Original Research Article

Caudal anaesthesia in paediatric patients: Comparison of analgesic efficacy between ropivacaine and bupivacaine

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Abstract

Background: In paediatric regional analgesia, caudal epidural technique is safe and commonly performed procedure for intra and postoperative analgesia especially for subumbilical surgeries. Bupivacaine has proved its efficacy in producing long lasting analgesia whereas Ropivacaine also provides similar type of pain relief and is less cardiotoxic than bupivacaine so good for caudal epidural analgesia. **Aim:** to compare an equal volume of bupivacaine and ropivacaine for caudal analgesia in paediatric patient undergoing subumbilic surgeries. **Material and Methods:** Sixty cases, in the age group of 2 to 10 years were randomly divided in to two equal groups, Group A (received 0.25% Ropivacaine -1 ml/kg body weight) and Group B (received 0.25% Bupivacaine -1 ml/kg body weight) via caudal route. Block was performed after induction of anaesthesia. **Results:** There were no significant differences between the two groups in base line parameters. Duration of analgesia for group A was hrs and 5.92 ±1.24 Hrs that for group B was 6.17 ± 1.1 hrs. There was no significant difference in duration of analgesia in two groups. **Conclusion:** Caudal Ropivacaine provides effective postoperative analgesia, similar to Bupivacaine in paediatric patients.
Key Words: Caudal anaesthesia, paediatric patients, analgesia, Ropivacaine, Bupivacaine.

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INTRODUCTION

Pain is an unpleasant emotional and sensory experience associated with actual or potential tissue damage. Pain has physical, physiologal and mental effect on individual post operatively. Pain is one of the most misunderstood, underdiagnosed and untreated medical problems particularly in children. A child's pain does not influence only the child, but also the family. The child's pain also increases stress in the family members. A child's ability to express or report pain is dependant on his/her physical and psychological developmental stage. One should never underestimate a child's report of pain, though a child may not be able to specify his/her feelings and pain experience.[1] It is challenging to assess pain through self-report with small children due to their lack of ability to communicate verbally. The scales may be too abstract for them. This is why in the assessment of pain in smaller children different face-scales have become generally used. Various multimodal technique for paediatric pain relief has been designed like systemic analgesia, peripheral nerve blocks, epidural analgesia and topical analgesia. In paediatric regional analgesia, caudal epidural technique is one of the most popular, reliable, safe and easy to administer and it is therefore the commonly performed procedure for intraoperative and postoperative analgesia especially for sub umbilical surgeries in young children. It provides excellent analgesia during surgery as well as in the postoperative period.[2] Bupivacaine has proved its efficacy in producing long lasting analgesia when administered in caudal epidural space.[3] Recently introduced amide local anaesthetic ropivacaine provide similar type of pain relief

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with less motor blockade.[4] Early report suggest that ropivacaine is less cardiotoxic than bupivacaine so good for caudal epidural analgesia. The aim of this study was to compare an equal volume of bupivacaine and ropivacaine for caudal analgesia in paediatric patient undergoing subumbilic surgeries.

MATERIAL AND METHODS

After approval of institutional ethical committee, a written informed parental or guardian consent was obtained in vernacular language in each case. Sixty cases, in the age group of 2 to 10 years were studied. They were randomly divided in to two equal groups, Group A and Group B.

Group A: Received 0.25% Ropivacaine – 1 ml/kg body weight.

Group B: Received 0.25% Bupivacaine – 1 ml/kg body weight.

Total volume for caudal block being 1 ml/kg in both groups, with maximum of drug volume of 20 cc.[5]

Selection of Cases: Patients under the study will undergo thorough pre anaesthetic evaluation including detailed history, clinical examination and necessary investigations depending on age, sex, disease of the patient.

Inclusion Criteria

1. Patients posted for elective subumbilicalsurgeries
2. Age 2 to 10 yrs of either sex
3. ASA grade I and II

Exclusion Criteria

1. ASA grade III and IV
2. Any abnormality of spine
3. Infection at caudal region
4. History of allergy to local anaesthetic
5. Coagulopathy or Anticoagulation
6. Active disease of CNS.

