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# Comparison between Ropivacaine 0.25% and Bupivacaine 0.25% in Paediatric Caudal Anaesthesia in Infra Umbilical Surgeries (A Study of 60 Cases)

Tejash H. Sharma<sup>1</sup>, Kaushik Sharma<sup>2</sup>, Dinesh Chauhan<sup>3</sup>, Jatin Patel<sup>1</sup>, Nilam Shah<sup>4</sup>

<sup>1</sup>Associate Professor, Department of Anaesthesiology, Dhiraj Hospital, Smt. B.K. Shah Medical Institute and Research Centre, Sumandeep Vidyapeeth (Deemed to be University), Vadodara, Gujarat, India; <sup>2</sup>OMFS Fellow, Oral/head and Neck Oncologic and Resconstructive Surgery North Memorial Medical Centre, Minneapolis, USA; <sup>3</sup>Head & Professor, Department of Anaesthesiology, Smt B. K. Shah Medical Institute and Research Centre, Sumandeep Vidyapeeth, An Institution Deemed to be University, Vadodara, Gujarat, India; <sup>4</sup>Ex Professor, Department of Anaesthesiology, Smt B. K. Shah Medical Institute and Research Centre, Sumandeep Vidyapeeth, An Institution Deemed to be University, Vadodara, Gujarat, India.

## ABSTRACT

**Background:** Caudal epidural is the most common regional anaesthesia technique for treating post-operative pain in pediatric patients. It is commonly used for procedures like urogenital, rectal, inguinal and lower extremity surgery. Objective: To compare the anaesthetic potential of bupivacaine 0.25% and ropivacaine 0.25% for infra-umbilical surgical procedures.

**Methods:** This study included 60 children of ASA (American society of anesthesiologists) I & II grade of either gender, scheduled for various elective infra-umbilical surgical procedures. Patients were randomized to receive bupivacaine 0.25% or ropivacaine 0.25% each total dose of 1 ml kg<sup>-1</sup>. The randomization sequence was computer-generated and prepared in a double-blind manner. Post-operative motor block was assessed with Bromage motor scale and postoperative analgesia was observed with an observer pain scale. Statistical data were analyzed by using student's unpaired t-test.

**Results:** The mean duration of analgesia in group B was 266.0±1.89 minutes and group R was 251±2.68 minutes. The difference was statistically highly significant (p<0.0001). The mean duration of motor block in group B was 236.0±1.89 minutes and in the group, R was 204±2.22 minutes. The difference was statistically highly significant (p<0.0001).

**Conclusion:** In the present study caudal administration of bupivacaine 0.25% (1 ml kg<sup>-1</sup>) resulted in a longer duration of analgesia and motor block compared with 0.25% ropivacaine (1 ml kg<sup>-1</sup>), with no significant difference in the hemodynamics and the incidence of side effects.

**Key Words:** Caudal block, Bupivacaine 0.25%, Ropivacaine 0.25%, Paediatric, Infra umbilical surgeries, Age 4-6 years.

## INTRODUCTION

A Caudal epidural is a common regional anaesthesia technique for postoperative pain management in pediatric patients as sacral hiatus gives us information about sacral hiatus regarding its patency and suitable for an epidural block.<sup>1</sup> It is used for procedures like rectal, inguinal, urogenital; and lower limb surgeries.<sup>2</sup> The use of regional anaesthesia with general anaesthesia results in a reduced concentration of inhaled agents and opioids resulting in quick recovery time and less nausea and vomiting. The caudal anaesthesia provides adequate anaesthesia without multidrug usage, invasive ventilation, minimal biochemical and physiological changes, reduced postoperative nausea and vomiting, rapid return of feeding, minimal postoperative apneic spells, re-

duction in a postoperative hospital stay and hence cost of treatment.

