



# Opioid-Free Anesthesia in Pediatric Patient

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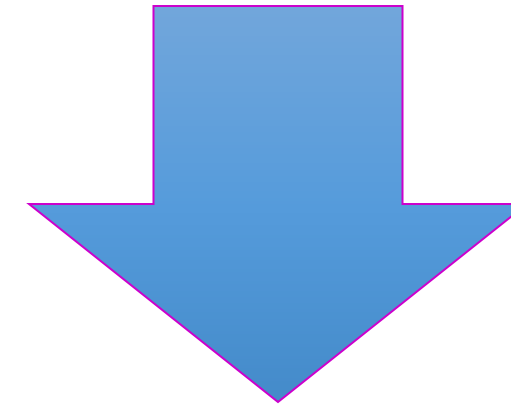
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Jakarta, Indonesia

# Introduction

- **Perioperative** pain management → important role → **outcome** of patients undergoing surgery in the pediatric population
- Opioid is the **most common analgesic** used to manage acute perioperative pain in children and adults

## Opioid Effect



Pain

- Respiratory depression
- PONV
- Constipation
- Pruritus
- Hyperalgesia





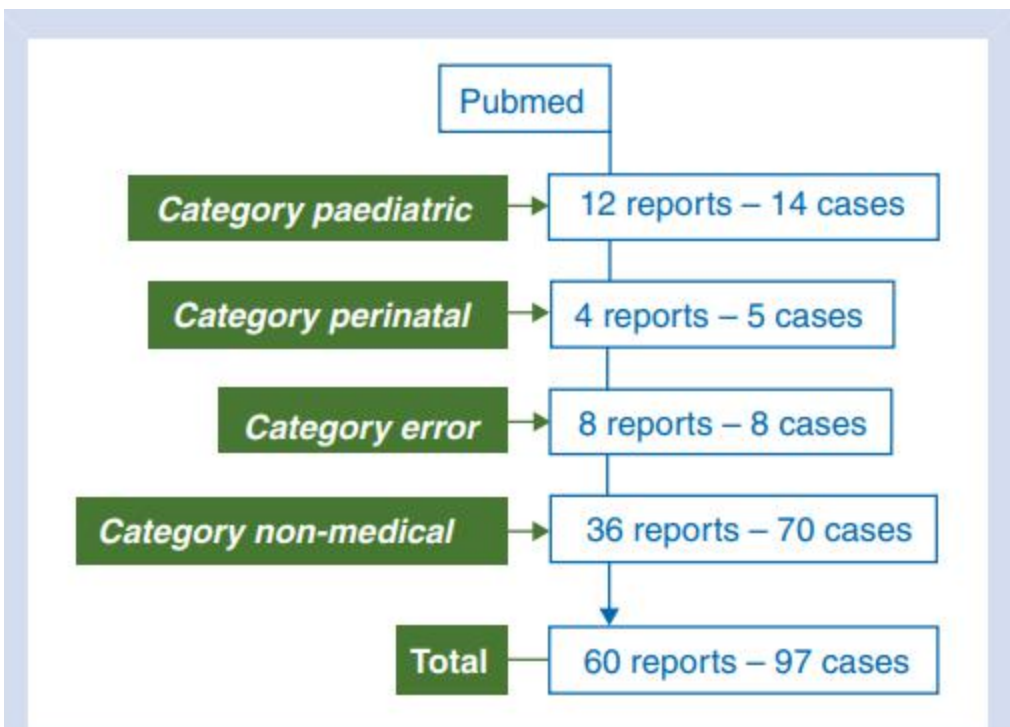
## REVIEW ARTICLES

# **Opioid-induced respiratory depression in paediatrics: a review of case reports**

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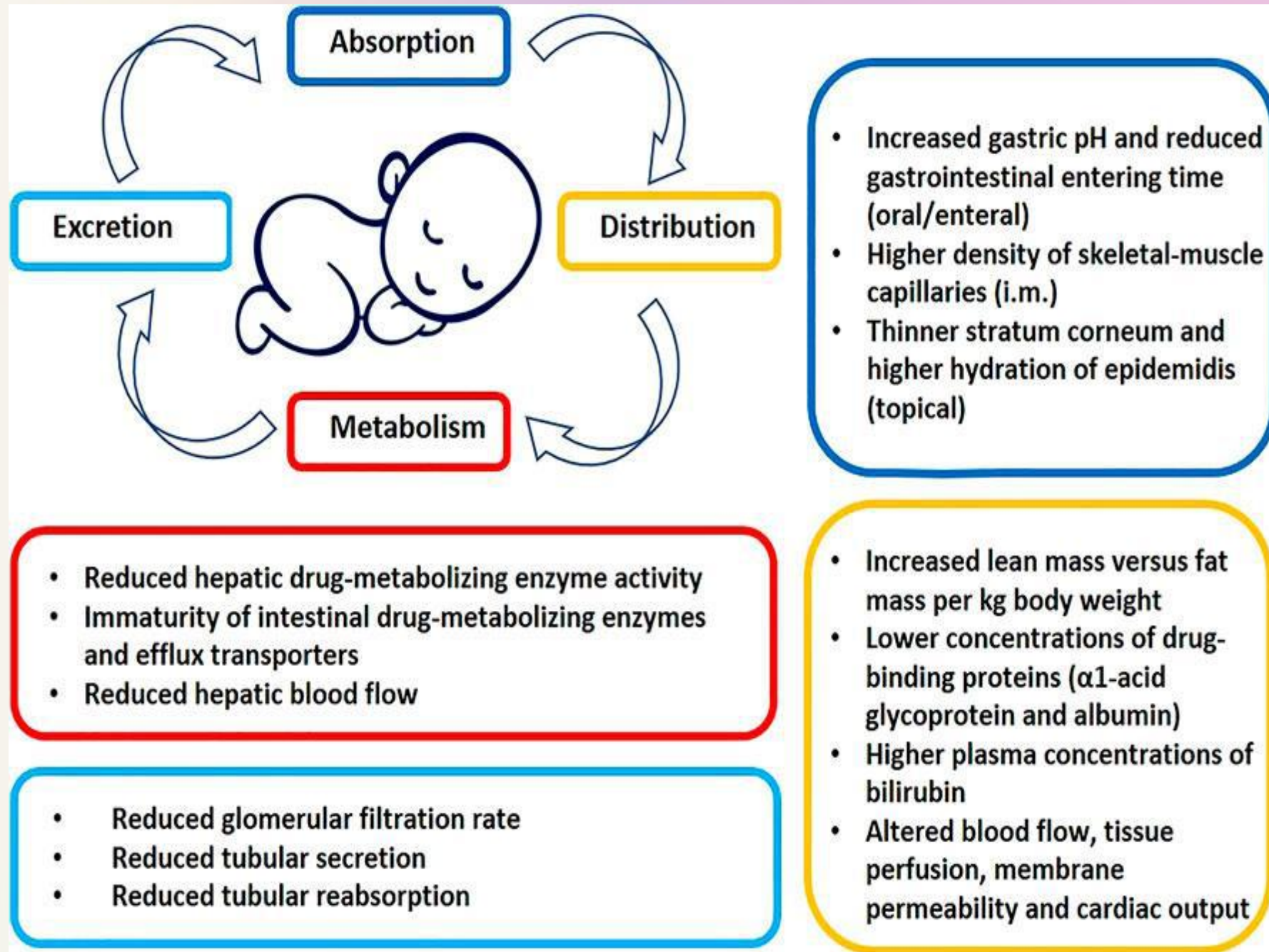
**Fig 1** Flow chart of the extraction of case reports on paediatric cases of OIRD from PubMed.

**Summary.** Opioids remain the cornerstone of modern-day pain treatment, also in the paediatric population. Opioid treatment is potentially life-threatening, although there are no numbers available on the incidence of opioid-induced respiratory depression (OIRD) in paediatrics. To get an indication of specific patterns in the development/causes of OIRD, we searched PubMed (May 2012) for all available case reports on OIRD in paediatrics, including patients 12 yr of age or younger who developed OIRD from an opioid given to them for a medical indication or due to transfer of an opioid from their mother in the perinatal setting, requiring naloxone, tracheal intubation, and/or resuscitation. Twenty-seven cases are described in 24 reports; of which, seven cases were fatal. In eight cases, OIRD was due to an iatrogenic overdose. Three distinct patterns in the remaining data set specifically related to OIRD include: (i) morphine administration in patients with renal impairment, causing accumulation of the active metabolite of morphine; (ii) codeine use in patients with *CYP2D6* gene polymorphism associated with the ultra-rapid metabolizer phenotype, causing enhanced production of the morphine; and (iii) opioid use in patients after adenotonsillectomy for recurrent tonsillitis and/or obstructive sleep apnoea, where OIRD may be related to hypoxia-induced enhancement of OIRD. Despite the restrictions of this approach, our analysis does yield an important insight in the development of OIRD, with specific risk factors clearly present in the data.

**Keywords:** case reports; codeine; opioid; opioid-induced respiratory depression; paediatrics



# Physiology and Drug Metabolism in Neonates



↓ plasma clearance  
↑ volume distribution  
↓ protein binding → ↑ free fraction drug



↓ GFR.

