Utilization and effectiveness of multimodal discharge analgesia for postoperative pain management

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ABSTRACT

Background: Although evidence-based guidelines recommend a multimodal approach to pain management, limited information exists on adherence to these guidelines and its association with outcomes in a generalized population. We sought to assess the association between discharge multimodal analgesia and postoperative pain outcomes in two diverse health care settings.

Methods: We evaluated patients undergoing four common surgeries associated with high pain in electronic health records from an academic hospital (AH) and Veterans Health Administration (VHA). Multimodal analgesia at discharge was characterized as opioids in combination with acetaminophen (O + A) and nonsteroidal antiinflammatory (O + A + N) drugs. Hierarchical models estimated associations of analgesia with 45-d follow-up pain scores and 30-d readmissions.

Results: We identified 7893 patients at AH and 34,581 at VHA. In both settings, most patients were discharged with O + A (60.6% and 54.8%, respectively), yet a significant proportion received opioids alone (AH: 24.3% and VHA: 18.8%). Combining acetaminophen with opioids was associated with decreased follow-up pain in VHA (Odds ratio [OR]: 0.86, 95% confidence interval [CI]: 0.79, 0.93) and readmissions (AH OR: 0.74, CI: 0.60, 0.90; VHA OR: 0.89, CI: 0.82, 0.96). Further addition of nonsteroidal antiinflammatory drugs was associated with further decreased follow-up pain (AH OR: 0.71, CI: 0.53, 0.96; VHA OR: 0.77, CI: 0.69, 0.86) and readmissions (AH OR: 0.46, CI: 0.31, 0.69; VHA OR: 0.84, CI: 0.76, 0.93). In both systems, patients receiving multimodal analgesia received 10%-40% less opioids per day compared to opioids only.

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Introduction

Postprocedure pain is a key component of surgical care.\(^1\) If poorly managed, it is not only associated with reduced quality of life and higher costs\(^2\) but also increased opioid use,\(^3\) risk of chronic pain, and opioid dependence.\(^4,5\) Regimens using multiple agents that target different pain-relieving mechanisms—so called “multimodal analgesia”—have been associated with improved pain outcomes and reduced opioid consumption in clinical trials.\(^6-13\) More specifically, the addition of nonsteroidal antiinflammatory drugs (NSAIDs) and/or acetaminophen to postoperative analgesic regimens reduces early pain intensity and morphine consumption.\(^14,15\) For these reasons, postoperative pain management guidelines including those issued by the American Pain Society and the American Society of Anesthesiologists recommend multimodal analgesia for postoperative pain.\(^16,17\) These guidelines have resulted in frequent implementation of multimodal analgesia in inpatient postoperative care.\(^18\)

However, to date, there is limited published data on guideline adherence for multimodal analgesia, specifically at discharge. Furthermore, the evidence of effectiveness of adherence to multimodal analgesic strategies outside of controlled trials is limited. Finally, the effectiveness of such strategies to improve important pain-related outcomes not typically evaluated in controlled clinical trials such as pain severity at follow-up visits or subsequent hospital readmissions also remains unknown. In addition, because postoperative opioid exposure for pain treatment has been implicated as a significant factor contributing to prolonged opioid use and even misuse,\(^5,6,10,12\) identification of opportunities such as those attributed to multimodal analgesic regimens to further limit opioid exposure could potentially positively impact the opioid-use epidemic in the US.\(^22,23\)

To address these shortcomings, we conducted a retrospective study using electronic health records (EHRs) in two diverse settings to test three key questions: (1) are multimodal guidelines being implemented at discharge following key surgeries known for intense postoperative pain?, (2) does the multimodal approach improve pain compared to opioids alone outside of controlled clinical trials?, and (3) do the benefits of multimodal analgesic regimens extend to important pain-related outcomes such as pain at follow-up visits and subsequent hospital readmissions? To answer these questions, we developed hierarchical models at a large academic hospital (AH) and then tested the generalizability of these results within the US Veterans Health Administration (VHA) data, which include 168 medical centers across all four US geographic regions.

Methods

Data sources

Academic hospital

In the AH, surgical patients were identified in the EHR, which used the EPIC system (Epic Systems, Verona WI) between 2009 and 2016. Specifically, data were extracted from Epic’s Clarity Terminology codes (Supplemental Table 1). The procedures included distal radial fracture, mastectomy, thoracotomy, and total knee replacement, which are reported to be associated with high postoperative pain and often the focus of randomized control trials to try and reduce the pain profile.\(^24-26\) We captured patient demographics, diagnosis, medications, and type of insurance coverage (in the AH). Patients were excluded if age at surgery was less than 18 y or death occurred during the hospitalization. For patients with multiple surgeries, only first surgery was included. Patients with concurrent procedures were included in the analysis.

Study variables

Pain medications

The drug formulary and vocabularies were mapped to a 2016 version of RxNorm, which is part of the Unified Medical Language System and produced by the National Library of Medicine.\(^27\) Prescription orders were distilled to the ingredient level. The algorithm used for data extraction accounted for any combination medications and trade names. The average daily oral morphine consumption for the inpatient stay and discharge medications were calculated using oral morphine equivalent conversion factors.\(^28,29\)
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