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Comparison Study of Caudal Bupivacaine versus Caudal Bupivacaine with Buprenorphine in Postoperative Paediatric Patients Posted for Inguinoscrotal Surgeries

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ABSTRACT

Background: Postoperative pain relief in children has always been very challenging. Various modalities have been tried to provide effective pain relief in paediatric population, caudal epidural being one of the most widely performed techniques. Various adjuncts have been added to local anaesthetics in caudal epidural to enhance its analgesic efficacy. The primary aim of this study was to compare the analgesic efficacy of caudal bupivacaine with caudal bupivacaine plus buprenorphine, the secondary aim being to study any associated side effects. **Materials and Methods:** 60 patients of ASA I and II physical status, aged 2-12 years posted for inguinoscrotal surgeries were randomly allocated into two groups of 30 each; group A patients received 1ml/kg of 0.125% bupivacaine while group B patients received 1ml/kg of bupivacaine with 4µg/kg with buprenorphine. Post-operative pain was assessed using Faces Pain Scale -Revised (FPS-R pain scale). At score ≥ 6 rescue analgesic intravenous paracetamol was given. Pain was assessed at 0,30,60 minutes and half hourly thereafter until 2 hours and hourly after that till 24 hrs following surgery. Post-operative sedation was assessed using Paediatric Analog Sedation Scale (PASS). Any side effects were also noted in both the groups. **Results:** The two groups were comparable with regards to demographic profile (i.e age and sex). The duration of surgery was also comparable in both the groups. However, the duration of analgesia was more in group B (9.833 ± .833 hrs) than in group A (4.866± .571 hrs) the difference being statistically significant. Number of rescue analgesics required was also more in group A (2.33± .479) than group B (1.16± .379), the difference again being statistically significant. More patients reported sedation in group B for prolonged duration albeit none showed a grade 3 or more sedation score. Nausea and vomiting and postoperative agitation were the only side effects reported, former reported more by group B patients and later by group A patient. **Conclusion:** The addition of buprenorphine to bupivacaine in caudal epidural significantly prolongs the duration of analgesia without producing any side effects.

Keywords: Caudal Epidural, Bupivacaine, Buprenorphine, Postoperative analgesia.

INTRODUCTION

Postoperative pain management in children has been revolutionized with the advent of newer and safer drugs and techniques. Effective pain relief is important not only in alleviating suffering but also in enhancing wound healing, improving functional residual capacities, better postoperative course in hospital, early discharge as well in reducing the number of readmissions.[1] Traditionally postoperative pain relief has been provided by single drug regimens but it has been documented that combination of different drug regimens provides more effective analgesia because of either additive or synergestic effects.[2,3] Although there are various modalities for effective perioperative pain management in children ranging from oral and parenteral medications to neuraxial techniques and regional nerve blocks, it has been observed that there is a wide discrepancy between available technology and clinical practice. Caudal epidural block is a popular procedure practiced around the world, along with general anesthesia for perioperative pain management in procedures involving abdominal surgery below the umbilicus, perennial, genitourinary, and lower limbs. Caudal epidural blocks with local anaesthetics decreases the doses of general anesthetics & also mitigates the stress responses to surgery. However, unwanted effects like vomiting, urinary retention, delayed mobilization, and rarely neurological deficits have been reported with the caudal epidural blocks. There are also some reported cases of systemic toxicity such as convulsions, hypotension, and arrhythmias. Various adjuvants have been added to local anaesthetic agents in caudal blocks to enhance the duration of intraoperative and postoperative

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analgesia. Buprenorphine is a highly lipid soluble drug and when given epidurally has 50 times higher affinity for mu (μ) opioid receptors in the dorsal horn of the spinal cord than morphine and hence in combination with bupivacaine augments the duration of analgesia without any delayed respiratory depression.4-7 However the literature is exiguous with regards to caudally administered buprenorphine in children, therefore the present study was designed to compare the efficacy of caudal block with bupivacaine and mixture of bupivacaine with buprenorphine for postoperative analgesia in children undergoing inguinoscrotal surgeries and also to study any associated side effects.

