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Original Contribution

A temporal analysis of opioid use, patient satisfaction, and pain scores in colorectal surgery patients ☆,☆☆

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Abstract
Background: Recent health care policy changes promote objective measurements of patient satisfaction with care provided during hospitalization. Acute postsurgical pain is a significant medical problem and strongly impacts patient experience and patient satisfaction. Multimodal analgesic pathways are used for acute pain management, but opioid medications remain a mainstay of treatment. Opioid use is increasing in the outpatient setting, but opioid use trends in the inpatient postsurgical setting are not well known. We hypothesized that use of opioid medications has increased over time along with decrease in postoperative pain scores and increase in pain-related patient satisfaction.
Methods: In this single-center study, we studied the trends and correlation in the average daily pain scores, opioid consumption, and patient satisfaction scores as measured by pain-related patient satisfaction questions in the Hospital Consumer Assessment of Healthcare Providers and System survey. Pain scores and opioid use data were obtained from electronic health records, vital signs monitoring, and medication databases. Adult patients who had nonemergent colorectal surgeries between January 2009 and December 2012 were included.
Results: We found no significant trend in opioid use or pain-related patient satisfaction scores. There was an average annual increase of 0.3 (98.3% confidence interval, 0.2-0.4; *P* < .001) in average daily pain score from 2.8 ± 1.5 to 3.8 ± 1.5. The univariable associations between time-weighted pain score, average daily opioid dose, and pain-related patient satisfaction score were all highly significant.
Conclusion: In this retrospective cohort study, opioid use and pain-related patient satisfaction scores were stable over time. Pain-related patient satisfaction scores were negatively associated with both pain score and opioid dose. The associations we report should not be considered evidence of a causal relationship.
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1. Background

In the past decade, increased use of opioid medication has helped many patients with better management of acute post-surgical pain, but at the same time, problems associated with use of opioids like adverse reactions, tolerance, dependence,

and abuse are widespread. In outpatient setting, opioid use and overdose-related deaths have increased substantially from 1999 to 2008 [1,2]. On the other hand, uncontrolled acute postsurgical pain is still a significant problem not only from medical care and outcomes perspectives but also from the patient satisfaction perspective [3].

Patient satisfaction as an outcome is gaining more attention after the Affordable Care Act of 2010, which focuses on increasing transparency and accountability in health care. The new law also promotes objective measurements of patient perspectives of health care so that both patients and payers can compare hospitals and make informed decisions. Patients' perception of pain control and the efforts by health care providers to help in their pain control are both important in determining patient satisfaction [4]. Anesthesiologists play an important role in perioperative pain management and can influence patient satisfaction scores. Although a multimodal approach [3,5] is recommended, opioids remain the mainstay of acute pain management.

Opioid medication usage can lead to better pain control, improved pain scores, and better patient satisfaction metrics. This study, therefore, aimed to test the hypothesis that inpatient opioid use has increased over time among colorectal surgery patients and is associated with decreased pain scores and improved patient satisfaction as measured by pain-related patient satisfaction score in Hospital Consumer Assessment of Healthcare Providers and System (HCAHPS) survey.

2. Methods

2.1. Data collection

From the Cleveland Clinic Perioperative Health Documentation System and hospital electronic medical record, we obtained data for adult patients who had nonemergent colorectal surgeries at the Cleveland Clinic between January 2009 and December 2012. We only included patients that completed the HCAHPS questionnaire. Patients who stayed less than 24 hours in the hospital were excluded. Pain scores are reported in the medical record using a numerical rating scale from 0 to 10 (0 = no pain and 10 = worst pain). Postoperative pain scores are recorded with vital signs at the time of nursing assessment. Oral and parenteral opioid utilization was assessed by using pharmacy data on amount of opioid actually administered to the patient. Opioids were converted to morphine equivalents by using the standard conversion chart.

2.2. HCAHPS survey

The HCAHPS survey is developed by the Agency for Healthcare Research and Quality and the Centers for Medicare and Medicaid Services to provide a standardized and publicly reported tool that allows objective and meaningful comparisons of hospitals on important quality of care issues [6,7]. The survey is administered to patients after hospital discharge via various valid methods like standard mail, speech-enabled/interactive voice response, and Web/e-mail.

The pain-related patient satisfaction score was calculated as the percentage of "top-box" responses ("always" response) among nonmissing answers ("always," usually," "sometimes," or "never") to 2 following pain-related HCAHPS questions: (1) During this hospital stay, how often was your pain well controlled? (2) During this hospital stay, how often did the hospital staff do everything they could to help you with your pain? Specifically, if both answers were "always," a patient will have 100% of "top-box" responses on pain-related HCAHPS questions. If 1 answer was "always," a patient will have 50% of "top-box" responses on pain-related HCAHPS questions. If none of the answers were "always," a patient will have 0% of "top-box" responses on pain-related HCAHPS questions. If the answer to a question is missing, the percentage of "top-box" responses is identified based on remaining question only. Thus, possible values for the primary outcome percentage of "top-box" responses on pain-related HCAHPS questions are 0%, 50%, and 100%. Postoperative pain score was defined as the time-weighted pain score per patient (before discharge) [8]. Time-weighted average pain score for a patient is the sum of the pain scores multiplied by the proportion of the time a patient experienced that pain out of total considered time.

2.3. Primary analysis

There were 3 primary outcomes: (1) postoperative daily opioid dose: we used log-transformed postoperative daily opioid dose for modeling purposes; (2) postoperative pain scores; and (3) pain-related patient satisfaction score. To analyze the trend in postoperative daily opioid dose and pain score, we built two separate linear regression models to assess the association between year of surgery and the 2 outcome variables. We used log-transformed daily opioid dose as an outcome to meet the model assumption of normality. Because the percentage of "top-box" responses on pain-related HCAHPS questions, pain-related patient satisfaction score only had 3 possible outcomes (0%, 50%, or 100%), the association between year of surgery and the pain-related patient satisfaction score was evaluated using a proportional odds model. All models were adjusted for the prespecified demographic, baseline and perioperative variables listed in Table 1. The predictor variable of interest, year of surgery, was treated as a continuous variable because we assumed that there was a trend in the primary outcomes. Bonferroni correction was used to adjust for multiple comparisons. Thus, 98.3% confidence intervals (CIs) were reported, and significance criterion was $P < .017$ (ie, .05/3).

In addition, we separately plotted the three outcome variables on the aggregate level (average across patients) over time for information purposes.

2.4. Secondary analysis

The association between the three primary outcome variables was assessed using Spearman correlation. As a post hoc analysis, we summarized the demographics, medical