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COMPARATIVE STUDY OF POSTOPERATIVE ANALGESIA BETWEEN CAUDAL ROPIVACAINE AND LOW DOSE CLONIDINE-ROPIVACAINE COMBINATION IN PEDIATRIC PATIENTS POSTED FOR HERNIA SURGERY

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ABSTRACT

Background: Caudal anaesthesia is most commonly used regional anaesthesia technique for infraumbilical surgeries like hernia repair in paediatric patients. Ropivacine is preferred for its less systemic toxicity and less motor blockade property, but has short duration of analgesia. Clonidine is used as an adjuvant in various concentrations to increase the duration of analgesia after single shot caudal anaesthesia. Caudal clonidine 2μg/kg with 0.25% ropivacaine, significantly prolonged the duration of analgesia, but had postoperative hypotension and prolonged sedation.Therefore to avoid such complications, we compared the efficacy of caudal clonidine in lower dose (1μg/kg) as an adjuvant with 0.2% ropivacaine on duration of analgesia, hemodynamic stability and sedation in pediatric patients undergoing hernia surgery in a prospective, randomized, double blinded manner.

Methods: 60 patients of age group 1-10 years, ASA physical status I and II were randomly allocated to either group R or RC. Patients in group R received ropivacaine 0.2%, 1 ml/kg; group RC received ropivacaine 0.2% plus clonidine 1mcg/kg, total volume being same 1 ml/kg. Hemodynamic parameters, duration of analgesia and post-operative sedation were noted throughout the peri and postoperative period.

Results: There was no significant difference in hemodynamic parameters and Post-operative sedation score in both groups. Duration of analgesia in group RC (9.916±0.9475 hours) was significantly more (P<0.001) than that in group R (5.851±0.7080 hours).

Conclusion: Single shot caudal block with 0.2% ropivacaine combined with clonidine 1mcg/kg provided prolonged duration of analgesia post-operatively without any hemodynamic side effects and post-operative sedation.

INTRODUCTION:

Caudal epidural is the most popular, reliable, safe and commonly used regional anesthesia technique for infraumbilical surgeries in pediatric patients[1]. One of the main drawbacks of this procedure is short duration of analgesia in spite of use of long acting local anaesthetic like bupivacaine and ropivacaine[2]. Therefore there is always a search for safer adjuvant of local anaesthetic to prolong the duration of analgesia.

Lower incidence of cardio and neurotoxicity as well as less motor blockade property has made ropivacine as a safer alternative to bupivacaine for paediatric caudal anaesthesia[3].

Clonidine, an α_2-adrenergic agonist, which was widely used as antihypertensive, presently it has been increasingly used for sedation, premedication and adjuvant of analgesia[4]. Postoperative analgesia was significantly prolonged when clonidine was added as neuraxial adjuvant[5]. Moreover, catheter insertion and continuous infusion of local anesthetics become unnecessary, when clonidine is used as an additive[6].

In most of the previous studies[7,8] ,caudal clonidine adjuvant was added along with 0.25% ropivacaine in 2μg/kg dose for successful postoperative prolongation of analgesia, but unfortunately incidence of postoperative sedation and hypotension were increased. To avoid such complications, here we undertook the study to assess the effect of lower dose of clonidine as adjuvant with low concentration of ropivacaine. Therefore main aim of our study was to assess postoperative analgesic duration of 0.2% ropivacaine along with low dose clonidine adjuvant (1μg/kg) in comparison to plain caudal 0.2% ropivacaine in paediatric patients undergoing hernia repair in a prospective, randomized, double blinded manner. Postoperative sedation and hemodynamic status were also compared between two groups.

METHODS:

After obtaining Institutional Ethical Committee approval and written informed consent from the parents, 60 paediatric patients of American Society of Anesthesiologist (ASA) grade I and II(age group 1-10 years)posted for hernia surgery were enrolled in this study.

Exclusion criteria:

Patients with coagulation abnormality, ASA status III or IV, local infection at caudal region, congenital anomaly, allergy to study drugs, pre-existing neurological abnormality were excluded from our study.

The sample size was estimated from the data of previous study[8] using an alpha level of 0.05 and a beta power of 0.90. The calculation revealed that 20 subjects per group were needed to detect significant difference in duration of postoperative analgesia. Here we increased the sample size by 50% to account for skew deviations of the variables in the study. Enrolled patients were randomly allocated by a computer generated randomization table in double blind, prospective manner to one of the two groups- Group R (Ropivacaine group,n=30) or Group RC (Ropivacaine plus clonidine group,n=30). Concealment was achieved by centralized off site computer allocation process.

