

Chapter 7

Pain in the Orthopedic Rehabilitation Patient

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Introduction

Despite continued advances in acute treatment options for the orthopedic patient, postoperative pain and its effects on the patient remain problematic. Inadequate pain control has been related to adverse events, such as coronary ischemia and infarction, impaired pulmonary function, paralytic ileus, decreased immune function, poor wound healing, urinary retention, venous thrombosis, unnecessary psychological distress, and anxiety [1]. Uncontrolled postoperative pain has also been shown to promote extended hospital stays, increased re-admissions, and higher total direct medical costs [2–4].

Arthritis is the most significant cause of disability in older Americans. It affects over 70 million people and accounts for as much as 120 billion dollars in costs annually [5]. In the United States, it is estimated that by 2030 the demand for both total knee arthroplasty (TKA) and total hip arthroplasty (THA) will increase by 673% and 174%, respectively [6, 7].

Pain following Total Joint Arthroplasties (TJAs)

Acute post-surgical pain (APSP) can often become intractable and may lead to chronic post-surgical pain (CPSP). If long-term pain persists for greater than 2 months after surgery, it has been shown to halt the recovery process, disrupt

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activities of daily living (ADL), affect quality of life, and result in physical debility leaving the patient dissatisfied with their surgical experience [8–10].

A recent prospective cohort study, which compared standardized pain scores from various surgical procedures performed in a large number of hospitals, found that major orthopedic surgery was highly associated with elevated pain scores. In fact, 22 of the 40 procedures with the highest pain scores were orthopedic surgical procedures of the extremities [11].

As for total joint arthroplasty (TJA), persistent pain and dissatisfaction at least 6 months following surgery can be as high as 20% for TKA and 8% THA. Wyld et al. [12] found that 44% of TKA patients and 27% of THA patients reported persistent pain of any severity 3–4 years after undergoing surgery. It should be noted that the majority reported mild and infrequent pain that was notably reduced from their preoperative state; however, 15% of TKA patients and 6% of THA patients reported severe-extreme persistent pain.

CPSP has a high likelihood of affecting patients undergoing shoulder replacement surgery as well. A study by Bjørnholdt et al. [13] defined persistent pain as pain experienced constantly or every day within the last month, at a level that interfered with daily activities. Although it was defined slightly differently, persistent pain was reported to be as high as 22% 1–2 years after primary shoulder replacement, and presumed neuropathic pain was 13%.

Psychosocial Predictive Factors/Concomitant Pain Problems

When working to achieve adequate pain control in the orthopedic rehabilitation patient, it is important to be aware of the psychosocial factors and predictors that put a patient at risk for developing CPSP. Persistent post-surgical pain and achievement of rehabilitation milestones are independently and notably associated with psychosocial factors, such as pre- and postoperative levels of anxiety and depression, maladaptive coping skills, social support systems, and pain catastrophizing (PC) [9, 14–16].

A wide variety of factors such as genetics, age, education, socioeconomic status, surgical duration and techniques, type of anesthesia, pain in other body areas, comorbidities, chronic opioid use, pre-operative pain, and acute postoperative pain have also been linked to an increased risk of developing CPSP [17, 18]. A recent systematic review and meta-analysis found that catastrophizing, pre-surgical mental health, preoperative knee pain, and pain at other sites are the strongest independent predictors of persistent pain following TKA [19].

Shift of Pain Burden from Acute Care Hospital to the Rehabilitation Hospital

Due to surgical advancements and subsequent shorter hospital courses of patients undergoing common orthopedic procedures such as total joint arthroplasties, the burden of early adequate pain management has recently begun to shift to inpatient rehabilitation hospitals, community-based health care providers, and the patients themselves [20].

Pathophysiology

Iatrogenic Post-Surgical Pain

Orthopedic surgery causes tissue injury and leads to the release of inflammatory mediators that may activate central and peripheral mechanisms of pain. This is termed “incisional pain” and is defined as acute pain resulting from nociceptive, ischemic, and inflammatory mechanisms, as well as nerve damage [21].

