

## ORIGINAL RESEARCH

## REGIONAL ANESTHESIA

# Comparison of caudal bupivacaine and bupivacaine-tramadol combination for postoperative analgesia in children undergoing lower abdominal surgeries

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## Abstract

**Background & objectives:** Postoperative pain needs to be relieved with minimum side-effects and as cheaply as possible. A combination of drugs may be the best way to treat postoperative pain. Caudal block has been conveniently used by the anesthesiologists in pediatric surgery for this purpose. This study compared the use of bupivacaine alone with bupivacaine plus tramadol for a single shot caudal block to find out whether tramadol can be an effective adjuvant to bupivacaine for providing better postoperative analgesia in children undergoing lower abdominal surgery.

**Methodology:** This randomized controlled trial was conducted at Department of Anesthesiology, Shifa International Hospital, Islamabad, for six months. A total of 150 children undergoing lower abdominal surgery were randomly allocated into two groups using a lottery method; 75 children in Group B were treated with bupivacaine-with tramadol, and 75 patients in Group A were treated with bupivacaine only. A caudal epidural block was performed immediately after induction of anesthesia. Study outcomes were monitored in terms of duration of analgesia using TPPPS pain score. Results: - The average age of the patients was 5.14±2.76 years. Mean duration of analgesia was significantly high in group B (Bupivacaine with Tramadol) was compare to group A (Bupivacaine) [7.37±1.96 vs. 11.12±1.86 hours; p=0.0005].

**Conclusion:** We conclude that Tramadol 2 mg/kg when administered caudally with bupivacaine provided prolonged analgesia and its use was safe in children.

**Key words:** Pain; Pain, Postoperative; Anesthesia, Caudal; Bupivacaine; Tramadol; Pediatric

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## 1. Introduction

Caudal epidural anesthesia is one of the most effective pain relief methods used in children, produced by injection of a local anesthetic into the caudal canal. It is used to provide anesthesia and analgesia for surgeries below the umbilicus. The Toddler-Preschooler Postoperative Pain Scale (TPPPS) pain scoring system of pain evaluation is used in children with scores ranging from 0 to 10. A score of more than 3 is considered severe pain (Box 1).

The time between the caudal block and the first dose of analgesic given postoperatively recorded in hours is the analgesia duration. The goal of postoperative pain relief is to reduce or eliminate pain with minimum side effects and in our setup as cheaply as possible. A combination of drugs may be the best way to treat postoperative pain. Tramadol is a weak opioid that is used worldwide to treat children with moderate to severe, acute or chronic pain. Tramadol can be used in children for postoperative pain.<sup>3</sup> Caudal block has proved

| Box 1: Modified TPPPS (Toddler preschool postoperative pain score) |         |             |                |
|--|---------|-------------|----------------|
| Variable   | Score 0 | Score 1     | Score 2        |
| Verbal complaint/cry   | None    | Only once   | > Once         |
| Groan/moan/grunt   | None    | Only once   | > Once         |
| Facial expression  | Neutral | One grimace | Grimace > Once |
| Restless motor behavior  | None    | One episode | > One episode  |
| Rub/touch painful area   | None    | Only once   | > Once         |

useful in a variety of lower abdominal operations.<sup>4</sup>

The present study compared the duration of analgesia, after a single shot caudal block with bupivacaine alone with bupivacaine plus tramadol, to find out whether tramadol can be an effective adjuvant to bupivacaine for providing better postoperative analgesia in children undergoing lower abdominal surgeries.

## 2. Methodology

This randomized controlled trial was conducted at the Department of Anesthesiology, Shifa International Hospital, Islamabad, for six months. The sample size was calculated using WHO sample size calculator with the following assumptions:

Two-sided alpha = 0.5%

Mean duration of analgesia (P1) = 13.5<sup>9</sup>

Mean duration of analgesia (P2) = 6.5<sup>8</sup>

Standard Deviation =  $\frac{(4.1+2.2)}{2} = 3.15$

Total sample size = 150 patients; 75 in each group

The sampling technique used was non-probability consecutive sampling.