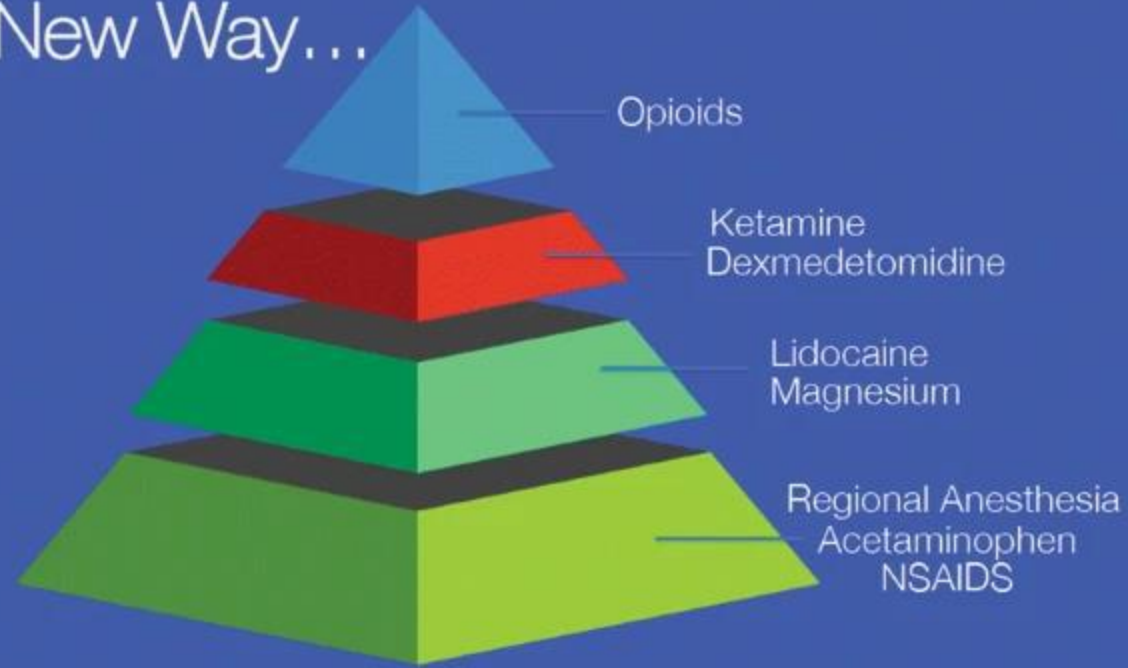


↓ renal clearance of opioids

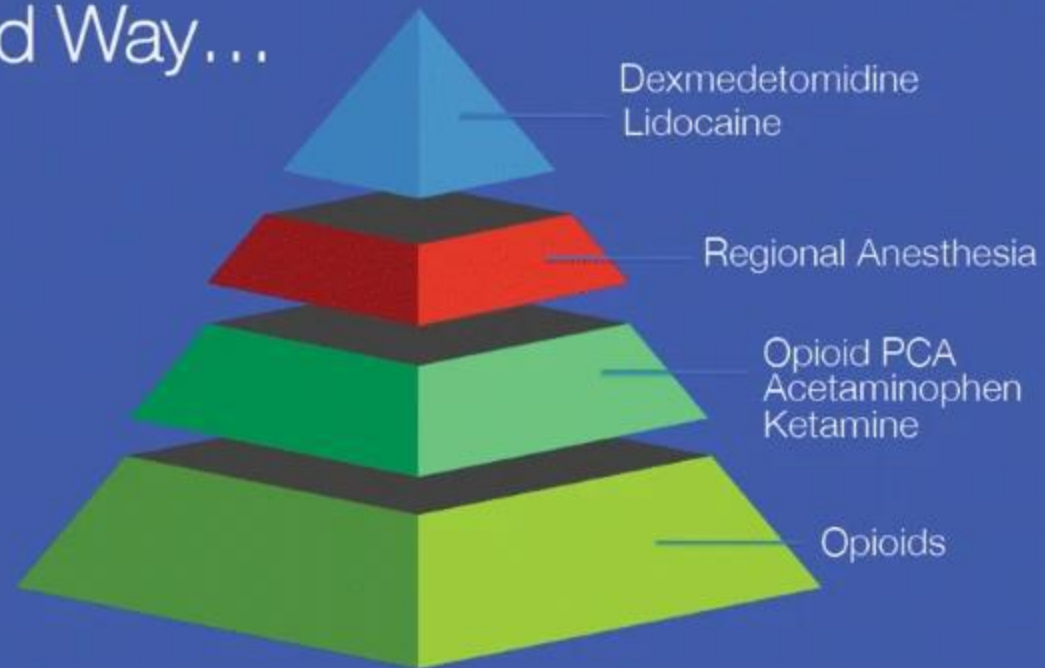


**Higher Complication**

A New Way...



Old Way...



