



# Analgesic Requirements in Adolescents Undergoing Bariatric Surgery—an Observational Study

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## Abstract

**Aim** To examine the impact of preexisting psychiatric/psychological diagnoses on perioperative analgesic requirements in adolescents with morbid obesity undergoing bariatric surgery.

**Methods** A retrospective cohort study of adolescents with morbid obesity undergoing bariatric surgery. Primary and secondary outcomes included perioperative analgesic intake and pain scores (Numerical Rating Scale (0–10) NRS) throughout the hospital stay.

**Results** From our Bariatric Surgery Research Registry, we identified 17 adolescents with psychiatric/psychological diagnoses prior to undergoing bariatric surgery. Fifteen patients from the same registry and without such diagnosis undergoing bariatric surgery during the same time interval served as controls. In both groups, there was a predominance of female patients. During the perioperative period, in both groups, oral morphine equivalent and ketorolac and acetaminophen intake were similar. Notably, the perioperative median pain scores at the times examined were below 5 for all patients. The median pain scores in the PACU, day of surgery, and first postoperative day were similar. Conversely, on postoperative day 2, pain scores were higher in patients with diagnoses of psychiatric/psychological disorders ( $p = 0.004$ ) compared to those without.

**Conclusion** In this cohort of morbidly obese adolescents undergoing bariatric surgery, patients with and without preexisting psychiatric/psychological diagnoses had similar analgesic requirements during the perioperative period. This finding appears contrary to those suggesting that preexisting depression and/or anxiety might be associated with increased analgesic requirements during the perioperative period.

**Keywords** Anesthetics · Analgesia · Obesity · Pediatric surgery · Pain

## Introduction

Severe obesity, defined as a body mass index greater than the 99th percentile for age and sex, is the fastest growing category of obesity among youth in the USA [1]. Bariatric surgery has

emerged as a valuable treatment option for weight loss and is associated with reduction in co-morbid diseases including type 2 diabetes and hypertension [2, 3]. Notably, patients undergoing bariatric surgery have an increased risk of depression and anxiety [4, 5] and information obtained during a

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preoperative psychological evaluation can have predictive value on long-term outcomes. For example, patients with binge eating disorder and those who have major depressive disorders and behavioral/externalizing dysfunction are more likely to have a higher body mass index 5 years after surgery [6]. Emerging evidence indicates that preexisting psychiatric/psychological diagnoses can be associated with increased perioperative opioid requirements and prolonged opioid use postoperatively [7].

We conducted a retrospective cohort study to examine the impact of preexisting psychiatric/psychological diagnoses on perioperative pain and opioid consumption in adolescents with a body mass index greater than 40 which is classified as morbidly obese by the International Federation for the Surgery of Obesity and Metabolic Disorders. Each participant underwent laparoscopic sleeve gastrectomy (LSG) at Children's National Health System. We hypothesized that among adolescents undergoing bariatric surgery, patients with preexisting psychiatric/psychological diagnoses would require more opioids and have higher pain intensity during the perioperative period compared to those without such diagnoses.

## Methods

The Children's National Health System Institutional Review Board approved the creation of a Bariatric Surgery Research Registry and use of psychological evaluation materials for clinical investigation purposes. Informed assent and consent was obtained from all study participants and their parents. We collected perioperative data including psychological assessment, pain scores, and perioperative opioid intake from patients undergoing LSG between 2010 and 2016. Patients enrolled in studies evaluating the use of dexmedetomidine during LSG were excluded [8].

## Psychological Assessment

All adolescents receiving LSG at Children's National Health System complete a presurgical psychological evaluation, approximately 1–3 months prior to surgery consisting of a clinical interview and screening for psychiatric disorders using the adolescent report screener from the Schedule for Affective Disorders and Schizophrenia for School-Age Children Present and Lifetime Version (KSADS-PL) [9]. These tools were administered by a clinical psychologist. For the current study, diagnoses of depression and/or anxiety were considered in order to group adolescents into those meeting criteria for a depressive or anxiety disorder and those who did not meet criteria. Common pharmacotherapy management for preexisting psychiatric/psychological preoperative diagnoses included serotonin reuptake inhibitors for depressive disorder.