Children of both sexes, ASA I and II, 6 months to 12 y of age, undergoing lower abdominal surgeries were enrolled in the study. Children with congenital heart disease, any coagulation disorder, sepsis, uncorrected hypovolemia, parental refusal, malformations of the sacrum (myelomeningocele, spina bifida), or infection at the site of injection, were excluded.

Formal approval was obtained from the hospital ethics committee. Informed consent was taken from the guardians of the children. The baseline characteristics such as age and sex were noted in a Performa specifically designed for the current study. Patient monitoring was started in terms of pulse, NIBP, SpO<sub>2</sub>, and ECG in the operating room. An intravenous line was maintained with a 22G cannula in every child. Anesthesia was induced with propofol 2.5 mg/kg or by inhalation of sevoflurane in oxygen and nitrous oxide. Tracheal intubation was done using succinylcholine 2 mg/kg body weight.

**Table 1: Comparative descriptive statistics and t-test of age and weight**

| Variable    | Group A      | Group B      | p    |
|-------------|--------------|--------------|------|
| Age (Years) | 4.83 ± 2.767 | 5.43 ± 2.72  | 0.55 |
| Weight (Kg) | 12.98 ± 4.69 | 13.68 ± 5.84 | 0.48 |

*Data presented as Mean ± SD*

A caudal epidural block was performed immediately after induction of anesthesia. 150 patients were randomly allocated to two groups based on the lottery method. Group A patients received 0.5 ml/kg of bupivacaine 0.25%, while Group B patients received 0.5 ml/kg of bupivacaine 0.25% plus tramadol 2 mg/kg. Any children having an allergy to bupivacaine or any contraindication to the neuraxial blockade were excluded from the study. Both groups received a fixed volume of solution injected caudally i.e. 1 ml/kg. Anesthesia was discontinued after the dressing of the wound had been completed.

Study outcomes were monitored in terms of the duration of analgesia using the TPPPS pain score. The duration of analgesia was taken from induction of caudal injection to first administration of supplementary analgesia. In case of a pain score of more than 3/10; rescue analgesia was administered with either nalbuphine or oral paracetamol IV.

**Statistical analysis:** Data were entered and analyzed by using SPSS version 21.0. The mean and standard deviations were calculated for continuous variables like age, weight, duration of analgesia. Frequencies and percentages were calculated for the gender and the ASA physical status. Independent samples t-test was used to see the difference in the mean duration of analgesia between the groups. A p-value ≤ 0.05 was considered

significant. Factors, including age, weight, gender and ASA physical status were controlled by stratification. Post-stratification independent sample T-test was applied. A p-value ≤ 0.05 was significant.

## 3. Results

A total of 150 children undergoing lower abdominal surgeries were randomly allocated into two groups. Seventy-five children in Group B were treated with bupivacaine plus tramadol, and 75 patients in Group A were treated with bupivacaine only. Most of the children were 2 to 6 y of age as presented in Figure 1. The mean age and weight of the patients in both groups are shown in Table 1. The average age and weight in patients of both group was statistically not significant as p-values were 0.55 and 0.48 respectively. There were 112 (74.7%) males and 38 (25.3%) females (Figure 2). Regarding ASA status, 71 (47.3%) patients were in ASA –I and 79 (52.7%) in ASA-II. A comparison of the duration of analgesia between groups is shown in Table 2 shows the

**Table 2: Comparison of mean duration of analgesia (h) between groups n=150**

| Age group    | Description             | Group A     | Group B      | p-value |
|--------------|-------------------------|-------------|--------------|---------|
| All patients | n                       | 75 (100)    | 75 (100)     | <0.001  |
|              | Mean duration           | 7.37 ± 1.96 | 11.12 ± 1.86 |         |
| ≤1 y age     | n                       | 11 (14.7)   | 9 (12)       |         |
|              | Mean duration           | 7.64 ± 1.91 | 11.33 ± 1.93 |         |
|              | 95% Confidence Interval | 6.35–8.92   | 9.84–12.82   |         |
| 2 to 6 y     | n                       | 44 (58.7)   | 43 (57.3)    |         |
|              | Mean duration           | 7.39 ± 2.03 | 11.12 ± 1.99 |         |
|              | 95% Confidence Interval | 6.77–8.01   | 10.50–11.73  |         |
| 7 to 12 y    | n                       | 20 (26.6)   | 23 (30.7)    |         |
|              | Mean duration           | 7.20 ± 1.88 | 11.04 ± 1.63 |         |
|              | 95% Confidence Interval | 6.32–8.08   | 10.34–11.75  |         |