MATERIALS AND METHODS

After obtaining the approval of the Institutional Ethical Committee; and after informed consent from parents, 60 children under American Society of Anesthesiologists (ASA) Grade I and II, between 2-12 years of age undergoing elective inguinoscrotal surgeries eg. hernia, hydrocele, undescended testis, hypospadias was included in the present study. Patients in whom there was parent refusal or history of allergy to any drugs used in study, history suggestive of bleeding diathesis, infection at the site of caudal injection or caudal vertebral anomalies, presence of bilateral disease or patients coming in emergency for torsion testis or obstructed inguinal hernia were excluded from the study. Patients were randomly allocated into two groups of 30 each by drawing slips from a sealed envelope before induction of anaesthesia.

Group A (30 patients) - received caudal bupivacaine 0.125% in a dose of 1ml/kg upto a maximum of 20ml, just after induction of general anaesthesia.

Group B (30 patients) –The children received caudal bupivacaine 0.125% in a dose of 1ml/kg with 4μg/kg of buprenorphine upto a maximum of 20ml, just after induction of general anaesthesia.

Patients underwent a thorough preanaesthetic check-up prior to surgery. Solid foods were restricted for 8 hours, but clear fluids were allowed up to 2hours prior to surgery. A written informed consent was taken from the parents. An intravenous access was achieved after applying local anesthesia and all the children were premedicated with injection midazolam 0.02mg/kg and injection atropine 0.02 mg/kg. Children were brought to the operation room and preinduction monitors such as a precordial stethoscope, pulse oximeter, electrocardiogram, and noninvasive blood pressure (NIBP) were attached. Children were induced with injection propofol 2 mg/kg intravenous and appropriate size proseal Laryngeal Mask Airway (LMA) inserted. Anaesthesia was maintained with 40% oxygen, 60% nitrous oxide, and Propofol infusion at the rate of 4mg/kg/hr started and patients kept on spontaneous ventilation. The patients were then turned to lateral decubitus position with knee flexed.

Group A patients received caudal block with 1 ml/kg of bupivacaine 0.125% while Group B patients received caudal bupivacaine with buprenorphine 4μg/kg. Vital signs such as pulse rate, NIBP, respiratory rate, and oxygen saturation were monitored throughout. At the end of surgery, anaesthetic agents were discontinued, LMA extubated and 100% oxygen through face mask was administered for 3–5 min. The total duration of surgery was recorded for comparison. Once the vital signs were stable, the child was shifted to the recovery room and was placed in the recovery position. When fully awake and hemodynamically stable, children were transferred to the postoperative ward.

Postoperative pain was assessed using, Faces Pain Scale- Revised (FPS-R). Pain was assessed at 0, 30 min, 60 min, and half hourly thereafter for 2 hours and hourly after that until 24 hours following surgery. At the score ≥6 rescue analgesic intravenous paracetamol 15mg/kg was given. Time of requirement of first rescue analgesic was also noted as also the number of top ups of rescue analgesics in 24 hours. Sedation was also assessed in both the groups using Paediatric analog sedation score (PASS).[8] A score of 0 = no sedation, 1 = slightly sedated, 2 = moderately sedated, 3 = well sedated, and 4 = heavily sedated. Any side effects like nausea, vomiting, urinary retention, pruritis, respiratory depression etc were also noted.

RESULTS

Table 1: Demographic Profile of Patient

Demographic Profile	Group A	Group B	P-value
Age(Years)	4.7 ± 0 .3	5.2333 ± 0.3610	0.3319
Weight(kg)	17.1333 ± 0.699	19.400 ± 0.994	0.7303
Duration of surgery (min)	76.166 ± 2.20	74.3333 ± 1.8682	0.3834

TABLE 2: NATURE OF SURGERY

Nature Of Surgery	Number Of Patients	
	Group A	Group B
Orchidopexy	5	7
Uretheroplasty	9	10
Herniotomy	14	12
Hydrocelectomy	2	1

Table 3: Duration of Analgesia

Time in Hours	Group A	Group B	P-Value
Mean± SD	4.866 ± 0.571	9.833 ± 0.833	0.0000