Drugs used commonly in caudal analgesia are lignocaine, bupivacaine, ropivacaine, etc. along with adjuvants. Although, opioids are not recommended for daycare surgeries because of the risk of respiratory depression.<sup>3</sup> Ropivacaine is a new long-acting amide local anaesthetic agent, with the fewer toxic central nervous system and cardiac effects provide greater separation of motor and sensory effects. The sensory block provided by ropivacaine is similar to that produced by an equivalent dose of bupivacaine in peripheral nerve block and extradural. The motor block produced by ropivacaine is less intense, shorter in duration and slower in onset than that after an equivalent dose of bupivacaine.<sup>4</sup>

### Corresponding Author:

**Dr. Jatin Patel**, Associate Professor, Department of Anaesthesiology, Dhiraj Hospital, Smt. B.K. Shah Medical Institute and Research Centre, Sumandeep Vidyapeeth (Deemed to be University), Vadodara, Gujarat, India; Phone: 94273322100; Email: [dtejash@gmail.com](mailto:dtejash@gmail.com)

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General anaesthesia in a paediatric age group may be associated with difficulty in intubation due to anatomy of the larynx, delayed recovery from muscle relaxant, more incidences of postoperative nausea and vomiting which may interfere with pain perception in the paediatric patient due to excessive crying.

## MATERIALS AND METHODS

This study was conducted in Dhiraj hospital in Department of Anesthesiology after approval from the ethical committee (SVIEC/ON/MEDI/BN-PG12/D12305). All the parents of patients' participating in the study were explained clearly about the purpose and nature of the study in the language they could understand. They were included in the study only after obtaining written informed consent.

### Inclusion Criteria

- ASA Grade I and II
- Age between 4-6 years
- Planned for elective infra-umbilical surgeries

### Exclusion Criteria

- History of drug sensitivity to ropivacaine or bupivacaine
- Parental denial for consent
- Age <4yrs or >6yrs
- Skin infection at the local site
- Congenital skeletal deformity
- Emergency admission
- Bleeding disorders

This study included 60 children of the American society of anesthesiologist's (ASA) grade- I & grade- II, of either gender, scheduled for various elective infra-umbilical surgical procedures such as herniotomies, circumcision, orchidopexy, perineal surgeries and minor lower extremity procedures under caudal epidural anaesthesia. Patients were randomized to receive bupivacaine 0.25% in Group B or ropivacaine 0.25% in Group R each total dose of 1 ml kg<sup>-1</sup>. The randomization sequence was computer-generated and prepared in a double-blind manner. Each local anaesthesia solution was prepared in transparent syringes.

All patients were examined pre-operatively for detailed clinical and physical examination, necessary laboratory investigation was carried out. All the patients were kept nil per orally for 6 hours before surgery. In the operation room after taking i.v. line, i.v. infusion with Isolyte -P was started according to body weight. All patients were pre-medicated with injection glycopyrrolate 0.004 mg kg<sup>-1</sup> i.v. injection Ondansetron 0.1 mg kg<sup>-1</sup> i.v. injection midazolam 0.03mg/kg and oxygenated with the facemask. Electrocardiogram (ECG), SpO<sub>2</sub>, heart rate (HR), respiratory rate (RR) and non-invasive blood pressure (NIBP) were recorded. Inj. ketamine

1-1.5 mg kg<sup>-1</sup> i.v. was given to make the patient immobile while performing a caudal block. Patients were placed in left lateral Sim's position, the vitals were checked again including the adequacy of spontaneous breathing. After the administration of the drug patients were kept in the supine position. Upon the establishment of the block, the surgeon was allowed to perform the surgery. Intermittent injection ketamine 0.5 mg kg<sup>-1</sup> was given when needed. Oxygen was given throughout the surgery.

Patients were monitored for ECG, SpO<sub>2</sub>, RR, HR, NIBP and vitals were recorded at 5-minutes intervals for 30 minutes, then every 10 minutes till surgery was over and half-hourly after shifting the patient to the recovery room until rescue analgesia. Patients were monitored for pain by Observer Pain Score (OPS) (Table 1).<sup>5,6</sup> Rescue medication (rectal suppository of diclofenac 1.5 mg kg<sup>-1</sup>) was given when the OPS score ≥4. The Post-operative motor block was observed every 30 minutes by Bromage motor block scale till complete recovery of the patient.

**Table 1: Observer Pain Scale<sup>5,6</sup>**

	Score
No Pain	
Laughing Euphoric	1
Happy Contented	2
Calm or Asleep	3
<b>Mild-Moderate Pain</b>	
Crying Grimacing, Restless Can Distract With Toy or Parental Presence	4
<b>Severe Pain</b>	
Crying Grimacing, Restless Can Distract With Toy or Parental Presence	5

## RESULTS

A total number of 60 children in the age group of 4–6 years belonging to ASA grade I and II were enrolled in this study. They were divided into two groups of 30 each.

