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Evaluation of Caudal Epidural With Bupivacaine 0.2θ% Versus Ropivacaine 0.2% For Post Operative Pain Relief In Paediatric Lower Abdominal Surgeries

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Abstract: *Postoperative pain in paediatric population is challenging. Regional anaesthesia techniques provide a good postoperative pain relief with minimal adverse outcomes. Bupivacaine has been extensively used for paediatric caudal analgesia. Ropivacaine, an s-enantiomer has less cardiovascular and neurological toxicity and less motor block when compared to* ***B****upivacaine, which makes it more suitable for intraoperative and post operative pain relief in paediatric population.*

Aim of the study*: To evaluate the analgesic effects of caudal Bupivacaine (0.2%) versus Ropivacaine(0.2 %) for Intraoperative and Post operative pain relief in paediatric age group for patients posted for infra umbilical surgeries.*

Materials and Methods*: The study included 50 children of 0 - 5 years of age, of both genders posted for infra umbilical surgical procedures. The patients were randomly allocated into 2 groups, Group B Inj Bupivacaine 0.2% (1ml/kg) and Group R Inj Ropivacaine 0.2% (1ml/kg). The peri operative hemodynamics and post operative pain scores were monitored.*

Results: *Both groups provided good intra and postoperative analgesia. Post operative pain scores were similar in both the groups in the first four hours. Pain scores were significantly less in Group R after the initial 4 hours. FLACC scores at 7hrs was 4.4 ±1.3 for Ropivacine group where as it was for 7.2±1 for Bupivacine group. Time for first rescue analgesic for Group R (380 ± 90min) was significantly longer than the Bupivacaine Group (270 ± 60min). The intraoperative and post operative haemodynamic changes between the two groups were comparable and were not statistically significant. Regression of motor block was early in Ropivacaine Group (120 ± 30min) than Bupivacaine group (216 ± 30 min). Neither of the two* ***groups*** *had any significant post operative complications.*

Conclusions: *Caudal epidural analgesia can be safely given in paediatric age group for infraumbilical surgeries with high success rate, less complications and offer good intra and post operative analgesia. The analgesic effect of Bupivacaine and Ropivacaine is comparable in the intraoperative and first 4hrs of post operative period. Duration of analgesia was more and motor block was less with* ***Ropivacaine*** *when compared to* ***Bupivacaine.***

Keywords: *Caudal epidural, Paediatric patients, Post-operative analgesia.*

I. Introduction

Pain is an unpleasant subjective sensation. Post operative pain is not only unpleasant but is associated with undesired adverse sympathetic stimulation and its consequences. The concept of post operative pain relief and its utilization in pediatric age group has improved dramatically over the recent years. The regional analgesia techniques significantly decrease post operative pain and systemic analgesic requirements. Caudal analgesia is one of the simplest and safest techniques in pediatric anesthesia with a high success rate.[1] Epidural space in children favors rapid longitudinal spread of drug and makes it effective in treating postoperative pain. Caudal analgesia is usually given after the induction as an adjunct to general anesthesia in pediatric infra umbilical surgeries. It provides intraopertaive analgesia, can decrease the requirement of inhaled anesthetics, attenuate the stress response to surgery, facilitates a rapid, smooth recovery and provides good post operative analgesia.

Bupivacaine provides reliable and long lasting post operative analgesia, but has more motor block and is more cardiotoxic. [2] Ropivacaine as compared to Bupivacaine has lesser cardiotoxicity[3] and motor blockade.[4] Ropivacaine may be a better local anaesthetic agent for caudal epidural analgesia in paediatric age group.[5,6] In the present study we evaluated the analgesic effects of caudal Bupivacaine (0.2%) versus Ropivacaine (0.2%) for Intra operative and post operative pain relief in pediatric age group for patients posted for infra umbilical surgeries.

II. Material and Methods

This is a Prospective Randomized study conducted on 50 children of both genders posted for elective infra umbilical surgical procedures. The study included the children in the age group of 1 – 5 yrs of both genders posted for infra umbilical surgical procedures. Patients with known contraindications for regional anesthesia such as coagulation derangements, infection at the site of caudal block, history of developmental delays or neurological diseases, those with documented allergy to local anesthetics or skeletal abnormalities in the caudal region were excluded from the study. The study population **was** divided into 2 Groups: Group B, which includes the Patients receiving 0.2% Bupivacaine 1ml /kg body weight and Group R which includes the Patients receiving 0.2% Ropivacaine 1ml/kg body weight.

