

Comparison of Post-Operative Analgesia with Bupivacaine versus Ropivacaine for Caudal Block in Paediatric Patients

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ABSTRACT

Objective: To compare the post-operative pain relief with Bupivacaine and Ropivacaine for caudal block in children in terms of mean duration of analgesia.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Anaesthesia, Combined Military Hospital, Rawlakot Pakistan, from Jul 2021 to Jun 2022.

Methodology: Hundred patients undergoing infra-umbilical surgery, such as circumcision, herniotomy, and orchidopexy of age 1-10 years, were included. After induction of general anaesthesia, a caudal block was given. Group-B patients were given 1 ml/kg of 0.25% Bupivacaine, whereas Group-R patients were given 1ml/kg of 0.25% Ropivacaine. Modified Hnnallah Pain Score was used to observe the post-operative analgesic effects of the block. The score was noted every 30 minutes. The pain-free duration was considered from the time of the caudal block till the modified Hannallah pain score of 4 or more. Injectable Paracetamol 10mg/kg was given as rescue analgesia as required.

Results: Demographic data was comparable in both groups with no statistical significance. In our study, we have found the duration of analgesia as 219.78±35.42 minutes in the Bupivacaine-Group compared with 198.24±34.5 minutes in patients in the Ropivacaine-Group (*p*-value of 0.54).

Conclusion: Ropivacaine is as effective as Bupivacaine regarding post-operative pain relief for caudal block in children.

Keywords: Bupivacaine, Caudal anaesthesia, Caudal block, Pain relief, Pediatric patients, Post-operative analgesia, Ropivacaine.

How to Cite This Article: Leghari KH, Ahmed A, Ahmed U, Ranjha AJ, Tiwana ZUD, Hussain A. Comparison of Post-Operative Analgesia with Bupivacaine versus Ropivacaine for Caudal Block in Paediatric Patients. *Pak Armed Forces Med J* 2023; 73(4): 1120-1123. DOI: <https://doi.org/10.51253/pafmj.v73i4.9171>

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INTRODUCTION

Post-operative pain is a major concern after any surgical procedure, especially after any major abdominal procedure.¹ The inflammatory response following surgery may lead to reduced bowel movements and the development of the ileus due to the activation of nociceptors by inflammatory mediators.² Pain control is traditionally achieved with the administration of opioids. However, administration of opioids has its limitations and is associated with undesirable side effects, especially in the paediatric group of patients.^{3,4} Caudal block is a type of central neuraxial block that results from blocking the sacral and lumbar nerve roots by injecting a local anaesthetic into the caudal epidural space. The analgesic effect of the block may extend for hours in the post-operative period.⁵

Bupivacaine belongs to the amide group of local anaesthetics and is one of the most frequently used

local anaesthetics for caudal block.⁶ It reduces inhaled and intravenous anaesthetic requirements, blunts the stress response to surgical stimulus, facilitates smooth and speedy recovery, and provides good immediate post-operative analgesia.^{7,8}

Ropivacaine also belongs to the amide group of local anaesthetics, but it is less lipophilic in comparison to Bupivacaine; hence, it does not readily penetrate the larger myelinated motor neurons, resulting in a relatively reduced motor block and longer post-operative analgesic effect and has a sensory-motor differentiation to a greater extent, which could be handy when the motor blockade is unwanted.^{9,10}

Caudal block, as regional anaesthesia itself, is a newer modality in the field of anaesthesia in this region and is practised in a few centres in Pakistan. The most commonly used local anaesthetic for this block is Bupivacaine. By carrying out this study, we can document our results of Ropivacaine and Bupivacaine as an effective tools to decrease post-operative pain. If the results of Ropivacaine are better or even comparable to

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Received: 17 Aug 2022; revision received: 07 Sep 2022; accepted: 20 Sep 2022

Bupivacaine, it will provide a better alternative for Bupivacaine for caudal block.

METHODOLOGY

The quasi-experimental study was conducted at the Department of Anaesthesia, Combined Military Hospital, Rawlakot Pakistan, after approval from the Ethical Review Committee of the hospital (Ltr no. 107/08/Coy). The sample size was calculated using an online sample size calculator.¹⁰ Non-probability, consecutive sampling technique was followed.

Inclusion Criteria: All patients of either gender scheduled to undergo infra-umbilical surgery such as circumcision, herniotomy, orchiopexy etc., having ASA Grade I and II and age range between 1 to 10 years were included.

Exclusion Criteria: Patients with any contraindication to neuraxial anaesthesia and a history of allergy to local anaesthetics were excluded.

Routine pre-anaesthesia assessment and history were taken. All relevant laboratory investigations were carried out as per institutional protocol. All patients were kept nil per oral for eight hours prior to surgery. A total of 100 patients were selected and equally divided into two groups.

