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Non-opioid analgesics: Novel approaches to perioperative analgesia for major spine surgery

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Perioperative pain management is a significant challenge following major spine surgery. Many pathways contribute to perioperative pain, including nociceptive, inflammatory, and neuropathic sources. Although opioids have long been a mainstay for perioperative analgesia, other non-opioid therapies have been increasingly used as part of a multimodal analgesic regimen to provide improved pain control while minimizing opioid-related side effects. Here we review the evidence supporting the use of novel analgesic approaches as an alternative to intravenous opioids for major spine surgery.

Introduction

Pain following major spine surgery can be severe. Poorly controlled pain may lead to increased morbidity and complications, including nausea, ileus, delayed mobilization, prolonged hospital stay, and development of chronic pain syndromes [1,2]. Effective pain control may contribute to improved surgical outcome, shorter hospital stay, and decreased risk of developing chronic pain [3].

Opioids are a first-line therapy for perioperative analgesia in major spine surgery. Many patients presenting for major spine surgery suffer from chronic pain treated with long-term opioid therapy

Abbreviations: ITM, intrathecal morphine; NMDA, N-methyl D-aspartate; NRS, numeric rating system; PCA, patient-controlled analgesia; VAS, visual analog scale.

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preoperatively. In a study of 1860 patients with chronic low back pain, 52% were prescribed opioids [4]. The National Medical Expenditure Survey showed that in the number of opioid prescriptions increased by 108% in patients with spinal disorders between 1997 and 2004 [5], despite a lack of evidence showing a benefit of opioid therapy for long-term management of chronic back pain [6]. Thus, preoperative opioid tolerance makes adequate pain control a significant challenge in spine surgery patients.

Opioids have numerous short- and long-term side effects. Short-term effects seen in the perioperative period include nausea, vomiting, ileus, pruritus, urinary retention, somnolence, and respiratory depression [7]. Chronic opioid use is associated with increased risk for postoperative pain, greater opioid consumption, prolonged use of health-care resources, and may contribute to central and peripheral sensitization and the development of hyperalgesia [8]. In addition, long-term opioid use causes adverse health effects, such as suppression of the hypothalamic–pituitary axis, leading to sexual dysfunction and increased risk of bone fracture and myocardial infarction [9]. Non-opioid analgesics have potential benefits to improve analgesia and decrease opioid consumption and opioid-related side effects, both perioperatively and chronically. In this study, we review novel analgesic approaches to perioperative analgesia for major spine surgery.

Assessment of pain

Analgesia after major spine surgery has been the subject of several recent systematic reviews [2,8,10]. A major challenge in studying perioperative pain management is the ability to accurately and objectively assess pain. In 2001, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) implemented pain management standards requiring assessment of four elements of pain: (1) intensity, (2) quality, (3) effect on function and quality of life, and (4) an objective measure of the amount of pain medication used [11]. Several methods have been used to assess pain management based on these measures. Pain intensity is frequently quantified using one of two validated tools, the numeric rating system (NRS) or the visual analog scale (VAS) in which patients are asked to rate their pain on a scale of 0–10. Pain scores are reported either at specific postoperative time points or as a time-averaged pain score [12,13]. Pain quality, including its physiologic and psychological components, can be assessed using tools such as the McGill pain questionnaire, which ascertains pain location, intensity, quality, pattern, and alleviating and aggravating factors [14]. The brief pain inventory is one of several measures developed to assess the impact of pain on a patient's quality of life. This tool has been used in the assessment of patients with both cancer and non-cancer pain and determines the effect of pain on activity, mood, ambulation, work, relationships, sleep, and ability to enjoy life [15]. Objective measurement of the type and amount of pain medication can be obtained by converting doses of all medications administered to morphine sulfate-equivalent dosages using an equianalgesic dosing table [16]. Finally, length of hospital stay, time to mobilization, and frequency of medication-related side effects are frequently used as surrogate measures of perioperative pain management.

A growing body of evidence suggests that psychological and emotional factors, such as anxiety and depression, influence the pain experience. The term “pain catastrophizing” has been used to describe an irrational focus on pain, and a tendency to perceive pain as worse than it actually is. Patients undergoing lumbar spine fusion who scored higher on Pain Catastrophizing and Hospital Anxiety and Depression Scales reported higher pain scores and required higher quantities of analgesics postoperatively [17]. Catastrophizing is associated with increased pain intensity and disability following lumbar spine surgery [18] and may provide a coping mechanism for some patients, such as those with low educational attainment [19] or chronic pain [20]. In a prospective trial of 81 patients with chronic low back pain, patients with “negative affect” (anxiety, depression, and catastrophizing cognitive style) experienced less improvement in pain, despite higher doses of opioids, and had higher rates of opioid misuse compared with those with low negative affect [21]. Assessment of affective components of pain may help to identify pain catastrophizers at risk for increased pain perioperatively. Studies reviewed in this article typically reported postoperative pain scores and opioid consumption as primary outcomes. Secondary outcomes include length of hospital stay, time to mobilization, and incidence of medication-related side effects.