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ORIGINAL ARTICLE

EFFICACY OF CLONIDINE AS AN ADJUVANT TO BUPIVACAINE FOR CAUDAL BLOCK IN CHILDREN UNDERGOING INFRA-UMBILICAL SURGERY

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ABSTRACT: Caudal epidural analgesia with bupivacaine is common in paediatric anaesthesia for providing intra and postoperative analgesia. But duration of analgesia even with bupivacaine; long acting anaesthetic is short only 4-6hrs. Hence, several adjuvants have been tried to prolong the duration of action of bupivacaine. We evaluated the efficacy of clonidine added to bupivacaine in prolonging the analgesic effect provided by caudal bupivacaine in children undergoing infra-umbilical surgery. Forty children, aged one to seven years, American Society of Anaesthesiologists (ASA) Grade I/II, undergoing infra-umbilical surgery, were included in prospective randomized double blind study to one of two groups: caudal analgesia with 0.75 ml/kg of 0.25% bupivacaine in normal saline (Group A) or caudal analgesia with 0.75ml/kg of 0.25% bupivacaine with 1 µg/kg of clonidine in normal saline (Group B). Post-operative pain was assessed for 24 hours using the Objective Pain Scale (OPS). The mean duration of analgesia was significantly longer in Group B (10.2 Hrs.) than in Group A (4.2 1Hrs); $P<0.05$, which was statistically significant. In both the groups, there were no significant changes in the heart rate and mean arterial pressure from the baseline value, in the intraoperative as well as postoperative period ($p>0.05$). The requirement of rescue medicine was lesser in Group B. Clonidine as an adjunct to bupivacaine prolongs the post-operative pain relief in children and is safe compared to bupivacaine alone in paediatric infra umbilical surgeries.

KEYWORDS: Bupivacaine, Caudal block, Clonidine, Post-operative analgesia, Infra umbilical surgery.

INTRODUCTION: Regional anaesthetic techniques have become routine interventions in paediatric surgeries. Caudal block was first described in1933, and is accepted as most popular method of providing intra- and post-operative analgesia for abdominal, perineal and lower limb surgeries in children. Bupivacaine is the most commonly used local anaesthetic for this technique. However, bupivacaine has the short duration of action, about four to six hours, when administered alone as a 'single shot technique'. Several adjuncts such as opioids, ketamine, midazolam, clonidine and neostigmine have been used with bupivacaine to prolong its action.[1,2,3,4,5]., and to prolong the duration of post-operative analgesia provided by the 'single shot' caudal technique.

Nowadays clonidine, an alpha 2 agonist has been extensively used in neuraxial blocks and peripheral nerve blocks to prolong the action of bupivacaine. It is one of the most commonly used additives with bupivacaine for caudal analgesia in children.[6] However, the role of clonidine in improving and prolonging the analgesia produced by caudal bupivacaine is highly variable in different published studies. Also, the duration of post-operative analgesia using caudal clonidine bupivacaine mixtures is also highly variable. We conducted this study to assess the efficacy of clonidine in prolonging the action of bupivacaine when used for caudal epidural analgesia in children undergoing sub-umbilical surgeries.

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MATERIALS AND METHODS: After obtaining informed parent/guardian consent 40 patients, ASA physical status I/II, in age group two to seven years, undergoing sub-umbilical surgeries were included in this prospective, randomised, double blinded single-centre study. Children with bleeding diathesis, congenital heart disease and anomaly of the lower back, sacral bone abnormalities, spina bifida, and infection at the site of caudal injection were excluded from the study. The children were randomly allocated into two groups of 20 patients each: Group A (Control group) and Group B (Study group). Group A received 0.75ml/kg of 0.25% bupivacaine in normal saline and Group B received 0.75ml/kg of 0.25% bupivacaine with 1ug/kg clonidine. All the children in both the groups were pre medicated with oral midazolam 0.5mg/kg 30 minutes prior to shifting them to the operating room.

The children were then shifted to the operating room and connected to monitors; pulse rate, non-invasive blood pressure, electrocardiogram and oxygen saturation (SpO2) were recorded. Patients were induced with 50% nitrous oxide, 50% oxygen and sevofluranre 8% delivered through Jackson Rees modification of Ayer's T-piece and face mask. Intravenous line was secured after achieving adequate depth of anaesthesia and lactated Ringer's solution was administered as per calculated fluid requirement by Holiday segar formula. Airway management was left to the choice of attending anaesthesiologist either appropriate size laryngeal mask or proper size endotrachial tube, with or without muscle relaxants.