All the patients were kept fasted according to standard protocol, and premedicated with oral midazolam (0.3 mg/kg) 1 hour prior to arrival in the preoperative room. Induction of anesthesia was achieved with sevoflurane 8% and 60% nitrous oxide along with oxygen.ASA standard monitors like non-invasive blood pressure (NIBP), electrocardiograph leads, pulseoxymetry, axillary temperature probe were attached. A peripheral intravenous line was secured and perioperative crystalloid solution was started according to body weight. A laryngeal mask airway of appropriate size was inserted and patients were kept on spontaneous ventilation with 3% sevoflurane in 60:40 nitrous oxide and oxygen combination. Caudal block was achieved with 25 millimetre 23 gauge short bevel needle under aseptic conditions in left lateral position and after negative aspiration, the patients received the injection according to their group distribution and turned supine immediately. Group R received 0.2% ropivacaine 1 ml/kg while Group RC received 0.2%

ropivacaine with an addition of clonidine 1µg/kg via caudal route with a total volume being constant at 1 ml/kg. Study solutions were prepared by a senior resident, who was given written protocol for drug preparation. Anesthesiologist who administered the drug and recorded the data was unaware of the composition of the solution administered. Heart rates (HR), non-invasive mean blood pressure (MAP), peripheral oxygen saturation (SpO2) were recorded before induction, after induction, after caudal injection and at 10 minutes interval thereafter throughout the procedure. At the start of skin closure, sevoflurane inhalation was stopped. After the end of the surgical procedures, the laryngeal mask was taken out when the patients were fully awake. MAP, HR, SpO2 and sedation were recorded at 10 minutes interval for the 1st postoperative hour and then at 2, 4, 8, 12, 18, and 24 hours by an observer who was unaware of the study. A modified objective pain scale(OPS) which was based on behavioural objectives like crying, facial expressions, position of legs and generalized motor restlessness, was used to assess postoperative pain and duration of analgesia, (where 0=excellent analgesia and 10= completely ineffective analgesia). When pain score >4, rescue analgesic intravenous injection tramadol 2 mg/kg was administered. The time for first rescue analgesia and duration of analgesia was noted. With administration of rescue analgesic, the study was ended and all parameters were noted. Sedation was measured with a sedation score[8] of 0-3, (3=spontaneous eye opening, 2= eye opening to verbal command, 1=eye opening to physical stimuli and 0= nonarousable). All the patients were observed for 24 hours in the post-operative care unit.

Statistical analysis:-All the data collected were subjected for statistical analysis with help of non parametric tests using SPSS 17 software and P<0.05 was taken as significant. All data are presented mainly as arithmetic mean and standard deviations.

RESULT:

Demographic profile of the patients in both groups was comparable in respect of age, weight, and ASA status (Unpaired t-test, table -1)

Table:1: Demographic distribution and duration of surgery for patients receiving ropivacaine (Group R) and ropivacaine-clonidine (Group RC).

Demographic parameter	Group R	Group RC	
Age (years)	5.017±2.181	4.80±2.240	0.837
Weight (Kg)	15.77±4.582	14.57±4.860	0.326
ASA physical status	1.10±0.305	1.17±0.379	0.456
Duration of surgery (minutes)	47.33± 17.207	50.00 ± 18.004	0.674

Addition of clonidine (1ug/kg) to caudal 0.2%ropivacaine as an adjuvant resulted in prolongation of duration of analgesia (9.9 hours in Group RC compared to 5.85 hours in Group R). This result is statically significant on comparison- with standard deviation of 0.9475 hours. Total analgesic requirement was also significantly less in patients received clonidine as adjuvant. Mean OPS score was comparable in both the groups. (unpaired t-test, P value <0.001, TABLE 2).

Table:2: Duration of analgesia in hour (DOA-H), Mean OPS score and total analgesic requirement in Group R and RC.

	Group R	Group RC	
DOA-H	5.851±0.7080	9.916±0.9475	0.000
Mean OPS score	3.84±0.56	3.45±0.61	0.63
Total analgesic requirement(mg)	56±0.60	31±0.547	0.042

Inter- and intra- group comparisons showed that hemodynamic parameters were comparable at different time intervals in the perioperative period (P>0.05, ANOVA).

80% patients of group RC and 90% patients of group R attained sedation score 3 after the completion of operation (P value >0.05, table 3) which was statistically insignificant.

Table 3: postoperative sedation score(POSC) in patients receiving ropivacaine (Group R) and ropivacaine-clonidine (Group RC).

