

Association between intraoperative opioid administration and 30-day readmission: a pre-specified analysis of registry data from a healthcare network in New England

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Abstract

Background: The use of intraoperative opioids may influence the rate of postoperative complications. This study evaluated the association between intraoperative opioid dose and the risk of 30-day hospital readmission.

Methods: We conducted a pre-specified analysis of existing registry data for 153 902 surgical cases performed under general anaesthesia at Massachusetts General Hospital and two affiliated medical centres. We examined the association between total intraoperative opioid dose (categorised in quintiles) and 30-day hospital readmission, controlling for several patient-, anaesthetist-, and case-specific factors.

Results: Compared with low intraoperative opioid dosing [quintile 1, median (inter-quartile range): 8 (4–9) mg morphine equivalents], exposure to high-dose opioids during surgery [quintile 5: 32 (27–41) equivalents] is an independent predictor of 30-day readmission [odds ratio (OR) 1.15 (95% confidence interval 1.07–1.24); $P < 0.001$]. Ambulatory surgery patients receiving high opioid doses were found to have the greatest adjusted risk of readmission (OR 1.75; $P < 0.001$) with a clear dose–response effect across quintiles (P for trend < 0.05), and were more likely to be readmitted early (post-operative days 0–2 vs 3–30; $P < 0.001$). Opioid class modified the association between total opioid dose and readmission, with longer-acting opioids demonstrating a stronger influence ($P < 0.001$). We observed significant practice variability across individual anaesthetists in the utilisation of opioids that could not be explained by patient- and case-specific factors.

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Conclusions: High intraoperative opioid dose is a modifiable anaesthetic factor that varies in the practice of individual anaesthetists and affects postoperative outcomes. Conservative standards for intraoperative opioid dosing may reduce the risk of postoperative readmission, particularly in ambulatory surgery.

Keywords: anaesthesia; analgesics; general; opioid; patient readmission

Editor's key points

- It is important to understand the factors that contribute to readmission after surgery.
- This study used routinely collected healthcare data to explore the effect of intraoperative opioid on readmission rates.
- Higher intraoperative opioid doses were associated with an increased risk of readmission.
- Readmission was not affected by preoperative opioid, but was increased by anaesthetist factors.
- The reasons for this need to be explored further, with consideration given to using standardised guidelines.

The Centers for Disease Control and Prevention reports a rapid increase in the use of prescription and non-prescription opioid drugs in the United States and Canada in the 2010s, leading to a spike in overdose deaths. Nearly half of all opioid overdose deaths in 2016 involved prescriptions.¹ In Massachusetts, in 2016, there were 1990 opioid-related overdose deaths—a 46% increase since 2014, according to the Massachusetts Department of Public Health.² This demonstrates the dangers of the recent development of opioid overuse in the general medical context in the United States.

During surgery, opioids are widely used to supplement general anaesthetic agents and are the most commonly used analgesic medications for acute surgical pain.^{3,4} Despite their advantages, the adverse effects of acute opioid administration are significant and include respiratory depression, ileus, nausea and vomiting, and hyperalgesia.^{5–8} In addition to these well-described short-term side-effects, the potential for perioperative opioid exposure to influence longer-term outcomes has also been demonstrated: a recent study of abdominopelvic operations found preoperative opioid use to be associated with postoperative complications and increased healthcare resource utilisation.⁹ These factors and broader public concern regarding the perioperative use of opioid medications¹⁰ have resulted in the emergence of opioid-sparing anaesthetic techniques as alternative approaches to achieving analgesia and 'balanced anaesthesia' with reduced reliance on opioids.^{11,12}

Despite the many potential effects of perioperative opioid exposure on postoperative outcomes, relatively little is known about the contribution of the intraoperative component of opioid administration. We sought to quantify the association between intraoperative opioid dose and 30-day hospital readmission (a common quality metric and general indicator of postoperative complications) in a diverse population of surgical patients. We also planned sensitivity analyses to assess the influences of ambulatory surgery status and opioid class on this relationship.

Methods

Study design and setting

We performed a pre-specified analysis of hospital registry data for patients undergoing surgery with general anaesthesia at Massachusetts General Hospital (MGH) and two affiliated community hospitals between January 2007 and December 2015. The study was approved by the Partners Institutional Review Board (protocol number 2015P002586) and was performed in a pre-specified fashion with a defined analytic plan. A strengthening the reporting of observational studies in epidemiology (STROBE)¹³ statement is provided in the Supplement (see '[STROBE checklist](#)').

Data sources

Study data were extracted from clinical and enterprise databases, including the Anesthesia Information Management Systems (AIMS), Research Patient Data Registry (RPDR), preadmission medication list (PAML), and Enterprise Performance Systems Inc. (EPSi) tool. The AIMS data warehouse contains data streamed directly from patient monitors, anaesthesia equipment, and the perioperative record. RPDR is a clinical database that compiles data from electronic health records at Partners HealthCare facilities for research purposes. The PAML is an electronic record of preadmission medications, which is first automatically populated with prescriptions from within the Partners HealthCare system, manually updated with information on outside medication during preoperative screening, and finally confirmed by the admitting nurse at the time of arrival on the day of surgery. EPSi is a financial tracking database used for internal cost tracking and value-based quality metrics, and contains encounter-level data on actual hospital costs, length of stay, and resource utilisation.^{14–17} Data from these sources were standardised across all three sites during the study period and recorded in a common research registry.

Subject selection

The study cohort consisted of all adult patients undergoing surgical procedures under general endotracheal anaesthesia between January 1, 2007 and December 31, 2015, who were extubated at the end of the case. Cardiac surgery cases and patients with an ASA physical status classification system score of V or VI were not eligible. We further excluded patients who underwent any other surgical procedure within 4 weeks before the index case, or for whom data on the exposure variable (intraoperative opioid dose) and outcome variable (30-day readmission) were not available. A sub-cohort of 13 122 patients (8.5%) of the included cohort was previously analysed in a published study examining the effects of neuromuscular blocking agents on 30-day readmission after abdominal surgery.¹⁸

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