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Efficacy of Caudal Anaesthesia With 0.375%Ropivacaine And 0.375% Bupivacaine in Paediatric Patients Undergoing Circumcision A Comparative Study

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Abstract:
Aim: *To compare the onset of anaesthesia, duration of motor block and postoperative analgesia among caudally administered 0.375% Ropivacaine and 0.375% Bupivacaine in paediatric patients undergoing circumcision*
Methodology: *In this observational study consecutive subjects getting either of two interventions may be recruited till the sample size is attained 74 paediatric patients planned for circumcision with ASA I allocated in two different groups, to receive either 0.375% Ropivacaine or 0.375%Bupivacaine. Onset of action and return of motor movements assessed based on Bromage scale. Mean duration of onset of anesthesia, duration of motor blockade and postoperative analgesia among two groups are compared using t-test.*
Results: *Both the groups were comparable regarding age, weight onset of action and postoperative analgesia but significant was noted in return of motor movements in both groups.*
Conclusion: Motor function recovery is much faster in Ropivacaine group making it a better choice in paediatric day care surgery compared to Bupivacaine.
Key words: *caudal block,Bupivacaine,Ropivacaine,Bromage scale*

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I. Introduction

The international association for the study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential " tissue damage, or described in terms of suchdamage".[1]

Caudal anaesthesia is commonly used in paediatric patients for pain relief following surgical procedure. Wide acceptance of caudal block is due to its technical simplicity, reliability, safety and rapid performance in large series of infants and children.

Bupivacaine is a commonly used local anaesthetic in caudal anaesthesia for perioperative analgesia in perineal and lower abdominal surgeries.2

Ropivacaine is a new aminoamide local anaesthetic which appears to cause less motor block and less cardiotoxicity than bupivacaine but produces a similar duration of analgesia.3

Ropivacaine, being a pure S (-) enantiomer, has a significantly higher threshold for cardiotoxicity and CNS toxicity than Bupivacaine. It is less lipophilic than Bupivacaine and less likely to penetrate large myelinated motor fibres; therefore, it has selective action on the pain transmitting A delta and C fibers rather than A (3 fibre which are involved in motor function.

Ropivacaine has several properties which may be useful in paediatric practice, namely the potential to produce differential neural blockade with less motor block, and reduced cardiovascular and neurological toxicity 8.

We planned this observational study to compare the quality and duration of analgesia along with motor and sensory block after single shot caudal block with either 0.375% ropivacaine or 0.375% bupivacaine in paediatric patients undergoing circumcision.

II. Aims And Objectives

To compare the onset of anaesthesia, duration of motor blockade and postoperative analgesia among caudally administered 0.375% ropivacaine with 0.375% bupivacaine in paediatric patients undergoing circumcision.

Caudal epidural blockade is the useful alternative to general anaesthesia or total intravenous anaesthesia as it provides effective post operative analgesia.7 This regional technique avoids polypharmacy

and other complications related to general anaesthesia. It is the most popular, reliable, safe and easy method to administer and is therefore commonly performed procedure for subumbilical surgeries in children.
Caudally administered ropivacaine provides effective postoperative analgesia, similar to bupivacaine in paediatric patient. Less motor blockade of ropivacaine makes it a more suitable agent for day care surgery.

Our study is the comparison between two local anaesthetic drugs namely ropivacaine and bupivacaine both belongs to the amide group of local anaesthetics in paediatric patients undergoing circumcision. Both the groups were comparable regarding onset of action and postoperative analgesia but significant difference were noted in return of motor movements in both groups. No much relevant complications noted during the study other than block failure in some cases.

III. Materials and methods

The study was done under the Department of anaesthesiology. Andhra medical college, King George hospital Visakhapatnam, after obtaining approval from Institutional ethical Committee between January 2018 to January 2019.60 paediatric patients posted for circumcision were divided into two groups.
Group 1- Recieved 0.375% Bupivacaine (1 ml/kg), maximum dose upto 2- 3 mg/kg.
Group 2- Recieved 0.375% Ropivacaine (1 ml/kg),
maximum dose upto 2- 3 mg

Sample size

Assuming a significance level of 5% to the power of 80%, Post operative analgesia duration with mean time of 5(SD 3.2)h in the ropivacaine group compared with 5(SD2.8)h in the bupivacaine group in the parent study and expected mean difference of 2 hours in the current study(equivalent study), a sample size of 37 paediatric patients undergoing circumcision for each group.

