

## Exploring post-operative pain relief in Pediatric Inguinal Hernia repair: Comparing Caudal Block versus local wound infiltration with Tramadol

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### Abstract

**Introduction:** Inguinal hernia (IH) repair is one of the most common procedure performed by paediatric surgeons. It is performed under general anesthesia with or without a Caudal Block. Inadequate assessment of post-operative pain and under treatment with analgesia in newborns and children may trigger a stress response. Recent evidence suggests that the infiltration of opioids into the wound at the end of the operation can produce an extended pain-free period and improve outcomes.

**Objective:** To compare the efficacy of two analgesic techniques: Caudal Block versus Local Wound Infiltration with Tramadol in providing post-operative pain relief.

**Study design:** Randomized control trial (Double-blinded study)

**Setting:** Department of Pediatric Surgery, Liaquat National Hospital, Karachi

**Duration:** From 1<sup>st</sup> January 2023 to 31<sup>st</sup> June 2023

**Material and Methods:** 60-patients with unilateral inguinal hernia operated by a single surgeon were included. Patients were randomly assigned into two equal groups. Group A was given Caudal Block and Group B was given local wound infiltration for post-operative pain relief. Both the groups were compared for post-operative mean duration of analgesia at different intervals for ten hours.

**Results:** The results revealed no statistically significant difference in the mean duration of analgesia between the groups ( $9.6 \pm 0.81$  hours for caudal block vs.  $9.47 \pm 0.90$  hours for wound infiltration,  $p=0.545$ ). Similarly, the rate of rescue analgesia did not differ significantly between the two groups (26.7% for Wound Infiltration vs. 13.3% for Caudal Block,  $p=0.197$ ). However, the Caudal Block group exhibited a significantly longer duration of general anesthesia and total procedure time compared to the Wound Infiltration group ( $p=0.03$ ).

**Conclusion:** Our study stated that local wound infiltration with Tramadol following inguinal hernia repair demonstrated comparable efficacy in providing post-operative analgesia to Caudal block with a combination of Tramadol and Bupivacaine. Moreover, local infiltration offers advantages such as simplicity, shorter procedure duration, and reduced risk of associated complications. These findings suggest that local wound infiltration with Tramadol may serve as a viable alternative to caudal block for post-operative pain management in pediatric inguinal hernia surgery.

**Keywords:** Inguinal hernia, post-operative analgesia, Caudal block, Wound infiltration

### Introduction:

Inguinal hernias and hydroceles are prevalent conditions encountered by paediatric surgeons, constituting a significant portion of their practice. Congenital inguinal hernias in children

typically occur due to the failure of the processus vaginalis to close, leading to the formation of an extra-abdominal passage for peritoneal fluid (resulting in a hydrocele) or viscera (resulting in a hernia).<sup>1,2</sup> The incidence of inguinal hernia has

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been reported in the range of 1-5%. Incidence of inguinal hernia is higher in boys and make up to 79% of children having inguinal hernia. The prevalence peaks at the age of five years with an incidence of 1.4% in boys and 0.4% in girls.<sup>3,4</sup> Once diagnosed, prompt elective repair of an inguinal hernia is recommended to mitigate the risk of complications.<sup>5</sup>

It's crucial to prioritize effective pain management in children undergoing surgical procedures like inguinal hernia repair. The misconception that children don't experience or remember pain as adults do has been debunked, emphasizing the importance of proper pain control.<sup>6,7</sup> There are several well-established assessment tools available for evaluating pain in children across different age groups and types of pain. These tools help healthcare providers better understand and address children's pain, ensuring appropriate pain relief and improving overall care. Self-reporting is generally considered the gold standard. However, there are pain scales tailored for different age groups and populations, including neonates, infants and children. Using appropriate pain scales ensures accurate assessment and effective management of pain across diverse patient populations.<sup>8</sup>

Various anesthesia techniques are practiced to avert and reduce stress and pain resulting from a surgical procedure.<sup>9</sup> Inguinal hernia repair can be carried out using general anesthesia and/or regional anesthesia, however in children caudal block is often used technique of regional anesthesia for inguinal hernia repair which offers effective pain relief.<sup>10</sup> Combining Bupivacaine with Tramadol extends the duration of analgesia, providing relief for up to 9 hours. This approach helps minimize the risk of triggering physiological stress responses and associated complications.<sup>11</sup>

