



## Perioperative Pain Management in Orthopaedics

### KEYWORDS

Pain, Rehabilitation, Nerve Blocks, Epidural, Transdermal

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**ABSTRACT** In 1995, the American Pain Society declared pain as the fifth vital sign. Pain is one of the primary fears of patients undergoing surgery. Pain is inadequately treated in as much as 50% of patients and more than 80% of patients receiving surgery experience some degree of pain. The control of postoperative pain is a major concern of the orthopaedic surgeon. Good pain control is not only more pleasant for the patient but can also lead to earlier mobilization, faster rehabilitation, improved patient satisfaction, and possibly earlier discharge. Currently, an array of choices is available to orthopaedic surgeons for postoperative pain management. These include narcotics (both oral and intravenous), nerve blocks, pain pumps, epidural injections, aspirin, nonsteroidal anti-inflammatory drugs, transdermal patches and suppositories, and muscle relaxants. The purpose of this poster is to provide an overview of the primary methods used to manage orthopaedic pain.

### 1. Introduction

One of the potential complications following an operation is the development of chronic pain. Orthopaedic procedures may induce more intense pain than do other surgical procedures because bone injury is more painful than soft-tissue injury. This is due to the periosteum having the lowest pain threshold of the deep somatic structures. The prevalence of persistent postoperative pain (for more than three to six months) remains alarmingly high. Optimization of pain control in the perioperative orthopaedic patient is of paramount importance to improve patient satisfaction, improve early mobilization, decrease length of hospitalization, and consequently decrease associated hospital and patient.

Currently, an array of choices is available to orthopaedic surgeons for postoperative pain management. These include narcotics (both oral and intravenous), nerve blocks, pain pumps, epidural injections, aspirin, non-steroidal anti-inflammatory drugs, transdermal patches, and muscle relaxants. Multimodal pain management, introduced by Wall in 1988 and popularized by Kehlet and Dahl in 1993, has been a great advance in postoperative pain management. The intention of multimodal pain management is to target different pain pathways for effective pain relief, without solely resorting to opioids.

### 2. Materials and Methods

Surgical trauma leads to the release of inflammatory mediators at the site of injury, resulting in a reduction in the pain threshold at the site (PRIMARY HYPERALGESIA) and in the surrounding uninjured tissue (SECONDARY HYPERALGESIA). Peripheral sensitization results from a reduction in the threshold of nociceptor afferent terminals secondary to surgical trauma. Central sensitization is an activity-dependent increase in the excitability of spinal neurons (spinal wind-up) as a result of persistent exposure to afferent input from peripheral neurons.

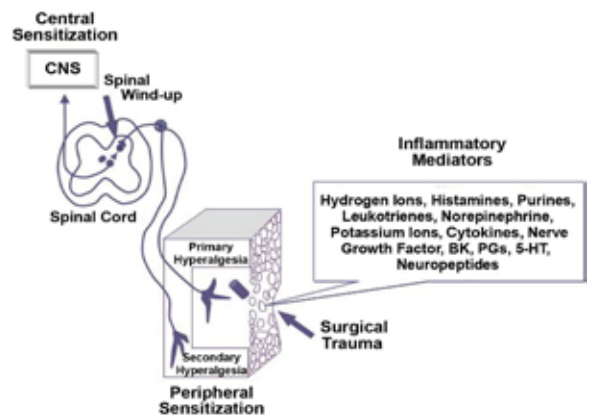
This is the mechanism by which pain may be prolonged beyond the duration normally expected following an acute insult. Prolonged central sensitization has the capacity to lead to permanent alterations in the central nervous system, including the death of inhibitory neurons and replacement with new afferent excitatory neurons. These altera-

tions lead to a prolonged state of sensitization, resulting in intractable postoperative pain that is unresponsive to many analgesics.

### MECHANISM AND ACTION OF THERAPIES

The goals of pain management are to meet the humanitarian need for pain relief and to facilitate rehabilitation and return to normal function, which are accomplished by reducing pain and inflammation at both the central and the peripheral level.

### CENTRAL SENSITIZATION



### OPIOIDS ( Morphine, Codeine, Hydrocodone, Fentanyl)

- Commonly used to treat moderate to severe pain, usually acute in nature, such as that associated with fractures and soft-tissue injury.
- Opioids produce their analgesic effect by mimicking the actions of endogenous opioid peptides at specific receptors within the central nervous system.
- They produce alterations in mood and sleep.
- The effects of opioids on bowel motility are the result of concomitant reduction in the propulsive peristaltic contractions of both the small and the large intestine and enhanced sphincter tone.
- Also, by stimulating the vagal nucleus in the medulla, opioids produce dose dependent bradycardia.

