RESEARCH PAPER

Postoperative pain management in children: Comparing pain scores in open vs laparoscopic surgeries

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ABSTRACT
Background: Postoperative pain in children is a critical determinant of recovery and overall surgical outcomes. The choice of surgical approach, particularly open versus laparoscopic surgery, may significantly influence pain intensity and analgesic requirements. Objective: To compare postoperative pain scores in children undergoing open versus laparoscopic surgeries and to evaluate associated analgesic requirements and recovery outcomes. Methods: This comparative cross-sectional analytical study was conducted at Ghulam Muhammad Mahar medical college Sukkur from march 2025 to march 2026 including 310 pediatric patients aged 2–14 years undergoing abdominal surgery. Patients were divided into open (n=156) and laparoscopic (n=154) groups. Results: The mean age was 8.6 ± 3.2 years. Pain scores were significantly higher in the open group at 6 hours (6.8 ± 1.4 vs 5.1 ± 1.2), 12 hours (5.9 ± 1.3 vs 4.3 ± 1.1), and 24 hours (4.8 ± 1.2 vs 3.5 ± 1.0) ($p<0.001$). Time to first analgesia was shorter in open surgery (1.8 ± 0.6 vs 3.2 ± 0.9 hours; $p<0.001$), with higher analgesic doses (4.6 ± 1.2 vs 3.1 ± 1.0; $p<0.001$) and greater opioid use (47.4% vs 27.3%; $p=0.001$). Hospital stay was longer in open cases (4.9 ± 1.5 vs 3.2 ± 1.1 days; $p<0.001$). Complications including nausea/vomiting (33.3% vs 23.4%; $p=0.048$), wound infection (11.5% vs 3.9%; $p=0.015$), and fever (21.8% vs 13.0%; $p=0.041$) were more frequent in open surgery. Conclusion: Laparoscopic surgery is associated with lower postoperative pain, reduced analgesic requirements, shorter hospital stay, and fewer complications compared to open surgery in children, supporting its preference when feasible..

Keywords Pediatric surgery, postoperative pain, laparoscopic surgery, open surgery, analgesia, pain score.
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INTRODUCTION

Postoperative pain in children is a clinical problem that has not been overcome despite the development of anesthesia and perioperative care. Communication barriers, differences in the perception of pain, and the use of age-specific assessment tools instead of direct verbal reporting usually result in under-recognition and under-treatment of pain in pediatric patients [1]. Poor pain management may cause prolonged recovery, heightened physiological stress reactions, oral impaired intake, and prolonged hospitalization, which may ultimately impact short-term healing and long-term mental well-being [3]. Contemporary pediatric practice thus focuses on systematic pain evaluation and personalized analgesic plans in order to maximize the results [2]. The kind of surgical method is a very important factor in the intensity of postoperative pain. The open surgical procedures usually imply more significant incisions, tissue trauma, and inflammatory reaction, and this may lead to more significant postoperative pain rates and a rise in the analgesic needs [5]. On the other hand laparoscopic surgery is a minimally invasive procedure that has smaller incisions and less tissue manipulation, which can lead to less postoperative pain and quicker recovery [4]. This has been a move towards minimally invasive procedures, which have had great impact on the practice of pediatric surgery in the past decades [6]. Nonetheless, the supposition that laparoscopic surgeries constantly lead to reduced pain is not equally uniform. Although this can help minimize incisional pain, other causes like pneumoperitoneum, visceral irritation, and referred shoulder pain may still play a role in causing much discomfort during laparoscopic surgeries [7]. Also, the

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differences in pain perception among the different age groups and procedures make straightforward comparisons across the surgical strategies that more difficult [9]. Such discrepancies demonstrate the significance of measuring pain outcomes in particular clinical situations instead of making generalizations [8].