# Do We Really Need Opioid?



## Box 1. Nociception vs pain

Nociception: a function of a specific sensory system.

Nociceptive system: a warning system with an adequate stimulus.

Noxious stimulus: A stimulus that is damaging or threatens damage to normal tissues.

Pain: a result of network activity in the brain.

<b>Nociception</b>	<b>Pain</b>
Third-person perspective	First-person perspective
Stimulus-related	Perception-related
Sensory discrimination	Suffering

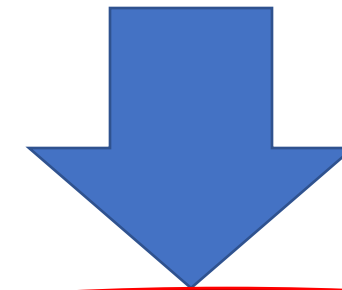
Blocked during  
anesthesia







Pain ? Hypovolemic? Hypercarbia?  
Bleeding ? etc etc and so many factor



**Surgical Stress response**

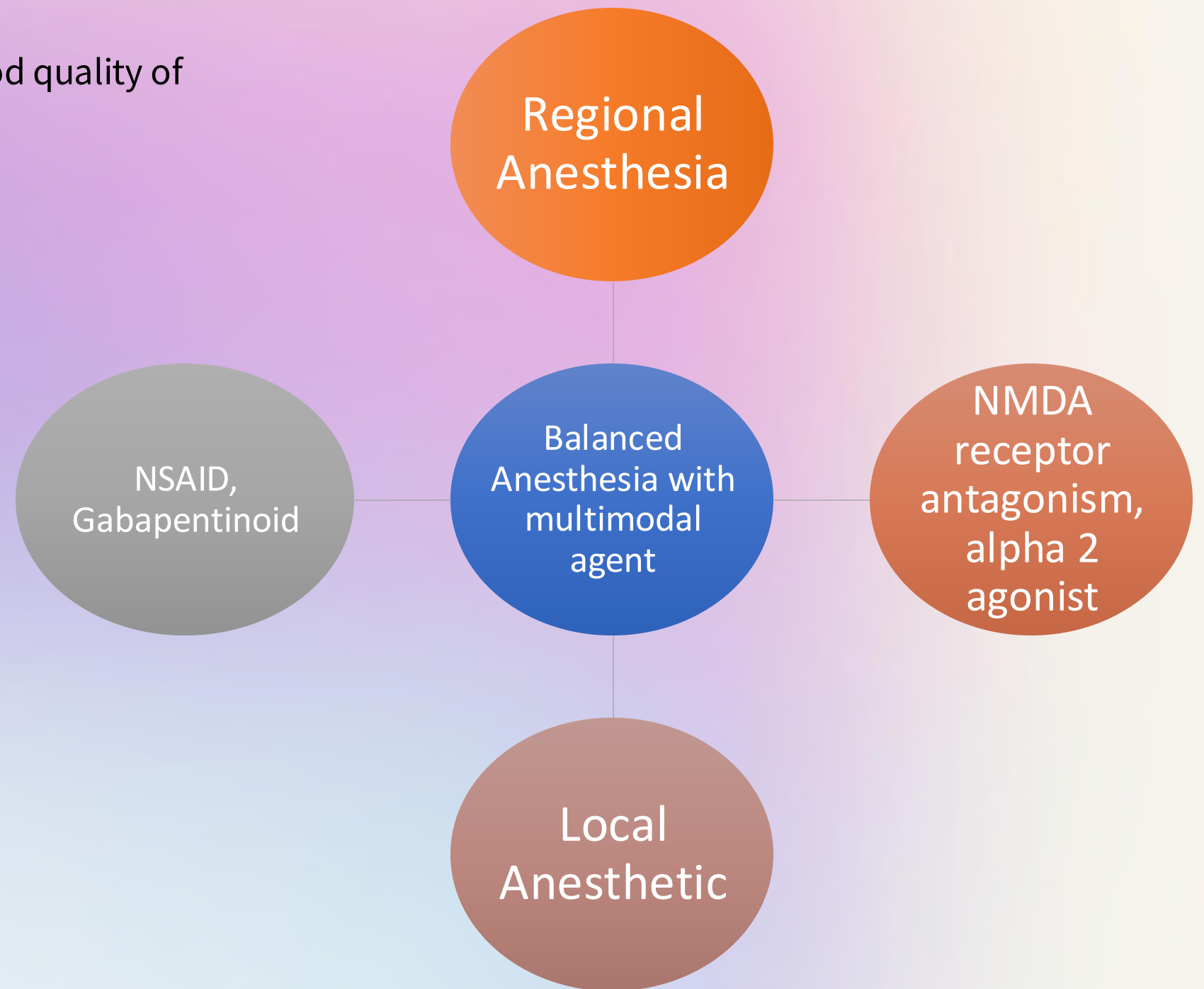
Neonates 9 day, Laparotomy  
exploration ec hollowviscus  
perforation

Should we give opioid ?