Inclusion criteria

- American Society of anaesthesiologists(ASA) physical status I
- Age between 2-6 years.
- Weight upto 15 Kg.

Exclusion criteria

- ASA grade more than 2
- Weight more than 15kg
- Local infection at the caudal region
- Congenital anomaly of the lower back and emergencies.

Methodology

During the preoperative visit, all the patients were evaluated and assessed. The study protocol was explained to the parents and written informed consent was taken from them.
Cases satisfying the inclusion criteria were selected and allotted into groups 1 and 2. All the patients were premedicated with syp. Pedicloryl (Triclorofos)75 mg/kg 1 hour before the surgery, Nil per oral status as per guidelines was ensured.

On arrival to operation theatre, standard monitoring was instituted, including ECG, non-invasive blood pressure and pulse oximetry. Baseline vitals of the patients were recorded. An intravenous line was established and Isolyte P solution was infused to provide fluid during surgery.
Patient were randomly allotted to one of two groups of 37 patients
each.
Group 1 - received lml/Kg of 0.375% bupivacaine.
Group 2 - received 1 mI/kg of 0.375% ropivacaine.

Intravenous access secured before the procedure and child is sedated with intravenous ketamine, midazolam and atropine. patients were placed in prone position, wedge kept under the pelvis and a caudal injection was performed using aseptic technique, with 22 gauge needle. Immediately after the caudal injection, the patients were turned to supine position for performance of surgical procedure. Skin incision was allowed after 10 minutes of caudal block.

Patients were transferred to postoperative wards, and they were monitored. They were assessed for quality of pain relief. Rectal paracetamol 15-20 mg/kg was administered when patients scored one or more on pain scale and the duration of pain relief was recorded. Motor power and level of sensory block were evaluated using Bromage scale every 30 minute interval until they regained complete motor power.

IV. Results

STATISTICAL ANALYSIS

Data was entered in Microsoft excel for statistical analysis. Quantitative variables were summarized using mean with standard deviation. Qualitative variables were summarized using proportions with 95% confidence interval. Test of significance using independent t-test for quantitative variables and mean Whitney U test for qualitative variables has been done. A p value of <0.05 was considered statistically significant. Mean duration of onset of anaesthesia, post operative motor movements and post operative analgesia among two groups are compared using t-test

V. Observations And Analysis

Table 1: Age Distribution in years

Group	Mean	SD	N	t	P Value
Bupivacaine	2.81	.81096	37	583	244
Ropivacaine	3.03	.79884	37		

Age distribution of two groups are given in table 1. As there were no statistical difference between (p>0.05) two groups, the two groups were comparable or age matched.

Table 2: Weight Distribution in Kgs.

Group	Mean	SD	N	t	P Value
Bupivacaine	12.54	1.09531	37	519.00	0.063
Ropivacaine	13.03	0.98563	37		

Weight distribution of two groups are given in table 2 . As there were no statistical difference between (p>0.05) two groups, the two groups were comparable or weight matched.

Table 3: Onset Distribution

Group	Mean	SD	N	t	P Value
Bupivacaine(mins)	5.95	1.5340	37	527.00	0.74
Ropivacaine(mins)	6.43	1.04191	37		

Analyzed using independent 1 test. No significance difference in Onset of action between two groups (p>0.05) which is statistically insignificant and both were comparable.

Table 4: Duration of Motor Blockade

Group	Mean	SD	N	t	P Value
Bupivacaine(mins)	90.75	3.35175	37	.000	.000
Ropivacaine(mins)	67.54	3.37140	37		

Duration of Motor Blcokade are given in table 4 and graph 4. There is statistical significant difference (p>0.05) observed between two groups with early return of motor movements observed in Ropivacaine group.

Table 5: Post–op-Analgesia

Group	Mean	SD	N	t	P Value
Bupivacaine(mins)	119.18	4.21975	37	647.00	.683
Ropivacaine(mins)	119.65	3.35175	37		

Post–op-Analgesia of two groups are given in table 5 and graph 5. As there was no statistical difference (p>0.05) observed between two groups, the two groups were comparable or post operative analgesia were comparable in both groups.

