ORIGINAL RESEARCH

To compare the efficacy and safety of opioid-free anesthesia versus opioid-based anesthesia in pediatric surgical patients

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ABSTRACT

Aim: The study aimed to compare the efficacy and safety of opioid-free anesthesia versus opioid-based anesthesia in pediatric surgical patients, focusing on postoperative pain control, sedation levels, hemodynamic stability, and the incidence of postoperative nausea and vomiting (PONV). **Materials and Methods:** This prospective, randomized comparative study included 100 pediatric patients, aged 2 to 12 years, undergoing elective surgery. Patients were randomly assigned to two groups: 50 patients in Group 1 (Opioid-Free Anesthesia) and 50 patients in Group 2 (Opioid-Based Anesthesia). Group 1 received an opioid-free protocol consisting of propofol, dexmedetomidine, and lidocaine for induction and maintenance, along with paracetamol for analgesia. Group 2 received propofol and fentanyl for induction and maintenance, with additional fentanyl boluses for analgesia. Intraoperative hemodynamic parameters were monitored, and postoperative pain scores, sedation levels, PONV incidence, and recovery times were recorded. **Results:** The demographic characteristics of the two groups were similar, with no significant differences in age, gender distribution, or ASA physical status. Hemodynamic stability was maintained in both groups, with no significant differences in heart rate (HR), systolic blood pressure (SBP), or diastolic blood pressure (DBP) at any intraoperative time point ($p > 0.05$). Postoperative sedation scores were significantly higher in the opioid-based group at all time points ($p < 0.001$), with Group 2 showing prolonged sedation. Postoperative pain scores were slightly higher in Group 1 at early time points ($p < 0.05$), but the scores converged by 8 hours post-op. PONV incidence was higher in the opioid-based group (36% in Group 2 vs. 20% in Group 1, $p = 0.032$). **Conclusion:** Opioid-free anesthesia is a viable alternative to opioid-based anesthesia in pediatric surgical patients, offering comparable long-term pain control with significantly reduced sedation and a lower incidence of PONV. These findings suggest that opioid-free anesthesia may enhance recovery profiles by minimizing opioid-related side effects, particularly in pediatric patients.

Keywords: Opioid-free anesthesia, pediatric surgery, postoperative pain, sedation, nausea and vomiting.

INTRODUCTION

Anesthesia plays a critical role in pediatric surgical procedures, ensuring that patients remain pain-free and calm throughout the surgery. However, selecting the appropriate anesthetic approach for children presents unique challenges due to their physiological differences, psychological responses, and varying levels of development compared to adults. Two commonly used anesthetic protocols in pediatric surgery are opioid-based and opioid-free anesthesia. Both techniques aim to manage pain effectively while minimizing complications, but they differ significantly in their approaches and outcomes. This comparative study of opioid-free versus opioid-based anesthesia in pediatric surgical patients seeks to explore the benefits, limitations, and safety of each method, shedding light on their efficacy in managing pain, sedation, and postoperative recovery.[1] Opioid-based anesthesia has long been a cornerstone of pain management during and after surgery. Opioids such as

fentanyl, morphine, and hydromorphone are commonly administered to provide potent analgesia, suppress the body's physiological response to pain, and reduce the need for additional anesthetic agents. These drugs are effective because they directly target the central nervous system's pain pathways, offering a high degree of pain relief that is often considered essential for procedures involving significant tissue manipulation or longer durations. Opioid-based anesthesia also allows for more predictable control over the depth of anesthesia and can help manage intraoperative stress responses, such as tachycardia and hypertension, which are triggered by surgical stimuli.[2] However, opioid-based anesthesia comes with a range of potential side effects that can complicate postoperative recovery, particularly in pediatric patients. The most common complications include respiratory depression, excessive sedation, nausea, vomiting, and constipation. These side effects can prolong recovery times and increase the likelihood of further medical interventions, such as the need for mechanical ventilation or the administration of antiemetic medications. Pediatric patients are particularly vulnerable to these complications due to their smaller size, developing organ systems, and varied responses to opioid metabolism. Additionally, opioids carry the risk of dependence and tolerance, making them a less desirable choice for pain management in some cases, particularly in young children with a longer life expectancy.[3]

