Male Gender, Smoking, Younger Age, and Preoperative Pain Found to Increase Postoperative Opioid Requirements in 592 Elective Colorectal Resections

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Abstract

Purpose

With increased awareness of the opioid epidemic, understanding contributing factors to postoperative opioid use is important. The purpose of this study was to evaluate patient and perioperative factors that contribute to postoperative opioid use after colorectal resections and their relation to pre-existing pain conditions and psychiatric diagnoses.

Methods

A retrospective review was conducted identifying adult patients who underwent elective colorectal resection at a single tertiary center between 2015 and 2018. Patient demographics, preoperative factors, surgical approach, and perioperative pain management were evaluated to determine standard conversion morphine milligram equivalents required for postoperative days 0 to 3 and total hospital stay.

Results

Five hundred and ninety-two patients: 46% male, median age 58 years undergoing colorectal resections for indications including cancer, inflammatory bowel disease, and diverticulitis were identified. Less opioid use was found to be associated with female gender ($\beta = -42$), patients who received perioperative lidocaine infusion ($\beta = -30$), and older adults (equivalents/year) ($\beta = -4$, all $p < 0.01$). Preoperative opioid use, preoperative abdominal pain, epidural use and smoking were all independently associated with increased postoperative opioid requirements.

Conclusions

In this study of patients undergoing elective colorectal resection, factors that were associated with higher perioperative opioid use included male gender, smoking, younger age, preoperative opioid use, preoperative abdominal pain, and epidural use. Perioperative administration of lidocaine was associated with decreased opioid requirements. Understanding risk factors and stratifying postoperative pain regimens may aid in improved pain control and decrease long-term dependency.

Introduction

Inadequate pain relief in the perioperative period is related to adverse effects. In the short-term, untreated pain can cause increased sympathetic activity with tachycardia and high systemic vascular resistance, leading to higher risk of myocardial infarction and stroke. [1, 2] Longer term adverse effects of unrelieved postoperative pain can lead to dependency and chronic pain syndromes. [3] Conversely, adequately
treated postoperative pain leads to shortened hospital stays, reduced hospital costs, and increased patient satisfaction. [4, 5]

Opioids have been the mainstay of traditional postoperative pain management despite their common side effects of constipation, fall risk, altered mental status, nausea and vomiting, urinary retention, and respiratory depression. [6] The opioid epidemic in the United States has increased provider awareness to limit opioid usage, [7, 8] however, usage remains high, especially in colorectal surgery which ranks third amongst surgical specialties in postoperative opioid prescriptions. [9] Enhanced recovery and multimodal protocols using a variety of non-opioid agents have been shown to decrease overall opioid usage. [10] Early studies evaluating the use of postoperative opioids have demonstrated associated factors to include preoperative opioid use, age, sex, history of chronic pain, psychiatric disorders, ethnicity, body mass index (BMI), and surgical approach. [2, 9, 11-15] However, available literature is limited and there is lack of large studies with reproducible results. Prevalence of anxiety and major depression in patients with colorectal cancer ranges from 1.6-57% and 1.0-47.2%, respectively, [16] and 25.8% and 21.2% in patients with inflammatory bowel disease. [17] This is compared to estimates of 8.1% of American adults having major depression [18] and 6.7% having anxiety. [19] Patients with major depression are more likely to initiate opioid therapy and more likely to progress to long-term use. [15]

This study sought to evaluate perioperative opioid use in patients undergoing elective abdominal colorectal resections and the impact of patient, surgery, and disease factors on opioid requirements under enhanced recovery protocol (ERP). No study to date has reported these variables in the same cohort of patients. Secondary goal was to determine association with morphine milligram equivalent (MME) opioid use and psychiatric medication use.

