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CAUDAL EPIDURAL ANALGESIA IN PEDIATRIC PATIENTS: COMPARATIVE STUDY BETWEEN BUPIVACAINE AND ROPIVACAINE

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ABSTRACT: AIM: To study the quality and duration of analgesia, motor and sensory block after a single shot caudal epidural with either 0.25% Bupivacaine or 0.2% Ropivacaine in paediatric patients. **MATERIALS AND METHODS:** 50 patients belonging to ASA-Physical status I-II of age groups 1-7 years were allocated into two groups of 25 each. Group-B received 0.25% Bupivacaine 1ml/kg, Group R received 0.2% Ropivacaine 1ml/kg for caudal block. **RESULTS:** In our study, the quality of analgesia, duration of analgesia and motor block were compared. The quality and duration of analgesia was similar in both the groups but motor recovery was significantly slow in Bupivacaine group. **CONCLUSION:** Less motor blockade of Ropivacaine makes it a more suitable agent for day care surgery.

KEYWORDS: Bupivacaine, Caudal Block, Motor Block, Ropivacaine.

INTRODUCTION: Pain, an unpleasant sensory and emotional experience associated with actual or potential tissue damage is not fully expressed in children. The concept of postoperative pain relief in paediatric age group using various agents through various routes of administration has been investigated. Regional anaesthetic techniques significantly decrease post-operative pain and systemic analgesic requirement and their side effects.

Caudal route was chosen for this study as it is one of the simplest and safest techniques in paediatric anaesthesia with a high success rate. It acts as an adjunct to intraoperative anaesthesia, decreases requirement of inhaled anaesthetics, attenuates stress response to surgery and facilitates rapid, smooth, recovery and provides good postoperative analgesia.

Hypothesis: Ropivacaine provides pain relief with less motor block and less cardiotoxicity when compared to Bupivacaine. Hence this study was undertaken to compare these two drugs via caudal route in paediatric patients. Our study compares the quality and duration of analgesia, motor and sensory block after a single shot caudal epidural with either 0.25% Bupivacaine or 0.2% Ropivacaine in paediatric patients.

MATERIALS AND METHODS: After obtaining ethical committee approval and parental informed written consent, 50 patients of ASA I-II, of age group 1-7 years scheduled for urogenital operations such as urethroplasty, herniotomy, orchidopexy were allocated randomly into two groups of 25 patients each. Group-B received 0.25% Bupivacaine 1ml/kg Group-R received 0.2% Ropivacaine 1ml/kg for caudal block Exclusion criteria: coagulopathies, local infection, skeletal deformities, h/o developmental delay, neurological diseases, allergy to local anaesthetics.

Patients fasted 4 hours and premedicated with oral Midazolam 0.5mg/kg 30 min before surgery. For all patients baseline pulse rate, blood pressure, respiratory rate were recorded. After applying all standard monitors an intravenous cannula was secured and Ringers Lactate solution started. Atropine 0.02mg/kg IV used as premedicant.

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After preoxygenation, General Anaesthesia was induced with Thiopentone sodium 5mg/kg IV. Endotracheal intubation was facilitated by administering Atracurium 0.5mg/kg IV After placing patient in left lateral position, under strict aseptic precautions 22G needle introduced in caudal epidural space. After confirming the space 1ml/kg of local anesthetic agent 0.25% Bupivacaine (Group-B) or 0.2% Ropivacaine (Group R) was given slowly. After deposition of drug in the epidural space, patients were placed in supine position and anaesthesia was maintained with 2% sevoflurane, 60% of nitrous oxide in oxygen and top up doses of atracurium. HR, BP, SPO₂ were recorded just before and after surgical incision and every 5min thereafter till the end of surgery. Residual neuromuscular blockade reversed with Neostigmine 50mcg/kg and patients transferred to postoperative ward after extubation. Using Face Legs Activity Cry Consolability (FLACC) pain scale with its 0-10 score range, each patient's pain intensity was assessed at the end of the surgery and then every 30min interval until the patient became fit to discharge from post-operative ward. If FLACC pain score was more than 4, rectal paracetamol 20 mg/kg was given. Motor block assessed on awakening using a 4 point Bromage scale. Observations were continued for 24 hours.

