



Comparative study of caudal Clonidine with ketamine added to ropivacaine in pediatrics for below umbilical surgeries

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Abstract

Aims: The purpose of our study was to compare the efficacy and safety of Clonidine to that of Ketamine added to 0.25% ropivacaine for caudal analgesia in children.

Settings and Design: prospective, double blind randomized controlled trial.

Material and Methods: Sixty children in the age group of 1 – 8 years undergoing sub umbilical surgeries were included in the study. After induction with general anaesthesia, caudal block was given with injection Ropivacaine 0.25% 1ml/kg and Clonidine 1µg/kg in group RC and injection Ropivacaine 0.25% 1 ml/kg and Ketamine 0.5 mg/kg in group RK.

Results: The mean duration of analgesia was 530±44.2 mins in RC group as compared to 395±43.4 mins in RK group. The duration of analgesia was significantly prolonged in group RC with p value of 0.000. The mean pain score of RK group was higher than RC group at 6th (3.5±0.57 vs. 3.0±0.37) and 8th hour (3.93±0.25 vs 3.63±0.49) postoperatively which was statistically significant. There was no significant difference between the two groups with respect to haemodynamic parameters as only one patient had bradycardia in RC group.

Conclusion: Ropivacaine (0.25%) with Clonidine (1µg/kg) in caudal block significantly prolongs the duration of analgesia compared to Ropivacaine (0.25%) with Ketamine (0.5mg/kg), without any adverse effects, can be used safely in paediatric caudal block.

Keywords: caudal, clonidine, ketamine, paediatric, ropivacaine

Introduction

In paediatric regional anesthesia, caudal epidural is one of the most popular, reliable, safe and easy methods to administer ^[1]. Ropivacaine, having lower incidence of cardiovascular side effects, neurotoxicity and lesser degree motor blockade, is suitable for caudal anaesthesia in children ^[2, 3].

Prolongation of caudal analgesia has been achieved by the addition of various additives like Fentanyl, Ketamine, clonidine ^[4, 5]. Side effects associated with the use of caudal Fentanyl are nausea, pruritus and respiratory depression ^[6]. Caudally administered Clonidine, an alpha 2 agonist, does not cause respiratory depression though it can sometimes cause bradycardia. Ketamine, has powerful analgesic effect and produces adequate analgesia without respiratory depression or haemodynamic instability when administered via caudal route ^[6, 7]. Purpose of our study was to compare the efficacy of caudal Clonidine & Ketamine combined with ropivacaine for below umbilical surgeries.

2. Materials and methods

This double study was conducted at Mahatma Gandhi Mission's Medical College Hospital, Aurangabad from July 2014 to August 2016 after approval from the institutional ethical committee. Children belonging to ASA grade 1 & 2 between 1 - 8 years of age posted for elective below umbilical surgeries were included in this study. Children with local infection at the caudal region,

bleeding diathesis, pre-existing neurological diseases and any congenital anomaly of the lower back were excluded.

A power analysis indicated that 28 patients per group would be required to detect a difference of 150 minutes in duration of analgesia for α error of 0.05 and β error of 0.8. Thus a sample size of n=30 per group was considered for our study. Patients were randomized into two groups – group RC & group RK by sealed envelop method, each group containing 30 children. Solutions used for injection were Inj. Ropivacaine (0.25%) 1ml/kg with inj Clonidine 1 mcg/kg in group RC and Inj. Ropivacaine (0.25%) 1ml/kg with preservative free Inj. Ketamine 0.5mg/kg in group RK. The anaesthesiologist who prepared the solution was different from the one who gave caudal epidural & observed the patient. Both patient & the observer were blinded to the study drug.