Standard monitoring was attached, and pre-operative vitals were recorded in the patient's operation room. All patients were pre-oxygenated, and general anaesthesia was induced with Sevoflurane; intravenous access was secured, and Paeds solution was started. A 1mg/kg Propofol bolus was given after standard premedication, and an appropriate size Igel was inserted. Spontaneous ventilation was preserved in all patients. After induction of general anaesthesia, all patients were placed in the lateral fetal position. The landmarks technique was followed for the block, "Swoosh test" was performed to confirm caudal epidural space.¹¹ Group-B patients were given 1ml/kg of 0.25% Bupivacaine, whereas Group-R patients were given 1ml/kg of 0.25% Ropivacaine. Patients were placed in the supine position for the surgical procedures. Maintenance of anaesthesia is done through Oxygen and Isoflurane. After 15 minutes of giving a caudal block, the effectiveness score was assessed intra-operatively before the start of the surgical procedure. If Sevoflurane concentration was reduced to 50% MAC, heart rate increased by 20% of baseline, and limb movement was observed, it was labelled an ineffective block. If the Sevoflurane concentration was reduced to 50% MAC and the heart rate increased by

20% of baseline, and no limb movement was observed, it was labelled as a partial block. If the Sevoflurane concentration was completely stopped and there was no change in heart rate with no movement on stimulation, it was labelled as a completed block. Data was collected for cases with complete blocks only.

Continuous intraoperative monitoring was done, and hemodynamic parameters were recorded every 5 minutes. Patients were shifted to recovery post-operatively. Modified Hnnallah Pain Score was used to observe the post-operative analgesic effects of the block.¹² The score was noted every 30 minutes. The pain-free duration was considered from the time of the caudal block till the modified Hannallah pain score of 4 or more. Injectable Paracetamol 10mg/kg was given as rescue analgesia as required.

Statistical Package for Social Sciences (SPSS) version 24.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Independent sample t-test and Chi-square test were applied to explore the inferential statistics. The *p*-value of 0.05 or less was taken as significant.

RESULTS

The age range in this study was from 1-10 years, with a mean age of 6.52±1.97 years. Out of these 100 patients, 91 were male, and 9 were female. In Group-B, 45(90%) patients were male, while 5(10%) were female; whereas in the Group-R, 46(92%) patients were male and 4(8%) were female. The difference in gender in both groups was statistically insignificant, with a *p*-value of 0.73.

In this study, we have found the duration of analgesia as 219.78±35.42 minutes in the Bupivacaine-Group compared with 198.24±34.5 minutes in patients with Ropivacaine-Group with a *p*-value of 0.54, (Table).

Table: Duration of Analgesia in Both Groups (n=100)

Group-B (n=50)	Group-R (n=50)	<i>p</i> -value
Duration of Analgesia in Minutes		0.54
Mean±SD		
219.78±35.42	198.24±34.5	

DISCUSSION

The most commonly employed regional anaesthesia techniques in the pediatric population are lumbar epidural, caudal block, penile nerve block, iliohypogastric, and ilioinguinal nerve block.¹² Compared to the adult population, lower concentrations of local

anaesthetics are generally sufficient; the quality of the block is comparable to adults; the only difference is that the onset is more rapid, and the duration is less.¹³ The search for the ideal local anaesthetic, one which has a wider safety margin, prolonged analgesia duration and no or minimal motor blockade, continues till today. Bupivacaine is a long-acting amide type of local anaesthetic routinely used for caudal and various other blocks. However, to minimize the risk of cardiotoxicity and unwanted motor blockade, anaesthesiologists favour a new long-acting local anaesthesia drug, Ropivacaine.¹⁴

We conducted this study to compare post-operative pain relief with Bupivacaine and Ropivacaine for caudal block in children regarding the mean duration of analgesia. We found out that Bupivacaine had a little longer analgesia duration than Ropivacaine, but this difference was statistically insignificant. A similar study by Ninu *et al.* observed that the quality and duration of analgesia provided by Bupivacaine and Ropivacaine were similar, and Ropivacaine produced a lesser amount of motor blockade.¹⁵ Two different studies conducted by Ivani *et al.* compared the effects of racemic Bupivacaine (0.25%), Levobupivacaine (0.25%) and Ropivacaine (0.2%). These studies concluded that the analgesic effect duration was almost similar with all three drugs. However, Ropivacaine significantly reduced motor blockade compared to the other two local anaesthetics.^{16,17}

In our study, we found out that analgesia time for Bupivacaine was slightly longer than the Ropivacaine; on the other hand, in a similar study, Abbaiah *et al.*¹⁸ found that Ropivacaine provided a longer duration of analgesia as compared to Bupivacaine, though the difference of time in both studies was not significant. In this study, the first rescue analgesia dose was given at 233 minutes in the Bupivacaine-Group. In contrast, it was 271 minutes in the Ropivacaine-Group.

Further studies should be carried out in which the effect of adding adjuncts like Dexmedetomidine and Tramadol to these local anaesthetics should be observed.

CONCLUSION

This study concluded that Ropivacaine is as effective as Bupivacaine in terms of post-operative pain relief for caudal block in children. We recommend that Ropivacaine be used preferably for caudal block in children to prevent post-operative pain in these patients.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

KHL & AA: Data acquisition, concept, critical review, approval of the final version to be published.

UA & AJR: Data acquisition, data analysis, critical review, approval of the final version to be published.

ZUDT & AH: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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