## Primary and Secondary Outcomes

The primary outcome was total perioperative analgesic use from the time of surgery until discharge from the hospital. Intravenous (iv) fentanyl and morphine was used intraoperatively and in the post anesthesia recovery room. Intravenous opioids were also administered on the hospital ward until subjects could take medications by mouth (usually postoperative day 1). Oral morphine-equivalent opioid intake (per body weight) was calculated as previously described using the conversion tool available at the website [www.globalrph.com/narcoticonv.htm](http://www.globalrph.com/narcoticonv.htm) [10]. Intravenous acetaminophen was administered as a loading dose (650–1000 mg) and around the clock every 6 h thereafter. Secondary outcomes included average pain scores (Numerical Rating Scale (0–10) NRS) from the day of surgery until discharge. Additional data included surgical, postoperative care unit and length of stay times. The acquisition and documentation of pain scores are part of the vital sign requirement at our institution. We utilized standard of care documentation of postsurgical pain scoring recorded by nursing staff before and after dosing of pain medication in the post anesthesia recovery room and by additional nursing staff at regular intervals on the surgical ward for the duration of the hospital stay. A NRS value of > 5 was used as a trigger for opioid administration.

## Anesthetic Technique

We followed our standard bariatric anesthesia practice and after an overnight fast of at least 8 h, a peripheral intravenous catheter was placed in the preoperative area. All patients received preoxygenation prior to induction of general anesthesia. If needed, 2 mg of midazolam was administered for anxiolysis. Standard American Society of Anesthesiology monitors were placed and general anesthesia was induced with intravenous propofol 2–3 mg/kg (ideal body weight) and succinylcholine 1 mg/kg (total body weight) to facilitate rapid sequence endotracheal intubation. General anesthesia was maintained with desflurane in an oxygen and air mixture. Desflurane was titrated throughout the case according to each patient's anesthetic requirements, keeping the heart rate and blood pressure within 20% of baseline, and maintaining a minimum of one MAC. Rocuronium was administered for maintenance of muscle relaxation and dosed at one-third of ideal body weight during the procedure. Once surgery was completed, neuromuscular blockade was reversed and the endotracheal tube removed once patients were awake. Participants recovered in the Post Anesthesia Care Unit (PACU) prior to transfer to the surgical care floor. All patients received fentanyl (per ideal body weight) intraoperatively for acute pain control. In general, intraoperative

fentanyl dosing was based upon changes in the hemodynamic profile of the patient during surgery at the discretion of the anesthesiologist. During the perioperative period, the pain management regimen for both groups included intravenous acetaminophen (650–1000 mg) and ketorolac (30 mg) scheduled every 6 h. Postoperative analgesia was provided as needed with morphine and/or fentanyl.

## Statistical Analysis

Descriptive statistics were first evaluated for all variables. Intraoperative and total morphine equivalent intakes, as well as ketorolac, and acetaminophen intakes, were analyzed using non-parametric tests (the Mann-Whitney Rank Sum test). The Mann-Whitney Rank Sum test also used the compared pain scores and times and length of stay. Sigmaplot 11 (StataCorp. 2009) was used for all analyses.

## Results

During the study period, we identified 17 patients who had and 15 (control group) who had no preoperative psychiatric/psychological diagnoses. Among patients with psychiatric/psychological diagnoses, 14 were diagnosed with depression. Of those 14, half also had diagnoses of attention deficit hyperactive disorder (ADHD,  $n = 6$ ), anxiety ( $n = 5$ ), substance use ( $n = 1$ ), and binge eating disorder ( $n = 1$ ). Nine patients had diagnoses of anxiety disorder (this includes the 5 who

also had depression). Two of the patients with anxiety but no depression also met criteria for ADHD.

In general, the majority of the participants were not taking chronic prescription medications prior to surgery. Preoperative psychiatric medications included venlafaxine (Effexor), lisdexamfetamine (Vyvanse), and bupropion (Wellbutrin) in six adolescents. These drugs were restarted after surgery at home. Additionally, no patient reported chronic pain or a pain syndrome and no participant consumed opioid analgesics. Among all patients, comorbidities also included obstructive sleep apnea, glucose intolerance, and hypertension. Table 1 lists the patient demographic characteristics.

Individuals in both groups were predominantly female (80%) and had a median age of 17 years. The control group had a predominance of African American patients (60%) whereas subjects with a preexisting history of depression and anxiety included 35% Caucasian, 24% African American, and 24% Hispanic ethnicities. Body weight and body mass index were similar in both groups.