Child was kept NBM 6 hours prior to the surgery and sips of glucose water advised 2 hours before the surgery. Informed and written consent was taken from the parents. Pre-operative parameters such as heart rate, blood pressure and oxygen saturation were recorded. Inj. Glycopyrrolate (5 mcg/kg) and Inj. Midazolam (0.04 mg/kg) was given intravenously. Hemodynamic parameters were recorded immediately after pre medication and were considered as baseline. Thereafter, child was induced with Inj. Thiopentone 5 mg/kg and inj. Atracurium 0.5 mg/kg. An appropriate sized ET tube passed. After passing

ETT, lateral position was given and under all aseptic precautions, caudal epidural block was given with 22 gauge 1.5 inch hypodermic needle & study drug was injected. Patient was made supine immediately; HR and MAP were recorded every 10 minutes after the block. Surgery was started 20 minutes after the caudal block. Intra operative anaesthesia was maintained with oxygen (50%), nitrous oxide (50%), Sevoflurane (1.5%) and Inj. Atracurium 0.1 mg/kg. Parameters like HR, MAP and SPO₂ were recorded every 10 min intra operatively. Any increase in HR of > 20% from baseline at the time if incision was considered as failure of block and rescue analgesia with Inj. Fentanyl 1µg/kg was given, and these cases were excluded from the study. IV fluid, RL was given based on Holliday Segar 4-2-1 formula. All anaesthetic gases were turned off at the end of the procedure and patient was reversed with Inj. Neostigmine 0.05 mg/kg and Inj. Glycopyrrolate 0.01 mg/kg on achieving spontaneous respiration. Post-operative HR and pain score were recorded at 1, 2, 4, 6, 8, 10, 12, 16, 20 and 24 hour. Ward staff was trained to assess the pain score. Analgesic effect was evaluated by observational pain score

No pain (Laughing - 1, Happy - 2, Neutral (Calm or asleep) - 3), Mild- moderate pain (Cry indicating pain (grimacing, restless, can distract with toy or parental presence) - 4), Severe pain (Crying screaming, inconsolable - 5)

Patients who had a pain score of 4 & above were administered with rescue analgesia in the form of paracetamol suppository 20mg/kg by the ward staff after consultation with the anaesthesia resident. The time of administration of first dose of paracetamol was noted.

Patients were observed for complications such as bradycardia (defined as decrease in heart rate >30% of the baseline), hypotension (defined as decrease in MAP >30% of the baseline), nausea, vomiting, urinary retention. Bradycardia was treated with inj. Atropine 10 µg/kg IV, hypotension with IV fluids, nausea and vomiting with inj. Ondansetron 0.1 mg/kg.

2.1 Statistical analysis

All data was presented as Mean ± Standard Deviation. Demographic data was analyzed using Chi-square test and statistical significance in mean difference was done using student's t test. The difference between the two groups was assessed by student's t test and chi square test. For all the tests a 'p' value of 0.05 and less was considered as statistically significant.

All statistical analysis was made using SPSS 22 for Windows (Statistical Package for Social Science).

3. Results

There were no statistically significant differences between the two groups with respect to age, gender, weight, type and duration of the surgery, baseline heart rate and blood pressure (Table 1 & 2) The two groups did not differ significantly with respect to the heart rate at any point. ($p > 0.05$) Fig 1 The two groups did not differ significantly with respect to MAP at any time ($P > 0.05$) Fig 2

The mean pain score of RK group was higher than RC group at 6th (3.5 ± 0.57 vs 3.0 ± 0.37) and 8th hour (3.93 ± 0.25 vs 3.63 ± 0.49) postoperatively which was statistically significant. The mean pain score of RC group at post op 10th hour was higher than RK

group. Fig 3

The mean duration of analgesia was 530 ± 44.2 mins in group RC, whereas 395 ± 43.4 mins in group RK. The p value was 0.000, which was significant. Fig. 4

4 Discussion

The past decade has witnessed many advances in the understanding and treatment of pain in children. Caudal epidural block remains the standard of care for providing post-operative analgesia in paediatric population. Clonidine & Ketamine have been used in various doses as an adjuvant to local anaesthetics to enhance the quality of analgesia in the postoperative period.⁶ Before undertaking this study We hypothesized that addition of Clonidine 1 mcg/kg and Ketamine 0.5 mg/kg to 1ml/kg of 0.25% ropivacaine equally prolongs the duration of postoperative analgesia. in pediatric patients undergoing below umbilical surgeries. In our study, we have used 0.25% ropivacaine for caudal block as 0.1% of ropivacaine used by Manickam et al^[9] showed less duration of analgesia compared to 0.2% and Koinig et al^[2] observed prolonged duration of analgesia and motor blockade with 0.5% ropivacaine compared to 0.25%. In our study we used inj Clonidine 1µg/kg as Klimscha et al⁸ demonstrated that addition of Clonidine 1 or 2µg/kg to bupivacaine 0.25% significantly prolonged the duration of analgesia within the first 24 hours. The duration of analgesia with BC1 group was 360 mins(270-360) and that in BC2 group was 360 mins(355-360). The analgesic efficacy did not increase by increasing the Clonidine dose from 1 to 2µg/kg but caused significant bradycardia.