Children in group B received caudal bupivacaine 0.25% (1 ml kg<sup>-1</sup>).

Children in group R received caudal ropivacaine 0.25% (1 ml kg<sup>-1</sup>).

The mean age in group B and group R was 4.7±0.15 and 4.8±0.16 years respectively (p = 0.59). In group B there were 21 males and 9 females. Group R had 29 males and 1 female. The groups were comparable concerning gender. The mean weight of the children in group B and group R was 13.13±0.36 kg and 13.87±0.36 kg respectively. The two groups did not differ significantly for the weight (p = 0.99).

The mean duration of surgeries in group B and group R was  $85.33 \pm 1.67$  and  $83.33 \pm 1.49$  minutes respectively ( $p = 0.15$ ). There were no significant changes in hemodynamics in both groups at any time interval ( $p > 0.05$ ).  $SpO_2$  remained stable throughout the surgery in both groups.

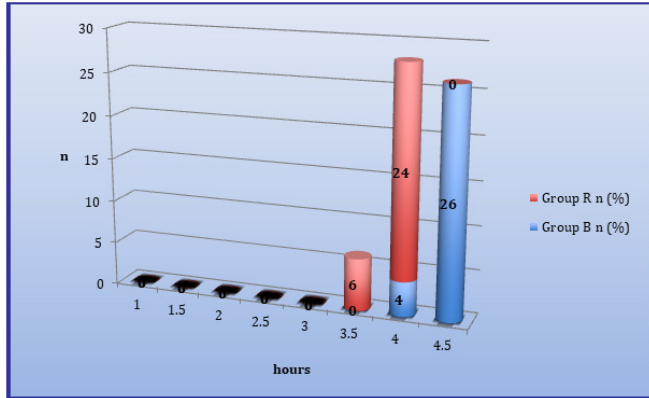


Figure 1: Motor block = 0 at various Time Intervals.

Out of 30 patients, 4 (13.33%) patients reached Bromage motor block scale 0 in 4 hours while 26 (86.66%) patients reached in 4.5 hours in group B. In group R out of 30 patients 6 (20%) patients reached Bromage motor block scale 0 in 3.5 hours while 24 (80%) patients reached in 4 hours as shown in figure number 1.

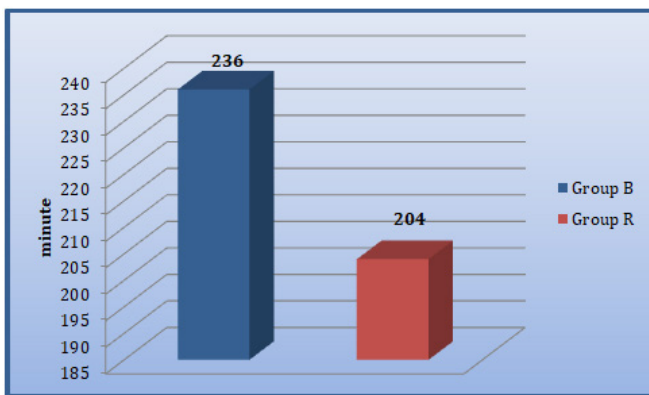


Figure 2: Means duration of motor block.

The mean duration of motor block in group B was  $236.0 \pm 1.89$  minutes and in the group, R was  $204 \pm 2.22$  minutes. The difference in the mean duration of motor block was statistically highly significant ( $p < 0.0001$ ) which is shown in figure number 2.

Out of 30 patients, 4 (13%) patients reached pain score 4 in 4 hours while 26 (86.66%) patients reached in 4.5 hours in group B. In group R out of 30 patients 19 (63.3%) patients reached pain score 4 in 4 hours while 11 (36.6%) patients reached in 4.5 hours as depicted in figure number 3.

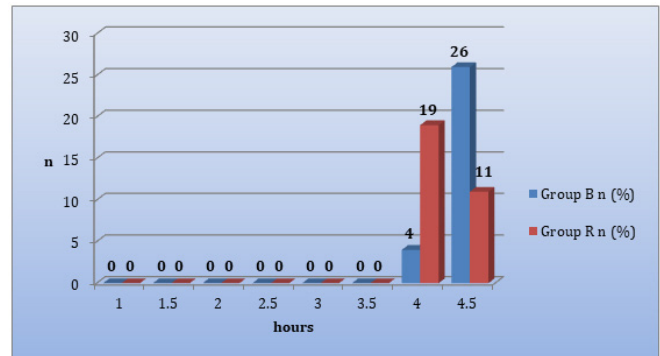


Figure 3: Pain score  $\geq 4$  at various time intervals.