Materials And Methods

Patient Demographics

A retrospective review was conducted identifying all adult patients (age >18) who underwent elective colorectal resection at a single tertiary center between 2015 and 2018 (n=592). Chart review data collected included patient demographics, preoperative psychiatric diagnoses and medications, surgical procedure and approach, and perioperative opioid requirements including postoperative day 0 through 3 (POD0-POD3) and during total hospital stay. POD 3 was chosen to be the cut off day under evaluation because preliminary data showed decline in use of all pain medications after this time. This study was approved by the Institutional Review Board and given the retrospective nature of the study; informed consent was not required.

Patient demographics and comorbidities collected included age, BMI, sex, functional status preoperatively, co-morbidities, smoking status, surgery indication, psychiatric diagnoses, psychoactive medications, preoperative pain medication use, preoperative abdominal pain, American Society of Anesthesiologists (ASA) scoring system, epidural, incision type, adjunct medications, pain service consult, postoperative opioid complications, discharge medications, and postoperative visit. Approach was
classified as minimally invasive surgery (laparoscopic or robotic incisions, as well as extraction site) or open (midline and Pfannenstiel). Conversion to an open procedure and laparoscopic-assisted cases were classified as open because size of incisions was consistent with open surgery. Psychiatric diagnoses were grouped based on Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) classification. Postoperative opioid use in standard conversion morphine milligram equivalents (MMEs)\[20\] was recorded for the intraoperative and postoperative period for days 0 to 3 and total hospital stay. Preoperative opioid use was a categorical variable, as doses could not be ascertained, nor duration of therapy. Univariate and multivariable analyses were performed to determine risk factors for increased perioperative opioid use and long-term opioid dependency in all groups. Opioid related complications were defined by chart review, and categorized as urinary retention, falls, nausea/vomiting, pruritus, and ileus. While we recognize that these complications are not dependent on opioid use alone, opioids are a known major contributing factor.[6]

**Enhanced recovery protocol**

Standardized contemporary enhanced recovery protocol (ERP) was used perioperatively. At this institution, an ERP has been implemented since 2011 with regular review and revision with compliance > 80%. The ERP is documented and ordered for elective operative cases and monitored for compliance by a multidisciplinary team monthly. Preoperative elements include iso-osmotic bowel preparation with oral antibiotics, oral hydration, carbohydrate loading, unrestricted clear liquids by mouth until 2 hours before surgery, cardiopulmonary evaluation and conditioning, physical conditioning (physical therapy where appropriate), correction of anemia, and evaluation and correction of malnutrition. Intraoperative measures include alcohol-based skin prep when appropriate, cefazolin-based antibiotic prophylaxis, normovolemia, normothermia (36 °C or greater), normoglycemia (<180 mg/dL), use of intravenous lidocaine, use of wound protectors, use of regional anesthesia adjuncts and minimally invasive surgery where appropriate, and, for patient in elective surgery with normal cardiac and renal function, use of uid resuscitation defined as infusion rates of 6-7 mL/kg/hr or 1L for every 180 minutes of operative time according to Shin et al. [21] Postoperatively, patients are routinely started on enteral feeding and ambulation immediately after surgery with multimodal pain management. All patients were prescribed scheduled Tylenol, selective NSAIDs, oral and IV opioids, muscle relaxants, gabapentin, and lidocaine topicals, unless contrainindicated tailored to co-morbidities, age, and patient needs. Spinal and epidural analgesia is not routinely included in the ERP at this institution due to common use of intraoperative lidocaine. Finally, alvimopan is a standard part of our ERP protocol in opioid-naïve patients.

**Statistical Analysis**

Patient characteristics, operative factors, and preoperative variables were analyzed in univariate analysis to identify trends associated with increased opioid use after surgery. All opioid use after surgery was converted to oral MME by standard CDC definition.[20] Linear regression models were used to evaluate the association between preoperative factors and adjuvant medication use on opioid use in the immediate postoperative setting (POD0-POD3). Variables statistically significant on univariate analysis
were included in the multivariable model. In this study, opioid use during POD0-POD3 was used as the outcome variable. Visual inspection of QQ plots showed most of the residuals fell in the expected order relative to a standard normal distribution. Estimated effects of predictors are reported as beta coefficients along with 95% confidence intervals. All statistical testing was two-sided and assessed for significance at the 5% level using SAS v9.4 (SAS Institute, Cary, NC).