Arthritic Pain

A large number of orthopedic patients in the rehabilitation setting have a high prevalence of osteoarthritis. Overall, the pathophysiology of osteoarthritis pain remains poorly understood, and it is well known that radiographic severity does not always correlate with clinical severity [22]. However, studies are finding that sensitization, both peripheral and central, as well as hyperalgesia, are prominent mechanisms in osteoarthritis pain and may be why patients with osteoarthritis experience chronic postoperative pain after a seemingly successful total joint arthroplasty [23, 24].

Bone Pain

The pain receptors of the periosteum are supplied by a plexus made up of myelinated A-delta and myelinated C-fibers [25]. The firing frequency of noxious stimulation is high in these fibers. Also, the periosteum has the lowest pain threshold of the deep somatic structures, which is one of the reasons why bone injury is more painful than soft tissue injury [26].

Catastrophizing

Pain catastrophizing is defined as an exaggerated negative mental set or focus on pain, which is brought to bear during an actual or anticipated painful experience [27]. As previously mentioned, it is one of the strongest predictors of persistent postoperative pain. In addition, elevated PC following knee surgery in patients with osteoarthritis has been correlated with disability and increased pain levels for up to 6 months postoperatively [28–30].

Symptoms

In the orthopedic rehabilitation patient, pain can be the sequela of symptoms caused by the inciting injury or by the surgical treatment, such as effusions, edema, structural deformities, and skin abnormalities, which include surgical incisions, ecchymosis, tenting, or blistering. In patients who have undergone TJA, it is important to keep in mind that TKA tends to be more painful than THA.

Function

Pain can frequently contribute to symptoms affecting the patient's function and overall health, such as sleep disturbances, weakness, decreased range of motion, endurance, proprioception, and balance.

Psychological

Acute and chronic pain can also be accompanied by emotional distress and can make a patient more susceptible to psychosocial consequences, such as anxiety and depression.

Nociceptive

Nociceptive pain is characteristically described as sharp, aching, or throbbing in nature and is often well localized.

Arthritic Pain

Typically, symptoms of arthritis include the following: joint pain and tenderness that is worse in the morning and lessens with mild to moderate activity; difficulty walking; increased pain with prolonged or vigorous activity that is relieved by rest; stiffness or limited range of motion.

Functional Limitations

Due to Pain or Fear of Activity

Pain is a predominant limiting factor for participation in therapy and functional gains. A study by Holla et al. [31] found that the initial experience of knee pain due to osteoarthritis during physical activity leads to anticipation that further activity will cause more pain. As a result, patients may avoid activity.

Limited participation and function, secondary to pain or fear of movement, can lead to physical deconditioning and can hinder activities of daily living (ADLs) as well as mobility. It may also predispose a patient to various medical complications affecting multiple organ systems, such as the pulmonary and cardiovascular systems. Decreased active and passive range of motion following TKA can require manipulation under anesthesia to prevent contracture formation.

Due to Mechanical

Functional limitations may be due to mechanical factors associated with the injury and treatment, both surgical and non-surgical. These include, but are not limited to joint precautions, immobilization, weight-bearing restrictions, range of motion restrictions, and the use of assistive devices or durable medical equipment.

Treatment

Multimodal Analgesia

Each institution should try to incorporate a comprehensive multimodal analgesia approach to pain management, which takes advantage of the synergistic effects of different classes of analgesic agents and targets various regions of the pain pathways. The ultimate goal of any multimodal approach is to maximize the benefits of each medication, while decreasing the need for opioid use and reducing the

analgesic-related adverse effects of each medication [2]. Physicians and rehabilitation hospitals should have standardized pain control protocols, but customization is often required to some extent based on allergies and comorbidities. For example, elderly patients with preexisting cognitive decline or mild dementia are at a greater risk for postoperative delirium, and medications like opioids should be used with caution. Multimodal analgesia has not only led to a decline of postoperative pain, but has led to a decrease in rates of delirium and reduction of cognitive dysfunction [32, 33].

