Sigma's 30th International Nursing Research Congress

Effectiveness of Analgesics Administered for Lower Extremity Fracture Pain During Hospitalization

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Purpose:

Effective treatment of acute pain in the immediate hospitalization following injury is critical to improve short-term patient outcomes (i.e. wound healing, stress response, hospital length of stay, cost) (Ahmadi et al., 2016; Wells, Pasero, & Mccaffery, 2008), as well as minimizing long-term negative patient outcomes (i.e. delayed return to work, disability, chronic pain) (Goldsmith & Mccloughen, 2016; Holmes et al., 2010; Rivara et al., 2008). For many lower extremity fractures patients, pain is poorly controlled during hospitalization (Archer, Castillo, Wegener, Abraham, & Obremskey, 2012; Bergman, 2007; Minick, Clark, & Dalton, 2012; Ware, Epps, Clark, & Chatterjee, 2012). Therefore, identifying which analgesic, combination of different analgesics, or analgesic and adjuvant analgesic combination most effectively decreases acute pain following lower extremity fracture is vital to improve patient outcomes during and after hospitalization, reduce healthcare cost, and minimize the risk of developing chronic pain. The definition of what constitutes effective pain relief varies. In general, a reduction of 45 – 50 % on the 0 – 10 numeric rating scale (NRS) is considered “very much improved” pain as it allows for increased functional ability, improved quality of life, and is considered to be a clinically beneficial outcome (Cepeda, Africano, Polo, Alcala, & Carr, 2003; Katz, Paillard, & Ekman, 2015; Moore, Derry, McQuay, & Wiffen, 2014; Teater, 2014). A 35% decrease is considered “much improved” and 20% is “minimal improvement” and considered a minimal clinically important difference (Cepeda et al., 2003). The aim in this study was to identify the analgesic, combination of different analgesics, or analgesic and adjuvant analgesic combination that generated the largest percent change from pre- to post-analgesic pain score.

Methods:

This was a descriptive retrospective cohort study of adults with lower extremity fractures admitted to an academic urban trauma center. Following university and hospital institutional review, participants were recruited from an urban trauma center where patients are first treated and stabilized on arrival in the emergency department (ED), before being admitted to an in-patient unit for further treatment. Participants were included if they had a minimum of one fracture to the lower extremity. Exclusion criteria included first-listed diagnosis of hip fracture, fractures to other body sites than lower extremities, head injury or mental status change, admitted to the intensive care unit, or an injury that resulted in an amputation. The following information were obtained from the ED flowsheet and the electronic medication administration record (eMAR): name, dose, and frequency of analgesics and adjuvant analgesics administered, pain scores with an associated date and time stamp, obtained using the 11-point Likert NRS (0 = no pain to 10 = worst pain imaginable). To calculate the percent change in pain, the following formula was used: 100*(post-analgesic pain score – pre-analgesic pain score) / pre-analgesic pain score (Farrar et al., 2001; Salaffi et al., 2004). Change in pain score was categorized as follows: very much improvement (≥ 45%), much improvement (35% - 44%), minimal improvement (20% - 34%), and no response (< 20%) (Cepeda et al., 2003). Statistical analyses were conducted using Base SAS® and SAS/STAT software, Version 9.4 of the SAS System for Windows (SAS Institute Inc, Cary, NC, USA). Continuous variables were summarized using means and standard deviations, and categorical variables were summarized using

frequencies and percentages. To examine differences based on percent change, a linear mixed effects model was used. A random subject effect was included to account for multiple observations from the same subject. The final data set included 70% of analgesics administered in the ED and 40% analgesics administered on the in-patient unit.

Results:

A majority of the 129 participants were male (73%), white (72%), with fibula and/or tibia fractures (66%), a mean age of 46 years (SD = 13.6), and an average length of stay of 3.7 (SD = 1.2) days. In the ED, the largest percent change from pre-analgesic to post-analgesic pain score for type of analgesic administered was for hydromorphone IV (M = 43%, SD = 27.6), followed by fentanyl IV (M = 35%, SD = 27.5), and morphine IV (M = 32%, SD = 15.4). The largest percent change in pain score for a specific analgesic dose was for hydromorphone 2 mg IV (M = 53%, SD = 29.8), followed by hydromorphone 0.5 mg IV (M = 50% SD = 26.3), and fentanyl 75 mcg IV (M = 43%, SD = 16.2). When combining all doses that were administered on the in-patient unit, morphine IV had the largest change in pain score (M = 54%, SD = 30.6), followed by hydromorphone IV (M = 30%, SD = 24.9), acetaminophen (M = 27%, SD = 43.5), and Oxycontin (M = 26%, SD = 36.6). The analgesic dose creating the largest percent change in pain score was morphine 4 mg IV (M = 54%, SD = 30.6), followed by oxycodone 15 mg PO (M = 36%, SD = 29.6), and hydromorphone 0.4 mg IV (M = 34%, SD = 22.4).

