

Comparison Of Two Different Concentration Of Ropivacaine With Clonidine As Adjuvant, In Caudal Epidural In Pediatric Patients.

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Citation

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Abstract

Background: The aim of this double blind, randomized, comparative study was to assess the analgesic efficacy and safety of two different concentrations of ropivacaine and fixed dose clonidine as an adjuvant for pediatric caudal block. **Methods:** Sixty ASA-I children undergoing elective ilio-inguinal surgery were randomly divided in two groups to receive, caudal injection with 0.1% ropivacaine 1ml/kg and clonidine 2µg/kg in group I or 0.2% ropivacaine 1ml/kg and clonidine 2µg/kg in group II after induction of standard general anesthesia. Intra and post-operatively HR, MAP and RR were monitored. Postoperative duration of analgesia, CHIPPS (Child and infant post-operative pain scale), sedation by Ramsay sedation scale and residual motor blockade by Modified Bromage scale were recorded. **Result :** There were no significant differences among the two study groups with respect to age, weight or duration of surgery. In both the groups none of patient required additional analgesia or anesthesia intra-operatively. Mean CHIPPS in group I was 0.89 ± 0.42 and in group II was 0.94 ± 0.58 , p-value 0.69 was statistically non significant. Duration of analgesia in both the groups was statistically not significant. Bradycardia, hypotension, and sedation were not recorded in both the study groups. **Conclusion:** It was concluded that, addition of clonidine to 0.1% ropivacaine gives similar quality and duration of analgesia as that of 0.2% ropivacaine and clonidine, without causing significant degree of post-operative sedation and motor weakness.

INTRODUCTION

Ropivacaine is the first s-enantiomer amino-amide local anesthetic in clinical use. It has lower potential for systemic toxicity with better sensory motor discrimination properties.^{1,2} Moderate concentration of caudal ropivacaine (0.25%-0.375%) in children have been shown to produce peak plasma levels (Cmax) that are close to levels associated with early signs of toxicity in adults and also produces residual motor block following caudal block in children.^{3,4,5} Reducing the concentration of ropivacaine from 0.2% to 0.1%, again gives the wider margin of safety.^{3,6}

Caudal epidural anesthesia is commonly used as adjuvant during general anesthesia for improving perioperative analgesia in pediatric sub umbilical surgeries.⁷ It also reduces stress response to surgery and decreases the requirement of general anesthetic drugs.^{8,9} Various adjuncts have been used previously to prolong the duration of caudal analgesia.^{10,11} Clonidine, α -2 adrenergic agonist, improves the quality and duration of caudally administered local anesthetics and reduce the need for additional analgesic

requirement without significant hemodynamic or respiratory effects.^{9,12,13,14}

Adopting an idea of managing pain before it occurs^{15,16}, we designed a prospective randomized double blind study. Primary aim of our study was to compare the analgesic efficacy of two different concentrations of ropivacaine along with clonidine in caudal block. Secondary aims were to assess residual motor blockade, sedation and adverse reaction or side effects if any.

MATERIAL AND METHODS

After obtaining Institutional ethics committee approval and written informed consent from parents of patients, ASA-I, 60 children of age group 1-6 yrs undergoing elective ilio-inguinal surgeries were included in the study. The study design was prospective, randomized and double blind; Patients were randomly allocated according to computer generated randomization. Exclusion criteria were patients who have contraindication for caudal block e.g. Local infection, bleeding tendencies and congenital anomalies and known cases of allergic drug reaction.

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Routine pre anesthetic check-up and baseline investigations were done. Intravenous maintenance fluid started at 4ml/kg/hr from NBM hrs. Patients were premedicated with Inj midazolam 0.03 mg/kg and Inj glycopyrrolate 0.004 mg/kg intravenously, 10 min prior to surgery. Inhalational induction was done with oxygen, nitrous oxide and 8% sevoflurane delivered through Jackson Rees modification of Ayre's T-piece and face mask, with standard monitoring. Appropriate size LMA was inserted and anesthesia was maintained with 33% oxygen, 67% nitrous oxide, and sevoflurane 2% with fresh gas flow 2-3 liters / min. After induction, patients were placed in left lateral decubitus position and a single shot caudal block was performed, with aseptic precautions, using a 23 G hypodermic needle, by an anesthesiologist who was blinded to the caudally administered drug. Group I patients received 0.1% ropivacaine 1ml/kg/segment with clonidine 2µg/kg and group II patient received 0.2% ropivacaine 1 ml/kg/segment with clonidine 2µg/kg . Surgery was allowed to start after 10 min of caudal block.

