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Long-term opioid use after inpatient surgery – A retrospective cohort study

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ABSTRACT

Background: Knowledge of incidence and risk factors for long-term opioid prescribing is critical for surgical patients. In this retrospective cohort study, we linked information available at the time of surgery with prescription data to ascertain characteristics associated with prolonged opioid therapy.

Methods: Patients (n = 6003) with claims in the Colorado All Payer Claims Database (APCD) were matched with 20,501 encounters in a clinical database. Rates of prescription filling were defined by at least one monthly opioid claim relative to the date of surgery. Associations of variables with claims during months 2–6 post-operatively ("long-term prescription filling") were evaluated, and significant variables were jointly modeled using binomial regression.

Results: Rates of patients filling opioid prescriptions preoperatively [month (M) relative to date of surgery] were 22%(−3 M), 24%(–2 M), and 27%(−1 M); after surgery, opioid fill rates were 62%(1 M), 28%(2 M), 24%(3), 24%(4 M), 23%(5 M), and 22%(6 M). The majority, 71–76%, of patients filling prescriptions in months 2–6 after surgery had also filled before surgery. In the binomial regression model, long-term opioid use was associated with prior opioid use ($p < 0.0001$), age ≥26 to < 65 relative to age ≥ 65 ($p < 0.0001$), orthopedic surgery ($p = 0.001$), colorectal surgery ($p = 0.003$), multiple procedures ($p < 0.0001$), and worse physical status classification ($p < 0.0001$).

Conclusions: Patients who had filled opioid prescriptions preoperatively comprised the majority of the group who filled long-term prescriptions. Surgical procedures were associated with discontinuation of previous opioid prescribing in some patients. For others, surgery marked the initiation of prolonged opioid therapy. Surgical encounters should include interventions aimed to reduce long-term opioid use.

1. Introduction

Hospital admissions for surgical procedures exceed 14 million per year in the United States alone (Semel et al., 2012). Since pain was coined "the fifth vital sign" in the late 1990s (McCaffery and Pasero, 1997) there has been a marked rise in the sales of prescription opioids, which has been linked to the rapid increase in nationwide opioid-related morbidity and mortality (Dart et al., 2015; Olsen et al., 2006; Volkow et al., 2014). However, the recent guidelines on opioid prescribing by the United States Centers for Disease Control and Prevention do not include specific information on how to address persistent pain after surgery (Dowell et al., 2016). Detailed knowledge on incidence and factors associated with long-term opioid prescribing in patients undergoing various types of surgery is required for the development of targeted interventions to improve pain therapy and reduce rates of long-term opioid use in at-risk patients.

When clinicians prescribe opioids after hospital discharge following surgery, actual patient requirements for pain medications need to be estimated. Over-prescription of opioid analgesic medications after a surgical procedure is common and has been identified as a potential source of opioid prescription-induced morbidity (Bartels et al., 2016). However, with increasing institutional and legislative efforts to curb over-prescription of postoperative opioids, patients requiring intensive long-term pain treatment may now be at risk for inadequate therapy. Current prescribing practices appear to occur following a "one-size-fits-all" pattern and not in a patient-specific manner (Chen et al., 2018).

Long-term-opioid use after surgery appears to vary greatly depending on the population studied: in specific groups, such as bariatric surgery patients, who took opioids prior to surgery, chronic opioid use after surgery occurred in up to 77% of patients (Raebel et al., 2013). In

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retrospective cohort studies using administrative data from Canada, long-term opioid use was observed in 3–7.7% of previously opioid-naïve patients (Alam et al., 2012; Clarke et al., 2014). The addiction and pain research communities have been called upon to provide more evidence supporting non-opioid analgesic strategies for patients with chronic pain (Tompkins et al., 2017). In the context of surgery, early identification of patients likely to continue taking post-operative opioids in excess of one month is paramount to addressing this issue. Providers may then develop a comprehensive pain plan that includes non-pharmacologic approaches, non-opioid analgesics, and patient and family education on opioid safety, safe storage, and substance use disorders.

The objective of this study was to link patient information that is available at the time of surgery with long-term post-operative opioid prescription patterns in a cohort of patients undergoing inpatient procedures at a U.S. academic medical center. To achieve our objective, we tested the hypothesis that there are important patient and procedural characteristics which predict long-term opioid therapy after surgery. Our approach included harmonizing and mining both a clinical (Epic) and a claims-based database, the Colorado All Payer Claims Database (APCD).