The use of Tramadol as a local anesthetic has shown promising results in both clinical and laboratory settings, with studies indicating its efficacy in providing post-operative analgesia for up to 10 hours.<sup>12</sup> Additionally, Tramadol has been found to extend the pain-free period after

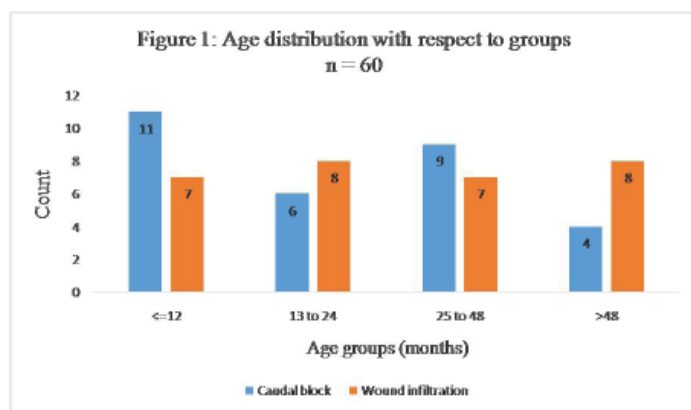
surgery and reduce the need for additional analgesia.<sup>13</sup>

Comparing two different techniques for post-operative analgesia following inguinal hernia repair in children is an important endeavor to identify the most effective approach. Testing the hypothesis that local anesthesia would provide superior analgesia to caudal anesthesia allows for informed decision-making regarding the optimal pain management strategy. Our study aims to determine which technique offers the best analgesic effect, ultimately improving the overall quality of care for pediatric patients undergoing inguinal hernia repair.

#### **Material and Methods:**

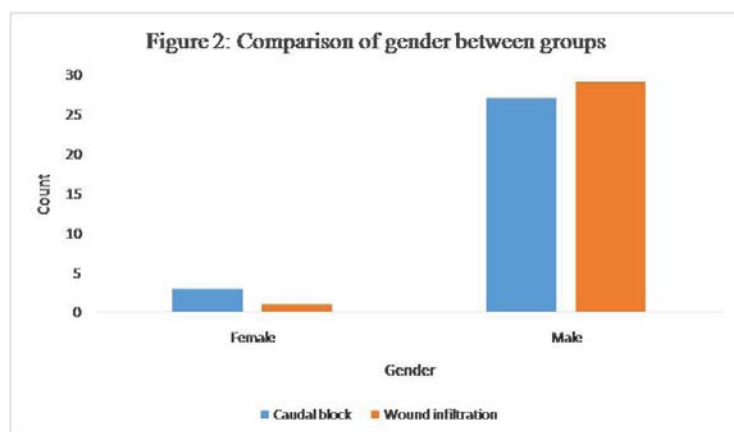
This double-blind randomized controlled trial conducted after obtaining permission from the Institutional Committee (IC). Consent was obtained from guardians of all patients, and inclusion criteria were carefully defined, focusing on children aged 0 to 7 years with unilateral inguinal hernia diagnosed clinically. Exclusion criteria were also clearly outlined to ensure the safety and integrity of the study, excluding patients with specific medical conditions or contraindications. This level of detail and adherence to ethical guidelines strengthens the validity and reliability of the study's findings.