Data given as n (%), Mean SD or Lower-Upper bound

significant difference between the groups ( $p < 0.001$ ). The mean duration of analgesia was significantly high in Group B as compare to Group A [ $7.37 \pm 1.96$  vs.  $11.12 \pm 1.86$  h;  $p = 0.0005$ ]. The effect of age was controlled through stratification analysis but the influence of this variable was not observed and found that the mean duration of analgesia was significantly higher in Group B as compared to Group A as shown in Table 2.

### 4. Discussion

The Society of Pediatric Anesthesia on its 15th annual meeting in Louisiana, defined the alleviation of pain as a basic human right, irrespective of age, treatment, primary service responsible for the patient care.<sup>1</sup> The goal of postoperative pain relief is to reduce or eliminate pain with minimum side effects. Effective pain relief results in early discharge from the hospital.<sup>1,2</sup>

The best way to treat postoperative pain is to combine drugs with different modes of action. A weak opioid tramadol is widely used to treat children with moderate to severe acute pain. Tramadol can be given to children to help reduce pain after the surgery.<sup>3</sup> Caudal block has proved useful in a variety of lower abdominal operations.<sup>4</sup> Ease of performance and reliability make caudal block the most commonly performed block in children.<sup>5,6</sup> Caudal administration of bupivacaine is a widespread regional analgesic technique for intra and postoperative analgesia during lower abdominal surgeries in children.<sup>5</sup> A special needle/catheter is penetrated through the sacrococcygeal ligament covering the sacral hiatus. The administration of opioids into the epidural space prolongs the duration of caudal analgesia.<sup>3,5</sup>

The mean duration of surgical analgesia provided by bupivacaine is limited according to many studies.<sup>7</sup> Different drugs have been studied such as tramadol, fentanyl, clonidine, and midazolam, as adjuvants with bupivacaine to prolong the postoperative analgesia. Tramadol is an analgesic agent acting centrally through

opioid receptors.<sup>7</sup> Results of a study in 2008 showed that the mean duration of analgesia for the caudal bupivacaine group was  $6.5 \pm 4.1$  h.<sup>8</sup> Another study showed that the mean duration of analgesia for caudal bupivacaine with the tramadol group was  $13.5 \pm 2.2$  h.<sup>9</sup>

Caudal anesthesia is the first technique of epidural anesthesia and is

the most commonly used technique for the management of pain following a vast range of surgical procedures within the distribution of T10–S5 dermatomes for young children because of its technical simplicity, reliability, safety, and low failure rate.<sup>10</sup>

Various additives to the local anesthetic solution have been used in an attempt to prolong the duration of a single-shot caudal epidural injection.<sup>11,12,13</sup> Opioids and non-opioids have traditionally been added to increase the duration of analgesia, but opioids have been associated with unacceptable side effects, as well as risks

