e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(10); 118-125

Original Research Article

A Comparative Study Between Clonidine used as Adjunct to Ropivacaine and Bupivacaine for Caudal Analgesia in Paediatric Patients

Varun Deshmukh[1], Darshan Dipakbhai Shah[2], Nidhi Pancholi[3], Pinank Pandya[4] ,Ekta Rairikar[5]

[1]Consultant Intensivist, Vishesh Jupiter Hospital, Indore, Madhya Pradesh, India

[2]Assistant Professor, Dep artmentof Emergency Medicine, Pramukh Swami Medical College, Bhaikaka University, Karamsad, Anand , Gujarat, India

[3]Associate Professor, Department of Obstetrics and Gynaecology, GMERS Medical College and Hospital, Gotri, Vadodara, Gujarat, India

[4]Consultant Intensivist, Jaslok Hospital and Research Centre, Mumbai, Maharashtara, India

[5]Assistant Professor, Department of Ophthalmology, Index Medical College Hospital and Research Centre, Indore, Madhya Pradesh, India

Received: 01-09-2024 / Revised: 21-09-2024 / Accepted: 15-10-2024

Corresponding Author: Dr Ekta Rairikar

Conflict of interest: Nil

Abstract

Background: Postoperative pain management in children is critical, as inadequate relief can lead to lasting negative effects. Clonidine, an α2-adrenergic agonist, may enhance analgesia when used with local anesthetics. The main objective of the study is to evaluate the effects of clonidine as an adjunct to caudal bupivacaine and ropivacaine in terms of analgesic efficacy, duration of analgesia, sedation levels, hemodynamic changes, and complications.

Methods: A prospective study was conducted involving 100 children aged 1-7 years undergoing elective infraumbilical surgeries. Patients were divided into four groups: Group A (bupivacaine), Group B (bupivacaine + clonidine), Group C (ropivacaine), and Group D (ropivacaine + clonidine). Pain was assessed using the FLACC scale, and the duration of analgesia was defined as the time from injection to first rescue analgesic requirement.

Results: The duration of analgesia was significantly longer in the clonidine groups: Group B had 9.89±1.72 hours compared to Group A's 6.13±1.28 hours ($p < 0.0001$). Group D had a duration of 9.3±1.3 hours versus Group C's 5.84±1.08 hours. Sedation levels and hemodynamic stability were monitored, with some observed side effects including sedation and hypotension.

Conclusion: Clonidine significantly prolongs the duration of postoperative analgesia when added to caudal bupivacaine and ropivacaine in pediatric patients. This adjunctive use may improve pain management strategies in pediatric anesthesia.

Keywords: Clonidine, Bupivacaine, Ropivacaine, Pediatric Anesthesia, Postoperative Analgesia, Caudal Block.

Introduction

Pain is one of the most misunderstood, underdiagnosed and untreated medical problems particularly in children. It is a likely reflection of myths like the child's lack of ability to perceive pain or remember painful experiences and relative lack of knowledge about age specific aspects of physiology and pharmacology and routine pain assessment. New JACHO (joint commission on accreditation of health care organization) regards pain as fifth vital sign and requires care givers to regularly address and assess pain. Since October 17, 2005, focuses on children's pain started with IASP's Global day against pain in children. IASP (International association for study of pain) defines pain as "An unpleasant emotional and sensory experience associated with actual or potential tissue damage or described in terms of such damage". It further states that pain is always subjective. Each individual learns the application of the word through experiences related to injury in early life, thus it emphasizes the importance of early pain experiences in shaping the response to future pain. Inadequate pain relief during childhood may have long term negative effects including harmful neuroendocrine responses, disrupted eating and sleep cycles and increased pain perception during subsequent painful experiences. Post-operative pain has adverse psychological effects in child. Pain can result in restless and uncooperative patient. So, it is preferable to prevent the onset of pain rather than to relieve its existence. Various multimodal techniques for paediatric pain relief have been designed. These involve regional

anaesthesia with systemic analgesics, out of which the most commonly used regional block in paediatrics is caudal epidural block.