# Opioid-Free Anesthesia

- A multimodal technique which permits for a good quality of anesthesia and analgesia without opioid
- Enhanced recovery and better outcome

Final Pediatric ERAS Protocol
Preoperative ERAS education Optimize medical comorbidities
Avoid prolonged fasting <b>Administer nonopioid analgesia</b> Venous thromboembolism prophylaxis Pre-incision antibiotic prophylaxis Standard anesthetic protocol Minimally invasive technique <b>Prevention of nausea/vomiting</b> No nasogastric tubes Standardized hypothermia prevention No intraperitoneal perianastomotic drains Goal-directed/near-zero fluid therapy Early removal of urinary catheters <b>Prevention of postoperative ileus</b> <b>Opioid-sparing pain regimen</b>
Perioperative nutritional screening <b>Early mobilization</b> Adult protocol compliance and outcomes





# Outcomes for 41 260 pediatric surgical patients with opioid-free anesthesia: One center's experience

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## Seattle Children's Develops Nation's First Opioid-Free" Surgery Center

by Fred Pennic 04/29/2020 – Leave a Comment

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### Abstract

**Background:** Opioid use is common and associated with side effects and risks. Consequently, analgesic strategies to reduce opioid utilization have been developed. Regional anesthesia and multimodal strategies are central tenets of enhanced recovery pathways and facilitate reduced perioperative opioid use. Opioid-free anesthesia (OFA) protocols eliminate all intraoperative opioids, reserving opioids for postoperative rescue treatment. Systematic reviews show variable results for OFA.

**Methods:** In a series of Quality Improvement (QI) projects, multidisciplinary teams developed interventions to test and spread OFA first in our ambulatory surgery center (ASC) and then in our hospital. Outcome measures were tracked using statistical process control charts to increase the adoption of OFA.

**Results:** Between January 1, 2016, and September 30, 2022, 19872 of 28574 ASC patients received OFA, increasing from 30% to 98%. Post Anesthesia Care Unit (PACU) maximum pain score, opioid-rescue rate, and postoperative nausea and vomiting (PONV) treatment all decreased concomitantly. The use of OFA now represents our ambulatory standard practice. Over the same timeframe, the spread of this practice to our hospital led to 21388 of 64859 patients undergoing select procedures with OFA, increasing from 15% to 60%. Opioid rescue rate and PONV treatment in PACU decreased while hospital maximum pain scores and length of stay were stable. Two procedural examples with OFA benefits were identified. The use of OFA allowed relaxation of adenotonsillectomy admission criteria, resulting in 52 hospital patient days saved. Transition to OFA for laparoscopic appendectomy occurred concomitantly with a decrease in the mean hospital length of stay from 2.9 to 1.4 days, representing a savings of >500 hospital patient days/year.

**Conclusions:** These QI projects demonstrated that most pediatric ambulatory and select inpatient surgeries are amenable to OFA techniques which may reduce PONV without worsening pain.



ORIGINAL ARTICLE

Open Access



# The effect of anesthesia without opioid on perioperative opioid demand in children with severe obstructive sleep apnea (OSA) for adenotonsillectomies — single-center retrospective observational study

Connie Mun-Price<sup>1</sup>, Kathleen Than<sup>1</sup>, Margaret J. Klein<sup>1</sup>, Patrick Ross<sup>1</sup>, Eugene Kim<sup>1</sup>, Christian Hochstim<sup>2</sup> and Makoto Nagoshi<sup>1\*</sup>

## Abstract

**Background:** Children with severe obstructive sleep apnea (OSA) carry a higher risk of respiratory complications after adenotonsillectomy. Their altered sensitivity to opioids may be a significant contributor to respiratory morbidity. The purpose of this study was to identify how anesthesia without opioids affects perioperative opioid demand and postoperative course.

**Methods:** A chart review of children with severe OSA (apnea hypoxia index; AHI  $\geq 10$ ) undergoing adenotonsillectomies was performed. Comorbidities and perioperative medications were documented. Perioperative opioid doses within 48 h of procedure were calculated as morphine equivalents (mcg/kg). Pain scores, rescue medications, and postoperative complications in PICU and non-PICU settings were also documented. Anesthesia without opioid and with opioid groups were compared.