Nafiu et al^[7] and ODES et al^[6] studied the effects of Ketamine 0.5mg/kg added to bupivacaine and ropivacaine respectively where they concluded that addition of Ketamine prolonged the duration of analgesia significantly as compared to plain groups. Simple et al^[10] found the higher incidence of behavioural side effects with caudal Ketamine 1 mg/kg hence in our study, the dose of Ketamine taken was 0.5 mg/kg.

There was decrease in heart rate in both the groups with mean heart rate of 98 ± 7.46 per minute in group RC and 100.6 ± 8.16 per minute in group RK at 60 minutes ($p = 0.211$) with no significant difference ($p = 0.785$).

Akbas^[11], Bajwa¹ and ODES et al^[6] observed gradual decrease in the heart rate in Clonidine and Ketamine group which did not differ significantly at any point. They also found no significant difference in the MAP between the two groups at any time interval.

In our study, the duration of analgesia was prolonged in patients receiving Clonidine 530.7 ± 44.2 mins and 395.8 ± 43.4 mins in Ketamine group which was statistically significant ($p = 0.000$).

Manickam et al^[9] reported an increased duration of analgesia of 590 ± 83.93 min in ropivacaine-Clonidine (0.1% 1 ml/kg + 1µg/kg) group and 388.25 ± 82.35 min in 0.2% 1 ml/kg ropivacaine group. Even though, increasing the concentration of ropivacaine increased the mean duration of analgesia, it was found to be significantly longer by addition of Clonidine ($p = 0.001$).

Bajwa et al^[1] studied that the first analgesic requirement time was statistically prolonged in ropivacaine-Clonidine (0.25% 0.5 ml/kg + 2µg/kg) group (13.4 ± 3.4 h) when compared to plain ropivacaine (0.25% 0.5 ml/kg) (8.5 ± 3.4 h) ($p < 0.005$).

Gupta et al^[12] in their study found that the duration of analgesia

using ropivacaine 0.2% 1ml/kg with Clonidine 2µg/kg was 10.1±3.2 h, which was comparable to our study.

ODES et al [6] observed that the duration of analgesia was 1032±270 mins in group R+K (0.2% 2mg/kg+0.5 mg/kg) as compared to 435.6±273 mins in group R (0.2% 2 mg/kg). The exact reason of such long duration of analgesia in ketamine group could not be found out, may be due to inclusion of only hernia surgeries in their study.

Ahuja et al [13] reported that the mean duration of analgesia in bupivacaine-ketamine (0.25% 1ml/kg+ 0.5 mg/kg) group was 8.23±0.57 hrs, which is comparable to our study.

Singh et al [5] observed the mean duration of analgesia in group BC (0.25% 0.75 ml/kg+1µg/kg) was 629.06±286.32 min, 615.00±292.73 min in group BK (0.25% 0.75 ml/kg +0.5 mg/kg). The duration of analgesia was almost similar in both the groups.

Akbas et al [11] reported that, the duration of analgesia in group RC (0.2% 0.75 ml/kg+1µg/kg) was 14±3.1 hr, 10±4.32 hr in group RK (0.2% 0.75 ml/kg + 0.5 mg/kg) and 4±3.23 hr in group R (0.2% 0.75 ml/kg). The mean duration of analgesia significantly higher in group RC than in group RK and group R (p<0.05). This was in accordance with our study. However, the longer duration of analgesia in both groups compared to our study

could be due inclusion of surgeries like inguinal hernia and circumcision, while our study included orthopedic procedures also.