Heart rate, MAP, RR, and SPO₂ were recorded before induction, after induction and then every 10 min after caudal block. Intra op increase in HR and MAP by more than 15% of baseline values was defined as inadequate analgesia and was decided to treat with inj fentanyl 1µg/kg IV. Intra and post operative decrease in HR andMAP by more than 30% of its baseline was defined as severe bradycardia and hypotension and treated with rapid infusion of fluids and with 0.01 mg/kg inj atropine IV.

At the beginning of skin closure, sevoflurane and nitrous oxide were discontinued. LMA removed and the child was shifted to recovery, breathing room air.

Post operatively along with HR , MAP, SPO₂ , RR patients were assessed for pain, sedation, and residual motor blockade after 30 min of extubation and at 2, 4, 6, 8, 12, and 24 hrs.

Postoperative pain was assessed by CHIPPS (Child and infant post-operative pain scale) and requirement of rescue analgesia in 24hrs was noted. CHIPPS score has five variables which include crying, facial expression , posture of trunk , posture of legs, motor restlessness and each variable has score of 0 (none), 1(moderate) and 2 (severe) to give a cumulative score of 0-10.¹⁷ If this score was ≥ 4 , patient received fixed dose of rescue analgesics as oral paracetamol 20 mg/kg. Duration of post op analgesia is defined as time

between caudal injection and first need for rescue analgesics (CHIPPS ≥ 4).

Sedation was assessed by 4 point Ramsay sedation scale (0- Eyes open spontaneously , 1-Eyes open to speech , 2- Eyes open with shaken , 3- Unarosable).³ This helped in identification of respiratory depression. Residual motor blockade was assessed by modified Bromage scale (0, no motor block, child moves limbs freely; 2, inability to flex knees; 3, no movement possible in legs) .⁹ Duration of surgery and wake up time were recorded .Time of first micturation and adverse effects if any, were also noted.

Data was analyzed by using MS excel, Statistical package for social sciences (SPSS) 17.0 and Minitab 15.0. We have used 2 independent sample t-test and Mann-Whitney U test to compare the demographic and vital parameters with the p-value < 0.05 considered as a statistically significant.

RESULTS

There were no significant difference among the two study groups with respect to age, weight, duration of surgery and wake up time($p \leq 0.05$) (Table 1).

Figure 1

Table 1, Comparison of demographic parameters.

Demographic parameters	Mean \pm SD (n=30)		p-value
	Group I	Group II	
Age (yrs)	3.13 \pm 1.650	3.17 \pm 1.510	0.935
Weight (kg)	12.87 \pm 2.596	13.80 \pm 3.398	0.237
Duration of surgery (min)	41.7 \pm 11.5	39.4 \pm 17.3	0.559
Wake up time (min.)	2.30 \pm 1.02	2.40 \pm 1.22	0.732

P value > 0.05 ,statistically not significant.

Following caudal injection, course of HR, MAP, and RR did not differ between the two groups intra-operatively. None of the children required additional analgesics in intraoperative period. Depth of anaesthesia was better maintained with 2% sevoflurane and caudal block. However, during emergence from anaesthesia sympatho-adrenergic response was blocked in both the groups. There were no significant differences between two groups in post operative HR, MAP, and RR ($p \leq 0.05$) (Fig 1, 2, and 3).

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Figure 2

Figure 1, Comparison of mean arterial pressure between two groups (no significant differences)

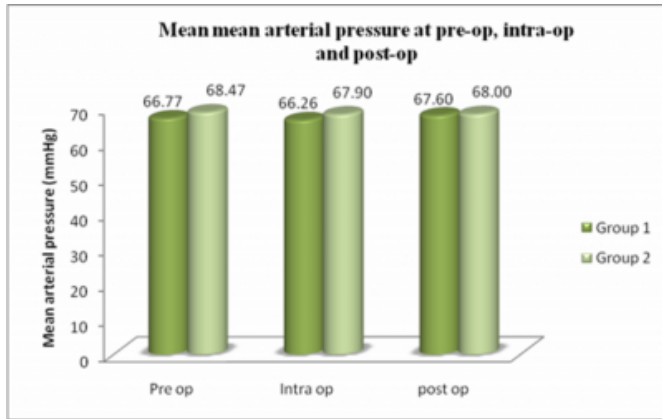


Figure 3

Figure 2, Comparison of Mean heart rate between two groups (no significant differences)