III. Procedure in Detail

The procedure included a thorough preoperative evaluation including history, physical examination, systemic examination, airway assessment and examination of spine. Base line vital parameters **were** noted. Relevant laboratory investigations were done in all the patients. Informed consent was obtained from the parents or guardians as applicable. Pre operative Fasting of 6hrs for Solid foods, 4hrs for breast milk and 2hrs for clear fluids was ensured. All the patients were pre medicated with syrup Midazolam 0.25mg/kg., 30 minutes before induction. Premedication on table included Glycopyrrolate 40ug/kg body weight and Fentanyl 1ug/kg. Intraoperative monitoring included SPO_2 with pulse oxymeter, ECG for rate and rhythm and blood pressure recording with paediatric NIBP cuff at regular intervals of 5minutes throughout the procedure. Baseline Heart rate and Mean Arterial Pressures noted 5minutes after premedication. Endotracheal intubation was facilitated by inducing with Inj Thiopentone sodium 5mg/Kg and administering Atracurium 0.5mg/Kg intravenously. Intubation was done with appropriate size uncuffed endotracheal tube. ETT was secured after confirming bilateral air entry. After securing the ETT patients were placed in Left lateral position. Under aseptic conditions caudal epidural space was identified by introducing a short beveled 22G needle. After confirming the space patients of Group B received 0.2% of Bupivacaine 1ml/kg bodyweight, where as Group R received 0.2% of Ropivacaine 1ml /kg body weight. Once the caudal is given, patients were placed in supine position and anesthesia was maintained by 0.5% Sevoflurane, 50% Oxygen and 50% Nitrous oxide and intermittent doses of atracurium as required. Heart rate and MAP were noted at the time of surgical incision. A raise in HR or an increase in MAP >15%, at the time of incision or 15minutes after the administration of local anaesthetic is considered failed block. Patients with failed or inadequate block were excluded from the study. Intraoperatve fluid was managed with Ringers lactate. At the end of the surgery residual neuromuscular blockade was reversed with combination of glycopyrrolate and neostigmine. Patients were transferred to post operative ward after complete recovery from neuromuscular blockade

Assessment in postoperative ward

In the post operative ward Pain and sedation were monitored along with vitals like HR, and MAP. Post operative pain was assessed using FLACC pain scale with 0-10 score range (Table 1). The intensity of pain was assessed at the end of surgery and then every **60min** interval for 8hrs.If FLACC score is more than 4, rescue dose of paracetamol 20mg/Kg was administered. Motor block was assessed on awakening by using a modified Bromage scale that consists of 4 points: 0 = full motor strength (flexion of knees and feet), 1 = flexion of knees, 2 = little movement of feet only, 3 = no movement of knees or feet. In children who are not responding to commands, intensity of motor block was assessed by noting the spontaneous flexion of legs or flexion to stimulus. All the patients were monitored for 24hrs post operative period for any adverse effects.

IV. Statistical Analysis

Statistical Analysis was done using Statistical Package for Social Sciences (SPSS) software. Data was expressed as mean and standard deviation. Data were compared using student t-test and chi-square test. P value <0.05 was considered statistically significant.

Table 1: FLACC Scale for Pain assessment [7, 8]

CATEGORIES	SCORING		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown; withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly normal position moves easily	Squirming shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs; frequent

			complaints
Consolability	Content, relaxed,	Reassured by occasional touching, hugging or being talked to; distractable	Difficult to console or comfort