### NONSTEROIDAL ANTI-INFLAMMATORY DRUGS ( Ibuprofen, Meloxicam, Naproxen, And Diclofenac )

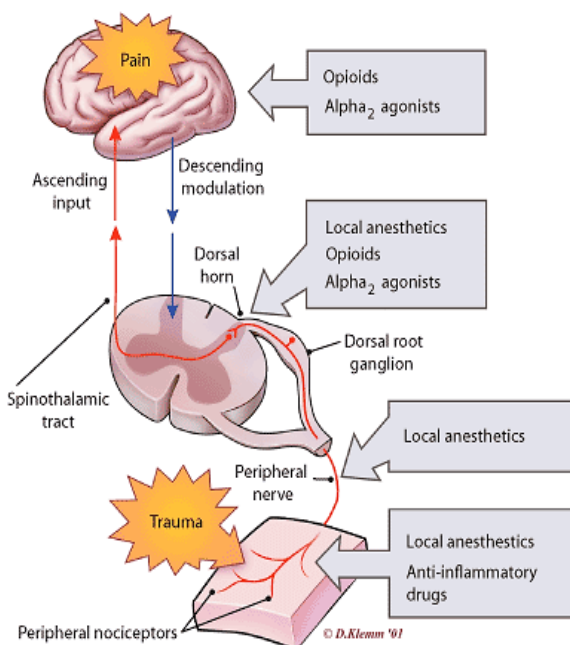
- The analgesia and anti-inflammatory activity of non steroidal anti-inflammatory drugs are produced by inhibition of the COX- 2 isoenzyme.
- They are used for managing pain associated with chronic conditions such as osteoarthritis, rheumatoid arthritis as well as pain from acute soft-tissue injury.
- Because NSAIDs prevent the formation of prostaglandins through the inhibition of COX-1, the tendency towards bleeding is increased.
- There is an elevated risk of gastrointestinal bleeding, ulceration, or ulcer-related complications.

### CENTRALLY ACTING NONOPIODS (Acetaminophen)

- They exert their analgesic effect by increasing the pain threshold, possibly by means of central inhibition of prostaglandin production. Their antipyretic properties have been attributed to their action on the hypothalamic heat centre.
- Oral acetaminophen , when compounded with narcotics, effectively relieves moderate-to-severe acute postoperative pain. Intravenous acetaminophen has proven efficacious for postoperative pain control following major orthopaedic surgery.
- While hepatotoxicity is the primary side effect, dosages associated with this complication thus far have ranged on the order of 1 to 4 g/day.

### LOCAL AND REGIONAL ANAESTHESIA

- Local anesthetics are used primarily for surgery, as opposed to acute injury or nonsurgical pain. Local anesthesia and regional blocks are often used by themselves for anesthesia and as part of a multimodal approach to perioperative pain management. Local anesthetics block peripheral nerve function through through sodium channel and axonal conductive blockade.



### MULTIMODAL ANALGESIA

- As the name implies, multimodal pain management involves the use of multiple agents that act at different re-

gions of the pain pathway. The rationale for this strategy is that it reduces the use of opioid agents and their adverse side effects. A combination approach allows better overall pain control. One aspect of multimodal pain management involves preemptive administration of analgesics and/or anti-inflammatory agents. The intention of multimodal pain management is to target different pain pathways for effective pain relief, without solely resorting to opioids.

- There is increasing evidence that multimodal therapy can shorten the hospital stay, lessen the adverse effects of opioids by decreasing dosage, and improve patient outcomes. These agents are given prior to the initiation of operative treatment and the release of local inflammatory pain mediators.

- A combination of approaches, both pharmacologic and nonpharmacologic (such as the use of ice or "cooling units"), can address multiple mechanisms of pain, with the added benefit of reducing side effects through the use of lower doses of individual modalities.

Recently, several studies have shown that, following hip or knee arthroplasty, administration of the COX-2- specific inhibitors valdecoxib and parecoxib significantly reduces the dose of opioid required for effective acute postoperative analgesia and provides better pain relief than does opioid analgesia alone

### TRANSDERMAL PATCHES AND SUPPOSITORIES

- While transdermal fentanyl patches add to the total narcotic dosage, they also provide an alternative route for administration of pain control. They have comparable efficacy and safety to patient-controlled morphine analgesia .

- Per rectal suppository administration of diclofenac sodium, tramadol are commonly used for post-operative pain relief.

### NON-PHARMACOLOGICAL MANAGEMENT

Examples of physical modalities include application of superficial heat or cold, massage, exercise, immobility, and electroanalgesia, such as transcutaneous electrical nerve stimulation (TENS).

- There is emerging evidence that CRYOSURGERY (application of ice) to the site of an arthroplasty results in improved pain control. Ice is believed to work by reducing inflammation, metabolism, and nerve conduction velocity. Combining ice application with compression for edema prevention results in further vasoconstriction and inflammation reduction.