www.jmscr.igmpublication.org
Index Copernicus Value: 79.54
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v7i4.51

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Comparison of Post-Operative Analgesia after Single Shot Caudal Epidural Block Using Ropivacaine with or without Clonidine in Children

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Abstract
Caudal epidural block is one of the most common regional anesthetic techniques in children being used to supplement general anesthesia for a wide variety of surgeries. The local anesthetics currently in use are safe and their pharmacological effects have been well evaluated. The aim of this study is to clinically evaluate the efficacy of caudal epidural clonidine in prolonging the post-operative analgesia when mixed with ropivacaine in children and to compare the post-operative pain-free duration and the side effects of ropivacaine with or without Clonidine. The addition of α-2 agonist, Clonidine to local anesthetic solution 0.2% ropivacaine has been shown to enhance the duration and quality of central and peripheral nerve blocks. The main advantage of Clonidine (versus opioids) is the negligible risk of respiratory depression.
Keywords: *Caudal epidural, post-operative analgesia, ropivacaine, Clonidine.*

Introduction

Pain is the uncomfortable conscious appreciation of a noxious stimulus. It consists of a constellation of unpleasant perpetual and emotional experiences, autonomic reflex responses and psychological and behavioral reactions. Pain is a protective mechanism designed to alert the body to potentially injurious stimuli. The alleviation of pain has been the focus of continuing human effort. However, it has been recognized for some time that the management of acute pain, specially, postoperative pain has been consistently inadequate. The situation in children has been even worse; children have long been under-medicated for acute pain[1].

The reasons for withholding analgesia from children are many and diverse, such as difficult to distinguish pain from hunger or fear in preverbal children, the myth that because some children do not act as if they are in pain, they are not in pain, The notion that children do not respond to pain to the same degree as adults etc.

Children learn quickly that if they complain of pain, then further pain, in the form of a second intramuscular injection, will follow. But because the analgesic effect of the injection takes some time, the children do not link the relief of the pain with the injection. The various modalities of postoperative pain relief currently available are:

1. On-demand administration of oral or parenteral analgesic drugs: Paracetamol, NSAIDs Opioids
2. Regional analgesia and nerve blocks: Central neuraxial block, Peripheral nerve block, Infiltration of wound with local anesthetic solution

Caudal epidural block is one of the most common regional anesthetic techniques in children being used to supplement general anesthesia for a wide variety of surgeries. The local anesthetics currently in use are safe and their pharmacological effects have been well evaluated.

Pre-emptive treatment will prevent the establishment of hypersensitivity by blocking the sensory input that induces central sensitization. The surgical model of pre-emptive analgesia acknowledges that, clinically, the initial tissue injury of surgery will be followed, in hours to days, with an inflammatory reaction to the damaged tissues. This inflammatory response will continue during wound-healing process. This model indicates that a single modality of pre-emptive treatment may be insufficient to eliminate postoperative pain because it would not last through the post-surgical inflammatory pain period. Thus, what is needed is a form of continuous pre-emptive analgesia. This could include NSAIDs to reduce the peripheral activation/sensitization of nociceptors, local anesthetics to block sensory inflow, and centrally acting opioids to prevent central sensitization throughout the postoperative period.[2]

Studies have indicated that pain score was lower, time to first dose of analgesic was longer and total morphine consumption was lower in the pre-emptive group than the group which received caudal analgesia after surgery.[3]

Caudal block is safe, easy to perform in children, gives reliable results in children, and requires no expensive or special equipment. It can be administered as single shot or as a continuous infusion through an indwelling epidural catheter. In children displacement of epidural catheter due to movements which are not under control, infection due to soiling because of the proximity to anal area is common. Single shot caudal epidural is more convenient and so preferred.

The use of adjuvants to local anesthetic has made it possible to prolong the duration of analgesia up to 24 hours, and at the same time reducing the doses and thus the toxicity of local anesthetics. It also obviates the use of epidural catheter that entails higher risks of displacement and costs.

The use of adjuvants in caudal block has several advantages. Several studies have demonstrated that clonidine or fentanyl when added to the local anesthetic in caudal block both enhances and prolongs the analgesia produced by the block without the unpleasant or hazardous side-effects associated with the use of other adjuvant drugs like, epinephrine and some newer adjuvants like neostigmine and dexmedetomedine.