Children aged 0 to 7 years with elective unilateral inguinal hernia repair, classified as ASA I or II, were included in this study. Demographic information was recorded for each patient using a designated form. In the operating room, patients were randomly assigned to Group A (Caudal Block) or Group B (Wound Infiltration) by the attending anesthetist opening sealed envelopes. Caudal blocks were administered in Group A, by instillation of a mixture of 1ml/kg of 0.25% Bupivacaine with 2 mg/kg of Tramadol into the epidural space, After performing skin closure with subcuticular absorbable vicryl suture infiltration of wound with 2mg/kg Tramadol in 0.2ml/kg of normal saline was performed in Group B and normal saline in Group A (0.2 ml/kg). Surgeons were kept unaware of the drug used. Caudal blocks were conducted us-



**Table 1: Descriptive statistics and characteristics of patients**

Variables	Mean±SD	95% CI	Median (IQR)	Max - Min
Age (months)	31.50±25.24	24.98 to 38.02	24 (42)	84 - 1
Weight (kg)	10.49±3.94	9.48 to 11.51	12 (5)	16 -3
Height (cm)	88.95±23.53	82.87 to 95.03	90 (41)	140 -50
Duration of surgery (min)	24.58±7.49	22.65 to 26.52	25 (10)	45 -15
Duration of general anesthesia (min)	31.67±8.57	29.45 to 33.88	30 (15)	50 -20
Duration of analgesia (hr)	9.53±0.85	9.31 to 9.75	10 (0)	10 - 8



**Table 2: Comparison of characteristics of patients between groups**

Variables	Caudal block n = 30	Wound infiltration n=30	p - value
Age (months)	27.83±24.39	35.17±25.93	0.26
Weight (kg)	9.70±3.84	12.15±6.82	0.092
Height (cm)	85.93±22.94	91.97±24.09	0.33
Duration of surgery (min)	26.83±7.13	22.33±7.27	0.019
Duration of general anesthesia (min)	34.83±7.82	28.50±8.22	0.003

ing standard techniques with Bupivacaine and Tramadol. Group A received a dressing over the sacral area, mimicked in Group B to eliminate bias in pain assessment. In Group B, Tramadol

was infiltrated subcutaneously after skin closure. Pain assessments were conducted at 1, 4, 8, and 10 hours post-operatively, with rescue analgesia provided as needed. Analgesic duration was recorded in hours, with confounding factors such as age and gender controlled through stratification.

## Results:

A total of 60 children with unilateral inguinal hernia were included in this study. These children were randomly divided into two groups, Group A received Caudal block and Group B was given local Wound infiltration. Age distribution of the patients with respect to groups was noted. as shown in figure 1.

The average age of the patients was 31.50±25.24 months. Similarly average weight, height, duration of surgery and duration of general anesthesia and analgesia were also recorded. (table 1)

Out of 60 patients, 56(93.3%) were male and 4(6.7%) were female who received Caudal block and Wound infiltration. (figure 2)

Average age, weight and height were insignificant between groups while average duration of surgery and duration of general anesthesia was significantly high in Caudal Block than Wound Infiltration as shown in table-2.

Average mean duration of analgesia in caudal block was 9.6±0.81 hours and in wound infiltration was 9.47±0.90 hours. Significant difference was not observed between groups (p=0.544) as presented in figure 3. Similarly average post operative pain between groups were not significant at different follow ups as shown in table-3.

Comparison of requirement of rescue analgesia between groups was also recorded. (table 4)

Rate of rescue analgesia was 26.7% in wound infiltration group and 13.3% in caudal block but significant difference was not observed between groups (p=0.197).

**Table 3: Comparison of post-operative pain assessment between groups**

Post-Operative Pain assessment (NIPS score / Cheops score)	Caudal block n = 30	Wound infiltration n=30	Total
1 Hours	3.47±0.97	3.37±1.29	0.73
4 Hours	3.17±1.42	3.17±1.62	0.99
8 Hours	3.20±1.40	3.10±1.68	0.82
10 Hours	3.50±2.79	3.87±2.05	0.56

**Table 4: Comparison of requirement of rescue analgesia between groups**

Requirement of rescue analgesia	Caudal block n = 30	Wound infiltration n=30	Total
Yes	4 (13.3%)	8 (26.7%)	12 (20%)
No	26 (86.7%)	22 (73.3%)	48 (80%)

Chi-square = 1.667, p = 0.197

Average duration of analgesia was insignificant between groups in age groups. (Figure 4) Similarly gender and weight were also not effective on average duration of analgesia between groups