Caudal block is a useful alternative to general anaesthesia and total I.V. anaesthesia as it provides effective post-operative analgesia. Unfortunately, motor block produced by caudal block may be a cause of distress to children in the post- operative period.[1]

Ropivacaine, a new amide local anaesthetic agent, offers a wider margin of safety than bupivacaine, with lower potential for central nervous system and cardiovascular system side effects. Ropivacaine also has greater sensory and less motor effects than bupivacaine.[2] In paediatric patients, this could allow more rapid mobilization after surgery. One of the main drawbacks of caudal technique is short duration of analgesia even with long duration local anaesthetics like bupivacaine and ropivacaine.[3]

Various additives e.g. Ketamine, Neostigmine, Clonidine, Ephedrine, and opioids have been used to prolong the duration of analgesia provided by single injection. Ketamine has potential risk of neurotoxicity and opioids have side effects such as nausea, vomiting and respiratory depression. Clonidine, an alpha 2 agonist, widely used as an antihypertensive agent in 70s and 80s, is now used as sedation, premedication and as adjuvant analgesic.[4] Its addition allows use of lower concentration of local anaesthetic for achieving same level of anaesthesia but with a prolonged duration of analgesia, thus increasing margin of safety and reducing incidence of motor block. Because of its sedative and analgesic effects, it is gaining popularity in anaesthesiology. It does demonstrate adverse effects like sedation, hypotention and bradycardia. Considering the above facts, we designed the present study using bupivacaine and ropivacaine alone and with clonidine in order to assess analgesic efficacy and duration of postoperative analgesia in children undergoing infraumbilical operations.

The main aim of study is to evaluate the effects of clonidine as adjunct to caudal bupivacaine and ropivacaine, and assess and compare the following parameters: 1) the quality and duration of postoperative analgesia in the all study groups. 2) The degree and duration of sedation. 3) The hemodynamic changes. 4) The complications, if any during the intra and post-operative period.

Materials and Methods

This study was conducted in 100 children undergoing elective infra-umbilical surgeries like herniotomy, orchidopexy, and hypospadias repair etc. during the period 2010 -2013.

Inclusion criteria: ASA (American Society of Anesthesiologists) risk I or II, Patients scheduled for elective surgery, Age of patient (1-7) either gender

Exclusion criteria: Parent's refusal, Patients with known allergy to ropivacaine, bupivacaine or clonidine, Contraindications for caudal blockade such as infection near the site of the needle insertion, Coagulopathy or anti coagulation, Congenital abnormalities of the lower spine or meninges, because of the unclear or impalpable anatomy.

Procedure: Following approval by the institutional ethics committee and written and informed consent, 100 patients scheduled for elective surgery under general anaesthesia were recruited for the comparative study. The patients were assigned randomly into either of four groups with each group including 25 patients.

Group A- 0.25% plain bupivacaine 1 ml/kg + 1 ml normal saline
Group B- 0.25% plain bupivacaine 1 ml/kg + clonidine 1 µg/kg in 1 ml normal saline
Group C- 0.2% plain ropivacaine 1 ml/kg + 1 ml normal saline
Group D- 0.2% plain ropivacaine 1 ml/kg + clonidine 1 µg/kg in 1 ml normal saline

The patients underwent a pre-anaesthetic check-up the day before surgery and all the routine and specific investigations were noted. Patients were kept fasting for 6 hours. All subjects received preoperative dose of oral midazolam 0.5 mg/ kg, 30 min before anaesthetic induction. After arrival in operating room, monitoring which included ECG, pulse oximetry, NIBP was applied and intravenous cannula was inserted into a suitable vein and inj. Isolyte P was started. The patient was given premedication in the form of Inj. Glycopyrrolate (4 µg/kg) and Inj. Ondansetron (100 µg/kg) intravenously. The patient was then pre-oxygenated via a facemask and JR circuit with fresh gas flow of 6 L/min oxygen for 5 min. Anaesthesia was induced with 7 mg/kg Inj. Sodium Pentothal i.v. and Inj. Succinylcholine 2 mg/ kg i.v. Patient was intubated with appropriate ET tube/ LMA. For maintenance of anaesthesia, Oxygen, Nitrous Oxide, Sevoflurane and Inj. Atracurium i.v. was given. No other narcotics, analgesics, sedatives, or antiemetics were administered intra-operatively.

