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Opioid-Sparing Techniques in Postoperative Pain Management in Pediatric Surgery

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ABSTRACT

Background: Combining non-opioid drugs with other techniques that lessen the requirement for opioids is called opioid-sparing

Methodology: It was a prospective observational study. 100 cases were included in the study. Patients aged 1 to 16 years. The study was conducted in Mohi-ud-Din Teaching Hospital, Mirpur AJK. Its duration was May 2023 to May 2024. IBM SPSS statistics 25 was used to analyze the data. Parental consent was taken before the data collection.

Results: The opioid-sparing group had a mean age of 7.2 ± 3.5 years, while the opioid-based group had a mean age of 7.5 ± 3.8 years (p-value = 0.65). Preoperative pain scores were nearly the same between the two groups, with 6.2 ± 1.5 in the opioid-sparing group and 6.3 ± 1.6 in the opioid-based group. The opioid-sparing group had a significant decrease in the incidence of nausea (8 percent) compared to 25 percent in the opioid-based group (p-value = 0.02). Vomiting occurred in 6 percent of opioid-sparing patients versus 18% in the opioid-based group (p-value = 0.03). Patients in the opioid-sparing group achieved earlier mobilization, averaging 10.5 ± 3.2 hours, compared to 15.8 ± 4.1 hours in the opioid-based group (p -value less than 0.001)

Calculations: Opioid-sparing strategies effectively lowered pain, opioid usage, and adverse events while improving recovery. They led to rapid mobilization, shorter hospital stays, and higher patient satisfaction level, highlighting their advantages in pediatric surgery.

Keyword: Opioid-sparing, Pain, Management, Pediatric Surgery

INTRODUCTION

Acute postoperative pain affects 80-86% of patients, yet less than half report adequate pain relief. Moderate to severe pain is noted in 70 to 75 percent of individuals' post-surgery, with 60-74% experiencing pain during the first two weeks after discharge. While opioids are central to pain management, their long-term use can lead to significant side effects, highlighting the need for opioid-sparing multimodal pain management strategies. (1). An opioid-free anaeshtetic strategy involves supplementary non-opioid drugs using a variety of methods using an assortment of non-opioid pharmaceuticals which target distinct painkiller systems.(2). These strategies are growing increasingly common not just to reduce the occurrence of side effects connected to opioids, but also to find therapeutic possibilities to minimize opioid use against the background of the local opioid recession, or which impacts both the adult and paediatric groups.(3,4). A of now, these approaches have been effective in treating pain after numerous operational procedures on paediatric patients. (5,6). Opioids are frequently employed to treat acute discomfort following surgery, especially intermediate to serious cases. (7).

Opioids were uses sparingly for pain following surgery in adolescents undergoing an appendectomy with laparoscopic surgery and cholecystectomy in the hospital. While the opioid-sparing regimen did not decrease inpatient opioid usage, it did result in fewer opioid prescriptions upon release. The study identified opportunities for treatment and education to enhance after surgery opioid prescription in paediatric operations.(8)

Employing opiate-sparing and opioid-free techniques in children can successfully treat pain while lowering the possibility of complications and helping to combat the opioid crisis. Each child must be examined individually in order to create a reliable and successful pain treatment strategy(9).

Erector spinae plane block are considered harmless for youngsters having cardiac operations. When used as part of a multimodal pain approach in an enhance med recovery after cardiac surgery program, paediatric patients with erector spinae plane block achieve effective pain management and use less opioids int eh initial 48 hours following surgery(10).

This study objective is to assess the efficacy of opioid-sparing techniques in reducing postoperative opioid consumption in pediatric surgery. Additionally, it seeks to evaluate the safety and effectiveness of alternative analgesic methods, including multimodal analgesia and regional anesthesia. Furthermore, the study will compare pain scores, recovery outcomes, and adverse effects between opioid-based and opioid-sparing pain management approaches to determine their relative benefits and potential risks.