Technique of Caudal Block: After gaining an IV access, all the monitors were applied. Patients were premedicated with inj. Midazolam 0.03 mg/kg, inj. Glycopyrrolate 0.04 mg/kg and sedated with inj. Ketamine 1 mg/kg i.v. oxygenation was maintained by face mask with spontaneous ventilation on Jackson Rees modification of Ayer's T- piece. Lateral position was given with head in extended position. Painting and draping was done under all aseptic precautions. Sacral hiatus was palpated and cornua of sacrum was identified. Surface anaesthesia was given at sacral hiatus with inj. Lignocaine 2% 1cc. A 21G hypodermic needle was introduced at an angle of about 45° to the skin, aiming to penetrate the posterior sacrococcygeal ligament and to enter the sacral canal. Epidural space was identified by give way sensation and confirmed by loss of resistance to air technique. Once through the ligament, the needle hub was depressed so that the needle lies more parallel with the skin. The needle was then advanced 1-2 mm up the sacral canal before injection. Negative aspiration of blood and CSF was done to avoid inadvertent intrathecal or intravascular injection. Drug doses used were 1ml/kg, according to Armitage formula40,41 with maximum drug volume 20 cc. The total amount of drug was injected over 60 to 90 seconds. After completion of caudal block, patient was made supine with slight head up position. Patients was handed over to surgeons 20 min after performance of block. inj. Ketamine 1 mg/kg i.v. was supplemented whenever child would wake up. The total number of ketamine supplementations were noted. Inj. Ketamine 1 mg/kg was given whenever child moved lower limb. These cases were considered failure of caudal block and were not included in study. All observations and particulars of each patient were recorded and statistically analysed. Quality of analgesia was analyzed by Hannallah pain scale[6]. If score more than 4 rescue analgesic in the form of ketamine 0.5 mg/kg was given.

RESULTS

Total 60 patients in the age group of 2 to 10 years posted for subumbilical surgeries were randomly divided in two groups. Patients from group A received Injropivacaine 0.25% 1ml/kg and group B received Inj bupivacaine 0.25% 1ml/kg. Herniotomy was performed in 21 cases from Group A and in 16 cases from Group B. Circumcision was done in 6 and 10 cases from Group A and B respectively. Three and four cases from Group A and B underwent orchidopexy respectively. Both the groups were comparable as there was no statistical significant difference between two groups with respect to age, sex and weight (Table 1).

There was no significant change in pulse rate from baseline in any of the groups. The difference between both the groups is statistically insignificant. None of the patients from any of the group had significant bradycardia, so no patient required chronotropic support for bradycardia. None of the patients required ionotropic support for hypotension from any of the groups, as well (Table 2).

Table 3 shows the total duration of analgesia from the time of injection of drug. 11 (36.63 %) cases from group A had analgesia lasting for 4 to <6 hrs. 19 (63.27 %) cases from group A had analgesia lasting for 6 to <8 hrs. The average duration of analgesia for group A was 5.92 ±1.24 Hrs 11 (36.63 %) cases from group B had analgesia lasting for 4 to <6 hrs. Only 1 (3.3%) cases from group B had analgesia lasting for 8 to <10 hrs. The average duration of analgesia for group B was 6.17 ± 1.1 Hrs. Statistically the difference between two groups is not

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significant ($p > 0.05$), indicating that duration of analgesia was almost same in group A and group B.

The mean pain score was higher in group B as compared to group A at all stages postoperatively till 7 hrs. postoperative pain score was significantly less in group A as compared to group B after 4 hrs ($p < 0.005$). The requirement of ketamine supplementation was the same in both the groups after 4 hrs.

Two patients from group A and one patient from group B had vomiting in the postoperative period. While two patients from both group A and group B complained of failure to pass urine at 6 hrs. The difference between both the groups is statistically insignificant.