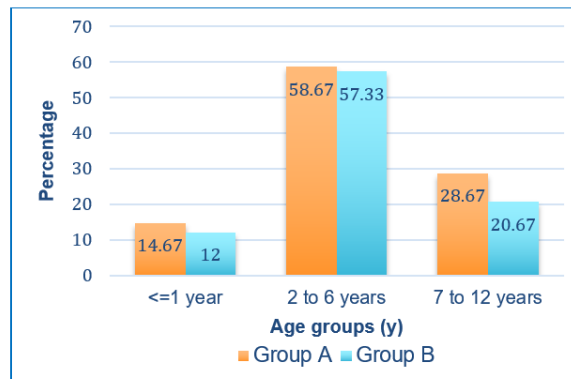


Figure 1: Comparative age distribution of the patients

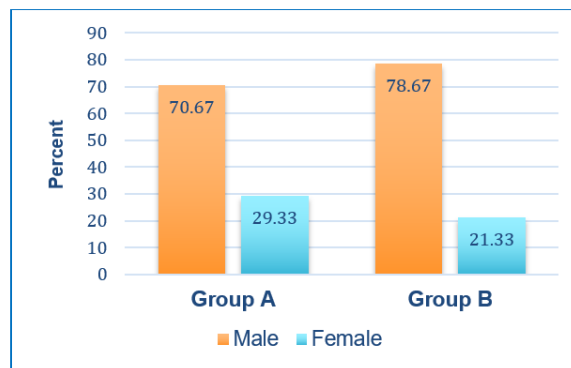


Figure 2: Gender distribution of the patients (n = 150)

of late respiratory depression, prolonged sedation, urine retention, or hypotension.

Caudal analgesia is frequently used for postoperative analgesia in children undergoing urogenital surgeries. Bupivacaine is used because of its long duration of action i.e. up to 6-12 h.

In a study by Laiq et al.<sup>14</sup> the mean age of children was  $5.5 \pm 1.51$  y, which is almost similar to our study.

In this study mean duration of analgesia was significantly higher in the bupivacaine with tramadol group as compared to bupivacaine group. The results were in accordance with several studies done previously. In Samad and Shah's study,<sup>15</sup> caudal tramadol with bupivacaine produced significantly prolonged postoperative analgesia. The duration of postoperative analgesia was  $17.88 \pm 1.96$  h in the tramadol – bupivacaine group as compared to  $12.05 \pm 1.63$  h in the ketamine – bupivacaine group.

Several other researchers observed prolonged analgesia provided by tramadol plus bupivacaine in children undergoing various surgery.<sup>9,16,17</sup> Choudhuri and colleagues reported that caudally administered 0.5 ml/kg bupivacaine (0.25%) plus ketamine or bupivacaine (0.25%) plus tramadol 1 mg/kg provided a significantly longer duration of analgesia without an increase in the adverse effects when compared to bupivacaine alone.<sup>8</sup>

Ozcengiz et al. got satisfactory results regarding postoperative pain relief in children undergoing inguinal surgeries by tramadol–bupivacaine mixtures in caudal blocks.<sup>18</sup> Batra et al. found tramadol–bupivacaine to provide prolonged and satisfactory analgesia in the postoperative period by caudal route in children operated for hypospadias.<sup>19</sup> Murthy and colleagues noticed epidural tramadol to be more effective than intravenous tramadol for postoperative pain relief.<sup>20</sup> Chrubasik found epidural tramadol to provide good analgesia postoperatively after abdominal surgeries and observed a very low concentration of tramadol in systemic circulation compared to intravenous administration.<sup>21</sup> Despite several studies done in favor of tramadol being effective in the epidural block, Professor DP and colleagues observed no significant effects of tramadol on prolongation of analgesic effects of bupivacaine when administered caudally.<sup>22</sup>

Parkash and colleagues studied caudal tramadol plus bupivacaine. They used different doses of 1 mg, 1.5 mg, and 2 mg/kg plus 0.5 ml/kg of 0.25% bupivacaine. They observed that a prolonged postoperative analgesic period was observed when 2 mg/kg of tramadol was used.<sup>23</sup> In another study by Senel and colleagues on the efficacy of caudal tramadol and bupivacaine in children undergoing inguinal herniorrhaphy, the results showed that patients who received bupivacaine 0.25 ml/kg and tramadol 1.5 mg/kg had a significantly longer time to administration

of first.<sup>18</sup> Most of the studies provide evidence that tramadol is a useful adjuvant when used with bupivacaine in epidural analgesia.

## 5. Conclusion

The results of this comparative study prove that tramadol 2 mg/kg, when administered caudally with bupivacaine for postoperative analgesia in children undergoing lower abdominal surgeries, provides prolonged analgesia and its use is safe in children.