Results

Cohort

Five hundred and ninety-two patients underwent elective colon and/or rectal resection between 2015 to 2018 at a single tertiary institution (Table 1). The mean age was 57.3 years (range 19.2 – 95.2 years), 54.2% female. Comorbidities included hypertension (40.7%), diabetes (15.0%), COPD (6.4%), and current smoking (22.1%). Preoperative steroid use was present in 104 patients (17.6%) and weight loss > 10% within the last 6 months in 44 patients (7.4%). Pre-surgery status was evaluated with American Society of Anesthesiologists (ASA) scoring system and patients ranged: ASA 1 (3.4%), ASA 2 (56.6%), ASA 3 (38.5%), and ASA 4 (1.5%). Approximately 40% of patients had one or more psychiatric diagnoses (Table 2), with 64.4% of these patients taking one or more prescription psychiatric medications. The most common conditions included major depression (22.1%), anxiety (18.6%), and substance abuse (14.0%). Several patients (8.6%) were taking a psychotropic medication without an associated psychiatric diagnosis.
Table 1: Patient Demographics. Original table.

| Demographic                          | Mean (range)  |
|--------------------------------------|---------------|
| Age                                  | 57.3 (19.2-95.2) |
| BMI                                  | 29.2 (14.1-60.3) |

| Demographic and Category            | n (%)         |
|-------------------------------------|---------------|
| Female                              | 321 (54.2)    |
| Insulin-dependent diabetes mellitus | 26 (4.4)      |
| Non-insulin dependent diabetes mellitus | 63 (10.6)   |
| Current smoker within one year      | 131 (22.1)    |
| COPD                                | 38 (6.4)      |
| Hypertension requiring medication   | 241 (40.7)    |
| Steroid use for chronic condition   | 104 (17.6)    |
| >10% weight loss in 6 months        | 44 (7.4)      |

| Indication                          |               |
|-------------------------------------|---------------|
| Malignancy                          | 299 (50.5)    |
| Crohn's disease and ulcerative colitis | 112 (19.0)  |
| Diverticulitis                      | 95 (16.0)     |
| Non-malignant polyp and other       | 86 (14.5)     |

| ASA                                  |               |
|--------------------------------------|---------------|
| 1                                    | 20 (3.4)      |
| 2                                    | 335 (56.6)    |
| 3                                    | 228 (38.5)    |
| 4                                    | 9 (1.5)       |
| Preoperative Abdominal Pain          | 333 (60.9)    |
| Minimally Invasive Incisions         | 214 (36.1)    |
| Open Incisions a                     | 378 (63.9)    |

*Minimally invasive incisions include extraction sites, laparoscopic and robotic ports. Open incisions are midline and Pfannenstiel incisions, through which a significant portion of dissection was performed, even if minimally invasive technique was used for another part of dissection.*
### Table 2: DSM-V diagnoses, medical treatments, and preoperative pain medications

| Psychiatric Diagnosis | Count (Percentage) |
|-----------------------|--------------------|
| Depressive Disorders  | 131 (22.1)         |
| Anxiety Disorders     | 110 (18.6)         |
| Substance Abuse       | 83 (14.0)          |

| Psychoactive Medications | Count (Percentage) |
|--------------------------|--------------------|
| Benzodiazepine           | 90 (15.2)          |
| Selective Serotonin Reuptake Inhibitors | 83 (14.0) |
| Anxiolytics, Sedatives & Hypnotics | 40 (6.8) |
| Serotonin Norepinephrine Reuptake Inhibitors | 29 (4.9) |

| Preoperative Pain Medications | Count (Percentage) |
|------------------------------|--------------------|
| Acetaminophen                | 156 (26.4)         |
| Opioids                      | 173 (29.2)         |
| NSAIDs                       | 79 (13.3)          |
| GABA Analogue                | 41 (6.9)           |
| Muscle Relaxant              | 28 (4.7)           |