Table 1: Demographic Distribution

	Group A (Ropivacaine)	Group B (Bupivacaine)	p value	Significance
Mean age ± SD (years)	5.13 ±2.47	5.33 ±2.31	0.32	Not Significant
Male: Female Ratio	6.5:1	5:1	0.62	Not Significant
Weight ± SD (Kg)	13.23 ± 3.80	13.6 ± 3.83	0.71	Not Significant

Table 2: Intraoperative hemodynamic Changes

Time of Assessment of parameter	Group A (Ropivacaine)	Group B (Bupivacaine)	p value	Significance
Baseline				
HR	108.4 ± 10.4	108 ± 9.76	0.8813	NS
MAP	68.68 ± 3.39	69.33 ± 2.87	0.4327	NS
SPO2	98.6 ± 0.5	98.43 ± 0.5	0.2022	NS
Immediately after block				
HR	107.87 ± 10.36	107.33 ± 9.25	0.8344	NS
MAP	68.54 ± 3.01	69.23 ± 2.76	0.3666	NS
SPO2	98.57 ± 0.5	98.37 ± 0.61	0.1954	NS
5 mins				
HR	107.13 ± 8.67	106.4 ± 8.41	0.7426	NS
MAP	67.77 ± 3.45	68.84 ± 2.92	0.2092	NS
SPO2	98.53 ± 0.51	98.43 ± 0.57	0.4867	NS
15 mins				
HR	106.77 ± 8.59	105.8 ± 8.01	0.6616	NS
MAP	68.25 ± 3.15	68.66 ± 2.94	0.612	NS
SPO2	98.57 ± 0.5	98.47 ± 0.57	0.4805	NS
30 mins				
HR	106.67 ± 7.56	105.47 ± 7.03	0.5312	NS
MAP	68.51 ± 2.58	68.52 ± 2.50	0.9921	NS
SPO2	98.43 ± 0.63	98.53 ± 0.51	0.5119	NS
45 mins				
HR	105.8 ± 7.15	105.2 ± 6.34	0.7351	NS
MAP	68.68± 2.92	68.64 ± 2.75	0.9603	NS
SPO2	98.4 ± 0.56	98.47 ± 0.57	0.6401	NS
60 mins				
HR	105 ± 6.98	104.33 ± 5.9	0.698	NS
MAP	69.37 ± 2.79	69.92 ± 4.11	0.5508	NS
SPO2	98.47 ± 0.51	98.47 ± 0.51	1.00	NS

Table 3: Duration of Analgesia from Time of Block

Duration inHrs	Group A (Ropivacaine)	Group B (Bupivacaine)	p Value	Significance
2to<4Hrs	0	0	-	-
4 to <6 Hrs	11	11	-	-
6 to <8 Hrs	19	18	-	-
8 to <10Hrs	0	1	-	-
Average	5.92 ±1.24	6.17 ± 1.1	0.4213	NS

Table 4: Comparison of post-operative pain score

Time of Assessment	Group A (Ropivacaine)	Group B (Bupivacaine)	p Value	Significance
0	0	0	1	NS
1 hrs	0.27 ± 0.69	0.47 ± 0.86	0.3312	NS
2 hrs	2.07 ± 0.98	2.13 ± 0.9	0.8112	NS
3 hrs	3.87 ± 1.38	3.93 ± 1.23	0.8656	NS
4 hrs	4.67 ± 0.96	5.47 ± 0.9	0.0018	S
5 hrs	5.4 ± 0.93	6.13 ± 0.51	0.0005	S
6 hrs	6.47 ± 0.86	7.6 ± 0.81	0.0001	S
7 hrs	7.27 ± 0.98	7.93 ± 0.37	0.0013	S

(S= Significant; NS= Not significant)