METHODOLOGY

This was a prospective observational study conducted at Mohi-ud-Din Teaching Hospital, Mirpur AJK. The study duration was May 2023 to May 2024. Pediatric patients undergoing elective and emergency surgical procedures. This study included 100 pediatric cases, with patients aged 1-16 years who underwent surgeries requiring postoperative pain management. Inclusion criteria required obtaining consent from guardians, while exclusion criteria included patients with known allergies to analgesic medications, a history of opioid dependency, or severe postoperative complications necessitating prolonged opioid use. Pain management protocols were categorized into opioid-sparing techniques and opioid-based management. Opioid-sparing approaches included multimodal analgesia with paracetamol, NSAIDs, gabapentin, and dexmedetomidine, as well as regional anesthesia techniques such as caudal blocks, epidurals, and nerve blocks. Non-

pharmacological methods, including distraction techniques, parental presence, and music therapy, were also utilized. Opioid-based management followed the standard postoperative opioid administration protocol of the hospital. Opioid consumption was measured in total postoperative morphine equivalents, and adverse effects, including nausea, vomiting, respiratory depression, and sedation, were monitored. Recovery outcomes such as time to mobilization, length of hospital stay, and patient/parent satisfaction were also evaluated. Statistical analysis was conducted using SPSS software, with mean, standard deviation, and range calculated for continuous variables, while categorical variables were analyzed using chi-square tests.

RESULTS

The opioid-sparing group mean age is 7.2 ± 3.5 years, while the opioid-based group calculated mean age is 7.5 ± 3.8 years (p = 0.65). Gender frequency distribution was similar, with 28 males and 22 females in the opioid-sparing group and 30 males and 20 females in the opioid-based group (p = 0.74). The mean weight was 24.3 ± 5.1 kg in the opioid-sparing group and 23.8 ± 5.5 kilogram in the opioid-based group (p = 0.68). Surgical distributions were also comparable, with abdominal surgeries accounting for 40% and 38%, orthopedic surgeries for 35% and 37%, and ENT surgeries for 25% and 25% in the respective groups.

Table 1: Demographic Characteristics

Variable	Opioid-Sparing (Frequency=n=50)	Opioid-Based (Frequency=n=50)	p-value
Age (in years)	7.2 ± 3.5	7.5 ± 3.8	0.65
Gender (M/F)	28/22	30/20	0.74
Weight (kg)	24.3 ± 5.1	23.8 ± 5.5	0.68
Surgery Type (%)			
- Abdominal	40	38	0.82
- Orthopedic	35	37	0.79
- ENT	25	25	1.00

The preoperative pain score was substantially equal between the groups: 6.2 ± 1.5 in the opioid drugs-grouping group and 6.3 ± 1.6 in the opioid drugs-based group. Nevertheless, pain after surgery scores after twenty-four hours were considerably lower in the opioids drugs-sparing group (2.8 ± 1.3) compared to the opioid drugs-based group (4.5 ± 1.5), with a p-value of <0.001, demonstrating a statically significant decrease in pain.

Table 2: Pain Scores Comparison (Mean ± SD)

Group	Preoperative Pain Score	Postoperative Pain Score (24h)	p-value
Opioid-Sparing	6.2 ± 1.5	2.8 ± 1.3	<0.001
Opioid-Based	6.3 ± 1.6	4.5 ± 1.5	<0.001

Complete opioid consumption was significantly less in the opioid drug-sparing group, with an average of 3.2 ± 1.1 milligram, compared to 7.5 ± 2.0 milligram in the opioid drug-based group (p-value < 0.001). The minimum opioid consumption recorded in the opioid-sparing group was 1.0 milligram, while the maximum was 5.8 milligram, whereas the opioid drug-based group ranged from 4.0 milligram to 12.0 milligram.

Table 3: Opioid Consumption

Group	Mean ± SD	Minimum	Maximum
Opioid-Sparing	3.2 ± 1.1	1.0	5.8
Opioid-Based	7.5 ± 2.0	4.0	12.0

The opioid drug-sparing group had a significantly less incidence of nausea (8%) compared to 25 percent in the opioid drug-based group (p-value = 0.02). Vomiting occurred in 6 percent of opioid-sparing patients versus 18 percent in the opioid-based group (p-value = 0.03). No respiratory depression cases were observed in the opioid-sparing group, while 5% of patients in the opioid-based group experienced it (p-value = 0.04). anesthesia was reported in 4 percent of opioid-sparing patients compared to 15% in the opioid-based group (p-value= 0.01), demonstrating the reduced side effect profile of opioid-sparing techniques.

