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Complexities of Perioperative Pain Management in Orthopedic Trauma

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Abstract

Purpose of Review This review discusses both obvious and hidden barriers in trauma patient access to pain management specialists and provides some suggestions focusing on outcome optimization in the perioperative period.

Recent Findings Orthopedic trauma surgeons strive to provide patients the best possible perioperative pain management, while balancing against potential risks of opioid abuse and addiction. Surgeons often find they are ill-prepared to effectively manage postoperative pain in patients returning several months following trauma surgery, many times still dependent on opioids for pain control. Some individuals from this trauma patient population may also require the care of pain management specialists and/or consultation with drug addiction specialists. As the US opioid epidemic continues to worsen, orthopedic trauma surgeons can find it difficult to obtain access to pain management specialists for those patients requiring complex pain medication management and substance abuse counseling.

Summary The current state of perioperative pain management for orthopedic trauma patients remains troubling due to reliance on only opioid analgesics, society-associated risks of opioid medication addiction, an "underground" prescription drug marketplace, and an uncertain legal atmosphere related to opioid pain medication management that can deter pain management physicians from accepting narcotic-addicted patients and discourage future physicians from pursuing advanced training in the specialty of pain management. Additionally, barriers continue to exist among Medicaid patients that deter this patient population from access to pain medicine subspecialty care, diminishing medication management reimbursement rates make it increasingly difficult for trauma patients to receive proper opioid analgesic pain medication management, and a lack of proper opioid analgesic medication management training among PCPs and orthopedic trauma surgeons further contributes to an environment ill-prepared to provide effective perioperative pain management for orthopedic trauma patients.

Keywords Opioids · Opioid medications · Pain management · Perioperative pain management

Introduction

Orthopedic trauma surgeons can sometimes struggle with providing the best postoperative pain management, while avoiding opioid overuse and abuse along with the potential risk of opioid addiction in a subset of trauma patients. Most orthopedic trauma patients will require opioid analgesics to control perioperative pain and will continue these medications into the short-term postoperative period [1, 2]. A balance must be achieved between positively influencing patient recovery profiles and rehabilitation to facilitate a return to activities of daily living, while also addressing the ever-present concerns of the opioid abuse epidemic [3].

Orthopedic trauma surgeons are often not prepared to effectively manage complex postoperative pain medicine issues in patients returning several months following trauma surgery, who still remain dependent on opioids for pain control. This challenging patient population may require the care of pain management specialists, multimodal non-opioid analgesic therapy plans, and/or consultation with drug addiction specialists. In addition, as the national opioid epidemic continues, orthopedic trauma surgeons often

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find it difficult to obtain consultation with pain management specialists for their patients.

In this review, the challenges of managing opioid analgesics in the orthopedic trauma setting along with the state of patient access to pain management are addressed. This review identifies some important systemic pain management issues of the orthopedic trauma patient population, briefly addresses analgesic alternatives/adjuvants to opioid analgesic monotherapy, and describes some of the barriers in gaining access to pain management specialist interventions for optimizing the long-term recovery and rehabilitation of the postoperative orthopedic trauma patient. In addition, this discussion will briefly incorporate aspects regarding current laws, patient health insurance coverage, healthcare provider reimbursement rates, and physician specialty training.

Opioids in Orthopedic Trauma

Orthopedic surgeons from the USA are the third highest prescribers of opioid analgesics, secondary only to primary care physicians (i.e., family medicine, general practitioners, and osteopathic physicians) and internists [4]. When comparing orthopedic surgeons from different countries, those in the USA prescribe significantly more opioid pain medications. For example, Lindenhovius et al. demonstrated that 77% of patients in the USA recovering from hip fracture surgery were prescribed opioid medications compared to an almost insignificant number of hip fracture trauma patients from the Netherlands [5]. A similar trend was true for ankle fracture surgeries where 82% of American patients recovering from such surgery were prescribed opioid analgesics following discharge while only 6% of Dutch patients received narcotic prescriptions postoperatively [5].