After endotracheal intubation, patients were placed in the lateral decubitus position, and a single dose caudal block was performed according to the group under sterile conditions using a 23G needle and standard loss of resistance technique. The drugs to be given in caudal block varied according to the group, and were administered after negative aspiration for blood and cerebrospinal fluid. The syringes for the study solutions were prepared by a senior resident of the anaesthesiology department

who was given written protocols for drug preparation and was unaware of the patients and operation theatre team. The site of injection was dressed and the patient was turned supine.

Haemodynamic parameters (heart rate, ECG, blood pressure), respiratory rate and peripheral oxygen saturation were recorded before induction, after induction and then immediately after caudal anaesthesia, and every 15 minutes during surgery thereafter.

Duration of anaesthesia, defined as time from induction of anaesthesia to the time of extubation; duration of surgery; and duration of postoperative analgesia, defined as time from single shot caudal injection of drug to the FLACC pain score of more than 4, were also noted. A decrease in MAP>30% was defined as hypotension and was treated with intravenous fluids/ Inj. Mephentermine. Perioperative blood loss was replaced meticulously using crystalloids and blood, as appropriate. A decrease in HR>30% was considered as bradycardia and was treated with Inj. Atropine 0.01 mg/kg.

Patient were reversed with Inj. Glycopyrrolate 8 µg/ kg and Inj. Neostigmine 0.05 mg/ kg. At the conclusion of surgery, the patient was awakened and transported to the post-anaesthetic care unit. Parameters that included pulse, SpO_2, respiratory rate, sedation score, FLACC score were recorded postoperatively at 0 minutes, 30 minutes, 1 hour, 2 hour, and then every 2 hour for next 24 hours in PACU. Recordings were done by a senior resident of anaesthesiology and a well trained staff. Any side effects, that is, nausea, vomiting and bradycardia were observed. Fall in oxygen saturation to less than 95% was considered as respiratory depression and patient was given oxygen by face mask at the rate of 4 L/minute.

Analgesia was assessed using FLACC pain scale. Children who had a pain score of more than 4 were administered inj. Diclofenac 2 mg/kg i.v. and study was considered complete. Time of administration of rescue analgesia was noted.

Table 1: FLACC score

	0	1	2
Face	No expression or smile	Occasional grimace or frown, Withdrawn, Uninterested	Freq to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, Tensed	Kicking or legs drawn up
Activity	Lying quietly normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, jerky
Cry	No cry (awake or asleep)	Moans or whimper, occasional complaint	Crying, steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

Sedation score

0. Eyes open spontaneously
1. Eyes open in response to verbal command
2. Eyes open in response to physical stimulation
3. Unarousable

All the observations were recorded and all the results were analysed using Epi- info7.0. Statistically data were presented as mean ± S.D. ANOVA (Analysis of Variance) test and Kruskel Wallis H test (equivalent to chi square test) was performed for the data evaluation. A value of $P<0.05$ was considered as a statistically significant difference.

Results

The present study is a randomized, double blind study, conducted in 100 children of ASA physical status I and II, aged 1-7 years, undergoing elective infra- umbilical surgeries like herniotomy, orchidopexy, hypospadias repair etc. and divided into four groups, 25 patients in each group.

Table 2: Demographic data

Variables		Group A	Group B	Group C	Group D	p value
Age in years	Mean	4.2	4.56	4.2	4.64	0.6275
	SD	1.66	1.42	1.76	1.22	
Weight in Kg	Mean	13.12	14.16	12.2	12.96	0.3462
	SD	4.32	4.69	5.38	2.56	
Sex ratio	23:2	23:2	20:5	22:3	23:2	NA

As per the table 2, mean age and weight in all groups are nearly same without any significant difference (p value > 0.05) (ANOVA test). There is slight female preponderance in group C.