*a* Neurocognitive disorder, sleep-wake disorders, trauma and stress disorders, schizophrenia, personality disorders, neurodevelopmental disorders, somatic symptom disorders, obsessive-compulsive disorders, and bipolar disorders each represented <1.5% of patients

*b* Anti-convulsants, tricyclic and tetracyclic antidepressants, antimigraine agents, atypical antipsychotics, anti-psychotics, central nervous system stimulants were used by <5% of patients

Preoperatively, many patients reported abdominal pain (60.9%). Most patients were opioid naive (70.8%) with pre-existing use of non-opioid pain medication use including NSAIDs (13.3%), gabapentin (6.9%), and muscle relaxants (4.7%) (Table 2). Patients using opioids preoperatively reported use due to tumor related factors, inflammatory bowel disease (IBD) associated abdominal pain, and previous surgeries. Some opioid prescriptions were for chronic pain syndromes.

The most common indication for surgery was malignancy (50.5%), followed by IBD (18.9%), and diverticulitis (16.0%). Open approach was more frequent than laparoscopic (63.9% versus 36.1%). Perioperative adjuvant pain control included lidocaine (65.9%), acetaminophen (26.4%), NSAIDS (13.3%), and epidural (6.1%). Contraindications to perioperative lidocaine use were hypotension, significant
hepatic or renal insufficiency, and seizure disorders, as well as epidural use. A minority of patients required consultation to acute pain service (8.3%).

The mean postoperative length of stay was 6.2 days (std dev: 4.3) with mean total hospital MME being 371.4 units (std dev: 367.3). MME requirements were greatest on POD 0 (MME = 152.1, std dev = 82.6) and subsequently decreased from POD1-3. Opioid naive patients required fewer opioids overall but followed a similar tapering trend from POD0-3. Almost half of patients (44.6%) had a postoperative opioid-related complication, including but not limited to urinary retention, falls, nausea/vomiting, pruritus, and ileus. Both opioid and non-opioid medications were prescribed at discharge and these amounts were not standardized. Almost all patients were discharged with an opioid prescription (94.3%). Adjunct pain medications upon discharge included acetaminophen (64.4%), NSAIDs (7.3%), gabapentin (7.6%), and muscle relaxants (5.1%).

Follow-up data was available for almost all patients (590/592) (Table 2). First postoperative visits were done on average of 15.8 days (range: 1-120 days) after discharge. Some patients requested an early refill on opioids before their first postoperative visit (11.2%) and a portion required a refill at their first postoperative visit (13.2%).

**Univariate analysis**

In univariate analysis (Table 3) of MME requirements POD0-POD3, increased usage was associated with patients who were younger, male, and comorbidities including current smoking, steroid use, and psychiatric diagnoses and medications. Increased opioid use was also associated with patients who experienced preoperative abdominal pain, as well as received preoperative opioids, intraoperative epidurals, and postoperative NSAIDs. Decreased MME requirements were associated with non-diabetic and non-insulin dependent diabetic patients, patients with dyspnea, or hypertension requiring medication. Patients who received perioperative lidocaine were associated with decreased MME requirement. Other demographic factors and incision type were not significantly associated with increased MME requirements in the immediate postoperative period.
Table 3: Univariate Analysis Results of Post-Operative Opiate Use (POD 0-3) Original table