## Primary and Secondary Outcomes

The consumption of oral morphine equivalent, ketorolac, and acetaminophen during the intra- and postoperative period in patients with a preexisting history of psychiatric/psychological diagnoses was similar to that in patients without such diagnoses (Table 2).

The median pain scores in the PACU, day of surgery, and first postoperative day were similar in patients with and

**Table 1** Patient demographics

Variables	Group		<i>p</i> value
	No psychiatric/ psychological diagnoses	Psychiatric/ psychological diagnoses	
Number (%)	15 (47)	17 (53)	
Sex			1.000
Male	3 (9)	4 (13)	
Female	12 (37)	13 (41)	
Age (years, median (IQR))	17 (15–17)	17 (16–17.5)	0.710
Race			1.000
White	4	6	
Black	9	4	
Hispanic	0	4	
Other	1	3	
Weight (kg, median (IQR))	143 (110, 155)	138 (114, 149)	0.791
BMI (kg/m <sup>2</sup> , median (IQR))	49 (39, 52)	45 (41, 55)	1.000

IQR indicates interquartile range. Psychiatric/psychological diagnoses included depression, attention deficit hyperactive disorder, anxiety, substance use, and binge eating disorder. The Mann-Whitney Rank Sum test was used to compare variables

**Table 2** Analgesic regimen and consumption during the perioperative period in adolescents undergoing bariatric surgery

Variables	Groups		<i>p</i> value
	No psychiatric/psychological diagnoses	Psychiatric/psychological diagnoses	
Analgesic use			
Oral morphine equivalent (mg/kg, median (IQR))	0.63 (0.47, 0.80)	0.60 (0.48, 0.80)	0.94
Ketoralac (mg/kg, median (IQR))	1.08 (0.26, 1.66)	1.09 (0.79, 1.82)	0.692
Acetaminophen (iv) (mg/kg, median (IQR))	26.77 (15.19, 36.03)	21.70 (12.14, 36.21)	0.521

Analgesic use was measured from the intraoperative period to the time of discharge. IQR indicates interquartile range and iv, intravenous. The Mann-Whitney Rank Sum test was used to compare variables

without a preexisting psychiatric/psychological diagnoses (Table 3).

On postoperative day 2, pain scores were higher in patients with psychiatric/psychological diagnoses ( $p = 0.004$ , Table 3). Noticeably, during the entire perioperative period, the median pain scores at the times examined were below 4.5 for all patients (Table 3).

Lastly, there was no statistically significant difference in the median PACU, day of surgery, and postoperative day 1 pain scores comparing patients with and without depression and anxiety. Further, nearly all patients were discharged on postoperative day one and two, except for one patient who was discharge on day 3.

## Discussion

Studies concerning acute and chronic pain have revealed that psychologic factors may affect patients' response to postoperative pain [11]. For example, Taenzer, et al. showed a positive correlation between the diagnosis of depression prior to surgery and degree of postoperative pain and analgesic

requirements [12]. Individuals with preexisting depression and anxiety have also been documented to have increased pain intensity after surgery and higher requirements for tramadol [13].

Because patients with psychiatric/psychological diagnoses have been shown to exhibit higher level of pain intensity after surgery, many practitioners may assume that perioperative opioid requirements are higher in this setting. In an adult study, investigators have shown that among participants undergoing weight loss procedures, 4% of patients will chronically use opioids during the first postoperative year [14]. Additionally, the preoperative use of opioids, non-opioid analgesics, and/or anxiolytic agents was predictors of chronic opioid use postsurgery [15]. However, it remains unknown whether this increased incidence of opioid use after bariatric surgery is associated with preexisting psychiatric/psychological disorders or is related to an increased incidence of perioperative pain.

Contrary to our hypothesis, we found that preexisting psychiatric/psychological diagnoses in a group of adolescents undergoing bariatric surgery was not associated with increased opioid and non-opioid analgesic requirements.