In our study one patient in RC group had bradycardia and was treated with inj. Atropine 10µg/kg iv. None of the patients in group RK had any complication. We did not find any other complication in the either groups.

Akbas et al [11] observed bradycardia in one child in group RC, nausea and vomiting in 5 children in group RC and RK. The criteria for bradycardia and hypotension were similar to our study.

Manickam et al [9] observed that the mean arterial pressure and heart rate were less in ropivacaine-Clonidine group as compared to plain ropivacaine (p=0.02), which was similar to our study.

Limitations

Our sample size was 30. May be, a larger group would have thrown some light on some complications. The person observing the pain score was not same for all the patients and the pain score used was observational, which might have influenced the duration of analgesia.

5 Tables & Figures

Table 1: Patient characteristics and clinical parameters

Parameter	Group RC	Group RK	P value
Age (years)	3.47±1.89	3.60±1.69	0.775 NS
Weight (Kg)	11.63±2.77	12.63±2.88	0.176 NS
Duration of surgery (minutes)	58.8 ± 13.04	56.7 ± 11.08	0.508 NS
Pre op HR (per minute)	107.13 ± 15.76	110.67 ± 14.65	P = 0.768 NS
Pre op MAP (mm Hg)	54.86 ± 5.85	54.46 ± 6.57	P = 0.958 NS

NS = Not significant

Table 2: Comparison of Surgical Procedures in two Groups

Type of surgery	Group RC		Group RK	
	No of Patients	Percentage	No of Patients	Percentage
Herniotomy	15	50	14	46.67
Orchidopexy	4	13.33	2	6.67
Hypospadias	3	10	5	16.67
Orthopaedic Procedure	6	20	4	13.33
Others	2	6.67	5	16.67
Total	30	100	30	100

