONS

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

NSAID use in orthopedics has long been controversial due to the theoretical inhibitory effects on osseous healing.³⁷ However, animal model studies have reported that NSAID use may not affect soft tissue healing.³⁷ Additionally, there is insufficient evidence against using NSAIDs for 14 days or fewer in soft tissue or osseous healing. Thus, NSAIDs may be critical in pain control in many sports medicine procedures.

Multiple regimens have been suggested for sports medicine procedures to reduce postoperative opioid requirements. Ibuprofen 600 mg every 6-8 hours and ibuprofen 800 mg every 8 hours as needed has been recommended regimens with opioid adjuncts as breakthrough modalities rather than primary analgesic options.^{38,39}

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. Daily ibuprofen dose should not exceed 2,400 mg, and daily naproxen dose should not exceed 1,100 mg (initial day can be up to 1,375 mg).

2. ACETAMINOPHEN

Acetaminophen 1,000 mg three times daily for 14 days has been suggested as an alternative to opioid analgesia for standard sports medicine procedures.³⁸ The FDA recommendation remains a maximum of 4,000 mg daily for less than 10 days in healthy adults with normal liver function, no other acetaminophen sources, and less than two alcoholic drinks daily. Recently, particular manufacturers such as McNeil's "Tylenol®" recommend 3,000-3,250 mg daily due to reports of an overdose in patients taking standard doses up to 4,000 mg daily.⁴⁰ However, these reports have been due to patients unintentionally ingesting acetaminophen through other sources (sleep medications, cough medications, etc.). Patients with abnormal liver function tests, active hepatitis, cirrhosis, or other active hepatic disease should consider a daily maximum of 2,000 mg daily or less. Standard precautions and contraindications should

be regarded, and pharmacy or medical specialists should be consulted for assistance in unclear cases.

3. PERIPHERAL NERVE BLOCKS

Adductor canal and femoral nerve blocks have been shown to contribute to postoperative analgesia in patients undergoing both arthroscopic and open knee surgery.⁴¹ Patients receiving preoperative blocks require fewer breakthrough opioid analgesics in the perioperative setting.^{42,43} Common block formulations include 0.25% or 0.5% bupivacaine, 0.5% ropivacaine, and 0.75% ropivacaine; however, multiple studies have not shown a significant difference in postoperative pain scores with different formulations.^{43,44} Adductor canal blocks have similar analgesic efficacy as femoral nerve blocks⁴⁵ with decreased rates of quadriceps weakness.⁴⁶ Adductor canal blocks may be preferable to femoral nerve blocks for ambulation and postoperatively rehabilitation.

Single infiltration, liposomal bupivacaine such as Exparel is widespread in some centers for peripheral nerve block in knee surgery. However, early evidence indicates similar analgesia conferred as peripheral nerve blockade in addition to standard bupivacaine infiltration intra-operatively.

4. CURRENT EVIDENCE FOR POSTOPERATIVE OPIOID REQUIREMENTS

The published literature from sports medicine surgery publications and other relevant sources provides valuable data to develop evidence-based opioid prescribing guidelines. Tables 1, 2, and 3 show the current best evidence on patient-reported opioid requirements after common simple knee arthroscopy, knee arthroscopy requiring bony work, and open knee procedures, respectively. A broad synthesis of this literature can be summarized accordingly:

- Opioids may be over-prescribed after sports medicine surgery, with approximately one-third of prescribed pills ultimately consumed by patients.^{20,39}
- Opioid use is higher, and the duration of use is longer after bony procedures than soft tissue procedures.⁴⁷
- On average, pediatric and adolescent patients (<18 years old) consume only about one-third of opioids prescribed after knee arthroscopy.²¹
- Multi-modal analgesia strategies result in decreased opioid use.⁴⁸

Additional supplemental findings for each procedure category are included.

RECOMMENDATIONS

MULTIMODAL ANESTHESIA

The presented studies represent the current sports medicine literature regarding opioid pain medication for knee procedures, including "simple" arthroscopic procedures, knee procedures involving bony work, and open knee procedures. For all sports medicine knee procedures, regard-

Table 1. Summary of studies with published opioid requirements in patients undergoing simple knee arthroscopy procedures.