Table 3: Duration of surgery

Duration (min)					
	Group A	**Group B**	**Group C**	**Group D**	**p value**
Mean	83.4	85.2	82.2	78.6	0.1267
SD	20.80	21.96	22.14	23.03	

There was no statistically significant difference in duration of surgery in all four groups. (p>0.05)

Table 4: Surgical procedures

Surgery	Group A	Group B	Group C	Group D
Inguinal hernia	12	13	14	12
Hypospadias & urethral fistula repair	7	7	8	9
Orchidopexy	4	3	1	2
Cystolithotomy	1	0	1	2
Extrophy bladder repair	1	2	1	0

Table 5: Mean duration of caudal analgesia in hours

	Group A	Group B	Group C	Group D	P-value
Mean duration of Analgesia (Hours)	6.1±1.28	9.89±1.72	5.84±1.08	9.3±1.3	<0.0001

Table 5 shows the duration of postoperative caudal analgesia in all four groups. This duration was significantly prolonged by addition of Clonidine.

Table 6: Duration of post-operative analgesia (groups A vs. B)

Duration of analgesia			
Mean±SD	Group A; 6.1±1.28	Group B; 9.89±1.72	p<0.0001

When clonidine is added as an adjunct to bupivacaine, it significantly prolongs the duration of post-operative analgesia (groups A vs. B)

Table 7: Duration of post-operative analgesia (groups C vs. D)

Duration of analgesia			
Mean±SD	Group C; 5.84±1.08	Group D; 9.3±1.3	p<0.0001

Addition of clonidine to ropivacaine significantly prolongs the duration of post- operative analgesia, (groups C vs. D)

Table 8: Duration of post-operative analgesia (groups B vs. D)

Duration of analgesia			
Mean±SD	Group B; 9.89±1.72	Group D; 9.3±1.30	P=0.1352

Addition of clonidine to either bupivacaine or ropivacaine does not produce statistically significant prolongation of duration of post-operative analgesia (group B vs. group D)

Table 9: FLACC score at 4 hours (groups A vs. B)

Duration of analgesia			
Mean±SD	Group A; 4.32±1.03	Group B; 2.8±0.70	P<0.0001

The above table and graph shows the comparison of FLACC scores at 4 hours post operatively. Adding clonidine significantly reduces the scores in group B as compared to group A.

Table 10: FLACC score at 4 hours (groups C vs. D)

FLACC score at 4 hours			
Mean±SD	Group C; 4.56±0.91	Group D; 2.8±0.5	p<0.0001

The above table shows the comparison of FLACC scores at 4 hours post operatively. Higher FLACC scores are observed at four hours in plain ropivacaine group (group C) as compared to clonidine group (group D).

Table 11: Mean Sedation Score in Immediate Post-operative Period

Group	0 min	30 min	60 min	120 min
A	2.24	2	1.72	1.04
B	2.68	2.36	1.92	1.48
C	2.16	1.92	1.56	1
D	2.44	2.2	1.76	1.28

Time Interval (minutes): Mean sedation score immediately after awakening was higher in groups B and D. After two hours of awakening, there was gradual fall in mean sedation score in all four groups.

Table 12: Intra-operative mean MAP

Group	0 min	15 min	30 min	45 min	60 min	75 min	90 min	105 min	120 min
A	67.17	65.18	63.64	63.37	63.23	63.21	63.29	64.32	64.32
B	67.01	65.01	63.15	62.78	62.68	62.84	62.92	63.21	63.21
C	67.02	65.02	63.34	63.00	63.07	62.96	63.12	64.04	64.04
D	67.07	65.07	62.51	62.27	62.18	62.24	61.78	62.10	62.10

Intra-operative mean MAP values are shown in the graph. In group B and D, there is slight fall in mean MAP after 30 minutes of caudal drug injection.