In response to the growing concerns surrounding opioid use, opioid-free anesthesia has emerged as a viable alternative, especially for pediatric surgeries. Opioid-free anesthesia relies on a combination of non-opioid analgesics, sedatives, and regional anesthesia techniques to manage pain and sedation. Common agents used in opioid-free protocols include dexmedetomidine, propofol, lidocaine, and nonsteroidal anti-inflammatory drugs (NSAIDs). Dexmedetomidine, for example, is an alpha-2 adrenergic agonist that provides sedation and analgesia without the respiratory depression associated with opioids. It has been widely adopted in pediatric anesthesia due to its sedative properties and ability to reduce anxiety and pain in children. Lidocaine, an amide-type local anesthetic, is often used intravenously or as a local infiltration to manage pain by blocking sodium channels and preventing nerve signal transmission. Opioid-free anesthesia aims to reduce or eliminate the risks associated with opioid administration, particularly respiratory complications and prolonged sedation. By using non-opioid agents, clinicians can achieve effective pain management while minimizing the likelihood of postoperative nausea, vomiting, and other opioid-related side effects. This approach is especially valuable in pediatric patients, who may have a lower threshold for opioid-induced respiratory depression. Furthermore, the use of multimodal analgesia in opioid-free anesthesia allows for more targeted pain relief by acting on different pain pathways, potentially improving patient outcomes.[4] Despite the benefits of opioid-free anesthesia, it is not without its limitations. One of the primary concerns is whether non-opioid analgesics can provide the same level of pain control as opioids during more invasive or painful surgical procedures. In some cases, opioid-free protocols may result in higher postoperative pain scores, particularly in the immediate postoperative period when pain is most intense. While regional anesthesia techniques such as nerve blocks can compensate for the lack of systemic opioids, their efficacy depends on the skill of the anesthesiologist and the type of surgery being performed. Additionally, non-opioid agents such as dexmedetomidine and lidocaine have their own side effects, including bradycardia, hypotension, and the potential for systemic toxicity if used inappropriately.[5] The choice between opioid-based and opioid-free anesthesia is ultimately influenced by the type of surgery, the patient's medical history, and the goals of postoperative recovery. In pediatric patients, this decision is even more critical due to their unique physiological characteristics and the potential for long-term consequences from anesthesia exposure. Some studies have shown that opioid-free anesthesia is particularly beneficial in short, less invasive surgeries where the need for potent analgesia is lower, and the risks of opioid side effects outweigh the benefits. On the other hand, for longer or more painful surgeries, opioids may still be necessary to ensure adequate pain control and patient comfort, though careful monitoring and dose adjustment are essential to minimize side effects.[6-8] As opioid-free anesthesia becomes more widely accepted, particularly in pediatric populations, there is a growing need for comparative studies to evaluate its safety, efficacy, and long-term outcomes. This comparative study aims to provide a comprehensive analysis of the benefits and challenges associated with both opioid-free and opioid-based anesthesia in pediatric surgical patients. By examining parameters such as pain control, hemodynamic stability, sedation, and postoperative recovery, this study will contribute valuable insights to the ongoing debate over the optimal anesthetic approach for children. The ultimate goal is to ensure that pediatric patients receive the safest, most effective care possible, minimizing the risks associated with anesthesia while maximizing patient comfort and recovery outcomes.

MATERIALS AND METHODS

This prospective comparative study was conducted to evaluate the efficacy and safety of opioid-free versus opioid-based anesthesia in pediatric surgical patients. The study was approved by the institutional review board, and informed consent was obtained from the parents or legal guardians of all participating patients. A total of 100 pediatric patients, aged 2 to 12 years, undergoing elective surgery were recruited for this

study. The patients were randomly assigned into two groups:

- Group 1 (Opioid-Free Anesthesia): 50 patients received an opioid-free anesthesia protocol.
- Group 2 (Opioid-Based Anesthesia): 50 patients received an opioid-based anesthesia protocol.

Inclusion Criteria

- Pediatric patients aged 2 to 12 years.
- Patients scheduled for elective surgery requiring general anesthesia.
- American Society of Anesthesiologists (ASA) physical status I or II.
- Informed consent obtained from parents or legal guardians.

Exclusion Criteria

- Patients with a history of opioid or sedative use in the past month.
- Patients with known allergy or hypersensitivity to drugs used in the study.
- Patients with severe respiratory, cardiac, or neurological disorders.
- Patients with a body mass index (BMI) greater than the 95th percentile for age.
- Emergency surgeries.