Table 4: Adverse Effects Occurrence (%)

Adverse Effect	Opioid-Sparing (%)	Opioid-Based (%)	p-value
Nausea	8%	25%	0.02
Vomiting	6%	18%	0.03
Respiratory Depression	0%	5%	0.04
Sedation	4%	15%	0.01

Patients in the opioid drug-sparing group achieved earlier mobilization, mean 10.5 ± 3.2 hours, compared to 15.8 ± 4.1 hours in the opioid drug-based group (p-value < 0.001). The length of hospital stay was also significantly reduced, with opioid-sparing patients staying at an mean of 2.1 ± 0.8 days compared to 3.5 ± 1.2 days in the opioid drug-based group (p-value < 0.001). Patient and parent satisfaction rates were notably higher at 90 percent in the opioid-sparing group compared to 75% in the opioid-based group (p-value = 0.02), further supporting the benefits of opioid drug-sparing approaches.

Table 5: Recovery Outcomes

Outcome	Opioid-Sparing	Opioid-Based	p-value
Time to Mobilization (hours.)	10.5 ± 3.2	15.8 ± 4.1	<0.001
Length of Hospital Stay (days)	2.1 ± 0.8	3.5 ± 1.2	<0.001
Patient/Parent Satisfaction (%)	90	75	0.02

DISCUSSION

Opioids were first used in medicine in 1853 as the principal treatment for acute post-operative pain. Opioid sparing analgesia approaches have been included in enhanced recuperation after surgery procedures to reduce opioid consumption and associated side effects. Adjunctive agents targeting non-opioid receptors in the body including acetaminophen drug, non-steroidal anti0inflammatory medications, α2-adrenergic agonists. (11)

In a pilot research, dextromethorphan drugs, acetaminophen drugs dexmedetomidine drugs, and ketamine drug have been used to provide analgesia while avoiding opioids. The painkiller and dexmedetomidine drugs are commonly prescribed at healthcare facility, whereas dextromethorphan drug and ketamine drug are recent additions. (12,13). In one of the studies, it was discovered that in pediatric surgical patients, the opioid-sparing regimen impact decreased the prescription of opioids at discharge, but not while they were in medical healthcare.(14).

An opioid-free pain treatment pathway following minor surgeries resulted in great patient satisfaction and relief from pain with minimum opioid use. Our findings revealed that both groups experienced equal levels of preoperative discomfort. However, after 24 hours, the opioid-sparing group had much less discomfort than the opioid-based group. The difference was statistically significant, demonstrating the efficacy of opioid-free approaches in alleviating postoperative pain. In pediatric cosmetic surgery, opioid-sparing procedures dramatically decreased discomfort following surgery scores when compared with opioid-based methods.

In one of the studies it was revelated that in pediatric patients undergoing surgery, the opioid-sparing regimen reduced the prescription of opioids upon discharge, but not when the patient was under medical care.

Reducing prescriptions for opiates in outpatient pediatric urological surgery did not raise pain levels.(17).

Opioid usage in pediatric ambulatory surgery has declined over time, with growing use of alternatives to opiates including intravenous acetaminophen(18).

In our study, the opioid-sparing group used far less opioids than the opioid-based group. Their intake varied form a lower minimum to a lower maximum, indicating a decreased reliance on opioids. This difference was of statistical significance, demonstrating the efficacy of opioid-sparing approaches in reducing opioid consumption. Another study indicated that opioid usage in the immediate postoperative phase did not alter long-term results in pediatric patients after spinal surgery (19).

In pediatric video-assisted thoracic surgery, opioid-sparing anesthesia was associated with a decreased risk of postoperative nausea, vomiting, and fever than opioid-based anesthesia (20).

Our investigation indicated that the opioid-sparing group had much fewer adverse effects than the opioid-based group. The opioid-sparing group had decreased rates of nausea, vomiting, breathing difficulties, and sedation, indicating a safer profile. These data illustrate the effectiveness of opioid-sparing approaches in lowering opioid-related problems.

CONCLUSION

Opioid-sparing approaches exhibited considerable benefits in postoperative paint management, resulting in decreased pain ratings and reduced opioid use. These strategies resulted in less opioid-related adverse effects, such as nausea, vomiting, respiratory depression, and drowsiness. Furthermore, individuals in the opioid-sparing group were able to leave the hospital sooner and for a shorter period of time. Reduced dependency on opioids helped to enhance recovery results and overall happiness for patients. Higher patient and parent scores for satisfaction bolstered the efficacy of opioid-sparing interventions. These findings emphasize the benefits of multimodal analgesia and reginal anaesthesia in paediatric surgery patients. Implementing opioid-sparing interventions. These findings emphasize the benefits of multimodal analgesia and regional anaesthesa in paediatric surgery patients. Implementing opioid-sparing methods can improve postoperative recovery while lowering opioid hazards.

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