Table 13: Intraoperative Mean Pulse Rate

Group	0 min	15 min	30 min	45 min	60 min	75 min	90 min	105 min	120 min
A	122.4	118.52	116.48	115.08	115	114.61	114.88	116	115.67
B	122.84	116.44	111.68	110.84	110.78	110.33	110.33	110.55	112
C	121.52	119.72	118.88	115.84	116.08	116.06	118.14	117.5	118.25
D	124.68	119.68	111.68	110.48	110.4	110.42	110.69	110.66	111

Intra-operative mean pulse values are shown in the graph. In group B and D, there is slight fall in mean pulse rate after 30 minutes of caudal drug injection.

Table 14: Post-operative Mean Pulse Rate

Group	30 min	60 min	120 min	240 min	360 min	480 min	600 min	720 min
A	115.8	116.92	118.72	121.6	121.7	129	131.1	130.6
B	112.8	113.2	115.2	116.24	117.4	118.38	120	119
C	115.76	117.4	119.6	121.6	122.13	125.6	126.4	128.5
D	111.52	112.8	114.12	115.16	116.6	118.76	117.67	122.6

In the post-operative period, the pulse rate increased gradually towards the pre- operative values in all four groups.

Table 15: Post operative complication

Post-op complication	Group A	Group B	Group C	Group D
Nausea And Vomiting	2(8%)	4(16%)	3(12%)	5(20%)
Bradycardia	0	1(4%)	0	2(8%)
Respiratory Depression	0	0	0	0

Discussion

Pain is an unpleasant subjective sensation which can only be experienced and not expressed, especially in children, who rely completely on their parents or care givers for their wellbeing. The concept of post-operative pain relief and its utilization in the paediatric age group has improved dramatically over recent years. In children, narcotics could cause respiratory depression; oral analgesics cannot be given for some time after general anaesthesia due to fear of vomiting and aspiration, and fear of needle-stick in case of parenteral analgesics. The regional techniques significantly decrease the post-operative pain and systemic analgesic requirement.

Caudal block is a useful alternative to general anaesthesia and total I.V. anaesthesia as it provides effective post-operative analgesia. Unfortunately, motor block produced by caudal block may be a

cause of distress to children in the post- operative period. [9] One of the main drawbacks of caudal technique is short duration of analgesia even with long duration local anaesthetics like bupivacaine and ropivacaine.[3] The quest for finding the ideal combination of drugs for caudal anaesthesia in children is never ending, but the efforts to use relatively safer drugs and that too in lower concentrations are growing day by day. Ketamine, Neostigmine, Clonidine, Ephedrine, and opioids have been used to prolong the duration of analgesia provided by single injection. Ketamine has potential risk of neurotoxicity and opioids have side effects such as nausea, vomiting and respiratory depression. Clonidine, an alpha 2 agonist, allows use of lower concentration of local anaesthetic for achieving same level of anaesthesia but with a prolonged duration of analgesia, thus increasing margin of safety and reducing incidence of motor block.[5] Clonidine produces analgesia by interacting with alpha 2 adrenergic receptors, located on superficial laminae of spinal cord and brain stem nuclei. It does demonstrate adverse effects like sedation, hypotension and bradycardia.

Using Clonidine makes catheter placement unnecessary for paediatric procedures, reducing the overall morbidity and cost of regional block procedure.

Ropivacaine has been extensively used for regional anaesthesia in adults and older children and has been used safely even in the younger age group as well for caudal epidural analgesia.[6, 7, 8] The lower incidence of cardiovascular and neurological toxicity as well as the ability to produce lesser motor blockade has made the ropivacaine a safer choice as compared to bupivacaine for caudal epidural anaesthesia especially for day care surgeries.[9] In the present study we attempted to compare bupivacaine and ropivacaine alone and with clonidine in order to assess analgesic efficacy and duration of postoperative analgesia in children undergoing infraumbilical operations. Sharpe [10] speculated that small volume of Bupivacaine (0.5ml/kg) may not be enough to deliver Clonidine up to the spinal cord leaving only direct action on the nerve routes in caudal area. These findings suggest that the addition of Clonidine 2µg/kg to low volume of caudal anaesthetics has limited clinical benefit in children undergoing circumcision. Therefore, we chose a standard dose of 1ml/kg 0.25% Bupivacaine in both bupivacaine groups. A higher concentration of ropivacaine 0.5% is associated with a prolonged duration of analgesia as compared to 0.25% ropivacaine but at this concentration, plasma levels are high and can cause early toxicity in children along with an increased motor blockade.[18] M. J. Da Conceicao et al9 studied effect of caudal analgesia using 0.375 % ropivacaine vs. 0.375 % bupivacaine in 3-6 year ASA I patients. They concluded that future studies should be done using less concentration of ropivacaine to obtain efficient sensory block with less motor block than 0.375% concentration. Hence we chose 0.2% concentration of ropivacaine. 2 mg/ml concentration of ropivacaine is considered equipotent to 2.5 mg/ml bupivacaine.[11]

