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Post-Operative Analgesia in Children: A Comparison between Caudal Bupivacaine with Buprenorphine and Caudal Bupivacaine with Rectal Diclofenac

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Abstract

Background: *Relief of post-operative pain is provided traditionally by single drug regimens but combinations of different regimens have been suggested to be more rational and effective. Rectal administration of NSAIDs in children is a safe and convenient route of drug absorption. The present study was designed to compare the efficacy and safety of caudal bupivacaine (0.125%) either with buprenorphine (4µg/ml) or with rectal diclofenac suppository (2.5 mg/kg).*

Material & Methods: *The present study was carried out on 50 children in the Department of Anaesthesiology and critical care at the attached group of hospitals, Dr. S.N. Medical college, Jodhpur. The randomly selected children belonging to either sex were allocated to two groups, each group consisted of 25 children. Routine monitoring of every child included precordial stethoscope, ECG, NIBP, SpO2 through pulse oxymeter and temperature. After surgery the children were transferred to recovery ward and were observed up to 1 hour and then in post-operative ward at 1, 4, 6, 12, 24 hours.*

Results: *Our study showed that the mean age of patients in group A was 4.78±2.446 yrs and group B was 5.240±2.521 yrs, it was not statistically significant (P>0.05) and mean values of weight and duration of surgery were also not statistically significant (P>0.05 respectively). At 6 hours of observation one patient in group A and 2 patients in group B demanded for rescue analgesia. At 12 hours of observation 4 patients from both groups demanded for rescue analgesia.*

Conclusion: *We concluded that caudal bupivacaine 0.125% in a dose of 1 ml/kg with rectal diclofenac Na suppository in a dose of 2.5 mg/kg just after induction of anaesthesia provides equivalent analgesia up to 24 hour in postoperative period with minimum side effects and lesser incidences of nausea and vomiting, sedation, time taken to void urine, in comparison to caudal bupivacaine in the same dose along with buprenorphine.*

Keywords: *Post-operative pain, Caudal anaesthesia, Buprenorphine, Bupivacaine, Rectal diclofenac Na.*

Introduction

The perception of pain in children is now no more a myth but a real fact and the detrimental effects associated with post-operative pain in the form of physical, physiological, social, emotional and psychological changes have been appreciated more authentically, so various routes, methods, drugs and technique have been adopted to minimize or alleviated post-operative pain.

Caudal anaesthesia has become increasingly wide spread in paediatric surgery in recent years especially for operations below the umbilicus as it is simple, safe and effective. Since the first paediatric report in 1933[1], several studies have described the indication for paediatric caudal block, the level of analgesia, recommended doses and pharmacokinetics of local anaesthetics used in caudal anaesthesia, general or specific advantages and disadvantages of the technique.

Because of long duration of action, bupivacaine the local anaesthetic agent is used most commonly for caudal epidural blockade. A simple working rule is in children less than 6 months of age 1ml/kg of bupivacaine 0.125% will block low thoracic dermatomes. In children above this age and below 20 kg wt 1 ml/kg of bupivacaine 0.25% will consistently block inguinal dermatomes, while above this weight the technique becomes inconsistent at blocking inguinal dermatomes. Pharmacokinetic data from several studies show that single epidural doses of 2.0-2.5 mg/kg of bupivacaine are associated with low plasma level of bupivacaine. However, few studies indicate that caudal block may results into more extensive block than is necessary.[2] caudal block may relieve early post-operative pain, but in the later period systemic analgesia was shown to be superior.

Relief of post-operative pain is provided traditionally by single drug regimens but combinations of different regimens have been suggested to be more rational and effective.[3] The argument for the use of a combination of analgesics is that drugs acting by different mechanisms results in additive or synergistic analgesia.[4] Opioids act on specific opioid receptors in the CNS to attenuate the pain related signals, while NSAIDS act mainly at the periphery to inhibit the initiation of pain signals interfering with prostaglandin synthesis after tissue injury.