Author	Journal	L.O.E.	Year	Procedure (# Patients)	Opioid Requirement	Comments
Kamdar PM, Liddy N, et al. ⁴⁹	Arthroscopy	II	2021	Meniscectomy, Meniscal repair, Chondroplasty (100)	0.6 pills (range:0-5)	Authors recommend #5 5mg oxycodone following simple knee arthroscopy
Wojahn RD, Bogunovic L, et al. ³⁴	JBJS	IV	2018	Meniscectomy, Meniscal repair, Chondroplasty, Loose body removal, and Debridement (221)	7 pills (hydrocodone 5-mg equivalents) (range 0-188)	Patients undergoing meniscal repair, smokers, and those taking opioids preoperatively are more likely to take ≥20 pills after the surgical procedure
Tepolt FA, Bido J, et al. ²¹	Arthroscopy	IV	2018	Meniscal repair/ Meniscectomy (18), Lysis of adhesions, Synovectomy, Chondroplasty, Lateral release, Diagnostic scope, Osteochondral defect drilling/fixation (22=remainder)	Meniscal repair/ Meniscectomy: 14.3 pills (0-47); Remainder: 8.9 tablets (0-52)	
Kamdar PM, Mandava NK, et al. ²⁸	Arthroscopy Sports Med Rehabil	IV	2020	Meniscectomy, Meniscal repair, Chondroplasty, Synovectomy (100)	1.9 pills (range 0-25)	Authors recommend #5 5mg oxycodone
Thompson MM, Popp L, et al. ⁵⁰	OJSM	IV	2021	Meniscectomy, Meniscal repair, Microfracture/ abrasion arthroplasty, Synovectomy, Chondroplasty, and Loose body removal (72)	7 +/- 5 hydrocodone/ acetaminophen 5/325 (range 0-20)	Authors recommend #10 hydrocodone/ acetaminophen 5/ 325
Bloom DA, Manjunath AK, et al. ⁵¹	Knee	III	2021	Arthroscopic Meniscectomy (554: 452 pre-institutional opioid reduction protocol implementation vs. 102 post-protocol implementations)	229.3+/-141 MME (30.6 pills) vs. 80.05+/-82.7 MME (10.7 pills) post-protocol	Institutional opioid reduction protocol involved prescribing only Tylenol postoperatively – opioids prescribed only if specifically requested by the patient

L.O.E = Level of evidence, MME = morphine milligram equivalents

less of type, we recommend a multimodal anesthesia strategy (Table 4). This includes using NSAIDs and acetaminophen postoperatively (unless medically contraindicated). For acetaminophen, we recommend standing doses totaling no more than 3000 mg daily (500 mg q4 hours or 1000 mg q8 hours standing) for up to 10 days postoperatively. For NSAIDs, we recommend a dose of naproxen 440 mg or 500 mg BID standing for ten days or 800 mg ibuprofen q8 hours standing for ten days. A concomitant proton pump inhibitor, such as omeprazole 20 mg BID or pantoprazole 40 mg daily, should be considered in patients over 50 years old or with gastric ulcer risk factors while taking NSAIDs.

For arthroscopic and open knee procedures, the authors recommend considering preoperative adductor canal blocks using 20 mL of 0.5% ropivacaine with epinephrine. Ultimately, the preoperative block type and the amount should be determined in conjunction with the anesthesiologist administering the block. Block type and dosage should be determined on a case-by-case basis. Still, we recommend adductor canal blockade over femoral blockade to provide analgesia while allowing early ambulation and rehabilitation for patients.

Table 2. Summary of studies with published opioid requirements in patients undergoing knee arthroscopy procedures involving bony work.