How to Use the FLACC
In patients who are awake: observe for 1 to 5 minutes or longer. Observe legs and body uncovered. Reposition patient or observe activity. Assess body for tenseness and tone. Initiate consoling interventions if needed.
In patients who are asleep: observe for 5 minutes or longer. Observe body and legs uncovered. If possible, reposition the patient. Touch the body and assess for tenseness and tone.
Face
➢Score 0 if the patient has a relaxed face, makes eye contact, shows interest in surroundings.
➢Score 1 if the patient has a worried facial expression, with eyebrows lowered, eyes partially closed, cheeks raised, mouth pursed.
FLACC Behavioral Pain Assessment Scale
➢Score 2 if the patient has deep furrows in the forehead, closed eyes, an open mouth, deep lines around nose and lips.
Legs
➢Score 0 if the muscle tone and motion in the limbs are normal.
➢Score 1 if patient has increased tone, rigidity, or tension; if there is intermittent flexion or extension of the limbs.
➢Score 2 if patient has hypertonicity, the legs are pulled tight, there is exaggerated flexion or extension of the limbs, tremors.
Activity
➢Score 0 if the patient moves easily and freely, normal activity or restrictions.
➢Score 1 if the patient shifts positions, appears hesitant to move, demonstrates guarding, a tense torso, pressure on a body part.
➢Score 2 if the patient is in a fixed position, rocking; demonstrates side-to-side head movement or rubbing of a body part.
Cry
➢Score 0 if the patient has no cry or moan, awake or asleep.
➢Score 1 if the patient has occasional moans, cries, whimpers, sighs.
➢Score 2 if the patient has frequent or continuous moans, cries, grunts.
Consolability
➢Score 0 if the patient is calm and does not require consoling.
➢Score 1 if the patient responds to comfort by touching or talking in 30 seconds to 1 minute.
➢Score 2 if the patient requires constant comforting or is inconsolable.
Whenever feasible, behavioral measurement of pain should be used in conjunction with self-report. When self-report is not possible, interpretation of pain behaviours and decisions regarding treatment of pain require careful consideration of the context in which the pain behaviors are observed.
Interpreting the Behavioral Score
Each category is scored on the 0–2 scale, which results in a total score of 0–10.
0 _ Relaxed and comfortable **4–6** _ Moderate pain
1–3 _ Mild discomfort **7–10** _ Severe discomfort or pain or both

V. Observations and Results

The study included 50 patients posted for various infra umbilical surgeries. The type of surgeries included Inguinal hernia repair, Orchedopexy, Vesical calculus, Colostomies, Iliostomies, ovarian cystectomy etc (Table 2). The 50 subjects were divided into 2 groups of 25 each.
Group B: Received 0.20% Bupivacaine 1ml/kg body weight
Group R: Received 0.20% Ropivacaine 1ml/kg body weight

The demographic characters of both the groups were comparable (Table 3). The pre operative, intraoperative and post operative hemodynamic changes between the groups were comparable. No significant derangements in the hemodynamic parameters noted in either group and therapeutic interventions were not required. The p value as calculated by student t test was >0.01upto the first 60minutes, hence not statistically significant. There was a **statistically** significant **difference** in the pulse rate after 60minutes, may be due to more analgesic effect of Ropivacaine than Bupivacaine (Table 4).

The postoperative pain scores were evaluated by FLACC Scale for Pain assessment. The post operative pain scores were comparable in the first four hours with scores < 3 in both the groups. FLACC scores at 7hrs was 4.4 ±1.3 for Ropivacine group where as it was for 7.2±1 for Bupivacine group. The bupivacaine analgesia was the earliest to terminate. Higher pain scores were noted in Group B than in Group R, four hours after surgery which was statistically significant with the p values of < 0.05. Time taken for regression of motor blockade was more in Bupivacaine group (216 ± 30 min) than in Ropivacaine Group (120 ± 30min). The time for the first dose of rescue analgesic was 270 ± 60min in Group B as against 380 ± 90min in Group R. It was noted that Group R showed early regression of motor block, but prolonged analgesia. The calculated p value was < 0.05. Hence it was statistically significant (Table 5). None of the patients in either group had any notable post operative complications (Table 6).

Table 2: Nature of Procedures

S.No	Name of the Surgery	Group B	Group R
1	Ingunal Henia Repair	08	10
2	Colostomy	08	06

3	Iliostomy	05	04
4	Orchidopexy	03	03
5	Vescical Calculus	-	01
6	Ovarian cystectomy	01	01

Table 3: Demographic characteristics and Clinical Parameters

Variable	Group B	Group R	P Value
Age in years	3.72 ± 1.56	3.74 ± 1.65	0.78
Weight in Kgs	12 ± 2.8	12 ± 2.6	0.71
Gender M:F Ratio	2.2:1	2.03 :1	
Duration of Surgery in minutes	45.42 ± 10.8	46.22 ± 10.6	0.92
Baseline Heart Rate in minutes	106.76 ± 8.1	103.6 ± 8.3	0.90
Base line MAP	72.87 ± 5.78	74.64 ± 4.57	0.25