A multimodal approach, such as pharmacological and non-pharmacological approaches, depending on surgical procedure and patient features are necessary to prevent postoperative pain in children [10]. Proper comparison of pain scale in open and laparoscopic surgeries may aid in the optimization of analgesic regimens, decrease the waste of opioids, and enhance healing mechanisms [12]. Additionally, these comparisons may help clinicians to advise caregivers about anticipated postoperative experiences and healing durations [11]. Past research has shown contradictory results on the variation in the pain levels between laparoscopic and open surgeries in children. There are reports of substantially lower pain scores and decreased analgesic needs with laparoscopic methods and those with similar pain levels especially during the immediate postoperative period [13]. These differences can be explained by the variations in the surgical procedures, analgesic regimens, and approaches to measuring pain [15]. An organized assessment of postoperative pain outcomes, thus, is necessary to develop more specific clinical guidelines [14].

Objective

To compare postoperative pain scores in children undergoing open versus laparoscopic surgeries and to evaluate associated analgesic requirements and recovery outcomes.

Methodology

This was a comparative cross-sectional analytical study conducted at Ghulam Muhammad Mahar medical college Sukkur from march 2025 to march 2026, including 310 pediatric patients undergoing either open or laparoscopic surgical procedures.

Inclusion Criteria

Children aged 2–14 years undergoing abdominal surgery
Patients undergoing either open or laparoscopic procedures
ASA physical status I–III
Patients whose caregivers provided informed consent

Exclusion Criteria

Children with chronic pain disorders or neurological conditions affecting pain perception
Patients admitted to ICU postoperatively for >24 hours
Patients with cognitive impairment interfering with pain assessment
Patients receiving long-term analgesics or sedatives preoperatively
Incomplete records

Data Collection

Data were recorded using a structured proforma. Baseline variables included age, gender, weight, and indication for surgery. Operative variables included type of surgery (open vs laparoscopic), duration of surgery, and intraoperative complications. Postoperative pain was assessed using age-appropriate validated scales, including the FLACC scale for younger children and Wong-Baker FACES scale for older children. Pain scores were recorded at 6, 12, and 24 hours postoperatively. Additional variables included type of analgesia used, frequency of rescue analgesia, time to first analgesic requirement, length of hospital stay, and postoperative complications such as nausea and vomiting.

Statistical Analysis

Data were analyzed using SPSS version 25. Quantitative variables were presented as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Independent sample t-test was used to compare mean pain scores between open and laparoscopic groups. Chi-square test was applied for categorical variables such as analgesic requirement and complications. Repeated measures ANOVA was used to assess variation in pain scores over time. A p-value ≤ 0.05 was considered statistically significant.

Results

The study included 310 children with a mean age of 8.6 ± 3.2 years and mean weight of 26.4 ± 8.1 kg, representing a typical pediatric surgical population. Males were slightly more common (58.7%) than females (41.3%). Most patients were ASA I (47.7%) or ASA II (39.4%), with fewer in ASA III (12.9%), indicating predominantly low-risk patients. The distribution between open (50.3%) and laparoscopic (49.7%) surgeries was nearly equal, allowing fair comparison. Appendicitis was the leading indication (45.8%), followed by hernia (25.2%) and intestinal obstruction (17.4%).

Table 1: Baseline Demographic and Clinical Characteristics (n = 310)

Variable	Category	n (%) / Mean ± SD
Age (years)	Mean ± SD	8.6 ± 3.2
Gender	Male	182 (58.7%)
	Female	128 (41.3%)
Weight (kg)	Mean ± SD	26.4 ± 8.1
ASA Status	I	148 (47.7%)
	II	122 (39.4%)
	III	40 (12.9%)
Type of Surgery	Open	156 (50.3%)
	Laparoscopic	154 (49.7%)
Indication for Surgery	Appendicitis	142 (45.8%)
	Hernia	78 (25.2%)
	Intestinal Obstruction	54 (17.4%)
	Others	36 (11.6%)

Laparoscopic procedures had a shorter operative duration (64.2 ± 15.7 minutes) compared to open surgeries (72.5 ± 18.4 minutes; p=0.001). Blood loss was significantly lower in the laparoscopic group (46.8 ± 15.2 ml) versus open surgery (84.6 ± 22.3 ml; p<0.001), reflecting less invasiveness. Intraoperative complications were slightly lower in laparoscopic cases (6.5%) compared to open (11.5%), though not statistically significant (p=0.112). Conversion to open surgery occurred in 5.2% of laparoscopic cases.