After induction of anaesthesia, the patients were positioned in the left lateral position with hips and knees flexed. Under strict aseptic precautions, with a 22 G hypodermic needle single shot caudal block was performed, by an anaesthesiologist blinded to the drug which was to be administered to the epidural space. The drug was prepared by the anaesthesiologist not involved in the study. Group A received 0.75ml of 0.25% bupivacaine in normal saline and group B received 0.75ml/kg of 0.25% bupivacaine with 1ug/kg clonidine in normal saline. On completion of surgery, the residual effect of the muscle relaxant was reversed, patients were extubated when fully awake and duration of anaesthesia was noted in both the groups. Post operatively patients were assessed in the post-operative care unit (PACU) for 24 hours by anaesthesiologist and nurse not involved in the study. Hemodynamic parameters, heart rate and blood pressure were assessed in the PACU. Pain score was assessed by Objective pain scale score (OPS) using; Blood pressure, Crying, Movements, Agitation, and Verbalization of pain (Table1). The severity of the pain was determined using total of points noted.

Criteria	Finding	Points
Blood pressure	±10% of preoperative value	0
	>20% of preoperative value	1
	>30% of preoperative value	2
Crying	Not crying	0
	Crying, but stops with tender, loving care	1
	Crying without stopping, does not respond to tender, loving care	2
Movements	None	0
	Restless	1
	Thrashing around	2
Agitation	Asleep or calm	0
	Mild agitation	1
	Hysterical	2
Verbalization of pain	Asleep or states no pain	0
	States there is pain but cannot localize	1
	Can localize pain	2

Table 1: Objective Pain Scale

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OPS has five parameters, each was awarded score of 0-2 and sum total awarded score is taken to assess pain.

O=No pain.

1-3= Mild pain.

4-7= Moderate pain.

8-10=Severe pain.

The heart rate and blood pressure were measured in the interval of 15, 30, 45, 60, 90 and 120 minutes post operatively. Pain assessment was carried out by OPS score at 0, 1, 2, 3, 4, 5, 6, 12 and 24 hours post operatively. The time from arrival in PACU to the first time OPS score greater than 4 was recorded. The duration of analgesia was calculated from the time of injection of the drug in the epidural space to the time when OPS reached greater than 4, and documented as the duration of adequate caudal analgesia. Patients were administered rescue analgesia with Syrup paracetamol 10mg/kg on evidence of pain, when OPS reached a value of greater than 4. Postoperative sedation score was assessed by Ramsay sedation scale (Table2) every one hour for first 6 hours and then every 2 hours for the next 6 hours.

Ramsay Sedation Score:

1. Anxious, Agitated.
2. Cooperative, Oriented, Tranquil.
3. Responds only to verbal commands.
4. Asleep with brisk response to light stimulation.
5. Asleep with sluggish response to stimulation.
6. Asleep without response to stimulation.

	GROUP B	**GROUP BC**
	Number of patients	
1	Nil	Nil
2	12	2
3	6	10
4	2	8
5	Nil	Nil
6	Nil	Nil

Table 2: Ramsay sedation score

Excessive sedation was defined as a Ramsay sedation score of 5or 6.

Patients were also monitored in the post-operative period for occurrence of possible complications including respiratory depression, vomiting, hypotension and bradycardia. Respiratory depression was defined as decrease of (SpO2) less than 93% or a decrease in respiratory rate less than 10/min, requiring oxygen supplementation through face mask. Hypotension was defined as MAP less than 15% basal value and bradycardia was defined as a heart rate less than 80 beats/min.

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RESULTS: Mean age and weight were comparable between two groups (mean age of group A: 4.9 years, mean age of Group B 4.8 years, mean weight of group A: 13.5 kg, mean weight of group B: 14.6 kg, as shown in Table 3).

	Group A	Group B
Age (years)	4.7±1.29	4.7±1.37
Weight (kg)	13.46±6.03	14.56±4.42

Table 3: Demographic distribution

In both the groups, sex distribution was equal, constituting 80% males and 20%females. Hence there was no bias in sex distribution (Table 4).