Author	Journal	L.O.E.	Year	Procedure (# Patients)	Opioid Requirement	Comments
Tepolt FA, Bido J, et al. ²¹	Arthroscopy	IV	2018	ACL reconstruction (47)	20.6 pills (range 0-69)	Recommend \leq 22.5 MME; more for youth, self-pay, Medicaid, Worker's Comp.
Thompson MM, Popp L, et al. ⁵⁰	OJSM	IV	2021	ACL reconstruction (51)	19 +/- 15 hydrocodone/acetaminophen 5/325 (range 0-45)	Authors recommend #20 hydrocodone/acetaminophen 5/325
Lovecchio F, Premkumar A, et al. ⁵²	OJSM	IV	2020	ACL reconstruction (31)	7 pills (range 0-41)	Authors recommend #205mg oxycodone

L.O.E = Level of evidence, MME = morphine milligram equivalents

Table 3. Summary of studies with published opioid requirements in patients undergoing open knee procedures.

Author	Journal	L.O.E.	Year	Procedure (# Patients)	Opioid Requirement	Comments
Tepolt FA, Bido J, et al. ²¹	Arthroscopy	IV	2018	Tibial Tubercle Osteotomy (6), Medial Patellofemoral Ligament Reconstruction (7)	TTO: 17.0 pills (range 3-41), MPFL: 18.4 tablets (range 0-44)	

L.O.E = Level of evidence

“SIMPLE” KNEE ARTHROSCOPY

Knee arthroscopic surgery with partial meniscectomy is one of the most common routine orthopedic surgeons perform in the United States. While opioids may be routinely prescribed on an as-needed basis for breakthrough pain in addition to a standing acetaminophen and NSAID prescription, recent evidence indicates the amount of opioids required for adequate pain control is far less than was conventionally thought.^{28,49,52} For “simple” knee arthroscopic surgery including, but not limited to, partial meniscectomy, meniscal repair, loose body removal, chondroplasty, and synovectomy, five to ten 5 mg oxycodone tablets are the recommended postoperative opioid prescription ([Table 4](#)).

KNEE ARTHROSCOPY WITH BONY WORK

For arthroscopic procedures of the knee involving bony work such as tunnel drilling and preparation in ACL or PCL reconstruction, ten to twenty 5 mg oxycodone tablets are the recommended postoperative opioid prescription ([Table 4](#)).

OPEN PROCEDURES AROUND THE KNEE

For open sports medicine procedures around the knee, such as tibial tubercle osteotomy, medial patellofemoral ligament reconstruction, and OATS, twenty 5 mg oxycodone tablets are the recommended postoperative opioid prescription ([Table 4](#)).

CONCLUSIONS

We recommend implementing a multimodal anesthesia strategy for all knee procedures in sports medicine, regardless of the specific type of procedure. It is crucial to prioritize appropriate opioid dosing and postoperative multimodal analgesic strategy, as there has been a surge in opioid overdoses. The guidelines presented in this context provide a comprehensive and evidence-based approach to pain management, offering readily appropriate analgesic regimens and opioid dosages for frequently performed sports medicine knee surgeries.

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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DECLARATION OF ETHICAL APPROVAL FOR STUDY

Not applicable.

Table 4. Summary of recommended postoperative prescriptions for patients undergoing simple knee arthroscopy, knee arthroscopy with bony work, and open knee procedures, respectively.

Surgery Type	Representative Procedures	Recommended Postoperative Prescription
"Simple" Knee Arthroscopy	Diagnostic Arthroscopy Meniscectomy Meniscal Repair (All-inside AND/OR Inside-out) Chondroplasty Synovectomy Lysis of Adhesions	Naproxen 500 mg BID, dispense #20 Acetaminophen 500 mg q4 or 1000 mg q8, dispense #60 Oxycodone 5 mg q6 PRN, dispense #5-10
Knee Arthroscopy with Bony Work	ACL/PCL Reconstruction Meniscal Root Repair OCD Fixation	Naproxen 500 mg BID, dispense #20 Acetaminophen 500 mg q4 or 1000 mg q8, dispense #60 Oxycodone 5 mg q4-6 PRN, dispense #10-20
Open Knee Procedures	Osteochondral Allograft Transplantation Tibial Tubercle Osteotomy Medial Patellofemoral Ligament Reconstruction Opening/Closing Wedge Tibial/Femoral Osteotomy	Naproxen 500 mg BID, dispense #20 Acetaminophen 500 mg q4 or 1000 mg q8, dispense #60 Oxycodone 5 mg q4-6 PRN, dispense #20

DECLARATION OF INFORMED CONSENT

Not applicable.

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