	POSC (mean±SD) in group R	POSC (mean±SD) in group RC	
POSC_10M	2.84±0.460	2.76±0.505	0.589
POSC_20M	2.97±0.179	2.93±0.264	0.571
POSC_30M	3.00±0.000	3.00±0.000	
POSC_40M	3.00±0.000	3.00±0.000	
POSC_50M	3.00±0.000	3.00±0.000	
POSC_60M	2.99±0.183	3.00±0.000	0.321
POSC_2H	2.91±0.183	289±0.254	0.561
POSC_4H	2.91±0.254	2.77±0.450	0.070
POSC_8H	2.75±0.420	2.80±0.374	0.525
POSC_12H	2.74±0.440	2.80±0.400	0.549
POSC_18H	2.30±0.500	2.57±0.469	0.072
POSC_24H	2.90±0.250	2.89±0.187	0.5557

DISCUSSIION:

Nowadays clonidine is being increasingly used for potentiating various local anesthetic actions. Main aim of our study was to evaluate the efficacy of caudal clonidine in lower dose (1ug/kg) when combined with 0.2% ropivacaine.

Ideally we try to use safer local anesthetic in possible lower concentration for pediatric caudal anesthesia to avoid major side effects like hypotension, significant motor paralysis and postoperative sedation. Ropivacaine is a newer local anaesthetic with reduced systemic toxicity and wide safety margin, although toxicity has been reported in adults following various regional anaesthetic technique[9] with 0.5% ropivacaine. To avoid such complication we used ropivacaine in lower concentration (0.2%), as the concentration below 0.2% is hardly effective[10].

The analgesic action of epidurally administered clonidine is due to stimulation of descending noradrenergic medullospinal pathways and by inhibiting the release of nociceptive neurotransmitters in the dorsal horn of spinal cord. The analgesic effect is more pronounced after neuraxial injection, which suggests a spinal site of action and makes this route of administration preferable[11,12].

Klimscha in his study showed that addition of clonidine(1-2ug/kg) alongwith 0.25% bupivacaine significantly prolongs the duration of postoperative caudal analgesia than bupivacaine alone[13].The finding of our study is quite similar with Klimscha as postoperative analgesia was significantly prolonged with clonidine supplementation.

In another study, when Koinig[14] used caudal 0.5% ropivacaine, there was significant prolongation of analgesia for 24 hours along with distressing motor weakness. Subsequently he reduced the concentration to 0.25% ropivacaine to avoid the unwanted motor blockade but the duration of analgesia was significantly decreased (hours). So in our study, to decrease the distressing motor blockade, we used lower concentration of ropivacaine (0.2%), which provided analgesia only for 5.85 hours. This result is quite similar to the study of Breschan, C.[15], where 0.25% ropivacaine (1 ml/kg) provided median postoperative analgesia for 5.7 hours only. To prolong the duration of analgesia, Sharpe[16] compared the effect of clonidine 1 and 2 mcg/kg with local anaesthetic and found no significant advantage of higher dose of clonidine (2 mcg/kg). Moreover clonidine 2 mcg/kg produced unwanted sedation.

In another study by Bajwa[8] it was shown that though addition of caudal 2ug/kg clonidine along with 0.25% ropivacaine causes significant prolongation of analgesia, there were few

cases of hypotension and sedation in postoperative period. Therefore in our study to avoid such unwanted side effects, we added clonidine 1 mcg/kg as adjunct to caudal 0.2% ropivacaine which prolonged the duration (9.9 hours) of post operative analgesia without much sedation.

Neuraxial clonidine may cause bradycardia due to preganglionic sympathetic inhibition and relative vagal overactivity[17]. When Bajwa used caudal clonidine at dose of 2μg/kg, it caused bradycardia and hypotension in upto 3-5% patients. However, Laha A.[18] used caudal clonidine 2μg/kg along with ropivacaine 0.2% and found significant prolongation of analgesia (975±40 minutes) without any hemodynamic alteration. In our study, as we used lower concentration of ropivacaine (0.2%) along with lower dose of clonidine (1μg/kg), no such hemodynamic instability was noted. Our study result was quite similar with study of Manickam[19] who showed that clonidine 1μg/kg with ropivacaine 0.1% prolonged the duration and quality of analgesia compared to plain ropivacaine 0.1% and 0.2% without any significant sedation.

Major limitation of our study was that, it was a single centre study. Multicentre study with larger sample size in future will better establish the result.

From this study it was concluded that addition of lower dose clonidine (1μg/kg) as an adjuvant with ropivacaine 0.2% in paediatric caudal analgesia, significantly increases duration of postoperative analgesia in comparison to ropivacaine alone without significantly increasing other adverse effects.

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