**Results:** The analysis included 225 children. A significantly higher percentage of children received no postoperative opioids in the anesthesia without opioid group compared to those with opioid (46 of 88 children vs. 43 of 137;  $P < 0.05$ ). The incidence of severe postoperative pain between the two groups was not different in PICU ( $P = 0.88$ ) or non-PICU setting ( $P = 0.84$ ). Perioperative opioid administration was significantly lower in anesthesia without opioid (median, Q1, Q3: 0.0, 0.0, 83.0) compared to with opioid (144.4, 72.5, 222.2;  $P < 0.01$ ). Anesthesia without opioid was one of the independent factors to achieve perioperative opioid avoidance ( $<50$ mcg/kg).

**Conclusions:** Anesthesia without opioid for children with severe OSA for tonsillectomy significantly reduced perioperative demand for opioid and did not affect the occurrence of severe pain. Anesthesia without opioid is an effective strategy to minimize opioid demand perioperatively for children with severe OSA for tonsillectomy.

**Keywords:** Opioid avoidance, Severe OSA, Tonsillectomy, Pediatric

Opioid use (mcg/kg)	Anesthesia Without opioid (n = 88)	With opioid (n = 137)	P value
Median (Q1, Q3)			
Intraoperative			
(2009–2013)	NA	116.5 (65.3, 182.8)	
(2014–2018)	NA	68.4 (40.3, 119.8)	NA
(2009–2018)	NA	80.1 (47.4, 129.2)	
Postoperative			
(2009–2013)	76.3 (6.2, 219.6)	55.4 (17.6, 117.6)	0.96
(2014–2018)	0.0 (0.0, 74.1)	34.2 (0.0, 97.5)	0.09
(2009–2018)	0.0 (0.0, 82.3)	39.1 (0.0, 97.6)	0.06
Perioperative			
(2009–2013)	76.3 (6.2, 219.6)	177.6 (116.7, 271.8)	$<0.05^a$
(2014–2018)	0.0 (0.0, 74.1)	120.7 (55.8, 202.8)	$<0.001^a$
(2009–2018)	0.0 (0.0, 83.0)	144.4 (72.5, 222.2)	$<0.001$
Postoperative no opioid; n (%)	46 (52.3%)	43 (31.4%)	$<0.05$

Period 2009–2013 starts from January 1, 2009, to December 31, 2013. Period 2014–2018 starts from January 1, 2014, to December 31, 2018. Total postoperative opioid doses administered were compared between the anesthesia without opioid and with opioid group using the Mann-Whitney *U* test. Occurrence of postoperative no opioid consumptions was compared using the chi-square test

<sup>a</sup> After adjusting for multiple comparisons using the Bonferroni adjustment



Article

# The Utilization of an Opioid-Free Anesthetic for Pediatric Circumcision in an Ambulatory Surgery Center

Laura E. Gilbertson <sup>1,2,\*</sup>, Chhaya Patel <sup>1,2</sup>, Shuvro De <sup>3</sup>, Wendy Lo <sup>1</sup>, Michael Garcia-Roig <sup>3</sup> and Thomas M. Austin <sup>1,2</sup>

**Table 1.** Opioid-Free Fast Track Protocol.

Premedication with oral acetaminophen (15 mg/kg)
Inhalation anesthetic induction with nitrous oxide and sevoflurane
Intramuscular ketorolac (1 mg/kg) immediately after induction
Intranasal dexmedetomidine (1 mcg/kg) immediately after induction
Dorsal penile nerve block with 0.25% bupivacaine (1 cc/kg up to a maximum of 10 cc)
No peripheral intravenous catheter
Maintenance anesthetic with sevoflurane by mask
Phase II recovery postoperatively with immediate parental presence

**Table 3.** Key Perioperative Variables.

	Fast Track (n = 50)	Pre-Fast Track (n = 50)	p-Value *
<b>Combined In-Room and PACU Time (min)</b>	102.5 (97.0, 111.0)	129.0 (116.0, 137.8)	<0.001
<b>In-Room Time (min)</b>	37.0 (31.0, 42.0)	41.5 (34.3, 50.8)	0.002
<b>PACU Time (min)</b>	62.0 (60.0, 76.0)	85.0 (75.3, 91.0)	<0.001
<b>Intraoperative Morphine Equivalents (mg/kg)</b>	0 (0, 0)	0.15 (0.10, 0.19)	<0.001
<b>Postoperative Analgesic Administration (Yes)</b>	0 (0.0%)	3 (6.0%)	0.24
<b>Postoperative Q Score (0–3)</b>	3 (3, 3)	3 (3, 3)	0.24
<b>Perioperative Respiratory Complications (Yes)</b>	3 (6.0%)	0 (0.0%)	0.24

Abbreviations: PACU = Post-anesthesia Care Unit, Q = Quality. Data presented as count (percentage) or median [25% percentile, 75% percentile]. \* Based on Wilcoxon Rank Sum Test or Fisher’s Exact Test based on the distribution of the data. p-value < 0.05 considered statistically significant.