Table 2: Operative Characteristics According to Surgical Approach

Variable	Open (n = 156)	Laparoscopic (n = 154)	p-value
Duration of Surgery (min)	72.5 ± 18.4	64.2 ± 15.7	0.001
Intraoperative Complications	18 (11.5%)	10 (6.5%)	0.112
Blood Loss (ml)	84.6 ± 22.3	46.8 ± 15.2	<0.001
Conversion to Open	0 (0.0%)	8 (5.2%)	0.004

Postoperative pain scores were consistently higher in children undergoing open surgery at all time points. At 6 hours, pain was 6.8 ± 1.4 compared to 5.1 ± 1.2 in laparoscopic cases. This difference remained at 12 hours (5.9 ± 1.3 vs 4.3 ± 1.1) and 24 hours (4.8 ± 1.2 vs 3.5 ± 1.0), with all differences being statistically significant (p<0.001). This demonstrates a clear trend of reduced pain and faster recovery in the laparoscopic group.

Table 3: Comparison of Postoperative Pain Scores

Time Interval	Open (Mean ± SD)	Laparoscopic (Mean ± SD)	p-value
6 hours	6.8 ± 1.4	5.1 ± 1.2	<0.001
12 hours	5.9 ± 1.3	4.3 ± 1.1	<0.001
24 hours	4.8 ± 1.2	3.5 ± 1.0	<0.001

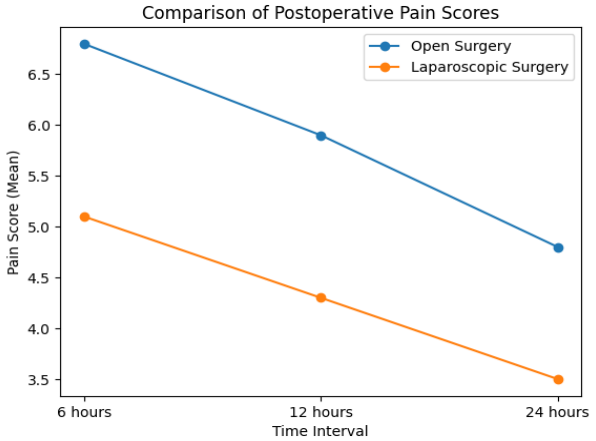

Figure 1: Comparison of Postoperative Pain Scores Between Open and Laparoscopic Surgeries at 6, 12, and 24 Hours

Children undergoing open surgery required earlier analgesia (1.8 ± 0.6 hours vs 3.2 ± 0.9 hours; p<0.001) and a higher number of analgesic doses (4.6 ± 1.2 vs 3.1 ± 1.0; p<0.001). Opioid use was also more frequent in the open group (47.4% vs 27.3%; p=0.001). Additionally, hospital stay was longer in open surgeries (4.9 ± 1.5 days) compared to laparoscopic cases (3.2 ± 1.1 days; p<0.001), indicating delayed recovery.

Table 4: Postoperative Analgesic Requirements and Recovery Outcomes

Variable	Open (n = 156)	Laparoscopic (n = 154)	p-value
Time to First Analgesia (hrs)	1.8 ± 0.6	3.2 ± 0.9	<0.001
Number of Analgesic Doses	4.6 ± 1.2	3.1 ± 1.0	<0.001
Opioid Requirement	74 (47.4%)	42 (27.3%)	0.001
Length of Hospital Stay (days)	4.9 ± 1.5	3.2 ± 1.1	<0.001

Postoperative complications were more common in open surgeries. Nausea and vomiting occurred in 33.3% of open cases compared to 23.4% in laparoscopic (p=0.048). Wound infection was significantly higher in the open group (11.5% vs 3.9%; p=0.015), and fever was also more frequent (21.8% vs 13.0%; p=0.041).