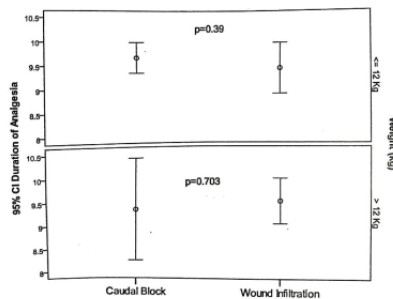
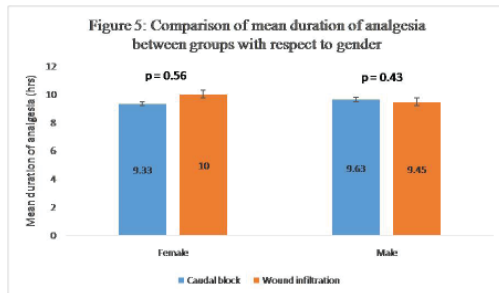
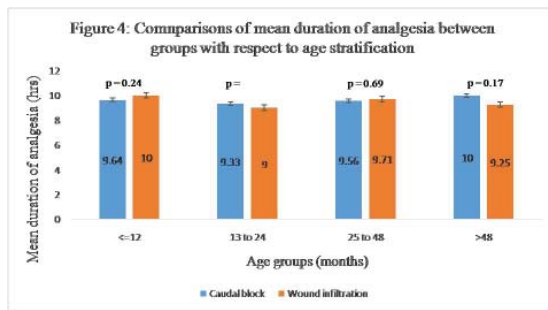


Figure 6: Comparison of mean duration of analgesia between groups with respect to weight

as shown in figure 5 and 6.

**Discussion:**

Pain is perhaps the most feared symptom, which a man is always trying to alleviate and conquer since ages. Children are special in this regard because in them it is very complex phenomenon. It is also very difficult to differentiate restlessness or crying fuel to pain from that of hunger or fear in the children. Langlade et al<sup>14</sup> suggested that the post operative pain treatment must be included in the anesthetic planning even before induction of anesthesia, adoption the idea of ‘managing pain before it occurs’

Caudal epidural blockage is widely used to provide peri operative analgesia in pediatric population. The placement of caudal epidural block post induction prior to surgical stimulation is considered to be an effective means of controlling pain in the post-operative period.<sup>15</sup> It also reduces the requirement of general anesthesia intra operatively without significant side effects and maintaining a smooth intra and post-operative period. Various studies establishing the efficacy of using longer acting local anesthetic such as Bupivacaine in the management of post-operative pain have been conducted.<sup>16</sup> Caudal block, however, can rarely be associated with severe complications such as inadvertent sub arachnoid or intra vascular injection of the local anesthetic.<sup>15</sup> Peripheral nerve blocks, such as ilioinguinal / iliohypogastric nerve block, pose a low risk of transient quadriceps paresis, hematoma and inadvertent bowel perforation.<sup>17</sup> Both techniques are time consuming, require large volumes and may result in high plasma levels of the local anesthetic agent.

Several research has been done by using Bupivacaine in combination with a variety of drugs e.g. Clonidine, Diamorphine, Tramadol etc. and claimed to achieve longer lasting analgesia when a combination of these drugs was used for caudal blocks.<sup>18</sup> Caudal opioids may offer analgesic advantages over Bupivacaine alone but have been associated with side effects such as respiratory depression. Tramadol is an analgesic assumed to lack a respiratory depression effect and has been

shown to provide effective, long lasting analgesia after epidural administration in adults and children. Addition of Tramadol to Bupivacaine administered caudally provides a dose related increase in postoperative analgesia.<sup>18</sup> Senel. AC et al. examined the analgesic efficacy of Bupivacaine, Tramadol, or a combination of both in children undergoing inguinal hernia repair. Their results showed that patients who were administered Bupivacaine and Tramadol caudally had a significant longer time period to administration of first rescue analgesia that is  $13.5 \pm 2.2$  hour, than either the Bupivacaine group  $10 \pm 2$  hour, or the Tramadol alone group  $5 \pm 1$  hour.<sup>19</sup>