Sex	**Group A**	**Group B**
Male	14	14
Female	6	6

Table 4: Sex distribution

The duration of analgesia and the time for first analgesic requirement was significantly prolonged in Group B (Table 5).

Mean duration of analgesia in hours ± SD	**Group A**	**Group B**	**P Value**
	4.2±0.66	10.2±0.81	<0.0001

Table 5: Duration of analgesia

The mean duration of analgesia in group B was 10.2 hours, whereas in group A was only about 4.2 hours. This means that group B has got extended duration of analgesia in comparison with group A. This duration of analgesia is also statistically significant as detected by using student 'T' test, by which the probability value is less than 0.05 ($P < 0.0001$) highly significant. In both the groups there was no significant change in the heart rate from the base line value (Table 6).

	Group A	**Group B**	**P-value**
Pre Op HR (bpm)	112±9	110±8	0.42
Intra Op HR (bpm)	108 ± 6	108±10	0.88
Post Op HR (bpm)	98 ± 5	102±8	0.074
Pre Op MAP (mm Hg)	84±3	83±5	0.55
Intra Op MAP (mmHg)	84±4	84±3	0.58
Post Op MAP (mmHg)	77±5	79±2	0.067

Table 6: Shows mean values with standard deviation of both groups and respective p-values

Both in the intraoperative and postoperative period ($P > 0.05$). Changes in the MAP (Mean arterial pressure) in the both groups did not show any marked deviation from the base line ($P > 0.05$). Post-operative sedation score was done using Ramsay scale every one hour for first 6 hours and then every 2 hours for next 12 hours.

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At no time during the study period patients were deeply sedated requiring Oxygen supplementation. Patients had a sedation score of 2, 3 & 4 as per Ramsay scale (Table 2) in the post-operative period. Group B had more number of patients with a sedation score of 3 and 4, when compared to group A. In both the groups no patient had a sedation score of 5 or 6.

DISCUSSION: We conducted this prospective randomised study in an attempt to assess whether administration of clonidine 1ug/kg to commonly administered bupivacaine for caudal block in children undergoing infra umbilical surgeries quality and duration of pain in the post-operative period. The present study data indicates that caudal blockade, with addition of clonidine 1ug/kg with 0.75ml of 0.25% bupivacaine significantly prolongs the duration of postoperative analgesia (Table –3). Our findings corroborate with previous studies.[7,8,9,10] which have reported clonidine 1-2mcg/kg added to bupivacaine for caudal block increase the duration of analgesia in small children undergoing ambulatory hernia repair and sub umbilical surgeries compared to bupivacaine alone.

In the present with 0.75ml of 0.25% bupivacaine used with clonidine 1ug/kg the duration of analgesia was 10.2 hours but 16 hours post-operative analgesia has been reported in one study.[10] which can be explained by the fact that the quality, level and duration of caudal blockade depends on the dose, volume and concentration of the drugs injected authors compared the duration of postoperative analgesia in children undergoing hypospadiasis repair with different volumes and concentration of fixed doses of ropivacaine local anaesthetic and concluded that high volume low concentration regime produces prolonged analgesia as compared to low volume high concentration. Our data with clonidine for caudal block corroborate with those results of previous studies.[11,12,13] where clonidine 1-2mcg/kg was added to bupivacaine for caudal blockade in supraumblical, urological and orthopaedic surgeries.

The undesirable side effects with neuraxial clonidine; hypotension and bradycardia have been reported in previous studies.[13,14,15] in adults and decrease in blood pressure within 5-15 minutes in children,[16] but no adverse hemodynamic effects; bradycardia or hypotension from the drug were seen in the present study.

Prolonged sedation with decrease in respiratory rate and fall in O_2 saturation (SpO_2) in the postoperative period has been observed.[17,18] However, we did not notice any excessive sedation. Sedation score was either 4 or less as per RSS in all patients.

CONCLUSION: We conclude, the combination of clonidine 1ug/kg with 0.75ml of 0.25% bupivacaine provides safe intraoperative as well as postoperative stable hemodynamic profile with prolonged postoperative analgesia without respiratory depression. This makes clonidine an ideal adjuvant to bupivacaine for paediatric caudal anaesthetic technique in infraumblical surgeries.

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