| Factor                                             | Beta  | 95% Confidence Interval | p value |
|----------------------------------------------------|-------|-------------------------|---------|
| Current Smoker within one year                     | 94.7  | 63.3 - 126.2            | <0.01   |
| Pre-op Opioids                                     | 88.0  | 59.3 - 116.6            | <0.01   |
| Number of psychiatric medications (2+ compared to 0) | 81.9  | 42.6 - 121.2            | <0.01   |
| Number of psychiatric medications (1 compared to 0) | 43.3  | 9.9 - 76.6              |         |
| Pre-op Abdominal Pain                              | 75.9  | 47.8 - 104.1            | <0.01   |
| Steroid use for chronic condition                  | 68.6  | 33.7 - 103.5            | <0.01   |
| Number of psychiatric diagnoses (2+ compared to 0)  | 58.5  | 21.4 - 95.6             | <0.01   |
| Post-op NSAID                                      | 45.2  | 14.0 - 76.3             | <0.01   |
| Epidural                                           | 36.0  | 86.1 - 196.3            | <0.01   |
| Number of psychiatric diagnoses (1 compared to 0)  | 35.8  | 3.4 - 68.2              | <0.01   |
| Age (unit = 1)                                     | -4.8  | -5.7 - -4.0             | <0.01   |
| Insulin dependent diabetes mellitus                | -17.9 | -83.2 - 47.4            | 0.02    |
| Non-insulin dependent diabetes mellitus            | -63.4 | -106.8 - -20.0          |         |
| Female                                             | -37.0 | -63.8 - -10.2           | <0.01   |
| Hypertension requiring medication                  | -70.8 | -97.6 - -44.1           | <0.01   |
| Dyspnea with moderate exertion                     | -102.5| -165.3 - -39.8          | <0.01   |

**Multivariable analysis**

Multivariable analysis (Table 4) performed on variables of significance identified on univariate analysis found the following persisted in association with increased total MME requirements POD0-POD3: younger age, male gender, and current smoker status. For each year decrease in age, MME usage was associated with an increase by 3.7 units on average ($\beta = 3.7; 95\% \text{ CI} 2.8 - 4.6; p<0.01$). Male gender was associated with mean increased MME requirements of 41.6 units total ($\beta = 41.6; 95\% \text{ CI} 17.4 - 65.7; p<0.01$). Current smokers were associated with an increased MME requirement of 44.4 units on average ($\beta = 44.4; 95\% \text{ CI} 14.9 - 73.9; p<0.01$). However, steroid use for chronic conditions, psychiatric diagnoses and active use of psychiatric medications, diabetes mellitus, dyspnea, and hypertension, were no longer associated with altered MME requirements.
Table 4: Multivariable Regression Analysis of Post-Operative Opioid Use (POD 0-3) Original table

| Factor                                           | Beta | 95% Confidence Interval | p value |
|--------------------------------------------------|------|-------------------------|---------|
| Epidural                                         | 94.1 | 42.5 - 145.8            | <0.01   |
| Pre-op Opioids                                   | 52.0 | 23.8 - 80.1             | <0.01   |
| Pre-op Abdominal Pain                            | 45.2 | 19.4 - 71.1             | <0.01   |
| Current Smoker within one year                   | 44.4 | 14.9 - 73.9             | <0.01   |
| Age (unit = 1)                                   | -3.7 | -4.6 - -2.8             | <0.01   |
| Female                                           | -41.6| -65.7 - -17.4           | <0.01   |
| Number of psychiatric medications (1 compared to 0) | 30.1 | -0.3 - 60.6             | 0.11    |
| Number of psychiatric medications (2+ compared to 0) | 23.4 | -13.3 - 60.1           | 0.11    |
| Post-op NSAID                                    | 21.8 | -7.28 - 50.9            | 0.14    |
| Insulin dependent diabetes mellitus              | 13.9 | -47.0 - 74.9            | 0.50    |
| Non-insulin dependent diabetes mellitus          | -21.1| -61.3 - 19.1            | 0.50    |
| Open Incision (vs MIS)                           | 5.8  | -19.07 - 30.7           | 0.65    |
| Steroid use for chronic condition                | 2.3  | -31.0 - 35.6            | 0.89    |
| Hypertension requiring medication                | -10.4| -38.1 - 17.3            | 0.46    |
| Dyspnea with moderate exertion                   | -45.7| -102.3 - 10.9           | 0.11    |