The dose of Clonidine for epidural administration is 1-5µg/kg. We chose a dose of 1µg/kg in our study based on the findings of Klimscha [12], showing that increasing the dose from 1 µg/kg to 2µg/kg did not enhance the analgesic effect of Clonidine but increased the incidence of side effects like respiratory depression, bradycardia and hypotension with increasing dose. Patients in our study were demographically similar in both groups. There were no statistically significant variations regarding age and body weight. Majority of patients had infraumbilical surgical procedures like inguinal hernia, hypospadias, orchidopexy. Duration of surgery was also similar in both the groups and statistically not significant. Different scores to assess the pain in children have been used. They include modified OPS (Objective Pain Scale), CHEOPS (Children's Hospital Eastern Ontario Pain Scale), Maunuksela score, Poker chip tool instruction sheet and FLACC scale. We chose the FLACC score to evaluate post-operative pain as it is easy to use, is validated and gives an objective evaluation. Duration of analgesia means time from injection of caudal to first dose of rescue analgesic i.e. FLACC > 4.

In children a mixture of 0.25% Bupivacaine with 1-2 µg/kg Clonidine has shown to improve the duration and quality of analgesia provided by caudal block. Study by Motsch et al [13] has shown a mean duration of analgesia of 20.9±7.4 hours in children receiving caudal Clonidine with Bupivacaine, but a dose of 5µg/kg of Clonidine was used.

The wide variation in the duration of action of Clonidine in the various studies could be due to: doses of Clonidine used differences in premedication and volatile anaesthetic used, type of surgery, indications for rescue analgesia, assessment of pain and statistical analysis. In our study, duration of postoperative analgesia using plain bupivacaine (group A) was 6.13±1.28 hours, which increased by adding clonidine (group B) to 9.89±1.72 hours. ($p < 0.0001$, significant). Our results were similar to that of Aruna Parameswari.[14] In their study, the mean duration of analgesia was significantly longer in group-B (Bupivacaine + clonidine) 593.4±423.3 minutes than in group- A (Bupivacaine) 288.7±259.1 minutes. Children in group B had lower pain scores and requirement of rescue medications.

Duration of post-operative analgesia using plain ropivacaine (group C) was 5.84±1.08 hours and adding clonidine to it (group D) increased the

duration to 9.3±1.3 hours. Mashallah Goodarzi [2] et al, in their study found Mean duration of analgesia was 3.3 ± 1.5 hours in plain ropivacaine group, while 7.2 ± 1.4 in ropivacaine and clonidine group. Thus they found that addition of 1 µg/ml clonidine in ropivacaine significantly increased the duration of post-operative analgesia. Kavita U Adate [16] et al found longer duration of postoperative analgesia with ropivacaine 0.2% with 2 µg/ml clonidine i.e. 21.37 ± 6.87 hours. This may be due to adding higher concentration of clonidine and use of a different pain assessment scale- poker chips scale. FLACC score at 4 hour after surgery were 4.32±1.03, 2.8±0.70, 4.56±0.91, 2.8±0.5 in groups A, B, C, and D respectively. This shows that rescue analgesia was needed early in plain ropivacaine and bupivacaine groups. Addition of clonidine delayed the first dose of rescue analgesic.