Rectal administration of NSAIDs in children is a safe and convenient route of drug absorption and diclofenac is available commercially in a paediatric suppository formulation. Diclofenac is completely absorbed after rectal administration and the sustained action of the drug may provide analgesia in the early and late post-operative phases, whilst the respiratory depressant effects of conventional opioid analgesia are avoided.

Buprenorphine has five times greater lipid solubility than morphine. When given epidurally, it has a 50 times higher affinity for μ opioid receptors in the dorsal horn of the spinal cord than morphine[5]. This should also extend its duration of action and has been confirmed clinically[6].

Caudal block using bupivacaine plus buprenorphine has reported as providing very effective, prolonged analgesia with few side effects in children after genitor-urinary surgery without any occurrence of late respiratory depression.[7] Several earlier clinical studies also reported a lack of late respiratory depression after epidural buprenorphine[6,8], even in high doses[9].

Since, the literature is silent and scarce on the issue of comparison of opiates and NSAIDS along with caudal bupivacaine, the present study was designed to compare the efficacy and safety of caudal bupivacaine (0.125%) either with buprenorphine (4μg/ml) or with rectal diclofenac suppository (2.5 mg/kg).

Material & Methods

The present study was carried out on 50 children in the Department of Anaesthesiology and critical care at the attached group of hospitals, Dr. S.N. Medical College, Jodhpur.

The randomly selected children belonging to either sex were allocated to two groups, each group consisted of 25 children, as follow:-

1. Group A (25 patients)- The children received caudal bupivacaine 0.125% and buprenorphine 4µg/ml in a dose of 1 ml/kg upto a maximum of 30 ml, just after induction of general anaesthesia.
2. Group B (25 patients)- The children received caudal bupivacaine 0.125% in a dose of 1 ml/kg upto a maximum of 30 ml and rectal diclofenac suppository in a dose of 2.5 mg/kg just after induction of general anaesthesia.

Inclusion criteria

1. Age, varied from 1-10 years.
2. The children presented for surgery such as herniotomy, orchidopexy and urethroplasty.
3. The children belonging to ASA grade II and I.
4. After getting approval from ethical committee.
5. After getting written and informed parent consent.

Exclusion criteria:

1. The children who had history of allergy or sensitivity to bupivacaine and diclofenac.
2. Any contraindication to caudal injection i.e. infection at the site, bleeding disorder, caudal vertebral anomalies etc.

Besides the complete examination of children, the either of parents was also interviewed to establish a close rapport with him or her and all the details of anaesthetic procedure and the technique to be adopted for post-operative pain relief with advantages and disadvantages associated with the technique were explained to them and a written and informed consent was taken.

Routine monitoring of every child included precordial stethoscope, ECG, NIBP, SpO2 through pulse oxymeter and temperature.

After surgery the children were transferred to recovery ward and were observed up to 1 hour and then in post-operative ward at 1, 4, 6, 12, 24 hours.

Results

Our study showed that the mean age of patients in group A was 4.78±2.446 yrs and group B was 5.240±2.521 yrs, it was not statistically significant (P>0.05) and mean values of weight and duration of surgery were also not statistically significant (P>0.05 respectively) (table 1).

The mean values of pulse rate & respiratory rate pre-operatively were 103.2±5.03, 18.20±1.71 respectively in group A & 102.96±5.6, 17.68±1.68 respectively in group B, but were not statistically significant and mean values of pulse rate & respiratory rate slightly increased post-operatively in both groups but were not statistically significant (P>0.05 respectively) (table 2).

The pain scores were statistically comparable with no difference at all time of observation between two groups (table 3). Most of the children in group A were more drowsy (grade-2) as compared to group B. After 12 hours of observation degree of sedation between the two groups was found to be statistically significant (P<0.05) (table 4).

Demeanour score was comparable between two groups during all the time of observation. The observation was statistically insignificant between two groups (table 5). After 6 hours of observation, all the children had full motor recovery and there was no statistical significant difference between the two groups (table 6).

At 6 hours of observation one patient in group A and 2 patients in group B demanded for rescue analgesia. At 12 hours of observation 4 patients from both groups demanded for rescue analgesia (table 7).