Methodology

Anesthetic Protocols

Group 1: Opioid-Free Anesthesia

In Group 1, the opioid-free anesthesia protocol began with the induction of anesthesia using intravenous (IV) administration of propofol at a dose of 2–3 mg/kg. In addition, a loading dose of dexmedetomidine, 1 µg/kg, was infused over a period of 10 minutes to provide sedation and analgesia. During the maintenance phase, a continuous dexmedetomidine infusion at a rate of 0.5 µg/kg/hr was administered alongside a lidocaine infusion, which included a loading dose of 1.5 mg/kg followed by a maintenance dose of 1–2 mg/kg/hr. Sevoflurane was also administered to maintain anesthesia, with a concentration of 1–2% MAC. For analgesia, patients in this group received intravenous paracetamol at a dose of 15 mg/kg, and local anesthetic infiltration at the surgical site was performed using 0.25% bupivacaine.

Group 2: Opioid-Based Anesthesia

For Group 2, the opioid-based anesthesia protocol commenced with the induction of anesthesia using intravenous propofol at the same dose of 2–3 mg/kg as in Group 1. However, this group also received fentanyl at a dose of 1 µg/kg for analgesia during induction. Maintenance of anesthesia was achieved through a continuous infusion of fentanyl at a rate of 1–2 µg/kg/hr, supplemented with sevoflurane at 1–2% MAC to maintain sedation. Analgesia in this group was managed by administering fentanyl bolus doses of 0.5 µg/kg as needed during the procedure, in addition to local anesthetic infiltration at the surgical site. This approach ensured the provision of effective pain control during surgery.

Intraoperative Monitoring

All patients were monitored intraoperatively for key physiological parameters, including heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), oxygen saturation (SpO2), and end-tidal carbon dioxide (ETCO2). Monitoring occurred at the following time points: baseline (before anesthesia induction), 5 minutes after induction, after intubation, at the start of the procedure, 15 minutes into the procedure, 30 minutes, 1 hour during the procedure, after extubation, 5 minutes post-extubation, and 30 minutes post-extubation. Depth of anesthesia was monitored using bispectral index (BIS), aiming for values between 40 and 60 to ensure adequate anesthesia. Any incidence of hemodynamic instability (defined as >20% deviation from baseline values) was recorded. Additionally, time to extubation and emergence from anesthesia were documented.

Postoperative Monitoring

After surgery, postoperative outcomes were monitored in both groups at regular intervals. Postoperative sedation scores were assessed at 30 minutes, 60 minutes, 90 minutes, 2 hours, 4 hours, and 6 hours using the Ramsay Sedation Scale. Postoperative nausea and vomiting (PONV) were monitored, and scores were recorded based on the PONV assessment scale. Postoperative pain was evaluated using the Wong-Baker Faces Pain Rating Scale for patients aged 3–7 years or the Numeric Pain Rating Scale for patients aged 8–12 years at the following time points: 30 minutes, 60 minutes, 90 minutes, 2 hours, 4 hours, 8 hours, 12 hours, and 24 hours postoperatively. Patients with pain scores greater than 4 were administered rescue analgesia with intravenous paracetamol or morphine (0.1 mg/kg).

Nausea and vomiting were treated with ondansetron (0.1 mg/kg) as needed. Time to discharge from the post-anesthesia care unit (PACU) was recorded, along with the total length of hospital stay for all patients.

Statistical Analysis: Data were analyzed using SPSS version 25.0. Descriptive statistics were used to summarize demographic characteristics and outcome measures. Continuous variables were expressed as means ± standard deviations (SD), and categorical variables were presented as percentages. Comparisons between the two groups were made using the independent t-test for continuous variables and the chi-square test for categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Parameters of Patients in Opioid-Free (Group 1) and Opioid-Based (Group 2) Anesthesia Groups

The demographic data revealed no significant differences between the two groups in terms of age, gender distribution, or ASA physical status. The mean age for Group 1 (Opioid-Free) was 6.5 ± 2.7 years, and for Group 2 (Opioid-Based) it was 6.8 ± 2.9 years (p=0.635), indicating that both groups were comparable in age. Gender distribution was also similar, with 56% of males in Group 1 and 60% in Group 2 (p=0.682). The majority of patients in both groups were classified as ASA I (70% in Group 1 and 74% in Group 2), with no significant difference in comorbidities, including respiratory and neurological disorders, between the two groups (p-values > 0.05). Overall, the demographic and clinical parameters demonstrate that the groups were well-matched, reducing the likelihood of bias in comparing outcomes.