When ordering pain medications in the rehabilitation setting, it is important to consider scheduling them, particularly prior to therapy. If medications are scheduled, analgesia is better optimized, as serum levels are more stable [34].

Medications

Acetaminophen

Acetaminophen is best used for mild pain and in conjunction with opioids such as hydrocodone or oxycodone. Attention should be paid to the patient's hepatic function.

Topical Lidocaine

Lidocaine ointment and patches may provide a good potential adjunctive option, as there are no significant side effects. Unfortunately, a study by Khanna et al. [35] found that lidocaine patches did not provide additional relief as compared to control subjects.

NSAIDs and COX-2 Inhibitors

NSAIDs work by inhibiting the synthesis of prostaglandins in body tissues, by inhibiting at least two cyclooxygenase (COX) isoenzymes, COX-1 and COX-2. This may inhibit chemotaxis, alter lymphocyte activity, decrease pro-inflammatory cytokine activity, and inhibit neutrophil aggregation. These effects may contribute to anti-inflammatory activity. Since the traditional NSAIDs inhibit both COX-1 and COX-2, they can elicit more side effects, in particular adverse gastrointestinal events and bleeding.

In general, traditional NSAIDs are not frequently used following TJA because patients are also being prescribed some type of anticoagulation for the prevention of

thromboembolism, so the use of NSAIDs in the setting of deep vein thrombosis prophylaxis would potentially increase the risk of bleeding. However, COX-2 inhibitors, such as celecoxib, do not affect COX-1 at therapeutic concentrations, thereby decreasing formation of prostaglandin synthesis and lowering the adverse effects on gastric mucosa. COX-2 inhibitors may be used cautiously as part of a multimodal treatment regimen.

Topical NSAIDs

Topical NSAIDs include medications such as diclofenac sodium 1% gel and diclofenac sodium 1.5% in 45.5% dimethylsulfoxide solution. These have shown to be beneficial in the treatment of knee osteoarthritis. This is a potential option for adult patients who are at risk of systemic toxicity from oral NSAIDs [4].

Tramadol

This is a non-opioid derived synthetic opioid. It may act at least partially by binding to opioid mu receptors causing inhibition of ascending pain pathways. However, there are studies showing that there is no difference in pain control between placebo and tramadol groups [36].

Opioids

Opioids bind to mu, kappa, and delta in the CNS and peripheral tissues; they pre-synaptically lower the influx of calcium to reduce neurotransmitter release in sensory C fibers and post-synaptically increase the transport of potassium in the cell to facilitate hyper-polarization in second-order neurons. There are studies indicating that patients placed on chronic opioids prior to total knee arthroplasty may be at greater risk of poor postoperative pain management [37]. Opioids are effective at relieving severe musculoskeletal pain. Adverse reactions of CNS depression, respiratory depression, nausea and vomiting, or constipation may require adjuvant drugs, such as anti-emetics or laxatives. Opioids may also impair judgment or motor skills, resulting in changes in balance or falls [4]. Oxycodone may be the preferred agent for two reasons. First, it has higher bio-availability as compared to morphine, resulting in more stable plasma levels. Second, oxycodone is not as affected by renal dysfunction, as compared to morphine [38].

N-Methyl-D-Aspartate (NMDA) Receptor Antagonists

NMDA receptor antagonists potentiate the effect of opioids and prevent hyperalgesic complications from uncontrolled pain [39]. The medication ketamine is the main example. A study by Remerand et al. [40] demonstrated that patients treated postoperatively after a total hip arthroplasty with ketamine had significantly decreased morphine consumption and decreased pain. All patients were managed with a multimodal pain management regimen concurrently. Side effects include hallucinations, nausea, emesis, and vision changes. This medication is only available intravenously and intramuscularly; therefore, it is not typically used in the inpatient or outpatient rehabilitation setting.