Table 1: Demographic profile of patients

Demographic	Group A	Group B	P-value
Age (Yrs) (Mean ±SD)	4.78±2.446	5.240±2.521	>0.05
Weight (kg) (Mean ±SD)	14.76±4.35	16.12±6.29	>0.05
Duration of Surgery (min.)	44.88±13.14	44.52±13.27	>0.05

Table 2: Mean value of pulse rate & respiratory rate in both groups

	Pre-operative		P-value	Post-operative		P-value
	Group A	Group B		Group A	Group B	
Pulse rate (Beats/min.)	103.2±5.03	102.96±5.6	>0.05	113.92±7.31	117.20±8.74	>0.05
Respiratory rate (bpm)	18.20±1.71	17.68±1.68	>0.05	20.76±1.81	20.24±1.92	>0.05

Table 3: Pain Score

	Groups	Pain Score				X^2	P-value
		0	1	2	3		
1 hr. post-op.	A	21 (84%)	4 (16%)	0	0	0.135	>0.05
	B	20 (80%)	5 (20%)	0	0		
4 hrs post-op.	A	23 (92%)	2 (8%)	0	0	0.222	>0.05
	B	22 (88%)	3 (12%)	0	0		
6 hrs post-op.	A	22 (88%)	3 (12%)	0	0	0.166	>0.05
	B	21 (84%)	4 (16%)	0	0		
12 hrs post-op.	A	20 (80%)	4 (16%)	1 (4%)	0	0.136	>0.05
	B	19 (76%)	5 (20%)	1 (4%)	0		
24 hrs post-op.	A	21 (84%)	3 (12%)	1 (4%)	0	0.142	>0.05
	B	21 (84%)	4 (16%)	0	0		

Table 4: Sedation Score

	Groups	Degree of Sedation				X2	P-value
		0	1	2	3		
1 hr. post-op.	A	1 (4%)	9 (36%)	15 (60%)	0	1.342	>0.05
	B	1 (4%)	13 (52%)	11 (44%)	0		
4 hrs post-op.	A	0	9 (36%)	16 (64%)	0	6.983	>0.05
	B	1 (4%)	17 (68%)	7 (28%)	0		
6 hrs post-op.	A	0	11 (44%)	15 (56%)	0	5.333	>0.05
	B	0	19 (76%)	6 (24%)	0		
12 hrs post-op.	A	0	14 (56%)	11 (44%)	0	8.419	<0.05
	B	0	23 (92%)	2 (8%)	0		
24 hrs post-op.	A	1 (4%)	15 (60%)	9 (36%)	0	8.084	<0.05
	B	1 (4%)	23 (92%)	1 (4%)	0		

Table 5: Demeanour Score

	Groups	Demeanour Scores			X^2	P-value
		1	2	3		
1 hr. post-op.	A	22 (88%)	2 (8%)	1 (4%)	0.761	>0.05
	B	20 (80%)	4 (16%)	1 (4%)		
4 hrs post-op.	A	23 (92%)	2 (8%)	0	1.022	>0.05
	B	22 (88%)	2 (8%)	1 (4%)		
6 hrs post-op.	A	22 (88%)	3 (12%)	0	0	>0.05
	B	22 (88%)	3 (12%)	0		
12 hrs post-op.	A	23 (92%)	2 (8%)	0	0.222	>0.05
	B	22 (88%)	3 (12%)	0		
24 hrs post-op.	A	20 (80%)	4 (16%)	1 (4%)	0	>0.05
	B	20 (80%	4 (16%)	1 (4%)		

Table 6: Degree of Motor Blockade

	Groups	Bromage Scale				X^2	P-value
		0	1	2	3		
1 hr. post-op.	A	12 (48%)	7 (28%)	5 (20%)	1 (4%)	1.521	>0.05
	B	15 (60%)	6 (24%)	4 (16%)	0		
4 hrs post-op.	A	19 (76%)	5 (20%)	1 (4%)	0	1.322	>0.05
	B	21 (84%)	4 (16%)	0	0		
6 hrs post-op.	A	24 (96%)	1 (4%)	0	0	1.020	>0.05
	B	25 (100%)	0	0	0		
12 hrs post-op.	A	25 (100%)	0	0	0	0	>0.05
	B	25 (100%)	0	0	0		
24 hrs post-op.	A	25 (100%)	0	0	0	0	>0.05
	B	25 (100%)	0	0	0		