On multivariable analysis, patients who did not receive preoperative lidocaine had an associated average MME increase of 29.4 units ($\beta = 29.4$, 95% CI 3.6 - 55.3, $p=0.03$). Preoperative abdominal pain was associated with an average MME increase of 45.2 units ($\beta = 45.2$, 95% CI 19.4 - 71.1, $p<0.01$). Preoperative opioid use was associated with an average MME increase of 52.0 units ($\beta = 52.0$, 95% CI 23.8 - 80.1, $p<0.01$). Application of an epidural was associated with an average MME increase of 94.1 units ($\beta = 94.1$, 95% CI 42.5 - 145.8, $p<0.01$). However, postoperative NSAID use ($p=0.14$) and incision type ($p=0.65$) were not associated with an influence in MME requirements.

**Discussion**

In this retrospective study of patients undergoing elective colorectal resection, younger age, male gender, preoperative opioid use, preoperative abdominal pain, use of perioperative epidurals, and smoking were found to be associated with increased opioid requirements. Use of intraoperative intravenous lidocaine was associated with decreased requirements. No association was found between diabetes, hypertension,
psychiatric conditions and medications, surgical approach (MIS versus open), nor BMI as a contributor to increased opioid requirements.

A retrospective cohort study published by Bartels et al. with an analysis of 6003 patients found long term postoperative opioid use was associated with age 26-65 relative to >65 years old. [2] Stafford et al. reviewing 2173 abdominopelvic procedures found that younger age was a predictor for opioid use for greater than 30 days after surgery. [11] On the other hand, Jiang et al. in a retrospective electronic medical record data extraction of 79,123 patients found that increasing age was a factor influencing chronic opioid use in surgical patients. [9] A retrospective cohort study of 6285 patients by Minkowitz et al. found age >65 years as well as male gender to be risk factors for opioid related adverse drug events postoperatively. [13] Hrebinko et al. in a 2020 retrospective study found among patients undergoing colorectal surgery gender-based differences were present in patient reported pain scores but not early postoperative opioid consumption. [22] In this study, younger patients and male patients were associated with increased opioid requirements in the immediate postoperative period. This could reflect a difference in pain perception, density of pain receptors, higher need of opioid medications due to higher muscle mass in younger patients, or different expectations of postoperative pain. Gender differences could be similarly affected. There is data suggesting that acute postoperative pain is linked to rates of continued chronic opioid use as was demonstrated by Sharma et al. in a systematic review and meta-analysis from 2021 showing more intense acute postoperative pain to be associated with increased risk of persistent postsurgical pain after gynecological and urological surgeries. Thus, higher opioid utilization for postoperative pain may not be linked to adverse long-term effect, as good perioperative pain control may reduce risk of opioid dependence. [23]

In this study current smoking was found to be associated with an increase in MME requirements. There are several possible causes for this correlation, for example smokers are more likely to have chronic cough or more profound effort and intensity of breathing which could increase pain in the immediate postoperative period. Additionally, postoperative physical mobility efforts might be more aggressive with smokers to avoid pulmonary complications, which could exacerbate postoperative pain.