In view of the above, this study was undertaken to evaluate and compare the efficacy and safety of clonidine as an adjuvant to local anesthetics to that of fentanyl when given caudally in children undergoing lower abdominal or perineal surgeries.

Materials and Methods

Pediatric patients posted for lower abdominal, perineal surgery of age group 1 to 12 years of ASA grade I & II. A sample of size 34 cases i.e. total 68 cases with Group I (Inj. Clonidine 1 µg/kg along with 0.75ml/kg of 0.2% Ropivacaine) to Group II (0.75ml/kg of 0.2% Ropivacaine) ratio being 1:1 satisfying the inclusion criteria would produce 80.0% statistical power (type II error = 0.20) and 5% type I error probability (□=0.05) to be able to detect the desired clinical significance of difference in outcome measure (Duration of analgesia) between two intervention groups with a two-tailed alternative hypothesis.

Inclusion criteria:

1. Consent
2. ASA grade I & II
3. Age: 1 to 12 Years
4. Type of surgery: Lower abdominal or perineal.
5. Weight 2-10kg

Exclusion criteria

1. Bleeding disorder
2. Patient with known hypersensitivity to Ropivacaine or Clonidine
3. Mentally retarded patients.
4. Infection at the site of needle placement.

We will be comparing the increase in the duration of analgesia and any qualitative difference in analgesia after addition of clonidine to local anesthetic solution 0.2% ropivacaine. We will also compare intra-operative hemodynamics, post-operative sedation, respiratory depression and any other side effects.

Global assessment of anesthesia defined as the time from caudal injection to the first administration of analgesia was recorded for both the groups: Any side effects in terms of hemodynamic alteration, respiratory depression, vomiting, urinary retention and sedation were noted.

Preanesthetic assessment

The cases were selected after a thorough pre anesthetic assessment, including detailed history, clinical examination and relevant laboratory investigations. The spine was examined for any evidence of sacral anomalies, skin infection, bony landmarks, movements and previous operations. Any child with a suspicion of infection over the sacral region and those with obvious bony anomalies of the sacrum were excluded from the study.

Investigations

1. Hemogram with PT and PTT.
2. urine- routine/microscopic
3. bleeding time
4. clotting time

Methods

NBM period

6 hours for solid food

4 hours for breast milk

2 hours prior for clear liquids

Premedication

Premedication was given with injglycopyrrolate10 ug/kg intramuscularly.

Anesthesia technique

Induction: General anesthesia induced with injthiopentone 5-6 mg/kg intravenously.

injvecuronium 0.1 mg/kg intravenously used to facilitate endotracheal intubation.

Maintenance

Maintenance of anesthesia was done with oxygen + nitrous oxide + sevoflurane. Inj vecuronium was used for muscle relaxation.

Caudal epidural block

Caudal block was performed after induction and before the start of surgery, using standard techniques

Equipment and drugs

The caudal sterile towel used for draping.

Epidural set consists of:

- Cleaning material: Sponge holding forceps, gauze pieces, savlon, povidone iodine, spirit.
- 23 G hypodermic needle.
- 10CC single use disposable plastic syringe.
- 20m1 ampoule of 0.2% ropivacaine.
- l ml ampoule of preservative free clonidine hydrochloride (CLONEON)

Technique of caudal epidural block

Position

After intubation, once the ventilation was stabilized, the children were turned into left lateral position and the legs flexed for performing the caudal block.

Preparation

After positioning the patient, the sacral area was properly cleaned by painting with povidone iodine cleaned with spirit and draped with sterile towel.

Identification of landmark's

The landmarks of posterior superior iliac spines and sacral cornua were identified by palpation. This was further confirmed by the formation of an equilateral triangle by the posterior superior iliac spine and sacral hiatus.

Procedure

The resilient feel of the sacro-coccygeal membrane was felt with the thumb and over this the skin was pierced at an angle of 60 degrees. The needle was then redirected at an angle of 45 degrees and the sacro-coccygeal membrane was pierced. Now the needle was made parallel to the skin and advanced by 2-3mm. The correct placement of needle in the epidural space was confirmed by aspiration of air bubbles in the syringe full of the drug solution to be

administered. Before giving the drug it was ensured that the needle tip was not in a blood vessel and that dura has not been punctured. In case of aspiration of blood, needle is removed and reinserted with a slight change of direction and if there is no blood on aspiration, the drug is injected. The needle is pulled out in one go and the site of puncture sealed with povidone iodine dressing to avoid infection. In case of 2-3 failed attempts in locating the caudal epidural space, the procedure was abandoned.