Table 4: Hemodynamic changes during surgery and post operative period

	Group B		Group R		P Value		Statistical significance
Mean Values	HR	MAP	HR	MAP	HR	MAP	
Base Line	133.96± 18.14	78.2± 5.3	137.59± 22.33	76.80± 5.9	0.31	0.38	NS
5minute after incision	125±8.3	75±4.6	120.8± 8.1	72.90 ± 5.7	0.90	0.15	NS
10 min	111.3±7.7	70±4.9	107.7±8.3	70.9±5.5	0.71	0.54	NS
20 min	109.22±8.22	71±5.3	107.42±6.92	69.1±5.7	0.4	0.22	NS
30min	90.0±6.48	71±5.8	91.2±6.01	70.2±5.7	0.71	0.62	NS
60 min	98.2±6.9	70±6.0	93.5±6.8	70±6.3	**0.01**	0.81	NS for MAP.
90 min	92.3±5.3	72±5.9	86.5±5.7	69.1±6.0	**0.0005**	0.09	NS for MAP
120 min	95.18±5.5	70.14±6.68	89.5±5.45	68.24±6.21	**0.0006**	**0.00001**	Statistically significant

Table 5: Post operative Pain Scores in two groups: FLACC Score

Duration after surgery	FLACC Score		
	Group B	Group R	P Value
2hours	<3.0	<3.0	
4 hours	4.0±0	3.0±0	1
5 hours	4.7±1	2.8±0.9	< **0.0001**
7 hours	7.2±1	4.4±1.3	< **0.0001**
Time taken for regression of motor blockade (in minutes)	216 ± 30	120 ± 30	< **0.0001**
Time for the first dose of rescue analgesic (in minutes)	270 ± 60	380 ± 90	< **0.0001**
P value <0.05, hence statistically significant.			

Table 6: Post Operative Events

	Group B	Group R
Nausea/vomiting	1	2
Respiratory depression	0	0
Bradycardia	0	0
Hypotension	0	0
Convulsions	0	0
Post operative sedation	0	0
Shivering	1	0

VI. Discussion

Caudal Analgesia in pediatric age group provides good perioperative analgesia and is much popular as an efficient means of providing post operative pain relief. The present study included 50 pediatric patients aged between 1 – 5 yrs posted for lower abdominal surgeries.

Bupivacaine and Ropivacaine are most common local anesthetic agents used for pediatric caudal analgesia.

Ropivacaine is less cardiotoxic and there is a greater separation of sensory and motor effects than with bupivacaine [9]. Therefore, Ropivacaine is increasingly used for caudal blocks in children. It has been reported that Ropivacaine causes vasoconstriction in contrast to vasodilation produced by bupivacaine [10]. A 2 mgkg-1 of 0.2% Ropivacaine provided excellent analgesia during surgery with satisfactory postoperative pain relief with

less motor block than higher concentrations [11, 12]. In the present study we compared the analgesic effects of Bupivacaine and Ropivacaine for **paediatric** caudals.

The duration of analgesia was significantly prolonged in **Ropivacaine** group (380 ± 90min) as compared to **Bupivacaine** group (270 ± 60) in our study. The results were similar to the study by Ivani et al who reported the duration of analgesia of 253 min with bupivacaine and 520 min with ropivacaine **[12]**. Chipde et al has found the duration of analgesia similar in both the groups but motor regression was earlier with ropivacaine group [13]. The regression of motor block in our study was earlier with Ropivacaine (120± 30min) than Bupivacaine group (216 ± 30). In a recent study Ropivacaine with Fentanyl was found to be better combination for pediatric surgeries for below umbilical surgeries [14]. Several studies have given emphasis to the fact that caudal **Ropivacaine** provides effective postoperative analgesia, similar to bupivacaine in paediatric patients along with the advantage of less motor blockade with Ropivacaine [15, 16, 17].

VII. Conclusion:

In our study we found prolonged duration of analgesia (as evidenced by lesser FLACC scores), lesser motor block and longer time for rescue analgesic in **Ropivacaine** group as compared to Bupivacaine group. We conclude that caudal Ropivacaine 0.2% 1ml/kg provides effective post-operative analgesia, with less motor blockade in pediatric patients posted for lower abdominal surgeries.

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