Effectively managing perioperative patient pain in the postoperative period can influence and reduce hospital length of stay; however, the orthopedic literature has demonstrated that opioids can also have detrimental effects on patient outcomes [6, 7], particularly following procedures such as total knee replacement [8], reverse total shoulder replacement [2], and in patients suffering from chronic disabling occupational musculoskeletal disorders [9]. As an example, Helmerhost et al. demonstrated that patients who continue to use opioid medications for several months following orthopedic trauma surgery suffer more psychological distress, pain, and disability [10]. In addition, there is also some evidence that postoperative opioid administration can inhibit bone healing in animal models [11].

There are no published guidelines or evidence-based protocols regarding the most appropriate length of time to administer opioid pain medication(s) in the postoperative orthopedic trauma patient [12]. Therefore, surgeons often struggle trying to balance optimal pain control with the potential risk of opioid abuse and addiction [13]. These orthopedic trauma surgeons have been trained in perioperative pain management. However, they are often not prepared to manage the many potential complexities (i.e., hyperalgesia, chronic pain, narcotic addiction) of postoperative pain in patients who return to the orthopedic clinic several months following surgery still dependent on opioid analgesics for pain control and often at ever-increasing dose requirements. This group of patients could benefit from the specialized care of trained pain management physicians and drug addiction specialists. Even many primary care physicians (PCPs) can find themselves struggling in attempts at securing access to specialized pain management and addiction consultation for postoperative orthopedic trauma patients requiring complex pain medication supervision [12].

Risk of Addiction

Many trauma patients often express characteristics that can make perioperative pain management challenging such as pre-existing drug and alcohol and opioid abuse along with psychosocial disorders and risk taking behaviors [1, 14, 15]. Therefore, these vulnerable patients have an increased likelihood of becoming opioid dependent during the postoperative period [6, 12]. Research has also identified various social factors that can stimulate an increased abuse potential of opioid medications in the acute postoperative period [3] such as previous use of opioid analgesics, a history of substance abuse, the female sex, history of depression and/or anxiety, and self-perceived risk of addiction [1, 16–20].

Orthopedic trauma surgeons often find themselves balancing pain control with the ever-present patient potential for opioid abuse and risk of opioid addiction [13]. Despite surgeons' fear of being partially responsible for instigating the risk of opioid dependence within the patient population they manage, narcotic addiction has reportedly more than doubled worldwide and dramatically increased in the USA [21•]. However, the risks of prolonged opioid analgesic use during the postoperative period leading to addiction can also be attributed to a lack of training complicated by a lack of established standards of care for postoperative pain medicine. Many surgeons are not well versed in existing evidence-based guidelines for opioid prescribing or with programs designed to reduce the abuse of prescription drugs (i.e., state prescription drug monitoring programs). Proper management of this patient population requires effective partnering with pain management specialists and primary care providers in the community. Implementing strategies that target patients at the greatest risk for opioid addiction will require strong coordination and collaboration at the federal, state, and local levels, as well as engagement of parent and youth influencers, healthcare professionals, and policy makers.

The potential of opioid addiction has also been attributed to a lack of proper postoperative analgesic medication management that has been implicated in the rise of opioid prescription overdoses. The US Centers for Disease Control and Prevention (CDC) now classifies "opioid prescription overdoses" as an epidemic [22]. The CDC further estimates that the rate of opioid overdose resulting in patient death has doubled since 2000 [23]. Strategies for curtailing opioid abuse and addiction include increasing training and awareness of medical professionals, maintaining diligence toward potential patient dependence, modifying attitudes, staying suspicious toward concerns of diversion, and maintaining onerous regulation. Effective analgesic access does not necessarily mean increased misuse and diversion, but rather balance, insight, education, control, and the elimination of overly liberal availability.

"Underground" Drug Prescription Marketplaces

When patients experience reduced or dwindling access to opioid prescription pain medication, some will resort to the "underground" drug market [24]. There are also situations where patients who receive opioid pain prescriptions do not consume the entire quantity of pills prescribed that could then be diverted or abused in non-medical situations [3, 25]. One mechanism to combat the potential for diversion of opioid analgesic agents would be for physicians to limit the number of prescriptions being written for narcotic medications. There are also several types of screening tools that physicians can use to identify at-risk patients before prescribing opioid analgesics [3]. Other preventative measures would be proper patient education and communication about perioperative pain expectations, improved coordination with the patient's primary care physician, setting early expectations regarding the duration of opioid analgesic therapy, and discussion on processes of tapering of opioid medications performed early during the in-house postoperative period [3].