Rehabilitation

Therapy

It is important to stress aggressive post-acute rehabilitation, with a focus on return to functional activity, in order to assure a reduction in the likelihood of uncontrolled pain [20, 41].

Modalities

Cryotherapy, or the use of ice/cold, may be beneficial to help with pain and swelling after TJA. One study by Su et al. showed that the use of a cryo-pneumatic device after TKA decreased opioid usage from hospital discharge to 2 weeks postoperatively [42]. However, a Cochrane review did not show clear evidence to support the use of cryotherapy [43].

Psychology

Most rehabilitation hospitals incorporate psychologists into the treatment program. Focus should be placed on the psychosocial factors that are known to play a key role in continued pain, such as pain catastrophizing [44].

Weight Reduction

Weight reduction is a goal that should be incorporated into the rehabilitation process due to the well-documented association with being overweight and joint symptoms [5].

Education

Information on postsurgical pain and management should be provided to orthopedic patients presenting to a rehabilitation facility. Knowing what to expect may help to alleviate anxiety associated with the rehabilitation process and the management of postoperative pain. More importantly, it can reduce the burden of acute and chronic opioid use.

A recent review showed that only 1 of 13 studies demonstrated an improvement in postoperative pain following pre-operative education, as compared to a non-educated group [45]. In contrast, there was a five-year retrospective study that looked at outpatient orthopedic surgical patients who underwent a comprehensive pre- and postoperative program with the intent of minimizing opioid use. The study revealed that 89% of the patients used less than or equal to 20 opioid tablets after undergoing common orthopedic procedures and no chronic opioid use was required [46].

Procedures

Injections

There are several forms of injections that can be performed to help with relieving pain in the orthopedic patient, prior to and after surgery, such as intra-articular corticosteroid injections of the hips, knees, and shoulders, and visco-supplementation with hyaluronic acid of the knee. Local infiltration anesthesia (LIA) with anesthetics, steroids, NSAIDS, and epinephrine has been shown to be beneficial in reducing pain following TKA [47]. Intrathecal and epidural anesthesia/analgesia, as well as peripheral nerve blocks, can be helpful in reducing pain postoperatively in total joint replacements.

Acupuncture

Although more studies need to be performed, Crespin et al. [48] found a significant decrease in moderate to severe pain after TJR with the use of acupuncture, from 41 to 15% of patients.

Surgery

Revision surgery may be required if the patient has uncontrolled pain due to a mechanical problem with prosthesis or malalignment.

Potential Treatment Complications

Modalities

Skin burns or breakdown of the incision may occur with modality use.

Medications

NSAIDS

Bleeding and renal dysfunction are the primary potential complications. There are concerns that the use of COX-2 inhibitors and NSAIDs may interfere with osseointegration and fracture healing, but there is little level I or II evidence available to support or to refute this concern.

Opioids

The risks of opioid use include addiction, allergic reaction, and the following systemic side effects:

System	Effect
Gastrointestinal	Nausea, vomiting, constipation, ileus
Respiratory	Respiratory depression, hypoxia
Integumentary	Pruritus
Neurologic	Delirium, somnolence
Genitourinary	Urinary retention

Rehabilitation

Potential complications of rehabilitation include falls and additional injuries, such as fractures, dislocation, and soft tissue damage.

Procedures and Surgeries

As with any procedure or surgery, there may be risk of infection or failure.

Conclusion

Early patient performance in therapy is closely tied to how well postoperative pain is controlled. Uncontrolled pain has a detrimental implication on the patient's ability to participate in therapy. As with any patient being admitted to a rehabilitation hospital, collaboration between the patient, family members, and interdisciplinary care team members including the surgeon, physiatrist, consulting physicians, nurses, therapists, social workers, and psychologist is critical to optimize early function and to maintain adequate pain control.

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