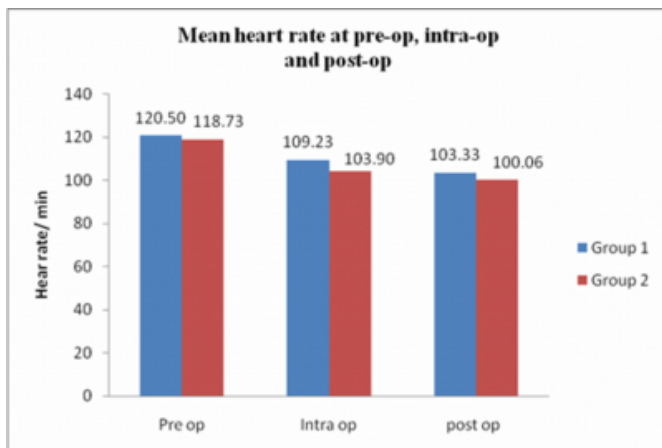
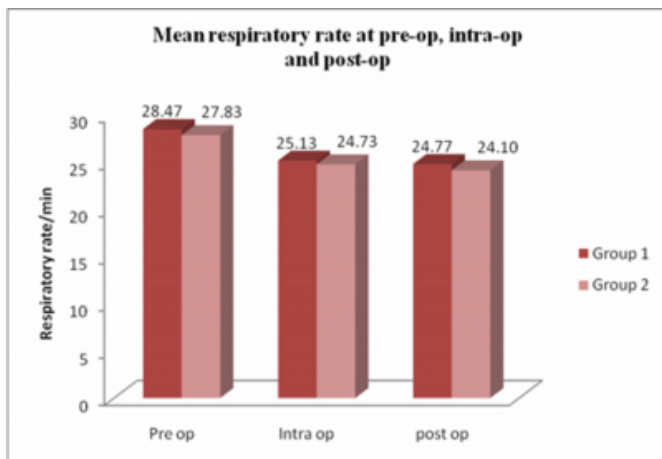


Figure 4

Figure 3, Comparison of mean respiratory rate between two groups (No significant differences)



Severe hypotension or bradycardia was not observed in both the groups. SPO₂ (>96%) was always within the clinically acceptable range.

The postoperative pain was assessed using CHIPPS. Mean CHIPPS in group I was 0.89±0.42 and in group II was 0.94±0.58 which is comparable (p=0.69). Duration of post-op analgesia between the two groups was compared using Mann-Whitney test. Group I had mean duration of analgesia of 22.50 ± 5.71 hours and group II had a mean duration of analgesia of 21.37±6.87 hours and the difference was statistically not significant with a P- Value 0.49 (Table 2, Fig 4). Only 3 patients in group I and 4 patients in group II required rescue analgesia once within the 24-hr. postoperative study period. While 90% children in group I and 86.8% children in group II were pain free for 24-hr postoperatively.

Figure 5

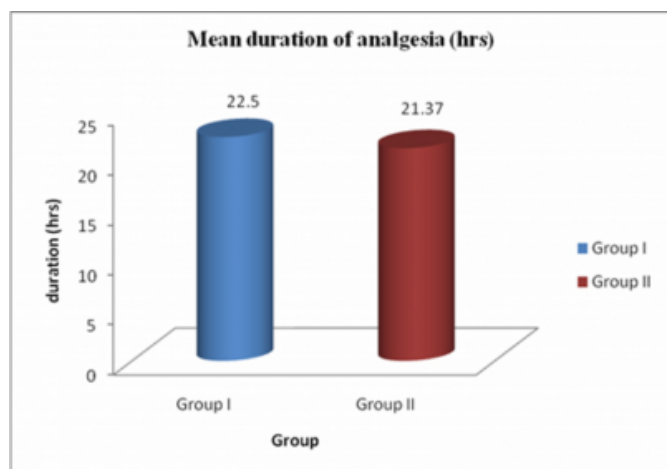
Table 2 Comparison of pain score in group I and group II.

Pain score at	Mean ± SD (n=30)		p-value
	Group I	Group II	
2nd hr	1.17 ± 1.39	1.3 ± 1.93	0.76
4th hr	1.07 ± 1.36	1.03 ± 1.03	0.915
6th hr	0.7 ± 1.08	1.20 ± 1.58	0.159
8th hr	1.40 ± 1.56	0.93 ± 1.43	0.234
12th hr	0.57 ± 0.93	0.63 ± 1.06	0.798
24th hr	0.43 ± 0.72	0.57 ± 0.97	0.55
Mean Chipps	0.89 ± 0.42	0.94 ± 0.58	0.69
Duration of analgesia (Hrs.)	22.50 ± 0.71	21.37 ± 6.87	0.49

P value>0.05, statistically not significant.

Figure 6

Fig.4 : comparison of duration of analgesia in both the groups.



There were no significant differences between group I and group II with respect to sedation score. (P-value > 0.05) (Table 3). Postoperative residual motor blockade was assessed by modified Bromage score. Score was zero in both the groups as all the children were able to move their legs in early wake up period only. There was no incidence of residual motor blockade and none of the patient had post-operative nausea, vomiting or retention of urine in both the group.