Preliminary studies have suggested that certain opioid medication prescriptions such as OxyContin could act as "gateway" drugs and place susceptible patients at an increased risk for the progression to drug abuse with heroin or other types of addictive injection drugs [26]. This can be problematic when postoperative trauma patients start "narcotic drug shopping," or if an opioid addiction is not properly managed, especially since heroin is much more readily available and costs for obtaining these illicit substances is less than that of prescription opioids. The CDC estimates that patients addicted to opioid pain medications are 40 times more likely to become addicted to heroin, and that the overdose rate of deaths by heroin in the USA has quadrupled from 2002 to 2013 [27].

Opioid analgesics were not always being prescribed in such large amounts for chronic non-cancer pain patients. Prior to the 1980s, opioid medications were viewed as habit forming and were socially distasteful. Evidence emerged in the 1980s that opioid medications could be safely prescribed and administered for long-term management of chronic pain, advocating an unwritten mandate that surgical patients should have perioperative pain associated with their surgery better managed (i.e., the era of pain as the "fifth vital sign"). This early concept has further led to several nationwide state legislative changes that relaxed narcotic prescription regulations and protected prescribing physicians. The Joint Commission also supported more improved and advanced use of narcotic analgesics postoperatively [28]. Therefore, as opioid prescribing regulations became more relaxed, the number of opioid prescriptions being written grew from 131 million in 2000 to 210 million in 2010 [29].

Pain Prescription Management and Law Enforcement

During the 1970s to 1980s, opioid analgesic prescriptions were not as regularly or as frequently prescribed for long-term postoperative pain management as they are currently prescribed in the USA. In addition, evidence continues to show that opioid prescription medication administration for extended periods of time into the postoperative period continues to increase. In this era of increased use of prescription opioid analgesics for longer periods coupled with various legal guidelines and prescriber protections, physicians must remain mindful that they remain vulnerable to legal mandates when inappropriately prescribing opioid analgesic medications [30, 31]. As a result, physician pain medicine specialists fear that management of postoperative pain using opioid analgesics may be interpreted by the authorities as "narcotic drug abuse" that could possibly lead to legal sanctions and/or jail time [31, 32]. This has also sparked a sense of serious concern, particularly among primary care physicians, orthopedic surgeons, and pain management specialists who now find themselves altering their original opioid prescription behaviors in response to potential legal ramifications from state and federal prescription monitoring services [33].

In the current legal atmosphere, stricter opioid prescription legislation and fear of potential judicial consequences have contributed to a shortage of trained pain management physicians, while new state laws have limited opioids post-surgery, typically to 5–7 days. There is also evidence nationally that fewer US medical students are choosing to pursue clinical careers in pain management fearing uncertain legal issues and changing legislative mandates [3, 31].

The Effects of the Type of Insurance and Access to Organized Pain Management

Studies have examined influences of the different types of insurances (i.e., cash pay, Medicaid, Medicare, or BlueCross) carried by orthopedic trauma patients and the ability of these patients to secure an appointment for outpatient pain management consultation in the new era of the Patient Protection and Affordable Care Act (PPACA) in the USA [34•]. Following passage of the PPACA, Medicaid eligibility has expanded medical care coverage to include individuals with incomes up to 138% of the federal poverty level, a substantial increase up from the previous threshold with incomes of 61% of the federal poverty level [35]. However, only 32 states in the USA along with the District of Columbia have implemented eligibility expansion, creating a medical care coverage gap that affects patients residing in those states without expanded Medicaid eligibility [35]. Despite passage of the PPACA, Medicaid patients still experience increased difficulty in obtaining access to the care of pain management specialists compared to trauma patients carrying other types of insurance [34•]. Therefore, questions remain whether or not it is the Medicaid reimbursement rates that are responsible for decreasing the likelihood of Medicaid patients securing an office visit with pain medicine physicians or if other important determinants in receiving timely medical care are responsible. This concept remains a critical component of pain management for the trauma patient. For example, it has been demonstrated that over 40% of motorcycle trauma patients are Medicaid patients [36], so could this type of insurance coverage be the determining factor to accessing pain management care for these patients? Medicaid's lower reimbursement rates could likely be one reason for physicians' unwillingness to accept Medicaid patients. Physician practices have indicated that patients using Medicaid consume more medical care resources and are increasingly likely to be involved in litigation [37] that further discourages physicians from accepting and treating Medicaid patients.