This study revealed use of intravenous lidocaine was associated with decreased postoperative opioid use. Intravenous lidocaine has been compared to epidurals and TAP blocks and found to be equivalent to epidural analgesia while being cheaper and less resource intensive with fewer complications. This is demonstrated in a randomized, double-blind controlled clinical trial by Dewinter et al. published in 2018 in 125 patients undergoing laparoscopic colorectal surgery [24] and a retrospective review of 216 patients undergoing major abdominal surgery by Terkawi et al. from 2016. [25] Conversely, in a prospective cohort study from 2018 assessing multimodal pain management and pain perception in open and laparoscopic colorectal surgery cases, Grass et al. found perioperative lidocaine and ketamine did not improve postoperative pain or decrease opioid use up to 96 hours postoperatively. [4] NSAID use is limited by cardiovascular, gastrointestinal and renal morbidity. Gabapentin is most effective as a preoperative adjunct, although a 2021 randomized controlled trial by Huynh and colleagues of 129 women undergoing minimally invasive hysterectomy found preoperative Gabapentin did not reduce total opioid use 24 hours
after surgery. [26] There is no good data on muscle relaxants such as cyclobenzaprine or methocarbamol, and one must consider sedative effects of these medications when evaluating the risks and benefits of adjunctive pain control. In this study, epidurals were associated with high MME use. This is likely because in our practice they are routinely used in patients with recognized significant difficulty in preoperative pain control. Epidural analgesia may have a benefit, but we do not have a comparison group of severe pain patients who underwent surgery without an epidural.

Anxiety, major depression, and substance use were found in our cohort of patients at rates of 18.6%, 22.1%, and 14%, respectively. Patients with depression have been reported to be more likely to initiate opioid therapy and twice as likely to progress to long-term use as was demonstrated in a review of studies published by Sullivan in 2018. [15] Pain and psychiatric diagnoses can complicate each other, and effects of psychotropic medications on postoperative pain are poorly understood, and neither are the interactions of multiple medications. This study did not show an association with increased MME requirement in patients with psychiatric diagnoses or using psychiatric medications on multivariate analysis.

In 2021, Brown et al. published a retrospective cohort study comparing Pfannenstiel extraction site incisions with other locations (on or off midline) in patients having robotic colorectal resections and found Pfannenstiel to be associated with similar postoperative pain and postoperative opioid use; however the prescription of nonopioid analgesics was significantly less in the Pfannenstiel group. [27] This study did not reveal an association between surgical approach and postoperative opioid use with open procedure being performed in 63.9% of cases. The high proportion of open cases is attributed to classifying laparoscopic assist cases as open in order to accurately evaluate pain needs based on incision size. Thus, our findings may be generalizable to open and laparoscopic cases.

Limitations

Limitations to this study include being a single center, retrospective study which makes generalizability difficult to obtain, in particular given the high incidence of preoperative abdominal pain in our patient population. However, with the use of an enhanced recovery protocol, which is common in colorectal surgery, many risk factors we observe for higher opioid use are not unique to our institution. This publication is first to examine association between opioid use in ERAS colorectal surgery population and preoperative pain, preoperative opioid use, open and minimally invasive surgery, and psychiatric medication use.

Conclusion

In this retrospective study of 592 patients undergoing elective colorectal resections to evaluate postoperative opioid requirements and risk factors, younger age, male gender, smoking, preoperative opioid use, preoperative abdominal pain, and epidural use were associated with increased opioid requirements in the immediate postoperative period. Perioperative lidocaine was associated with decreased opioid requirements. There was no significant association with opioid requirements with
incision size or psychiatric medication use. It is important to recognize and impact modifiable factors, such as preoperative abdominal pain, smoking, and preoperative opioid use in order to optimize postoperative care and pain management, as well as identify patients who will need higher opioid doses to have adequate pain control after major surgery.

Declarations

Author contribution

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Bergljot Karlsdottir, Peige Zhou, Joyce Wahba, Sarah Mott and Irena Gribovskaja-Rupp. The first draft of the manuscript was written by Bergljot Karlsdottir, Peige Zhou, Joyce Wahba and Irena Gribovskaja-Rupp and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data Availability Statement

This study was approved by the Institutional Review Board and given the retrospective nature of the study; informed consent was not required.

Conflict of Interest Statement

There are no conflicts to disclose

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