Figure 7

Table 3: Sedation state of the patients(n)

Time	Sedation score	Group I N=30	Group II N=30	P Value
1hr	0	22	19	0.388
	1	7	9	
	2	1	2	
	3	0	0	
2hr	0	16	20	0.279
	1	12	9	
	2	2	1	
	3	0	0	
4hr	0	22	27	0.098
	1	8	3	
	2	0	0	
	3	0	0	
6hr	0	22	10	0.267
	1	7	18	
	2	1	2	
	3	0	0	
12hr	0	21	22	0.843
	1	9	7	
	2	0	1	
	3	0	0	

P value>0.05, statistically not significant.

DISCUSSION

The key finding of our study is that caudal block for pediatric ilio-inguinal surgeries with low concentration Ropivacaine 0.1% with clonidine as an adjuvant gives similar quality of intra and post op analgesia without residual motor blockade as that of 0.2% Ropivacaine with clonidine . Our finding confirms with G. Ivani study, stated that addition of clonidine 2µg/kg to 0.1% ropivacaine resulted in better post-operative analgesia compared to 0.2% Ropivacaine alone.³

Ropivacaine has greater margin of safety as far as systemic toxicity is concerned due to its lower lipid solubility .^{18,19} No incidence of systemic toxicity of Ropivacaine in children have been reported so far, although caudal administration of 2.8 mg/kg results in plasma levels which are comparable to maximal tolerated levels in awake adult volunteers. The reduction of total amount of caudally administered Ropivacaine will further gives wider margin of safety.³ The G Luz et al. study reported that total and free plasma concentration of ropivacaine 0.2% were higher than those for ropivacaine 0.1% and bupivacaine 0.2%, but were just below the toxic levels. However reduction in the concentration of ropivacaine from 0.2% to 0.1% has been

found to result in inadequate intra –op analgesia in children.⁶ Many adjuvants have been used to enhance quality of analgesia of ropivacaine so far.^{9,20,21} Over the last 10 yrs, various papers have been published on use of caudal clonidine which enhances the duration and quality of local anesthetics in pediatrics.^{3,8,9}

In our study, by addition of 2µg/kg clonidine in 0.1% ropivacaine in caudal block, we were able to provide similar intra and post operative hemodynamic stability along with effective post- operative analgesia as that of 0.2% ropivacaine with clonidine. Depth of analgesia was maintained with 2% sevoflurane intra operatively and none of the patient required additional analgesia.

Epidural clonidine may also cause hypotension, bradycardia and sedation in higher doses.⁸ Serious adverse effects are uncommon in the dose range (1-2µg/kg) normally used in children.¹⁴ We did not appreciate any incidence of significant bradycardia or hypotension in both the groups.

Dose dependant sedation usually accompanies the use of clonidine for regional anesthesia.^{9,22,23} However with the 2µg/kg dose, we did not appreciate any excessive sedation. All the children were sleeping but arousable and this was appreciated by their parents.

Compared to other local anesthetics, ropivacaine produces less motor block due to its specificity to sensory c-fiber.²⁰ In our study, in both the groups, there was no residual motor blockade and all the children in both the groups were able to move the legs on operation table postoperatively. This is the main advantage of using weaker equi-analgesic solutions. Our findings confirms with G. Ivani study.³ There was absolutely no incidence of urinary retention and post operative nausea, vomiting.

In our institute, we routinely used intravenous midazolam and glycopyrrolate as a premedicant in pediatric patients. Midazolam is commonly used for anxiolysis, amnesia, and sedation, while glycopyrrolate produces antisialagogue effect without sedation. Mild increase in heart rate by glycopyrrolate is counteracted by midazolam.²⁴

There are several formulae for determining the volume to anesthetic level relationship for caudal anesthesia in infants and children. Dalens and Hasnaoui recommend caudal volumes between 0.7 and 1.0 ml to achieve an adequate level of analgesia (T10) for inguinal surgery. The larger volume (1ml/kg) provided more satisfactory analgesia than older

formulae.⁴ In our study, all the patients of ilio-inguinal surgeries were premedicated and induced with similar technique to eliminate any factor that could have interfered with analgesic requirement or hemodynamic variables.

Further study with larger sample size, with different concentration of ropivacaine is advocated to get distinct advantages.

Perioperative stable vital parameters, absence of side effects like sedation, bradycardia, PONV, respiratory depression and reduction in need of analgesics goes in favor of using ropivacaine - clonidine combination for pediatric caudal block.

In conclusion, 0.1% and 0.2% caudally administered ropivacaine offers similar results without any distinct advantage in improvement in analgesia. Use of 0.1% ropivacaine further gives wider margin of safety. Post operative pain relief without motor weakness was pleasant experience for our patients and their parents. Thus 0.1% ropivacaine with 2µg/kg clonidine is the safe and effective combination for caudal block in pediatrics day care surgeries.

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