## 6. Conflict of interests

None declared by the authors

## 7. Authors' contribution

MZ, HA: Concept, conduction of the study work, literature search, statistical analysis and manuscript editing

SJ: Concept, manuscript editing and supervision

## 8. References

1. Shrestha SK, Bhattarai B. Caudal bupivacaine vs bupivacaine plus tramadol in post-operative analgesia in children. *J Nepal Health Res Counc.* 2010;8:99-102. [PubMed]
2. Al-Zaben KR, Qudaisat IY, Abu-Halaweh SA, Al-Ghanem SM, Al-Mustafa MM, Alia Bari AN, et al. Comparison of caudal bupivacaine alone with bupivacaine plus two doses of dexmedetomidine for postoperative analgesia in pediatric patients undergoing infra-umbilical surgery: a randomized controlled double-blinded study. *Paediatr Anaesth.* 2015;25:883-90. [PubMed] DOI: [10.1111/pan.12686](https://doi.org/10.1111/pan.12686)
3. Fernandes ML, Pires KC, Tibúrcio MA, Gomez RS. Caudal bupivacaine supplemented with morphine or clonidine, or supplemented with morphine plus clonidine in children undergoing infra-umbilical urological and genital procedures: a prospective, randomized and double-blind study. *J Anesth.* 2012 Apr;26(2):213-8. [PubMed] DOI: [10.1007/s00540-011-1297-y](https://doi.org/10.1007/s00540-011-1297-y)
4. Engelman E, Marsala C. Bayesian enhanced meta-analysis of post-operative analgesic efficacy of additives for caudal analgesia in children. *Acta Anaesthesiol Scand.* 2012;56:817-32. [PubMed] DOI: [10.1111/j.1399-6576.2012.02651.x](https://doi.org/10.1111/j.1399-6576.2012.02651.x)
5. Sezen G, Demiraran Y, Karaqozi I, Kucuk A. The assessment of bupivacaine-tramadol and levobupivacaine-tramadol combination for preemptive caudal anaesthesia in children: a randomized, double-blind, prospective study. *Int J Clin Exp Med.* 2014;7(5):1391-6. [PubMed]
6. Suresh S, Long J, Birmingham P, De Oliveira GS Jr. Are caudal blocks for pain control safe in children? An analysis of 18,650 caudal blocks from the Pediatric Regional Anesthesia Network (PRAN) database. *Anesth Analg.* 2015;120:151-6. [PubMed] DOI: [10.1213/ANE.0000000000000446](https://doi.org/10.1213/ANE.0000000000000446)