Table 4: Number of Rescue Analgesics In 24 Hours

Number of Rescue Analgesic In 24 Hours	Group A	Group B	P-Value
Mean± SD	2.33 ± .479	1.16 ± .379	0.00000

Table 5: Paediatric Analog Sedation Scores (PASS)

Time	Groups	Sedation grade				
		0	1	2	3	4
I hr. post op	A	4 (13.3%)	10(33.3%)	16(53.3%)	0	0
	B	2 (6.6%)	8 (26.6%)	20 (66.6%)	0	0
4hrs. post op	A	10 (33.6%)	16 (53.3%)	4 (13.3%)	0	0
	B	8 (26.6%)	11 (36.6%)	11(36.6%)	0	0
6 hrs. postop	A	22 (73.3%)	8 (26.6%)	0	0	0
	B	8 (26.6%)	16 (53.3%)	4 (13.3%)	0	0
12hrs postop	A	25 (83.3%)	5 (1.6%)	0	0	0
	B	16 (53.3%)	12 (40%)	2 (6.6%)	0	0
24hrs postop	A	30 (100%)	0	0	0	0
	B	30 (100%)	0	0	0	0

Table6:Side Effects

Side-Effects	Group A	Group B
Nausea/ vomiting	2 (6.6%)	6 (20%)
Agitation	4 (13.3%)	1 (3.3%)

Mean age of patients in group A was 4.7 years and that in group B was 5.23 years [Table1]the difference being statistically insignificant (p> 0.05). Both the groups were also comparable with regards to weight and duration of surgery (p> 0.05). The commonly performed surgeries in both the groups were orchidopexy, herniotomy, uretheroplasty and hydrocelectomy in both the groups [Table 2]. The duration of analgesia [Table3] was more in group B (9.833± 0.833 hrs) than in group A (4.866± 0.571 hrs), the difference being statistically highly significant (P=0.0000). Also the number of rescue analgesic [Table4] in the form of intravenous paracetamol was more in group A (2.33± .479) than in group B (1.16± .379), the difference again being statistically highly significant (p<0.001).Sedation in both the groups was assessed using Paediatric Analog Sedation Scale (PASS) grades 0-4 [Table 5]. One hour postoperatively 13.3% patients in group A and 6.6% patients in group B showed grade 0 (no sedation) while 33.3% patients in group A and 26.6% patients in group B had grade 1 (slight sedation). 53.3 % in group A and 66.6% in group B had grade 2 (moderately sedated) sedation score.4 hours postoperatively 33.6% in group A and 26.6% in group B had grade 0, 53.3% in group A and 36.6% in group B had grade 2 while 13.3% in group A and 36.6% in group B had grade 2 sedation score. 6 hours postoperatively grade 0 sore was seen in 73.3% group A patients and 26.6% group B patients, grade 1 score of 26.6% in group A and 53.3% in group B patients while 13.3% patients in group B showed a score of grade 2. 12 hours postoperatively 83.3% patients in group A and 53.3% patients in group B showed grade 0, 1.6% patients in group A and 40% patients in group B showed grade 1 and 6.6% patients in group B showed grade 2 sedation. However 24 hours postoperatively all the patients in group A and group B were wide awake (Grade 0). None of the patients in either of the groups exhibited sedation score beyond grade 2. Commonly observed side effects were nausea vomiting (6.6% of group A and 20 % in group B), pruritis in 13.3% group B patients and agitation 13.3% in group A and 6.6% in group B [Table 6]. No serious side effects were noted.