Table 7: Demand of Rescue Analgesia

Time (hrs.)	Group A	Group B
1 hrs	0	0
4 hrs	0	0
6 hrs	1 (4%)	2 (8%)
12 hrs	4 (20%)	4 (20%)
24 hrs	1 (4%)	0

Discussion

Caudal block with local anaesthetic agent with or without adrenaline has already gained a wide popularity to provide intra-operative analgesia with or without supplementation of GA, particularly below umbilical surgery as well as to provide adequate post-operative analgesia depending upon the drug used for caudal block.

McGown RG (1982)[10] found that caudal anaesthesia in children is a technically simple procedure with low failure rate of 2.8% in his series. Brandao and Marlete (1969)[11] also reported only 2.6% failure rate with caudal block. Thus, failure rate of 2% in the study coincided with the finding of above authors.

In our study, we induced the children either with intravenous pentothal or with gaseous inhalational agent prior to caudal block which allowed caudal block to be performed with more ease and intra-operative surgical conditions also remained satisfactory.

In the study the success rate of caudal administration was 98%, remaining 2% of the patients not included in the study were probably due to some anatomical variations of sacral canal, thus further confirmed the findings of previous authors. There was also better haemodynamic stability in intra-operative period similar to the study of McGown RG in 1982.[10]

We have opted injection bupivacaine as a local anaesthetic agent in concentration of 0.125% at a dose of 1 mg/kg. Bupivacaine 0.125% provided equipotent analgesia and significantly less motor blockade than 0.25% bupivacaine for caudal block. Our findings are supported by the study of Wolf AR et al (1988)[12].

We have also used burprenorphine caudal epidurally in a dose of 4µg/kg body weight, that is in accordance with Girotra S et al (1990)[7] and Anil Kumar TK et al (1994)[13].

Rectal diclofenac carries the advantage of the possible avoidance of 'first pass' effect (De Boer AG et al in 1982)[14] and thus reduces side effects seen with oral NSAIDs. The dose of rectal diclofenac (2.5 mg/kg) used in our study was based on the study conducted by Moores MA et al (1990)[15].

At all the specific time of observation, there was no statistical significant difference in pain scores upto 24 hours. After that we did not observe the patients. The mean duration of analgesia upto 24 hours have also been observed by Girotra S et al (1990)[7] & Anil Kumar TK et al (1994)[13] who have used caudal buprenorphine. Gadiyar V et al (1995)[16] & Moores MA et al (1990)[15] have also reported mean duration of analgesia upto 24 hours when used rectal diclofenac Na without caudal bupivacaine, but in the intial post-operative period (upto 2-3 hrs), the children appreciated pain.

Sedation was seen more in group A as compared to group B at all the time of observation. It is not always possible to distinguish sedation from analgesia in children, and the greater sedative effect of buprenorphine might be mistaken for analgesia in children who fall sleep. Girotra S et al (1990)[7] also found significant incidences of sedation with caudal buprenorphine.

Majority of children in both groups were cheerful & calm. Girotra S et al (1990)[7] found that all patients in caudal buprenorphine group were calm & cheerful at 8 hours after operation (<0.01), where as in caudal bupivacaine group only 60% of patients were calm & cheerful.

Conclusion

We concluded that caudal bupivacaine 0.125% in a dose of 1 ml/kg with rectal diclofenac Na suppository in a dose of 2.5 mg/kg just after induction of anaesthesia provides equivalent analgesia upto 24 hour in postoperative period with minimum side effects and lesser incidences of nausea and vomiting, sedation, time taken to void urine, in comparison to caudal bupivacaine in the same dose along with buprenorphine.

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