7. Solanki NM, Engineer SR, Jansari DB, Patel RJ. Comparison of caudal tramadol versus caudal fentanyl with bupivacaine for prolongation of postoperative analgesia in pediatric patients. *Saudi J Anaesth.* 2016;10:154-60. [PubMed] DOI: [10.4103/1658-354X.168807](https://doi.org/10.4103/1658-354X.168807)
8. Choudhuri AH, Dharmani P, Kumari N, Prakash A. Comparison of caudal epidural bupivacaine with bupivacaine plus tramadol and bupivacaine plus ketamine for postoperative analgesia in children. *Anaesth Intensive Care.* 2008 Mar;36(2):174-9. [PubMed] DOI: [10.1177/0310057X0803600206](https://doi.org/10.1177/0310057X0803600206)
9. Senel AC, Akyol A, Dohman D, Solak M. Caudal bupivacaine-tramadol combination for postoperative analgesia in pediatric herniorrhaphy. *Acta Anaesthesiol Scand.* 2001;45:786-9. [PubMed] DOI: [10.1034/j.1399-6576.2001.045006786.x](https://doi.org/10.1034/j.1399-6576.2001.045006786.x)
10. De Beer DA, Thomas ML. Caudal additives in children – solutions or problems? *Br J Anaesth.* 2003;90(4):487-98. [PubMed] DOI: [10.1093/bja/aeg064](https://doi.org/10.1093/bja/aeg064)
11. Ansermino M, Basu R, Vandebek C, Montgomery C. Nonopioid additives to local anaesthetics for caudal blockade in children: a systematic review. *Paediatr Anaesth.* 2003;13(7):561-73. [PubMed] DOI: [10.1046/j.1460-9592.2003.01048.x](https://doi.org/10.1046/j.1460-9592.2003.01048.x)
12. Bano F, Haider S, Sultan T. Comparison of caudal bupivacaine and bupivacaine midazolam for peri and postoperative analgesia in children. *J Coll Physicians Surg Pak.* 2004;14:65-8. [PubMed]
13. Raffa RB, Friderichs E, Reimann W, Shank RP, Codd EE, Vaught JL, et al. Complementary and synergistic antinociceptive interaction between the enantiomers of tramadol. *J Pharmacol Exp Ther.* 1993;267:331-40. [PubMed]
14. Laiq N, Khan MN, Tahmeedullah, Gandapur YK and Khan S. Comparison of caudal bupivacaine and bupivacaine-tramadol for postoperative analgesia in children undergoing hypospadias surgery. *J Coll Phys and Surg Pak.* 2009;19 (11):678-81. [PubMed]
15. Samad R, Shah TH. Comparison of caudal tramadol-bupivacaine and ketamine-bupivacaine for postoperative analgesia in children. *J Coll Phys and Surg Pak.* 2013;18(2):54-58. [Free Full Text]
16. Gunes Y, Gunduz M, Unlugenc H, Ozalevli M, Ozcengiz D. Comparison of caudal vs. intravenous tramadol administered either pre-operatively or postoperatively for pain relief in boys. *Paediatr-Anaesth.* 2004;14:324-8. [PubMed] DOI: [10.1046/j.1460-9592.2003.01214.x](https://doi.org/10.1046/j.1460-9592.2003.01214.x)
17. Prakash S, Tyagi R, Gogia AR, Singh R, Prakash S. Efficacy of three doses of tramadol with bupivacaine for caudal analgesia in paediatric inguinal herniotomy. *Br J Aneasth.* 2006;97:385-8. [PubMed] DOI: [10.1093/bja/ael155](https://doi.org/10.1093/bja/ael155)
18. Ozcengiz D, Gunduz M, Ozbek H, Isik G. Comparison of caudal morphine and tramadol for postoperative pain control in children undergoing inguinal herniorrhaphy. *Paediatr Anaesth.* 2001;11:459-64. [PubMed] DOI: [10.1046/j.1460-9592.2001.00694.x](https://doi.org/10.1046/j.1460-9592.2001.00694.x)
19. Batra YK, Prasad MK, Arya VK, Chari P, Yaddanapudi LN. Comparison of caudal tramadol vs. bupivacaine for postoperative analgesia in children undergoing hypospadias surgery. *Int J Clin Pharmacol Ther.* 1999;37:238-42. [PubMed]
20. Murthy BV, Pandya KS, Booker PD, Murray A, Lintz W, Terlinden R. Pharmacokinetics of tramadol in children after i.v. or caudal epidural administration. *Br J Anaesth.* 2000;84:346-9. [PubMed] DOI: [10.1093/oxfordjournals.bja.a013437](https://doi.org/10.1093/oxfordjournals.bja.a013437)
21. Churhbasik J, Warth L, Wust H, Zindler M. Analgesic potency of epidural tramadol after abdominal surgery. *Pain.* 1987;30:S154.
22. Prosser DP, Davis A, Booker PD, Murray A. Caudal tramadol for postoperative analgesia in paediatric hypospadias surgery. *Br J Anaesth.* 1997;79:293-6. [PubMed] DOI: [10.1093/bja/79.3.293](https://doi.org/10.1093/bja/79.3.293)
23. Prakash S, Tyagi R, Gogia AR, Singh R, Prakash S. Efficacy of three doses of tramadol with bupivacaine for caudal analgesia in paediatric inguinal herniotomy. *Br J Aneasth.* 2006;97:385-8. [PubMed] DOI: [10.1093/bja/ael155](https://doi.org/10.1093/bja/ael155)