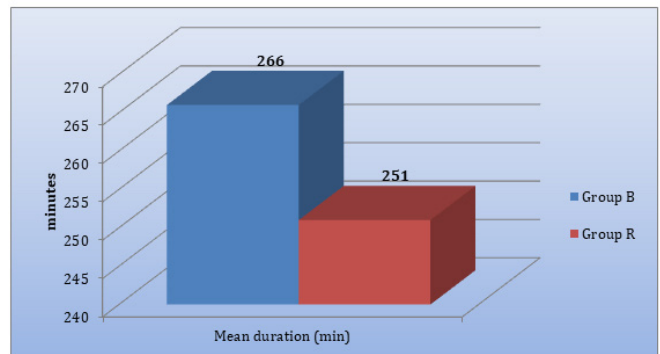


Figure 4: Mean duration of Analgesia.

The mean duration of analgesia in group B was  $266.0 \pm 1.89$  minutes and in group R was  $251 \pm 2.68$  minutes. The difference in the mean duration of analgesia was statistically highly significant ( $p < 0.0001$ ) which is shown in figure number 4.

No single incidence of any complications like hypotension, dural puncture, failed technique, convulsions, bradycardia, hyperthermia or urinary retention was observed during our study.

## DISCUSSION

The past decade had witnessed many advances in the understanding and treatment of pain in children. A caudal epidural blockade is one of the most popular regional block used in paediatric anaesthesia.<sup>7,8</sup> When comparing postoperative analgesia and motor block by caudal administration of either ropivacaine 0.25% or bupivacaine 0.25%, previous studies produced equivocal results. Some showed superior post-operative analgesia<sup>1</sup> and significantly lower incidence of motor block<sup>2</sup> with Ropivacaine 0.2%, whereas some reported no difference between ropivacaine and bupivacaine in terms of duration and quality of analgesia and motor block.<sup>3</sup>

In the present study, there was no significant difference in the two groups with regarding age and weight. In both the groups more than 80% of the patients were male. This could

be due to the inclusion of surgeries such as herniotomy, orchidopexy, hypospadias and circumcision in our study. In our study, there was no significant difference with mean heart rate, systolic and diastolic blood pressure and respiratory rate. Our study co-relates with the study of Da Conceicao (1999).<sup>2</sup>

The duration of motor block was statistically highly significantly longer with group B than group R ( $p < 0.0001$ ). Our results coincide with results of previous studies.<sup>2,4,9,10</sup> The duration of analgesia was statistically highly significantly longer with group B than group R ( $p < 0.0001$ ), which coincides with the study earlier studies.<sup>4,9</sup> Caudal injections of 0.75 ml kg<sup>-1</sup> either ropivacaine 0.25% or bupivacaine 0.25% was used, the duration of analgesia observed was 208 and 220 minutes respectively which was less than the duration of analgesia compared to our study (251±2.68 group R, 266±1.89 group B) as we had used 1ml kg<sup>-1</sup> dose.<sup>4</sup> In the study of Dr. Ray<sup>7,8,9</sup>, the duration of analgesia was longer in each group than that of observed in our study, this may be due to using different methods of assessing pain. In the study the duration of analgesia was longer with group R than group B that does not coincide with our study.<sup>1</sup> While in the study of Da Conceicao MJ<sup>2</sup> the duration of analgesia was almost equal in both groups.

## CONCLUSION

The present study demonstrated that caudal administration of bupivacaine 0.25% (1 ml kg<sup>-1</sup>) resulted in a longer duration of analgesia and motor block compared with 0.25% ropivacaine (1 ml kg<sup>-1</sup>), without any significant difference in the hemodynamic parameters and the incidence of side effects. Bupivacaine is better suited for orthopaedic surgeries as it allows more motor blockade than ropivacaine. Addition of an adjuvant may increase the analgesic duration of either drug which can reduce overall intravenous analgesic requirements. Further larger studies with adjuvants are required for more understanding.

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