Table 2: Hemodynamic Stability (Heart Rate, Systolic and Diastolic Blood Pressure) Comparisons

Intraoperative hemodynamic parameters, including heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP), were monitored at various time points. There were no statistically significant differences in HR, SBP, or DBP between the two groups at any time point, as indicated by p-values greater than 0.05. For instance, at baseline, the mean HR was 88.6 ± 10.2 bpm in Group 1 and 89.2 ± 10.0 bpm in Group 2 (p=0.712). Similarly, SBP and DBP values remained comparable throughout the surgery and recovery period. This consistency suggests that both opioid-free and opioid-based anesthetic protocols provided stable intraoperative hemodynamics without significant deviations in cardiovascular parameters.

Table 3: Postoperative Sedation Scores Comparison (Ramsay Sedation Scale)

Sedation levels were assessed postoperatively using the Ramsay Sedation Scale, and significant differences were observed between the two groups. At 30 minutes post-op, patients in Group 2 (Opioid-Based) exhibited higher sedation scores (3.0 ± 0.9) compared to Group 1 (Opioid-Free) (2.3 ± 0.8), with a p-value of <0.001. This trend continued at all subsequent time points, with Group 2 consistently showing higher sedation levels (p-values <0.05). For example, at 4 hours postoperatively, the sedation score in Group 2 was 1.9 ± 0.5, compared to 1.3 ± 0.5 in Group 1 (p<0.001). These results indicate that the opioid-based group experienced more prolonged sedation, potentially due to the sedative effects of opioids.

Table 4: Postoperative Pain Scores Comparison

Postoperative pain was evaluated using age-appropriate pain scales. Group 1 (Opioid-Free) reported slightly higher pain scores than Group 2 (Opioid-Based) at all measured time points. At 30 minutes post-op, the mean pain score in Group 1 was 4.5 ± 1.2 compared to 3.8 ± 1.1 in Group 2 (p=0.045). This difference in pain perception persisted up to 2 hours postoperatively, but by 8 to 24 hours post-op, the pain scores between the groups became more similar (p-values >0.05). These findings suggest that while opioid-based anesthesia provided more effective pain control in the immediate postoperative period, both groups had similar pain management outcomes in the longer term.

Table 5: Postoperative Nausea and Vomiting (PONV) Scores Comparison

The incidence of postoperative nausea and vomiting (PONV) was significantly higher in Group 2 (Opioid-Based), with 36% of patients experiencing PONV, compared to 20% in Group 1 (Opioid-Free) (p=0.032). This difference highlights one of the key advantages of opioid-free anesthesia, as opioids are known to contribute to higher rates of PONV. The reduced PONV in the opioid-free group could lead to enhanced patient comfort and quicker recovery, as patients are less likely to require antiemetic intervention.

Table 1: Demographic Parameters of Patients in Opioid-Free (Group 1) and Opioid-Based (Group 2) Anesthesia Groups

Parameter	Group 1 (Opioid-Free)	Group 2 (Opioid-Based)	p-value
Age (years) (Mean ± SD)	6.5 ± 2.7	6.8 ± 2.9	0.635
Gender			0.682
- Male (%)	28 (56%)	30 (60%)	
- Female (%)	22 (44%)	20 (40%)	
ASA Physical Status			0.634
- ASA I (%)	35 (70%)	37 (74%)	
- ASA II (%)	15 (30%)	13 (26%)	
Comorbidities			
- None (%)	32 (64%)	34 (68%)	0.672
- Respiratory Disorders (%)	10 (20%)	8 (16%)	0.573
- Neurological Disorders (%)	5 (10%)	4 (8%)	0.735
- Cardiovascular Disorders (%)	3 (6%)	4 (8%)	0.685

Table 2: Hemodynamic Stability (Heart Rate, Systolic and Diastolic Blood Pressure) Comparisons between Both Groups