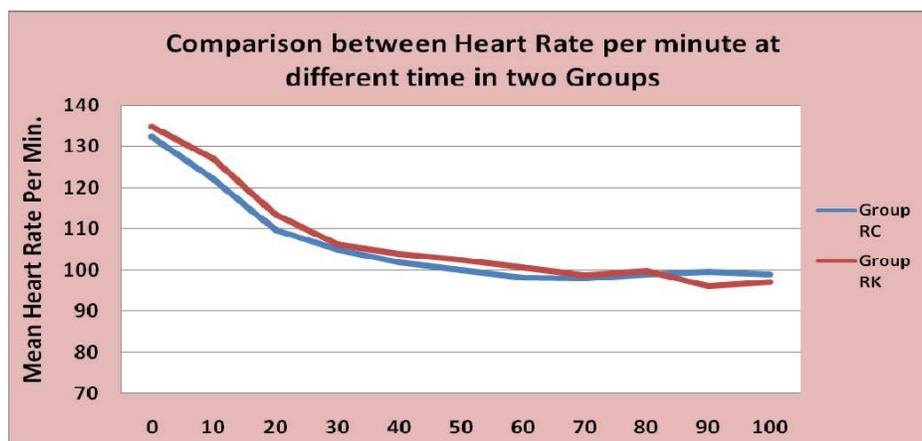


Fig 1: Comparison of heart rate per minute at different time in two groups

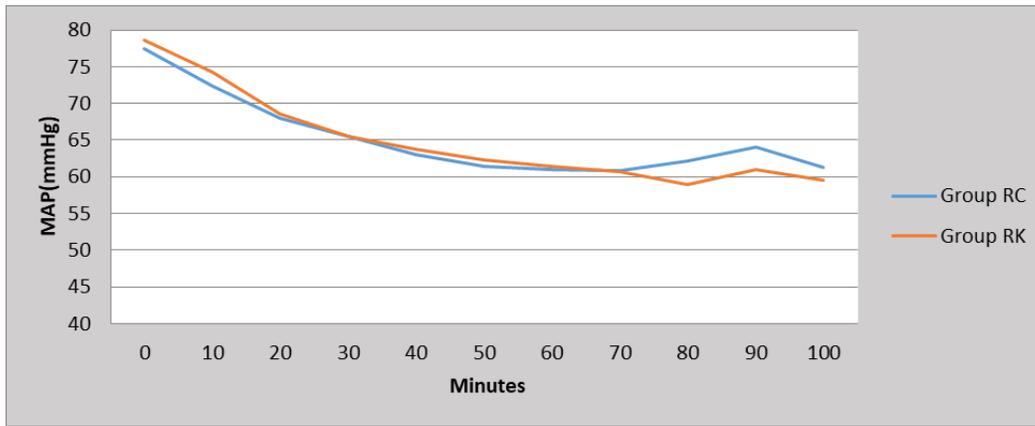


Fig 2: Comparison between MAP at different time in two groups

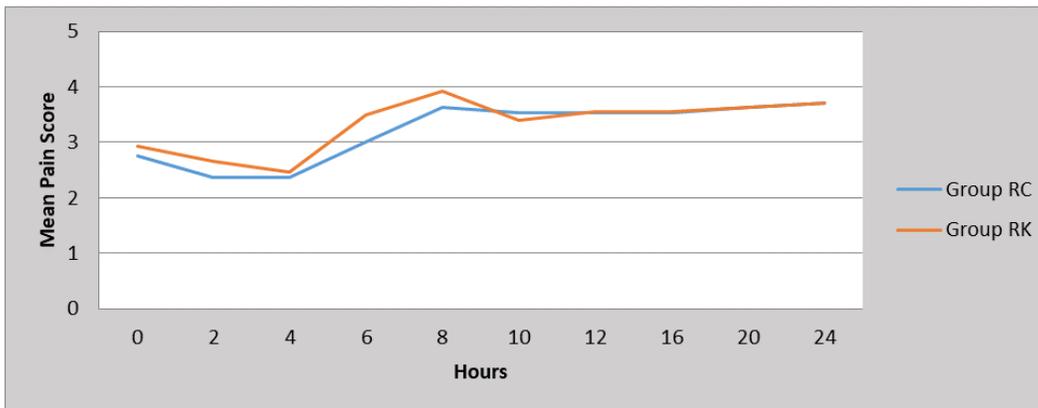


Fig 3: Comparison of pain score at different time in two group

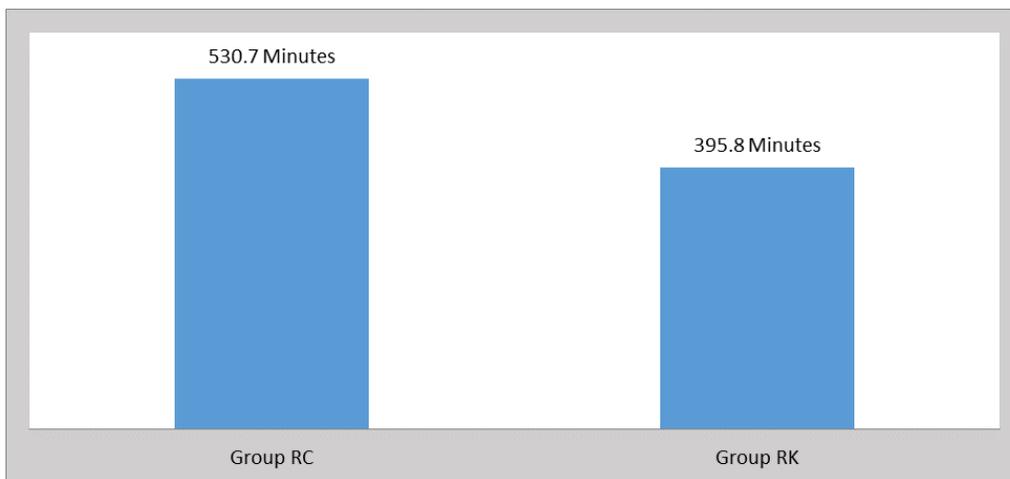


Fig 4: Comparison of duration of analgesia between two groups

6 Conclusion

Ropivacaine (0.25%) with Clonidine (1µg/kg) in caudal block significantly prolongs the duration of analgesia compared to Ropivacaine (0.25%) with Ketamine (0.5 mg/kg), without any adverse effects.

7 References

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