Type of Insurance and the Low Medication Management Reimbursement Rates

In the USA, there has been an increase in the number of new CPT codes for interventional techniques being performed by pain management specialists [38]. This has occurred even as patients find it more difficult to find pain medicine physicians able to manage chronic pain conditions and dependence on opioid analgesic medications. Throughout the USA, interventional pain management specialty practices can sometimes find themselves under increased financial constraints (especially since the introduction of the PPACA [37]), causing these specialists to be more inclined to schedule and treat patients that require interventional pain medicine techniques versus those in need of pain medication management [38–42]. As an example, from 2000 to 2013, there was an annual increase of 7.5% in the number of interventional procedures being performed among Medicare patients despite only an annual increase of 2.1% in the Medicare patient population [43•]. Similar trends have also been observed in the Medicaid patient population [44] with the more lucrative and less legally liable interventional techniques being performed more frequently. This could be due to the potential financial consequences associated with the rise in lawsuits from the mishandling of opioid prescription medication management that can deter interventional pain medicine physicians from accepting those patients for the management of opioid medications [30, 31].

Status of Pain Management Training Among Primary Care Physicians

PCPs are well positioned within the healthcare system of the USA to medically manage the analgesic medication prescription needs of postoperative patients, including orthopedic trauma patients. Approximately 20% of all PCP visits are secondary to pain related issues [45]. However, large numbers of these healthcare professionals have not received formal training in the specialty of pain medicine and lack the advanced education necessary to properly manage complex postoperative pain issues. These healthcare professionals furthermore lack an understanding of the elaborate pathophysiologic mechanisms of pain, have not been educated on the organizational schemes of treating the psychosocial pathology of drug addiction, and overall are not well positioned to adequately manage chronic opioid analgesic medications. Therefore, many healthcare practitioners do not feel comfortable managing chronic pain or treating opioid addicted patients [29, 46].

There is also evidence that those prescribed opioid therapy for 90 days or longer (especially high-dose opioid therapy) are less likely to remain dependent on opioid medications when the patients' PCPs have consulted pain medicine specialists [47]. In addition, there has been an effort to provide advanced training for PCPs on the proper use of opioids since the need for PCPs with knowledge of pain management has grown [3]. For example, the University of Washington has recently launched a telemedicine educational program called "TelePain" to provide advanced education to PCPs and emergency medicine physicians [28]. With more in-depth training and education in opioid pain medication management, PCPs could certainly perform a more vital role in reducing risks associated with opioid analgesic use in the orthopedic trauma clinical setting.

Multimodal Pain Management Options for the Orthopedic Trauma Patient

Overreliance on a single class of analgesic medication(s) can result in adverse events (AEs) caused by the analgesic medications being administered, organ toxicity, limited analgesic efficacy, and diminished patient satisfaction. In efforts to minimize dose-dependent AEs and potential toxicity associated with analgesic mono-therapy, a growing number of orthopedic and anesthesiology-based caregivers advocate for a stepwise, multi-medication approach for postsurgical pain management. Several medical societies, including the American Society of Anesthesiologists and American College of Orthopedic Surgery, recommend a balanced approach, or now more commonly referred to as "multimodal" analgesia, rather than overreliance on intravenous and/or oral opioids (Table 1) [50–52].

Opioids can have various idiosyncratic or dose-limiting side effects that may curtail their overall effectiveness while at the same time exposing patients to dangerous AEs [53–56]. In addition to life-threatening respiratory depression, opioids can increase constipation and cause ileus, nausea, vomiting, wound dehiscence, urinary retention, central nervous system (CNS) disturbances, and moderate-to-severe pruritus that can lead to additional patient discomfort and dissatisfaction and ultimately delay surgical recovery [53–56]. These complications of opioid therapy can ultimately result in increased length of hospital stays along with increased hospital cost.