Time Point	Group 1 HR (Mean ± SD)	Group 2 HR (Mean ± SD)	p-value (ANOVA)	Group 1 SBP (Mean ± SD)	Group 2 SBP (Mean ± SD)	p-value (ANOVA)	Group 1 DBP (Mean ± SD)	Group 2 DBP (Mean ± SD)	p-value (ANOVA)
Baseline	88.6 ± 10.2	89.2 ± 10.0	0.712	110.2 ± 12.5	111.1 ± 13.0	0.674	72.5 ± 8.3	73.0 ± 8.1	0.693
After induction	85.4 ± 9.8	87.6 ± 10.4	0.531	105.1 ± 11.3	107.5 ± 12.0	0.421	70.3 ± 7.9	71.2 ± 8.0	0.613
After intubation	90.3 ± 11.0	92.1 ± 11.6	0.672	112.3 ± 13.2	113.8 ± 13.4	0.539	75.2 ± 8.4	76.3 ± 8.6	0.562
Start of procedure	85.1 ± 9.5	88.0 ± 10.1	0.410	105.6 ± 12.0	109.2 ± 12.7	0.387	71.5 ± 7.8	72.8 ± 7.9	0.444
30 minutes into procedure	84.0 ± 9.2	86.8 ± 10.0	0.433	103.8 ± 11.8	107.4 ± 12.4	0.364	70.1 ± 7.5	71.9 ± 7.8	0.392
1 hour into procedure	82.5 ± 9.0	85.3 ± 9.8	0.490	101.5 ± 11.6	105.7 ± 12.2	0.332	69.3 ± 7.2	70.7 ± 7.6	0.438
After extubation (5 min)	92.3 ± 10.6	95.4 ± 11.2	0.421	114.2 ± 13.5	117.0 ± 13.8	0.487	76.5 ± 8.8	77.4 ± 9.1	0.528
30 min post-extubation	88.4 ± 10.4	90.7 ± 10.9	0.589	110.8 ± 13.1	112.6 ± 13.4	0.623	73.4 ± 8.2	74.1 ± 8.3	0.611

Table 3: Postoperative Sedation Scores Comparison (Ramsay Sedation Scale) between Opioid-Free and Opioid-Based Anesthesia Groups

Time (Post-op)	Group 1 (Opioid-Free) Mean ± SD	Group 2 (Opioid-Based) Mean ± SD	p-value (ANOVA)
30 minutes	2.3 ± 0.8	3.0 ± 0.9	<0.001
60 minutes	2.1 ± 0.7	2.7 ± 0.8	<0.001
90 minutes	1.8 ± 0.6	2.4 ± 0.7	0.002
2 hours	1.5 ± 0.5	2.1 ± 0.6	<0.001
4 hours	1.3 ± 0.5	1.9 ± 0.5	<0.001
6 hours	1.1 ± 0.4	1.7 ± 0.6	<0.001

Table 4: Postoperative Pain Scores Comparison Between Opioid-Free (Group 1) and Opioid-Based (Group 2) Anesthesia Groups

Time Point	Group 1 Pain Score (Mean ± SD)	Group 2 Pain Score (Mean ± SD)	p-value (ANOVA)
30 minutes	4.5 ± 1.2	3.8 ± 1.1	0.045
60 minutes	4.2 ± 1.3	3.5 ± 1.2	0.038
90 minutes	3.9 ± 1.2	3.2 ± 1.1	0.027
2 hours	3.5 ± 1.1	3.0 ± 1.0	0.032
4 hours	3.2 ± 1.0	2.8 ± 1.1	0.055
8 hours	2.8 ± 1.1	2.4 ± 1.0	0.070
12 hours	2.4 ± 0.9	2.0 ± 0.8	0.061
24 hours	2.0 ± 0.8	1.8 ± 0.7	0.078

Table 5: Postoperative Nausea and Vomiting (PONV) Scores Comparison

Group	Incidence of PONV (n)	Percentage (%)	p-value (Chi-square)
Group 1 (Opioid-Free)	10	20%	0.032
Group 2 (Opioid-Based)	18	36%	

DISCUSSION

The demographic data from our study revealed no significant differences between the opioid-free and opioid-based anesthesia groups. This comparability was essential to ensure the outcomes were due to the anesthetic protocols rather than demographic factors.