Conclusion:

In an effort to minimize negative short-and long-term outcomes due to inadequate pain relief, effective pain management is crucial. However, in this study of 129 hospitalized trauma patients with lower extremity fractures, few of the analgesics or analgesic and adjuvant analgesic combinations administered in the ED or on the in-patient unit resulted in a very much improved pain score, which would indicate increased functional ability for the patient. In the ED, all of the analgesics administered resulted in at least minimal improvement of pain. Of the 22 analgesic doses administered on the in-patient unit, only one (morphine 4 mg IV) was highly effective by reducing the pain score by more than 45%, oxycodone 15 mg PO was moderately effective (≥35%), 11 achieved at least a minimally effective pain relief (≥20% – 34%%), and nine analgesic doses did not even achieve 20% improvement in pain. This study, as with many retrospective chart reviews, had limitations such as missing data and variability in recording some data. The standard deviation was large for many of the analgesics, which is indicative of a large amount of variability in the data. As the pain score is a subjective phenomenon, the same dose of analgesic could result in different pain relief for individual patients. Often, the pain scores were documented as “patient asleep”, which makes it difficult to determine whether the patient’s pain decreased or whether the central nervous system effects of the analgesic resulted in sleepiness regardless of the patient’s the pain. Also, a higher pre-analgesic pain score can result in a larger pre-to post-analgesic difference compared to a lower pre-analgesic pain score (Breivik et al., 2008). Nurses in emergency departments and trauma resuscitation units are involved in the direct care of patients with acute pain following traumatic injuries. Nurses are in an excellent position to determine whether pain management is adequate for patients and can initiate an alternate treatment if pain relief is inadequate. Findings from this study provide critical information on the effectiveness of medications administered for pain during hospitalization for patients with lower extremity fractures and there is an opportunity to use the information from this study to guide pain management protocols.

Title:
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Keywords:
analgesic, fracture and pain

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Abstract Summary:
Participants will identify analgesics that resulted in the largest percent change in pain score in a cohort of patients with lower extremity fracture pain during hospitalization, treated in the emergency room and on the in-patient unit.

Content Outline:

1. Introduction
    1. Effective treatment of pain following injury is critical to improve short-and long-term patient outcomes.
    2. It is currently not clear which analgesic, combination of different analgesics, or analgesic and adjuvant analgesic combination most effectively reduces acute pain in hospitalized patients with lower extremity fractures.
    3. Percent change was calculated for pain scores recorded with analgesics and adjuvant analgesics administered in the emergency department (ED) and in-patient unit using the formula: 100*(post-analgesic pain score – pre-analgesic pain score) / pre-analgesic
2. Body
    1. In the ED
        1. The largest percent change for type of analgesic administered
            1. Hydromorphone IV (M = 43%, SD = 27.6)
            2. Fentanyl IV (M = 35%, SD = 27.5)
            3. Morphine IV (M = 32%, SD = 15.4).
        2. The largest percent change in pain score for a specific analgesic dose
            1. Hydromorphone 2 mg IV (M = 53%, SD = 29.8)
            2. Hydromorphone 0.5 mg IV (M = 50% SD = 26.3)
            3. Fentanyl 75 mcg IV (M = 43%, SD = 16.2).
        3. On the in-patient unit
            1. The largest percent change for type of analgesic administered
                1. Morphine IV (M = 54%, SD = 30.6)
                2. Hydromorphone IV (M = 30%, SD = 24.9)
                3. Acetaminophen (M = 27%, SD = 43.5)
                4. Oxycontin (M = 26%, SD = 36.6).
            2. The largest percent change in pain score for a specific analgesic dose
                1. Morphine 4 mg IV (M = 54%, SD = 30.6)
                2. Oxycodone 15 mg PO (M = 36%, SD = 29.6)
                3. Hydromorphone 0.4 mg IV (M = 34%, SD = 22.4)
3. Conclusion
    1. few of the analgesics or analgesic and adjuvant analgesic combinations administered in the ED or on the in-patient unit resulted in a very much improved pain score, which would indicate increased functional ability for the patient.
    2. Nurses are in an excellent position to determine whether pain management is adequate for patients and can initiate an alternate treatment if pain relief is inadequate.
    3. Findings from this study provide critical information on the effectiveness of medications administered for pain during hospitalization for patients with lower extremity fractures.

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