VI. Discussion

Caudal block is the useful alternative to general anaesthesia or total intravenous anaesthesia as it provides effective post operative analgesia. It is the most popular, reliable, safe and easy method to administer 9 and is therefore the commonly performed procedure for subumbilical surgeries in children. Inadequate treatment of pain can result in short and long term morbidity. Postoperative pain management is an integral part of practice of paediatric anaesthesia.

In this study, caudal anaesthesia was given using either 0.375% bupivacaine 1m1/kg or 0.375% ropivacaine 1 ml/kg with maximum dose upto 2-3mg/kg was used:

- To determine the onset of anaesthesia with bupivacaine and with ropivacaine for paediatric patients undergoing circumcision.
- To compare and assess the duration of motor blockade
- To assess postoperative analgesia among two groups.

There were no significant difference observed between the two groups in age, weight, onset of action, postoperative analgesia, heart rate, mean arterial pressure and oxygen saturation.
Patient remained hemodynamically stable throughout the operation in both groups.

The quality and duration of postoperative pain relief did not differ significantly between the two groups. Postoperative pain score was comparable in two groups, there was no significant difference at any time interval ($p>0.05$).

Statistically significant difference with p value <0.05 was obtained for duration of motor blockade among two groups. Significantly higher motor power score was observed in ropivacaine group at 60min when compared to that of bupivacaine at 90min with significant difference in p value(<0.05).
Complete sensory recovery(post operative analgesia) was achieved in 120 min after surgery in both groups was found to be statistically insignificant (p value- > 0.05).

Our study shows that a single shot caudal injection of ropivacaine when comparing with bupivacaine provides reliable and long lasting analgesia in paediatric patients undergoing circumcision with early return of motor movements. Pharmacokinetic studies of ropivacaine shows that 1m1/kg 0.375% ropivacaine by caudal block produce maximal plasma concentration of 0.72± 0.24 mg/I, which is much lower than the maximal tolerated plasma concentration of ropivacvaine in adult volunteers (2.2± 0.8 mg/ml).

Habre et al[5] reported that maximum plasma concentration of ropivacaine was achieved at 2 hours following caudal block which is much later than for bupivacaine in (29± 3.1) children.
Da Conceiao and Coelho[3] reported significantly shorter duration of motor block with 0.375% ropivacaine as compared to 0.375% bupivacaine.

Manjushree Ray et al compared the quality and duration of caudal block produced by 0.25% Ropivacaine and 0.25% Bupivacaine.[4]Degree of motor block was less in Ropivacaine group compared to Bupivacaine group.
Ivani G et al[2] reported that 2 mg/kg of 0.2% ropivacaine is sufficient to obtain sensory block for lower abdominal or genital surgery in children. In our study 0.375% ropivacaine has provided excellent analgesia during surgery and postoperative period.

Ivan G et al[2] reported a significant difference in the duration of analgesia between bupivacaine and ropivacaine. But other workers did not support their view and average duration was 5 hrs for both the drugs.
All patients showed some amount of motor weakness in both groups, immediately after surgery. But after 2hours almost normal motor power was recorded in ropivacaine group. Significantly higher motor power was observed in ropivacaine group at 60minutes after surgery.

Khalil et al[6] also reported significant motor block initially which almost recovered to normal power with three hours in ropivacaine group. Motor recovery was significantly slow in bupivacaine group in their study.

CONCEICAO et al[3] suggest that caudal anaesthesia with ropivacaine in paediatric patients is effective and produces less motor block in the postoperative period. Ropivacaine has greater sensory and fewer motor effects than bupivacaine. No significant difference between the groups in time to first post operative analgesia. Ropivacaine inducesensory block similar to that of Bupivacaine and motor block of shorter duration.

VII. Conclusion

Caudal epidural blockade with either 0.375% bupivacaine or 0.375% ropivacaine, are effective in providing postoperative analgesiaafter circumcision in children. Ropivacaine provides effective postoperative analgesia similar to bupivacaine in paediatric patients. The efficacy of ropivacaine is similar to that of bupivacaine for caudal blocks and, although it may be slightly less potent than bupivacaine when administered epidurally, equieffective doses have been established. Less motor blockade of ropivacaine makes it a more suitable agent for day care surgery.

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