Multimodal analgesia has been defined as simultaneous and/or progressive administration of different analgesics, adjuvants, and different forms of analgesic delivery systems that suppress pain transmission in the peripheral and central

Table 1 American Society for Anesthesiology postoperative pain practice guidelines

Perioperative techniques for pain management guidelines

For the surgical patient, the literature supports the efficacy and safety of three techniques used by anesthesiologists for perioperative pain control:

- Epidural or intrathecal opioid analgesia
- PCA with systemic opioids
- Regional analgesic techniques, including but not limited to intercostal blocks, plexus blockade, and local anesthetic infiltration of incisions (e.g., intercostal, ilioinguinal, interpleural, and nerve plexus blockade; the literature is equivocal regarding the analgesic benefits of preincisional infiltration)

Recommendations

- Anesthesiologists who manage perioperative pain should utilize therapeutic options such as epidural or intrathecal opioids, systemic opioid PCA, and regional techniques, after thoughtfully considering the risks and benefits for the individual patient. These modalities should be used in preference to intramuscular opioids ordered "as needed"
- The therapy selected should reflect the individual anesthesiologist's expertise, as well as the capacity for safe application of the modality in each practice setting
- Special caution should be taken when continuous infusion modalities are used, as drug accumulation may contribute to adverse events

Multimodal techniques for pain management guidelines

- The literature supports the administration of two analgesic agents that act by different mechanisms via a single route for providing superior analgesic efficacy with equivalent or reduced adverse effects. Examples include:
  - Epidural opioids administered in combination with epidural local anesthetics or clonidine
  - IV opioids in combination with ketorolac or ketamine
- Dose-dependent adverse effects reported with administration of a medication occur whether it is given alone or in combination with other medications. For example:
  - Opioids may cause nausea, vomiting, pruritus, or urinary retention
  - Local anesthetics may produce motor block
- When compared with oral opioids alone, the literature is insufficient to evaluate the postoperative analgesic effects of oral opioids combined with:
  - NSAIDs (e.g., ibuprofen, ketorolac)
  - Coxibs (e.g., celecoxib, rofecoxib, parecoxib)
  - Acetaminophen
- The Task Force believes that NSAID, coxib, or acetaminophen administration has a dose-sparing effect for systemically administered opioids
- The literature suggests that two routes of administration, when compared with a single route, may be more effective in providing perioperative analgesia. Examples include:
  - Epidural or intrathecal opioid analgesia combined with IV, IM, oral, transdermal, or subcutaneous analgesics vs epidural opioids alone
  - IV opioids combined with oral NSAIDs, coxibs, or acetaminophen vs IV opioids
- The literature is insufficient to evaluate the efficacy of pharmacologic pain management combined with non-pharmacologic, alternative, or complementary pain management when compared with pharmacologic pain management alone
- Whenever possible, anesthesiologists should employ multimodal pain management therapy
- Unless contraindicated, all patients should receive an around-the-clock regimen of NSAIDs, coxibs, or acetaminophen; in addition, regional blockade with local anesthetics should be considered
- Dosing regimens should be administered to optimize efficacy while minimizing the risk of adverse events
- The choice of medication, dose, route of administration, and duration of therapy should be individualized
- Sedative, analgesic, and local anesthetics are all important components of appropriate analgesic regimens for painful procedures

Adapted from American Society of Anesthesiologists Task Force on Acute Pain Management [48]

nervous systems [57–61]. Multimodal analgesic regimens can be designed to:

- Inhibit the release of peripheral noxious mediators
- Block conduction of noxious impulses in sensory nerves
- Enhance spinal inhibition of pain transmission
- Suppress pain perception in the CNS.