This is in agreement with the study by Aruna Parameswari4 and Akilandeswari Manickam [15] who reported higher FLACC scores in plain bupivacaine or ropivacaine group. Thus, addition of clonidine delayed the first dose of rescue analgesic. In our study, the period of sedation was significantly longer in children who received clonidine.

However, it is difficult to distinguish between sedation and analgesia, as we noticed that all children were asleep provided they were comfortable and they became restless or awake only when they were in pain and required analgesia. The greater analgesic effect of clonidine might be mistaken for sedation and vice versa. Hence, it cannot be concluded that the longer duration of sedation was caused entirely by the sedative effect of clonidine. In the immediate post- operative period Sedation score was higher in the clonidine groups.

Patients were sedated but arousable. After four hours the mean sedation scores in both the groups was almost same and statistically not significant. Patients were not deeply sedated (unarousable, Score -3), during the study period. This finding is consistent with findings by De Negri et al.[16] Sedation after epidural clonidine results from activation of α_2 adrenoceptors in the locus coeruleus, an important modulator of vigilance.

This suppresses the spontaneous firing rate of the nucleus, thereby resulting in increased activity of inhibitory interneurons such as gamma aminobutyric acid (GABA)-ergic pathways, to produce CNS depression. Our study shows that addition of one µg/kg of Clonidine to Bupivacaine and ropivacaine slightly reduces pulse rate and MAP (3 - 10%) after 15-30 minutes of caudal administration, but does not require pharmacological intervention and does not have significant effect on the patient's hemodynamic status. Probable explanation being, clonidine given by neuraxial route decreases the impulse generation by preganglionic sympathetic nerves. Similarly, the dominance of the para sympathetic nervous system results in an increased vagal tone, which causes bradycardia. Findings of Motsch [27], Jamali S [17] and Archna Koul2 also support our result of slight drop in pulse rate and MAP after administration of clonidine.

The incidence of nausea vomiting was slightly higher in children who received clonidine. It was treated with Inj. Ondansetron 0.15ml/kg i.v. Joshi W [18] also reported the same finding in their study. There was no apparent motor deficit in our patients probably due to the lower concentration of ropivacaine used. The findings are in accordance with Zaric D et al.[19] In our study, we have not observed decrease in respiratory rate and fall in SpO2 requiring oxygen supplementation. This is comparable with studies of J.J.Lee [20] and Lt Col Upadhay [21].

Conclusion

This study was conducted in 100 children, graded ASA I and II, undergoing elective infra-umbilical surgeries under general anaesthesia. The patients were assigned randomly into four groups of 25 patients each. Caudal epidural was given in all patients according to their groups, after giving general anaesthesia. Two groups received plain ropivacaine (0.2%) and bupivacaine (0.25%) 1 ml/kg. In the other two groups clonidine (1 µg/kg) was added.

The patients were observed post- operatively for quality and duration of analgesia (using FLACC score), sedation, hemodynamic and respiratory variables. It was found that addition of clonidine to both, ropivacaine and bupivacaine, significantly increases the duration of post- operative analgesia.

References

1. Da Conceicao MJ, Coelho L. Caudal anaesthesia with 0.375% ropivacaine or 0.375% bupivacaine in paediatric patients. Br J Anaesth, 1998 Apr; 80(4):507-8.
2. Mashallah Goodarzi, Comparison of Ropivacaine-Clonidine with Plain Ropivacaine for Caudal Analgesia in Children. ASA abstracts;A-1310
3. Koining H, Krenn CG, Glacer C, Marhofer P, Wilding E, Brunner M et al. The dose response of caudal ropivacaine in children. Anaesthesiology 1999; 90:1339- 44.
4. Lloyd-Thomas AR. Pain management in paediatric patients. Br J Anaesth 1990; 64: 85-102.
5. Lonnquist PA. Adjuncts to caudal block in children. Quo vadis Br J Anaesth 2005; 95: 431-3.
6. Joshi W, Connelly NR, Freeman K, Reuben SS. Analgesic effect of clonidine added to