DISCUSSION

Pain is a common human experience as a symptom frequently encountered in clinical practice. It is usually associated with actual or impending tissue damage. Pain is consistent and predominant complaint of most individuals following most surgical interventions. "Failure to relieve pain is morally and ethically unacceptable." Adequate pain relief could be considered as a basic human right. Postoperative pain is an acute pain and should be treated adequately to decrease morbidity and hospital stay. Post-operative analgesia provides not only pain relief but also inhibits trauma- induced nociceptive impulses so as to blunt autonomic reflexes. It allows the patients to breathe freely and ambulate early to enhance early restoration of function.[7] Common approaches to the treatment of postoperative pain following infra-umbilical surgeries like herniotomy, orchidopexy etc., in children includes the use of intravenousopioids, non-opioids, regional nerve block techniques, caudal block. Use of intravenous opioids in children is associated with side effects such as somnolence, emesis, and ileus. This can delay the return of normal activity and hospital discharge. Regional technique such as caudal block is free from such side effects and has proven effective in controlling postoperative pain following surgery. The main disadvantage of caudal blockade is the relatively short duration of postoperative analgesia, even with the use of relatively long acting local anaesthetic agents such as bupivacaine.[8] Ropivacaine has been extensively used for regional anaesthesia in adults and older children and has been used safely even in the younger age group as well for caudal epidural analgesia. The lower incidence of cardiovascular side effects and neurotoxicity as well as the ability to produce lesser motor blockade has made the ropivacaine a safer choice as compared to bupivacaine for caudal epidural anaesthesia especially for day care surgeries.[9,10] A higher concentration of ropivacaine 0.5% (0.75 ml/kg) is associated with a prolonged duration of analgesia as compared to 0.25% ropivacaine but at this level plasma levels are high and can cause early signs of toxicity in children along with an increased motor blockade.32 In the present study 0.25% ropivacaine in the dose of 1ml/kg and 0.25% bupivacaine 1ml/kg was used caudally and compared for the duration of analgesia and any adverse effects. Both the groups were homogenous with reference to age, sex, weight and duration of anesthesia and surgery. Mean age of patients in group A was 5.13±2.47 years whereas in group B mean age was 5.33±2.31 years. the difference in male female ratio between the groups was statistically insignificant (p> 0.05). Mean weight of patients in group A was 13.23±3.80 kg while mean weight of patients in group B was 13.6±3.83 kg. There was no significant change in pulse rate from baseline in any of the groups intraoperatively and postoperatively. The difference between both the groups is statistically in significant. Eleven (36.63 %) cases from group A had analgesia lasting for 4- 5.99 hrs. nineteen (63.37 %) cases from group A had analgesia lasting for 6- 7.99 hrs. Statistically the difference between two groups is not significant (p>0.05), indicating that duration of analgesia in group A and group B Similar. Quality and duration of analgesia did not differ significantly between the two groups. Average duration of analgesia was 5.92 ±1.24 Hrs in ropivacaine group and 6.17±1.1 Hrs in bupivacaine group in this series. Ivani et al reported a significant difference in the duration of analgesia between the bupivacaine (253 min) and ropivacaine (520 min). But other workers did not support their view and average duration was 5 hours for both the drugs.[11] In our study, the quality of analgesia post-operatively was assessed by using Hannallah Pain Scale at 1 hour intervals while in the recovery room and thereafter 1 hourly for 7 hours. Postoperative pain score was comparable in two groups in the first 4 hours but it was significantly less in ropivacaine group after 4 hours (p <0.05). Ray M et al observed less post operative pain score in ropivacaine group after 5 hours in their study between the two groups to receive either 0.25% bupivacaine or 0.25% ropivacaine via caudal block. These results correlate well with our findings.[12]Lonnquist PA *et al* 2000 also observed in their study that caudal block with ropivacaine 2 mg/kg in children aged 1-8 year results in plasma concentration of unbound ropivacaine

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well below toxic concentration in adults.[13] The dose studied was associated with adequate post-operative analgesia. Breschann C *et al* observed in their study that only one child in ropivacaine group had sign of pain 2 hour after surgery in children undergoing inguinal hernia repair via caudal block either 0.25% bupivacaine or 0.2% ropivacaine.[14] The quality of analgesia post-operatively was assessed by using Hannallah Pain Scale at 1 hour intervals while in the recovery room and thereafter hourly for 7 hours. Postoperative pain score was comparable in two groups in the first 4 hours but it was significantly less in ropivacaine group after 4 hours ($p < 0.05$). In conclusion, caudal ropivacaine provides effective postoperative analgesia, similar to bupivacaine in paediatric patients.

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