**Table 3** Pain scores and anesthesia times

Variables	Groups		<i>p</i> value
	No psychiatric/psychological diagnoses	Psychiatric/psychological diagnoses	
Pain scores (median (IQR))			
PACU	3.8 (2.3, 5.4)	4.0 (2.3, 5.5)	1.000
Day of surgery	4.4 (3.0, 4.7)	3.5 (2.5, 4.0)	0.122
Postoperative day 1	3 (2.3, 3.8)	2.5 (1.8, 3.9)	0.345
Postoperative day 2	0.4 (0.2, 0.4)	2.3 (1.5, 2.9)	0.004
Surgical time (min, median (IQR))	167 (133, 210)	190 (128, 232)	0.533
PACU time (min, median (IQR))	153 (150, 220)	195 (150, 220)	0.484
Length of stay (hours, median (IQR))	48 (24, 48)	24 (24, 48)	0.348

Pain scores were measured using the numeric rating scale (0–10). IQR indicates interquartile range, PACU indicates postoperative care unit, day of surgery indicates time from PACU discharge to the hospital ward until the midnight hour. Psychiatric/psychological diagnoses included depression, attention deficit hyperactive disorder, anxiety, substance use, and binge eating disorder. The Mann-Whitney Rank Sum test was used to compare variables

Additionally, our patients with preexisting psychiatric/psychological diagnoses had similar pain scores compared to patients without the same such history, except during postoperative day 2. On average, the median NRS scaled score was similar between the two groups. Our data suggest that among adolescents with obesity, preexisting psychiatric/psychological diagnoses is not associated with increased opioid requirements during the immediate postoperative period after LSG. Therefore, our hypothesis that among adolescents undergoing laparoscopic bariatric surgery, preexisting psychiatric/psychological diagnoses would be correlated with increased opioid requirements was disproven.

We also hypothesized that pain scores would be lower in the group without preexisting psychiatric/psychological diagnoses. Surprisingly, the data from this review revealed similar analgesic requirements in the early postoperative period as reported with the total oral morphine equivalent metric. It is noticeable that in our patient cohort, the use of a multimodal analgesic regimen including opioids, intravenous acetaminophen, and ketorolac was quite effective in achieving adequate postoperative pain control. In fact, the pain scores were below 5 for most of the perioperative period.

In the patient cohort studied here, we used adjunctive analgesic preparations to minimize the use of opioid therapy. Intravenous ketorolac and acetaminophen were given continuously throughout the hospital stay. Each patient was given a postoperative prescription for oxycodone elixir, and ibuprofen and acetaminophen recommended as needed. Per the electronic record, there were no documented refilled prescriptions for oxycodone.

One must acknowledge the limitations of this study. We included a small subset of our patients undergoing laparoscopic sleeve gastrectomy and conducted a retrospective study of opioid usage during surgery. Additionally, while each preoperative interview included questions about the presence of musculoskeletal disorders including discomfort and pain and a review of all medications, we did not specifically screen for preoperative pain conditions. The period of disruption of chronic psychiatric medications was minimal as patients were discharged postoperative day 1 or 2. As their bariatric diet was advanced, capsules were opened and sprinkled on yogurt or pudding. Patients were able to transition to swallowing their capsules or pills after their first postoperative visit which was usually approximately 2–3 weeks after surgery.

We also recognize the well-known subjectivity associated with the NRS pain scoring system and while the NRS scores were fairly low, we did not capture other details related to overall patient satisfaction with pain control. Nevertheless, despite our study limitations, this pilot data illustrates analgesic requirements during the perioperative period in a unique patient population and will inform the design and power calculation of larger prospective studies to validate the results.

## Conclusion

In this cohort of adolescents undergoing bariatric surgery, the preexistence of psychiatric/psychological diagnoses did not alter analgesic requirements in the preoperative period. Unfortunately, adolescent patients with psychiatric/psychological diagnoses are at increased risk of opioid misuse [15]. Key studies reveal that pediatric providers frequently prescribe excess opioid and the resulting leftover opioid remains in the home after completion of therapy, providing a prescription drug reservoir potentially capable of contributing to the ongoing epidemic of opioid misuse and abuse [16]. Therefore, it is imperative that clinicians understand pain intensity and analgesic requirements in this unique population as choice of postoperative prescription medications maybe tailored to avoid abuse potential after discharge.

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## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that there are no competing interests.

**Statement of Human and Animal Rights** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

**Informed Assent and Consent** Informed assent and consent was obtained from all individual participants and their parents in this study.

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