bupivacaine 0.125% in paediatric caudal blockade.Paediatr Anaesth 2004 Jun;14(6):483-6.
7. Tripi PA, Palmer JS, Thomas S, Elder JS. Clonidine increases duration of bupivacaine caudal analgesia for ureteroneocystostomy:a double-blind prospective trial. J urol.2005 Sept; 174(3):1081-3.
8. Yildiz TS, Korkmaz F, Solak M, Toker K. Clonidine addition prolongs the duration of caudal analgesia. Acta Anaesthesiol Scand 2006 Apr; 50(4):501-4.
9. Hansen TG, Henneberg SW, Walther-Larsen S, Lund S, Lund J, Hansen M. Caudal bupivacaine supplemented with caudal or intravenous clonidine in children undergoing hypospadias repair:a double-blind study.Br J Anaesth.2004 Feb;92(2):223-7.
10. Sharpe P, Klein JR, Thompson JP, Rushman SC, Sherwin J, Wandless JG, Fell D. Analgesia for circumcision in a paediatric population:comparison of caudal bupivacaine alone with bupivacaine plus two doses of clonidine.Paediatr Anaesth 2001 Nov,11(6):695-700.
11. McClure J. Ropivacaine. Br J Anaesth 1996; 76:300-7.
12. Kimchi W, Chiari A, Michalek- Sauberer A, Wildling E, Lerche A, Lorber C, Semsroth M .The efficacy and safety of a clonidine/bupivacaine combination in caudal blockade for paediatric hernia repair.Anaesth Analg 1998 Jan;86(1):54-61.
13. Motsch J, Bottiger B W, Bach A, Bohrer H, Skoberne T, Martin E. Caudal clonidine and bupivacaine for combined epidural and general anaesthesia in children.Acta Anaesthesiol Scand.1997 Aug;41(7):877-83.
14. Aruna Parameswari, Anand M Dhev,and Mahesh Vakamudi, Efficacy of clonidine as an adjuvant to bupivacaine for caudal analgesia in children undergoing sub-umbilical surgery. Indian Journal of Anaesthesia 2010; Sept-Oct 54(5):458- 463.
15. Akilandeswari Manickam, Mahesh Vakamudi, Aruna Parameswari, Chetana Chetan. Efficacy of clonidine as an adjuvant to ropivacaine for caudal analgesia in children undergoing subumbilical surgery. J anaestheiol clinical pharmacol 2012; 28:185-9.
16. De Negri P, Ivani G, Visconti C, De Vivo P. How to prolong postoperative analgesia after caudal anaesthesia with ropivacaine in children: S-ketamine versus clonidine. Paediatr Anaesth. 2001 Nov;11(6):679-83.
17. Jamali Samir, Sylvaine Monin, Christian Begon, Anne-Marie Dubousset, and Claude Ecoffey.Clonidine in paediatric caudal anaesthesia. Anaesth Analg 1994; 78:663-666.
18. Joshi W,Connelly NR,Freeman K,Reuben SS.Analgesic effect of clonidine added to bupivacaine 0.125% in paediatric caudal blockade.Paediatr Anaesth 2004 Jun;14(6):483-6.
19. Zaric D, Nydahl PA, Philipson L, Samuelsson L, Heierson A, Axelsson K, et al. The effect of continuous lumbar epidural infusion of ropivacaine 0.1%, 0.2%. 0.3% and 0.25% bupivacaine on sensory and motor block in volunteers. A double blind study. Reg Anaesth 1996;8:127-9.
20. J J Lee and A.P.Rubin.Comparison of a bupivacaine –clonidine mixture with plain bupivacaine for caudal analgesia in children.British Journal of Anaessia 1994;72:28-262.
21. Lt. Col. Upadhyay K. K, Dr Brig. Prabhakar T., Dr Lt Col. Handa R.,Dr Beena Haridas, Study of the efficacy and safety of clonidine as an adjuvant to bupivacaine for caudal analgesia in children. Indian J Anaesth.2005; 49(3):199-201.