RESULTS:

VARIABLE	GROUP B	GROUP R	P value
AGE (IN YEARS)	3.72 ±1.56	3.70±1.66	0.96
WEIGHT(IN Kg)	12±2.64	12±2.77	1.0
GENDER M:F RATIO	23:02	23:02	1.0
DURATION OF ANESTHESIA IN MIN	35±17.76	31±10.61	0.3385
BASELINE HEART RATE (BEAT PER MIN)	106.8±8.1	104±8.3	>0.10
BASELINE MAP	72.9±5.7	75±4.6	>0.10

Table 1: Patient Characteristics and Clinical Parameters

Fig. 1

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The calculated p value is >0.10 , so this is statistically not significant. There were no differences between the two age groups in age, weight, gender, duration of anaesthesia, baseline blood pressure and heart rate.

HEART RATE	R GROUP	B GROUP	
	HR $\pm$ SD	HR $\pm$ SD	P VALUE
BASE LINE	104 $\pm$ 8.3	72.90 $\pm$ 8.1	>0.10
AFTER INCISION 5MIN	91 $\pm$ 7.7	97.7 $\pm$ 8.3	>0.05
10 MIN	91.3 $\pm$ 6.9	93.5 $\pm$ 6.8	>0.06
20 MIN	89 $\pm$ 6.48	91.2 $\pm$ 6.01	>0.07
30 MIN	88 $\pm$ 5.5	89.5 $\pm$ 5.45	>0.10
60 MIN	85 $\pm$ 5.3	86.5 $\pm$ 5.25	>0.06
90 MIN	82 $\pm$ 5.1	85 $\pm$ 5.1	>0.05

Table 2

Fig. 2

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MEAN ARTERIAL PRESSURE	R GROUP	B GROUP	
	MEAN $\pm$ SD	MEAN $\pm$ SD	P VALUE
BASE LINE	75 $\pm$ 4.6	72.9 $\pm$ 5.7	>0.10
AFTER INCISION 5MIN	70 $\pm$ 4.3	68.9 $\pm$ 4.6	>0.10
10 MIN	70 $\pm$ 4.9	68.1 $\pm$ 5.1	>0.07
20 MIN	71 $\pm$ 5.3	68.2 $\pm$ 5.5	>0.10
30 MIN	71 $\pm$ 5.8	68.2 $\pm$ 5.7	>0.10
60 MIN	70 $\pm$ 4.4	70 $\pm$ 4.7	>0.07
90 MIN	72 $\pm$ 5.9	68.8 $\pm$ 5.2	>0.10

Table 3

Fig. 3

The p value calculated by student 't' test. p value is >0.10, hence it is not statistically significant.

The preoperative, intraoperative and postoperative haemodynamic changes between the groups were comparable and were not statistically significant and therapeutic interventions were not required.

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POST OPERATIVE PAIN SCORING IN TWO GROUPS: FLACC SCORE (Face Legs Activity Cry Consolability Scale)

DURATION AFTER OPERATION	R GROUP		B GROUP		P value
	MEAN	SD	MEAN	SD	
0 hour	0	0	0	0	<0.0001
2 hour	1.4	0.49	1	1	<0.0001
4 hour	2.6	0.9	2.8	0.9	<0.0001
6 hour	3.9	1.5	4.4	1.3	<0.0001
8 hour	5.5	1.2	6	1.4	<0.0001

Table 4

Fig. 4

The calculated p value is <0.01 to 0.05. Hence it is significant.