Sabbath et al. performed a double blind comparative study and concluded that caudal Tramadol with Bupivacaine provides prolonged and good quality post operative analgesia compared to Caudal block with plain Bupivacaine in children undergoing inguino-scrotal surgeries. Addition of Tramadol (2 mg/kg) with caudally administered 0.25% Bupivacaine (0.75 ml/kg) resulted in significantly longer post operative analgesia period ( $10.4 \pm 2.2$  hours) in one group while in another group in which only 0.25% Bupivacaine (0.75 ml/kg) was used, mean duration of analgesia was ( $2.85 \pm 0.84$  hours).<sup>20</sup>

In our study, the mean duration of analgesia was found to be  $9.6 \pm 0.81$  hours (observed in the group that received a combination of 0.25% Bupivacaine 1 ml/kg with Tramadol 2 mg/kg caudally) which is comparable to above mentioned studies. Furthermore, in this study the rescue analgesia was required in 13.3% of the patients in caudal block at 8 hours. This is also close to the study performed by Majid et al, which showed that after caudal administration of Bupivacaine and Tramadol, rescue analgesia was required in only 16% of the children at 8 hour. Another study by Prosser et al. demonstrated that only 6.7% of patients required rescue analgesia within 1 hour after caudal Tramadol (2 mg/kg).<sup>21</sup>

Another study showed that wound infiltration and wound instillation with a local anesthetic solution performed by the surgeon can produce effective post-operative analgesia after hernia

repair in children. Wound infiltration with local anesthetic is a simple, effective and comparatively inexpensive means of providing good analgesia for a variety of surgical procedures without any major side effects. Local anesthetic effects of opioids have been demonstrated in both clinical and laboratory studies.<sup>22</sup> Tramadol is a weak opioid and is effective local anesthetic in minor surgeries.<sup>23</sup> Only a few studies are available in which wound infiltration is compared with other regional techniques for post-operative pain control.

Greek et al observed that sub cutaneous Tramadol infiltration can provide effective analgesia and may have anti inflammatory effects.<sup>21</sup> Demiraran et al demonstrated the same post operative pain relief among post-hernia repair pediatric patients. They used Tramadol in comparison to Bupivacaine and reached the same conclusion. The mean duration of analgesia was observed to be  $6.72 \pm 4.09$  hours in Tramadol group which was significantly longer than the duration of analgesia observed in groups that received intramuscular Tramadol and caudal Bupivacaine.<sup>12</sup> In the same study, the first rescue analgesia was required in 16% of children. Both values are comparable to the finding observed in my study which shows that local Wound infiltration with Tramadol prior to wound closure in hernia repair, provided post-operative analgesia for  $9.47 \pm 0.90$  hours and the rescue analgesia was required in 26.7% of children but the difference did not prove to be statically significant when compared with the caudal block. A recent study was conducted comparing the Caudal block and Wound infiltration for inguinal procedures in children which also emphasizes the use of local wound infiltration since it is more efficient and minimizes the risk of complications.<sup>24</sup>

In my study, the duration of general anesthesia and this the total time of the procedure was significantly more in Caudal block group as compared to Wound infiltration group. This could be because of the fact that after maintaining general a anesthesia, the child is placed in a proper decubitus position and the sacral site is aseptically prepared by the anesthetist before placement

of Caudal block which consumes time while wound infiltration at the end of inguinal hernia repair is easy to perform and less time consuming.

### Conclusion:

This study failed to establish any difference in the post-operative pain relief whether local infiltration of Tramadol into the wound is performed or a combination of Bupivacaine and Tramadol is used for Caudal block in two equal randomized groups. In this study, both modalities were equally effective in providing post-operative analgesia to children post-inguinal hernia repair.

Since wound infiltration is simplest to apply and less time consuming, this study reinforces the view that simple Wound infiltration with local anesthesia should be encouraged in pediatric anesthesia and could be used as an alternative to the Caudal block particularly in a situation where Caudal block is contraindicated or in a setting where there are limited highly trained personnel and monitoring facilities.

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### Role and contribution of authors:

Hina Yousuf, collected the data references and did the initial write up, critically reviewed the article and made final changes

Ayesha Abdul Samad, collected the data and references, and also helped in introduction and discussion writing.

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