## Implementation of a pediatric enhanced recovery pathway decreases opioid utilization and shortens time to full feeding☆

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### ABSTRACT

**Background:** We hypothesized that an enhanced recovery after surgery (ERAS) pathway for pediatric patients undergoing surgery for inflammatory bowel disease (IBD) would be beneficial.

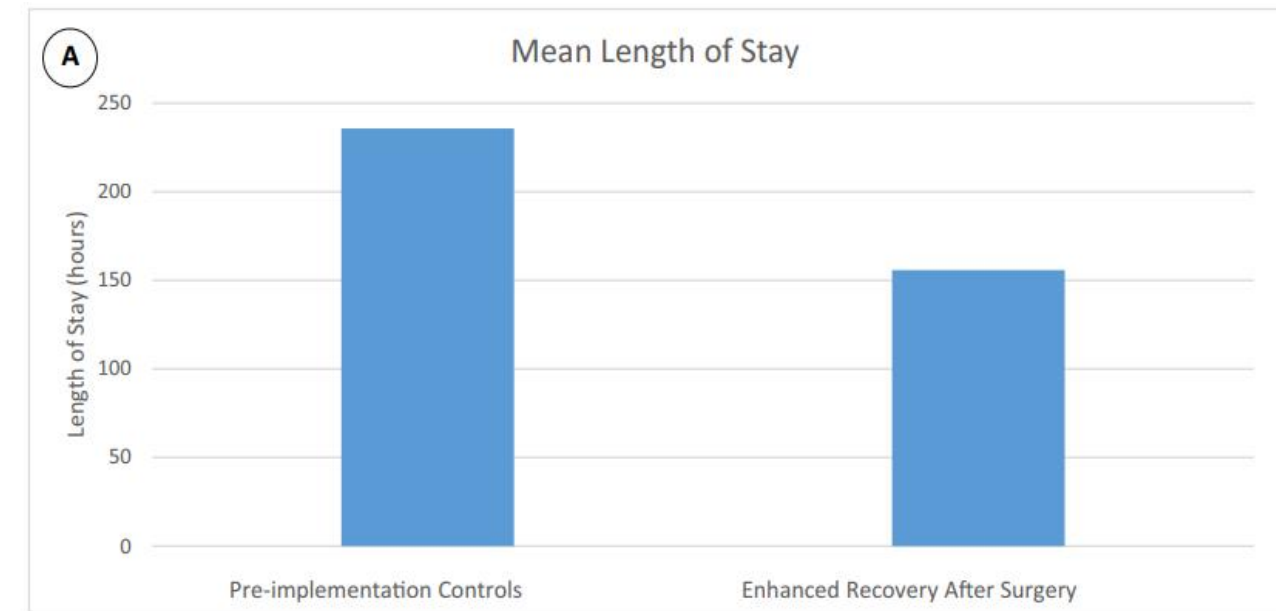
**Methods:** This is a single institution retrospective comparative study comparing patients treated with an ERAS pathway to consecutive patients in a Preimplementation Cohort (PIC) with similar open and laparoscopic surgeries for IBD. The pathway emphasized **minimal preoperative fasting, multimodal and regional analgesia, and early enteral nutrition after surgery**. Primary endpoints were time to 120 mL of PO intake (POI), length of stay (LOS), opioid utilization, and 30-day surgical outcomes. Continuous and categorical variables were compared ( $p < 0.05$ ).

**Results:** There were 23 PIC and 28 ERAS patients with similar demographic data and surgical and anesthetic approaches. **ERAS patients experienced a significant increase in the use of regional anesthesia, faster time to POI, and a nonsignificant decrease in mean LOS. ERAS patients had decreased total and daily opioid use with similar complication rates.**