DISCUSSION

Caudal epidural block has become ubiquitous in paediatric lower abdominal surgeries. When given in conjunction with general anaesthesia, caudal block not only has volatile anaesthetic agent and neuromuscular sparing action but it also provides intense intraoperative and postoperative analgesia.[9,10] Bupivacaine has been most commonly used local anaesthetic for caudal epidural blocks.[11] In our study we used 1ml/kg of 0.125% bupivacaine for caudal block. This is in concordance with Wolf AR et al and Malviva et al who concluded that bupivacaine 0.125% when compared with 0.25% bupivacaine provided an equipotent analgesia with significantly less motor block, a dose of 1ml/kg being more efficacious.[12,13]

The administration of opioids into the epidural space has been well archived in paediatric practice and contributes significantly to the augmentation of postoperative analgesia by local action on opioid receptors present on the substantia gelatinosa on the dorsal horn of the spinal cord. Buprenorphine is a potent partial agonist with 25-50 times more affinity than morphine for mu (μ) opioid receptors and when given in conjunction with bupivacaine enhances the duration of postoperative analgesia.[14] In our study mean duration of analgesia in group A comprising of 1ml/kg of caudal bupivacaine 0.125% was 4.866 ± 0.571 hours while that in group B comprising of 1ml/kg of caudal bupivacaine 0.125% with 4μg/kg of buprenorphine was 9.833 ± 0.833 hours the

difference being statistitically highly significant (p< 0.001). Also the patients in group A received significantly more number of rescue analgesics than group B (group A- 2.33 ± .479, group B 1.16 ± .379, p<0.001). Bupivacaine though a long acting local anaesthetic provides a duration of analgesia ranging from 4-6 hours depending upon volumes and concentrations used when given caudally.[15] In a study by Kaur et al duration of analgesia by caudal bupivacaine lasted from 3-7 hours, mean being 5.63 hours, however the concentration used by them was 0.25% bupivacaine.[16] The addition of buprenorphine as an adjuvant to caudal bupivacaine enhances the duration of analgesia.[14,17] In our study Buprenorphine 4µg/kg when given with 0.125% of bupivacaine provided mean duration of analgesia upto 9.83± 0.833 hours (9-10.6 hours). The results of our study are consistent with that of Girota et al who reported the duration of analgesia with caudal buprenorphine ranging from 10.8 hours to more than 24 hours.[18]Lanz et al also demonstrated a duration of analgesia of 12 hours with 0.3mg buprenorphine given caudally.[19]

Sedation in both the groups was assessed using pediatricanalog sedation scale (PASS). In group A 33.3% patients reported grade -1 (mild sedation) and 53.3% reported grade -2 (moderate sedation) in the first hour postoperatively. 4 hours postoperatively 53.3% patients showed grade-1 sedation score and 13.3% exhibited grade-2. Six hours postoperatively 53.3% showed grade 1 score and the remaining 46.7% were fully awake. 12 hours postoperatively only 1.6% patients had grade -1 score. All the patients were fully awake at 24 hrs postoperatively. The sedation in group A could be attributable to propofol infusion received intraoperatively.[20] In group B 66.6% patients had grade- 2 and 26.6% had grade -1 sedation score one hour postoperatively while 4 hours postoperatively 36.6% patients exhibited grade 1 and an equal percentage showed grade 2 scores. Also 6 hours postoperatively 13.3% patients in group B had grade 2 and 53.3% had grade 1 sedation score. 12 hours postoperatively 6.6% patients still had grade 2 scores while 40% showed grade 1 score. Prolonged duration of sedation could be explained on the basis of synergistic effects of caudally administered buprenorphine.[21] However none of the patients in our study showed grade -3 and beyond sedation score.

Postoperative nausea and vomiting was seen in 6.6% of patients of group A and 20% of patients in group B. Caudal epidural blocks are known to reduce the incidence of postoperative nausea and vomiting.[22] However a higher percentage of postoperative nausea and vomiting was observed in group B because of the concomitantly caudally administered buprenorphine with bupivacaine.[18,23,24]

4 patients in group A and 1 patient in group B showed agitation in recovery room which could be attributable to pain or early recovery. All the patients voided urine within 8 hours of surgery. No other side effects like pruritis or delayed respiratory depression were seen with the buprenorphine group.

CONCLUSION

Caudal bupivacaine 0.125% when given in combination with 4µg/kg of buprenorphine provides an effective and prolonged postoperative analgesia in paediatric patients undergoing inguinoscrotal surgeries. Buprenorphine is a safe drug with negligible side effects when given caudally and should be reinvigorated in paediatric caudal epidurals.

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