Table 5: Postoperative Complications

Variable	Open (n = 156)	Laparoscopic (n = 154)	p-value
Nausea/Vomiting	52 (33.3%)	36 (23.4%)	0.048
Wound Infection	18 (11.5%)	6 (3.9%)	0.015
Fever	34 (21.8%)	20 (13.0%)	0.041
Readmission	10 (6.4%)	4 (2.6%)	0.098

Discussion

In the current research study, it is shown that laparoscopic surgery among children is linked with lower scores of postoperative pain, decreased analgesic needs and quicker recovery than the open surgeries. The open surgery group scored significantly higher in pain at all the measured time points (6, 12 and 24 hours) suggesting that there was a lasting difference in the perception of postoperative pain. This has clinical significance as early postoperative pain directly affects the mobility, feeding, and general recovery in children. These findings were also supported by a previous study that found that the early postoperative pain scores were significantly reduced in children who underwent a minimally invasive surgery than in those who underwent open surgery [15]. Small incisions, low tissue manipulation, and low inflammatory response can be

attributed to the reduced pain in the laparoscopic group. Conversely, open surgery has more somatic and visceral trauma which causes increased nociceptive stimulation. Although there were fears that pneumoperitoneum might add to the discomfort during laparoscopic surgeries, the total pain burden was less in this group in our study. The same results have been observed in earlier studies where laparoscopy methods have been linked to patient comfort after surgery and an earlier recovery to normal activity among pediatric patients [16][17]. This study further supports the benefits of laparoscopic surgery using its operative characteristics. The laparoscopic group experienced much less time under the scalpel and a considerable lessening intraoperative blood loss. Even though intraoperative complications were a little bit less in the laparoscopic group, it was not found to be statistically significant, indicating that both methods are rather safe provided that they are done properly. A study in the past also supported the safety issue of minimally invasive procedures showing less blood loss and the same complication rates in laparoscopic surgeries in children [18].

The prevalence of analgesic needs was significantly greater in the open surgery group, as the former needed an analgesic earlier, had more doses and used more opioid. This is an indication of the intensity of the postoperative pain and the magnitude of the extra pressure on pain management measures during open surgery. This decreased need in opioid dosing in laparoscopy is especially pertinent in the light of increasing apprehension about the adverse effects of opioids in children. An earlier study also found reduced opioid use and pain management with laparoscopic surgeries highlighting the importance of minimally invasive surgery in facilitating opioid-sparing interventions [19]. Also, the results of recovery were significantly different in the two groups. The average length of stay in children who underwent open surgery was longer and this can be explained by the fact that they experienced more pain, they had a slow mobilization and had more complications. Conversely, laparoscopic surgery enabled the discharge to be earlier implying improved overall recovery. One of the prior studies had shorter hospitalization and expedited functional recovery in laparoscopic children, which harmonized the results of this study [20]. The frequency of postoperative complications such as nausea, vomiting, wound infection and fever were higher in the open surgery group. Increased rate of wound infection could be attributed to the use of bigger incisions and exposing the tissues. Readmission rates were more common among open surgeries, but it did not reach the level of statistical significance, which means that the complications are more common, but not necessarily related to serious consequences. This research has also noted a reduced rate of complications especially the site of surgery infections in laparoscopic surgeries over the open surgeries [21]. In general, the results of this research play a powerful role in favor of laparoscopic surgery in the patients of the pediatric population due to the reduction of the pain, the decrease of analgesics and the enhancement of the recovery process. Nevertheless, one should take into account that the selection of surgical methodology also relies on the character of the disease, the experience of a surgeon as well as the resources at hand. Although laparoscopic surgery has some obvious advantages, open surgery has to be used in some clinical cases.

Conclusion

It is concluded that laparoscopic surgery in children is associated with significantly lower postoperative pain scores, reduced analgesic and opioid requirements, shorter hospital stay, and fewer postoperative complications compared to open surgical procedures. In contrast, open surgery is linked with higher pain intensity, increased analgesic demand, and delayed recovery. These findings highlight the clinical advantage of minimally invasive techniques in improving postoperative outcomes and support the preference for laparoscopic approaches whenever feasible in pediatric surgical practice...

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