The quality and duration of postoperative pain relief did not differ significantly between the two groups. Lack of analgesia was not found in any patients during surgery and there is no haemodynamic response to initial incision. Postoperative pain score was comparable in two groups in first five hours, but it is significantly less in Ropivacaine group.

Muscle Tone Muscle Power (Flexion)	Flaccid 0 Unable	Hypotonia 1 partial	Normal 2 Normal
Ankle	0	1	2
Knee	0	1	2
Thigh	0	1	2
Ability to stand	0	1	2

Table 5: Motor Power Scale

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	PONV	Respiratory Depression	Urinary Retention	Hypotension	Bradycardia
GROUP B	NIL	NIL	NIL	NIL	NIL
GROUP R	NIL	NIL	NIL	NIL	NIL

Table 6: Post-Operative Complications

DISCUSSION: Motor block resulting from caudal block is distressing to children and delays hospital discharge. Our results showed that a single shot caudal injection of Ropivacaine provides long lasting analgesia in paediatric patients following lower abdominal and perianal surgeries.^[1]

Ropivacaine was used as it causes less motor blockade than Bupivacaine. In this series, 1ml/kg of 0.2% Ropivacaine or 0.25% Bupivacaine was used for caudal analgesia. Ivani G et al.^[2] reported that 2mg/kg of 0.2% Ropivacaine is sufficient to obtain sensory block for lower abdominal or genital surgeries in children. Another reason of using 0.2% Ropivacaine is to avoid motor block in the post-operative period. Low concentrations and large volumes are the key to obtaining differential block in children because of the small diameter of A-delta and C fibres and small distance between the nodes of ranvier. Hence, 0.2% Ropivacaine was chosen for the study.

Pharmacokinetic studies of Ropivacaine showed that 1ml/kg of 0.2% of Ropivacaine by caudal block produces a maximal plasma concentration of 0.72+/-24mg/L, which is much lower than the maximal tolerated plasma concentration of Ropivacaine in adult volunteers (2.2+/-0.8mg/L).^[3] Habre et al.^[4] reported that maximal plasma concentration of Ropivacaine attained in 2 hours after caudal block which is much later than Bupivacaine (29+/-3.1) in children.

Manjushree Ray et al.^[5] reported that 0.75 ml/kg of 0.25% Ropivacaine (1.875 mg/kg) has provided excellent analgesia during surgery and post-operative period. Quality and duration of analgesia did not differ significantly between the two groups. Average duration of analgesia is 300 min in Bupivacaine group and 330 min in Ropivacaine group. Our study shows similar results. Ivani G et al.^[2] reported a significant difference in the duration of analgesia between the Bupivacaine group (253 min) and Ropivacaine group (520min). But other workers did not support this view and average duration was 5 hours for both the drugs.

All patients showed some motor weakness in both groups, immediately after surgery. But after 2 hours almost normal motor power was recorded in Ropivacaine group. Khaleel et al.^[6] also reported significant motor block initially which almost recovered to normal power within 3 hours in Ropivacaine group. Motor recovery was significantly slow in Bupivacaine group in this series. Complete sensory recovery was achieved in 90min in Ropivacaine group, but it took 120min in Bupivacaine group.

Da Conceicao MJ, Coelhoc: 1998.^[7] Caudal anesthesia with 0.375% Ropivacaine or 0.375% Bupivacaine in pediatric patients reported a significantly shorter duration of motor block with 0.375 % Ropivacaine as compared to 0.375 % of Bupivacaine.

P. A. Lonnqvist et al 2000.^[8] studied pharmacokinetics after caudal block of Ropivacaine (2mg/kg, 1ml/kg) in 20 children undergoing subumbilical surgery and concluded that Ropivacaine was well tolerated and provided satisfactory post-operative pain relief without observable motor block which also supports our study.

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CONCLUSION: Caudal Ropivacaine provides effective postoperative analgesia, similar to Bupivacaine but less motor blockade making it more suitable for day care surgery in paediatric patients.

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