2. Material and methods

2.1. Study design and study population

This study was designed as a retrospective cohort study according to the STROBE guidelines (von Elm et al., 2008). Ethics approval was obtained prior to initiation of this study from the Colorado Multi-Institutional Review Board. All adult patients who underwent a procedure requiring anesthesia services at the University of Colorado Hospital within a two-year time frame from 10/01/2011 to 09/30/2013 were screened for inclusion using the University of Colorado Hospital electronic health record database. Only procedures that required at least overnight hospitalization were included. Exclusion criteria included patients aged less than 18 years and patients with American Society of Anesthesiology (ASA) physical status classification 6 (cadaveric organ donors).

2.2. Data extraction from electronic health record

Epic (Epic Systems Co, Verona, WI, USA) is the electronic health record and order entry system used at the study site. We queried Epic for detailed records from each patient's hospitalization. Patient characteristics acquired from Epic included age, gender, race, and physical status classification characterized by ASA status: 1, normal healthy patient; 2, patient with mild systemic disease; 3, patient with severe systemic disease; 4, patient with severe systemic disease that is a constant threat to life; 5, moribund patient who is not expected to survive without the operation; 6, cadaveric organ donor (Hurwitz et al., 2017). Age groups were chosen based on detailed age categories found in the 2016 National Survey on Drug Use and Health (NSDUH, 2017). The date of surgery was defined from the medical record. Opioid prescriptions filled within 90 days prior to surgery and within 180 days after surgery were defined according to the date of surgery. These were grouped in monthly (i.e., 30 day) increments.

2.3. Data matching with the Colorado All Payer Claims Database (APCD)

Data from the Epic query were matched with the Colorado APCD using the following unique patient identifiers: first name, last name, date of birth, and date of surgery. In a first step, duplicate records were detected and eliminated. Next, APCD matched "person keys", which identified records as being associated with unique persons. Then, APCD queried their database for claims associated with these persons. In a stepwise fashion, we were able to match 6003 unique patients with claims in APCD and complete records from an initial dataset containing 20,501 clinical patient encounters in Epic (Fig. 1).

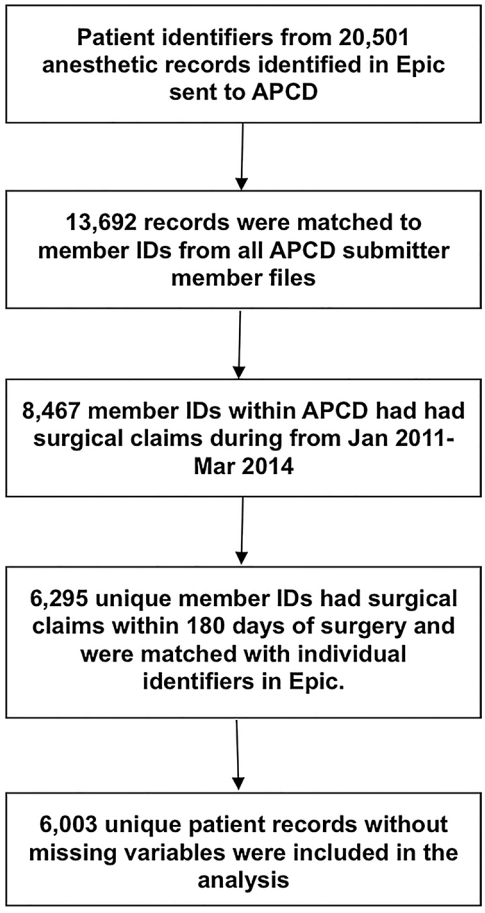

Fig. 1. Study flow diagram. CO APCD: Colorado All Payer Claims Database. For missing American Society of Anesthesiology (ASA) physical status classification, 292 member IDs were excluded from the final analysis.

2.4. Data analysis

Potential predictor variables of long-term opioid use (operationalized as filling an opioid prescription during the days 31–180 following surgery) were chosen based on the prior literature (Alam et al., 2012; Clarke et al., 2014) and our own hypothesized pathways. We evaluated associations between long-term opioid use and each independent variable with separate chi-square tests. We then jointly evaluated those significant variables in a binomial regression to estimate adjusted risk ratios for predicting long-term opioid prescription filling.

2.5. Power analysis

Following preliminary matching of the two databases, we estimated that a sample size of 6000 patients provides 90% power to detect an odds ratio of 1.21 or higher as statistically significant at a time point, assuming 20% of patients are long-term opioid users (i.e., filled a prescription at the 31–180 day interval), and assuming a multiple correlation between the independent variables of 0.75 or less (Hsieh, 1989). Because of the large sample size, we conservatively set significance at a two-tailed alpha-level = 0.01, and statistically significant results were further judged by evaluating the clinical relevance of the actual differences detected.