The multimodal analgesic concept is not unlike current multi-therapeutic management of a variety of disease states, including hypertension, diabetes, and infection. The evolved standard of therapy in these common conditions is to use smaller, non-toxic doses of a variety of different agents to control the disease process as opposed to utilizing a single agent at doses high enough to encounter AEs. For example, when treating asthma, it would be inappropriate to only prescribe a beta-blocker to control the broncho-constrictive component without also prescribing a corticosteroid to combat the inflammatory component. Administration of agents having different mechanisms of action can provide important clinical benefits, including additive or synergistic effects and enhanced analgesic efficacy [57, 58]. Because of measurable gains in overall analgesic effect, dose requirements of each respective agent may be reduced significantly. As a result, dose-related AEs are minimized, diminished, or eliminated and overall patient safety is increased [58–60]. However, the potential downside of multimodal dosing regimens is that by definition, they will require that more medications be administered, could increase prescription costs and be more

Table 2 Perioperative multimodal or balanced analgesia

Advantages
• Reduction(s) in pain intensity scores
• Reduction in opioid-dose requirements (opioid-sparing effect)
• Reduction in opioid side effects and/or AEs
• Improved patient satisfaction
• Strong potential for improvement in surgical outcome(s)
Disadvantages
• Requires knowledge of multiple drugs, their pharmacokinetics and pharmacodynamics
• Every analgesic has its own unique adverse event profile
• May increase drug-drug interactions
• Requires skills in regional and neuraxial analgesia
• Possible post-discharge dosing confusion and compliance issues

Kehlet and Wilmore [57]; Elia et al. [60]; Rathmell et al. [61]

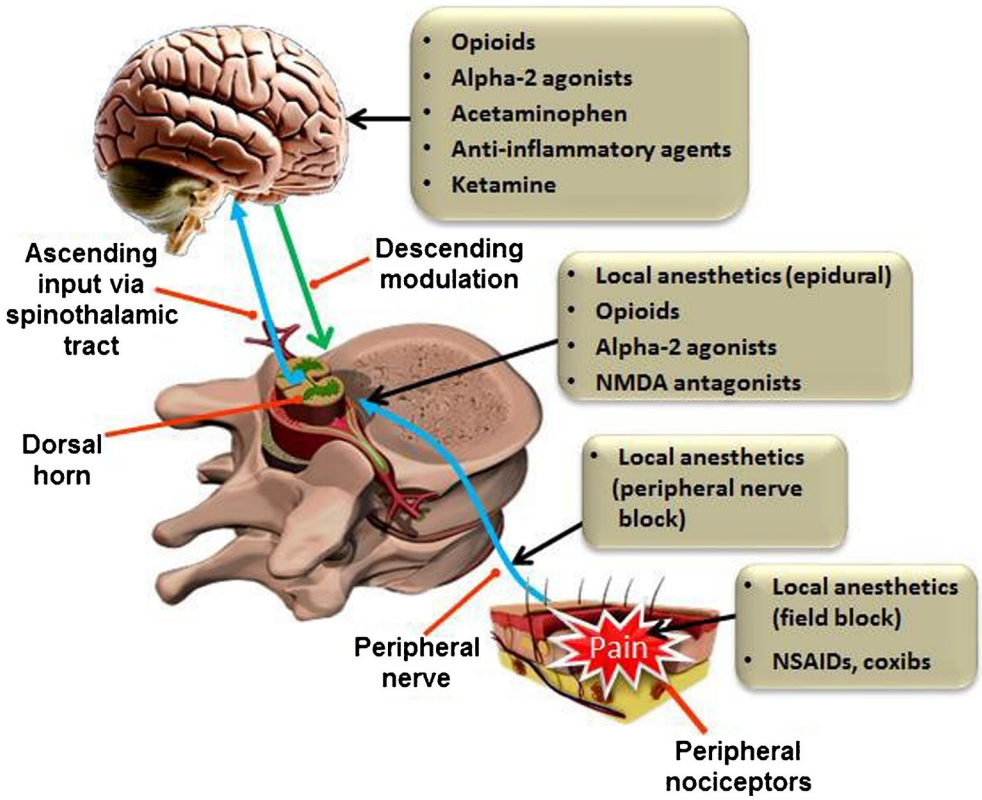

Fig. 1 Multimodal approach to perioperative pain management. Describes pain transmission pathways and targets for multimodal analgesia. Employs use of two or more opioid and non-opioid analgesics acting at different sites within central and peripheral nervous systems. Peripheral acting analgesics: NSAIDs, cox-2 inhibitors, and infiltration of local anesthetics (pain relief by limiting activation of peripheral nociceptors and reducing inflammation). Local anesthetics can be injected/infused to block pain in peripheral nerves. Neuraxial opioids, alpha-2-adrenergic agonists, and local anesthetics can modulate pain transmission in the spinal cord. Centrally acting analgesics: opioids, acetaminophen, tricyclic antidepressants, and alpha-2-agonists activate receptors/increase concentrations of inhibitory neurotransmitters in the brain and brainstem, blunting pain perception