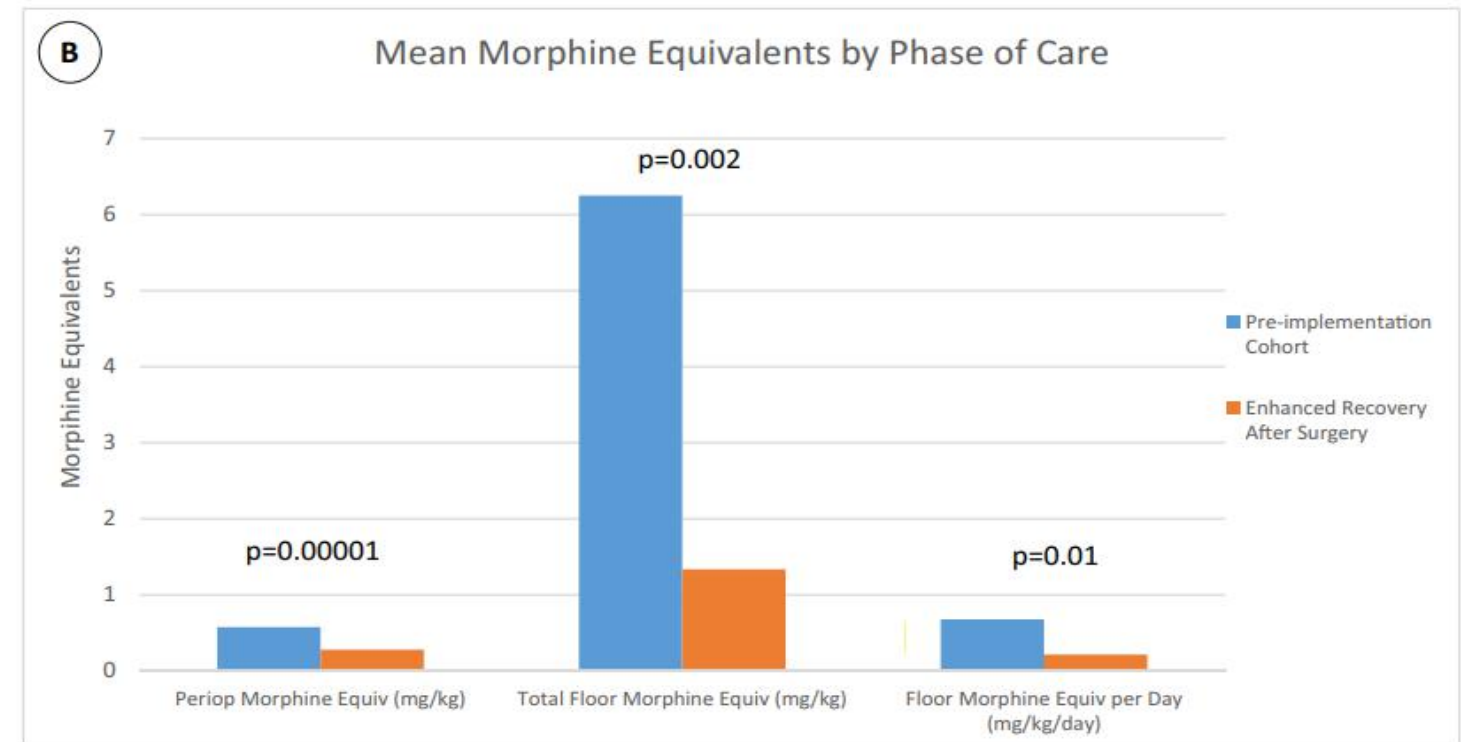
**Conclusion:** This study demonstrates the effectiveness of a pediatric ERAS pathway for IBD patients requiring laparoscopic and (unique to this study) open surgery. The study demonstrates that opioid utilization and time to feeding can be positively impacted using ERAS pathways without negatively impacting outcomes.

**Type of study:** Retrospective comparative study.

**Level of evidence:** Level III.



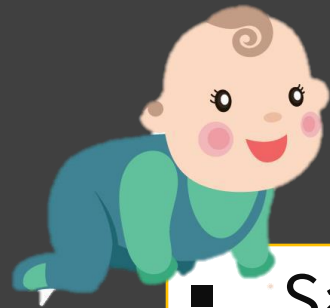
**Fig. 1.** Mean length of stay — mean number of hours for patients with similar CPT codes before (Preimplementation Cohort (PIC)) and after implementation of an enhanced recovery after surgery (ERAS) pathway for pediatric inflammatory bowel disease requiring surgery.



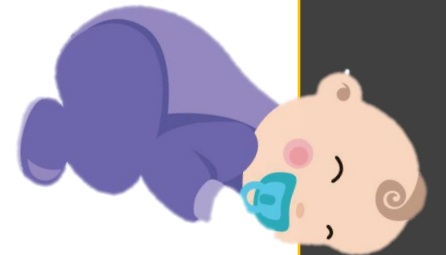
**Fig. 2.** Mean Morphine equivalents by phase of care — mean morphine equivalents for patients with similar CPT codes before (Preimplementation Cohort (PIC)) and after implementation of an enhanced recovery after surgery (ERAS) pathway for pediatric inflammatory bowel disease requiring surgery. There was decreased opioid utilization in the perioperative phase and the floor phase of care. This decrease was still present after standardizing for length of stay.



# Conclusion



- Safe and effective in pediatric patients for a variety of surgical procedures
- Provide adequate pain control and reduce the risk of opioid-related adverse events
- Faster recovery times and reduced postoperative sedation
- An interdisciplinary approach involving anesthesia providers, surgeons, pediatricians, and pain management specialists is essential to ensure comprehensive and individualized care for pediatric patients undergoing surgery without opioids



*Thank You!*