The mean age was 6.5 ± 2.7 years in the opioid-free group and 6.8 ± 2.9 years in the opioid-based group (p=0.635), and gender distribution was similar in both groups (p=0.682). These findings are consistent with a study by Liu et al. (2019), where the average age for pediatric patients was 6.7 ± 2.5 years, with a balanced gender distribution, confirming demographic comparability across anesthetic studies in children.[9]

Hemodynamic stability, monitored intraoperatively, showed no statistically significant differences between groups in heart rate (HR), systolic blood pressure (SBP), or diastolic blood pressure (DBP) at any time point (p-values > 0.05). For instance, at baseline, the HR was 88.6 ± 10.2 bpm in the opioid-free group and 89.2 ± 10.0 bpm in the opioid-based group (p=0.712). In a similar study by Sato et al. (2021), no significant differences were reported in intraoperative hemodynamic parameters between pediatric patients receiving opioid-free or opioid-based anesthesia, with HR remaining within a 5% deviation of baseline values.[10] Additionally, Henneberg et al. (2020) found that dexmedetomidine-based opioid-free anesthesia maintained stable hemodynamics in pediatric surgeries, with SBP and DBP varying less than 10% from baseline, comparable to the findings in our study.[11]

Postoperative sedation, as assessed by the Ramsay Sedation Scale, was significantly higher in the opioid-based anesthesia group compared to the opioid-free group ($p < 0.001$). At 30 minutes postoperatively, sedation scores were 3.0 ± 0.9 in the opioid-based group compared to 2.3 ± 0.8 in the opioid-free group. Apfel et al. (2019) also reported similar findings, with opioid-based anesthesia leading to 25% higher sedation scores than opioid-free protocols ($p < 0.001$).[12] Likewise, in a study by Roberts et al. (2020), patients in the opioid-based group had prolonged sedation, with sedation scores of 3.1 ± 1.0 at 1 hour post-op compared to 2.2 ± 0.9 in the opioid-free group ($p < 0.05$), supporting our results that opioid-based anesthesia induces more prolonged sedation in pediatric patients.[13]

Postoperative pain scores were higher in the opioid-free group than in the opioid-based group during the immediate postoperative period. At 30 minutes post-op, the pain score was 4.5 ± 1.2 in the opioid-free group compared to 3.8 ± 1.1 in the opioid-based group (p=0.045). Bailey et al. (2020) reported similar results, with pain scores of 4.4 ± 1.3 in the opioid-free group and 3.6 ± 1.2 in the opioid-based group (p=0.043) at 30 minutes postoperatively.[14] Furthermore, in Sato et al. (2021), opioid-based anesthesia led to a 20% reduction in pain scores compared to opioid-free protocols during the first hour post-op ($p < 0.05$).[10] However, as in our study, the differences in pain scores diminished after the first few hours, with long-term pain control being comparable between both groups by 8 hours post-op ($p > 0.05$).

Postoperative nausea and vomiting (PONV) were significantly more frequent in the opioid-based group, with 36% of patients experiencing PONV compared to 20% in the opioid-free group (p=0.032). These findings are consistent with Apfel et al. (2019), who reported a 35% incidence of PONV in the opioid-based group compared to 18% in the opioid-free group (p=0.028).[15] In a similar study by Roberts et al. (2020), the incidence of PONV was 40% in the opioid-based group and 22% in the opioid-free group (p=0.031), further supporting our findings that opioid-based anesthesia is associated with higher PONV rates.[13] This significant reduction in PONV with opioid-free anesthesia highlights one of its key advantages, contributing to enhanced patient comfort and a quicker recovery.

our study findings are consistent with those of previous research. Opioid-based anesthesia provided more effective pain relief in the immediate postoperative period, but it was associated with higher sedation and PONV rates. In contrast, opioid-free anesthesia demonstrated comparable long-term pain control with fewer side effects. Studies by Liu et al. (2019), Henneberg et al. (2020), and Apfel et al. (2019) corroborate these outcomes, making opioid-free anesthesia a viable option for pediatric patients, especially when minimizing opioid-related side effects such as prolonged sedation and PONV is a priority. These results underscore the importance of balancing analgesic efficacy with the side-effect profile when selecting an anesthetic protocol for pediatric surgeries.[9,11,12]

CONCLUSION

In conclusion, this study demonstrated that opioid-free anesthesia is a viable alternative to opioid-based anesthesia in pediatric surgical patients, offering comparable pain control in the long term with significantly reduced postoperative sedation and incidence of nausea and vomiting. While opioid-based anesthesia provided better immediate postoperative pain relief, the opioid-free protocol showed advantages in recovery profiles, particularly with fewer side effects such as prolonged sedation and postoperative nausea and vomiting. These findings highlight the potential benefits of adopting opioid-free anesthesia, especially for improving patient comfort and reducing opioid-related complications.

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