expensive to administer, require a broader caregiver knowledge base to maximize efficacy while avoiding drug-drug interactions and toxicity, have been found to be easier to prescribe in hospital or rehabilitation settings, and can pose compliance challenges for elderly outpatients. Advantages versus disadvantages of multimodal analgesia are outlined in Table 2.

In several postoperative trials, patients receiving multimodal therapy benefited from greater analgesic uniformity and expressed higher satisfaction than those treated with opioids alone, while also reporting improved mobilization and rehabilitation [56, 57, 59, 60]. In a meta-analysis of 52 randomized, placebo-controlled trials of multimodal analgesia versus opioid mono-therapy, Elia and colleagues reported that multimodal analgesia with non-steroidal anti-inflammatory drugs or acetaminophen resulted in a 15 to 55% decrease in opioid dosing [61]. The authors also noted significant reductions in postoperative pain intensity and a reduced incidence of nausea and vomiting (from 29 to 22%) and sedation (from 15.4 to 12.7%) when compared with patients prescribed opioids alone.

Multimodal analgesia often involves the use of peripheral and central acting analgesics using various techniques such as wound-site infiltration and peripheral nerve blockade with local anesthetics, spinal acting analgesics, neuraxial blockade using central acting analgesics, and non-opioid analgesics/adjuncts such as gabapentanoid agents, non-steroidals, acetaminophen, and ketamine. With effective use of multimodal analgesia techniques, only low or moderate prescription use of intravenous and/or oral opioids may be required for rescue analgesia. In certain surgical situations, opioids can be omitted completely from the postsurgical order sets, as there is an extensive list of multimodal analgesics being advocated for some orthopedic surgical pain management interventions. However, perhaps the best way healthcare providers can appreciate multimodal analgesia is to understand where and how different classes of analgesics interact within the noxious signaling pathways of the nervous system. Targeting noxious transmission and/or perception components of pain conduction can provide a rationale for how and when to prescribe local anesthetics, non-opioid analgesics, and analgesic adjuvants (Fig. 1).

Conclusion

The current state of perioperative pain management for orthopedic trauma patients remains somewhat troubling due to the many detrimental effects potentially created with reliance on only opioid analgesics, additional society-associated risks from opioid medication addiction, and an "underground" prescription drug marketplace. There remains an ever-changing climate and uncertain criminal and legal atmosphere related to opioid pain medication management that can further deter pain management physicians from accepting narcotic-addicted patients as well as discourage future physicians (i.e., medical students) from pursuing advanced training in the specialty of pain management. Several barriers continue to exist among Medicaid patients that deter this patient population from access to pain medicine subspecialty care. Additionally, diminishing medication management reimbursement rates make it increasingly difficult for these individuals to receive proper opioid analgesic pain medication management. An additional hurdle remains the lack of proper opioid analgesic medication management training among PCPs and orthopedic trauma surgeons that can further contribute to an environment ill-prepared to provide effective perioperative pain management for orthopedic trauma patients.

Author Contributions All authors have read the manuscript, agree that the work is ready for submission, and accept responsibility for the manuscript's contents. Each author is a major contributor, analyzed the published literature, prepared and edited the manuscript, and approved the final version of the paper. In addition, all authors agree to be accountable for every aspect of the work, ensuring that questions related to its accuracy or integrity of any part of the work has been investigated and resolved.

Compliance with Ethical Standards

Conflict of Interest Daniel H. Wiznia, Theodore Zaki, Michael P Leslie, and Thomas M. Halaszynski declare no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Disclaimer The manuscript is original work, has not been previously published, and is not under consideration for publication elsewhere.

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