Intraoperative monitoring

The patient was monitored using standard monitoring i.e. ECG, (noninvasive), heart rate, pulse-oximetry and blood pressure during the course of surgery. Intravenous fluids were given as per requirement.

Reversal

The neuromuscular blockade was reversed with inj neostigmine 50µg/kg and inj glycopyrrolate 10µg/kg at the end of surgery.

Postoperative monitoring

Postoperative monitoring was done in the post-anesthesia care unit (PACU) for 2-3 hours and in the ward using a standard proforma for next 24 hrs (Appx B). The assessment of pain relief was done by using an objective pain score (Hannallah-Broadman). In addition the following parameters were noted like duration of surgery, duration of pain free period and Any other complications namely - nausea, vomiting, motor weakness, respiratory depression, sedation, hypotension and bradycardia. At the onset of pain, rescue analgesia was given as appropriate and the total duration of analgesia was noted.

Observations & Results

Table 1 The age distribution of the cases studied between two intervention groups (n=68)

Age Group (years)	Ropivacaine + Clonidine Group (n=34)		Ropivacaine Group (n=34)		P-value (Ropivacaine +Clonidine v Ropivacaine)
	N	%	n	%	
2.0 – 2.5	7	20.6	12	35.3	0.340^{NS}
2.6 – 3.0	8	23.5	7	20.6	
3.0 – 3.5	10	29.4	11	32.4	
3.6 – 4.0	9	26.5	4	11.8	
Total	**34**	**100.0**	**34**	**100.0**	

Values are n (% of cases). P -value by Chi-Square test. P-value <0.05 is considered to be statistically significant. *P-value<0.05, **P-value<0.01, ***P-value<0.001, NS: Statistically Non-Significant.

Comments

1) The mean ± standard deviation of age of the patients from Ropivacaine + Clonidine Group and Ropivacaine Group is 3.06 ± 0.60 years and 2.87 ± 0.61 years respectively.
2) In both the intervention groups, the majority of patients were in the age group 3.0 to 3.5 years (Ropivacaine + Clonidine Group – 10 patients and Ropivacaine Group – 11 patients,).
3) The age distribution did not differ significantly between two intervention groups (P-value>0.05).

Table 2 The sex distribution of the cases studied between two intervention groups (n=68)

Sex	Ropivacaine + Clonidine Group (n=34)		Ropivacaine Group (n=34)		P-value (Ropivacaine +Clonidine v Ropivacaine)
	n	%	n	%	
Male	32	94.1	29	85.3	0.427^{NS}
Female	2	5.9	5	14.7	
Total	**34**	**100.0**	**34**	**100.0**	

Values are n (% of cases). P-value by Chi-Square test. P-value <0.05 is considered to be statistically significant. *P-value<0.05, **P-value<0.01, ***P-value<0.001, NS: Statistically Non-Significant.

Comments

1) In both the intervention groups, the majority of patients were males (Ropivacaine + Clonidine Group – 32 patients and Ropivacaine Group – 29 patients).
2) The sex distribution did not differ significantly between two intervention groups (P-value>0.05).

Table 3 The distribution of body weight of the cases studied between two intervention groups (n=68).

Weight (kg)	Ropivacaine + Clonidine Group (n=34)		Ropivacaine Group (n=34)		P-value (Ropivacaine +Clonidine v Ropivacaine)
	n	%	n	%	
5.5 – 7.5	4	11.8	9	26.5	0.176^{NS}
7.5 – 9.5	22	64.7	15	44.1	
>9.5	8	23.5	10	29.4	
Total	**34**	**100.0**	**34**	**100.0**	

Values are n (% of cases). P-value by Chi-Square test. P-value <0.05 is considered to be statistically significant. *P-value<0.05, **P-value<0.01, ***P-value<0.001, NS: Statistically Non-Significant.

Comments

1) In both the intervention groups, the majority of patients had weight between 7.5 to 9.5kg (Ropivacaine + Clonidine Group – 22 patients and Ropivacaine Group – 15 patients).
2) The distribution of weight did not differ significantly between two intervention groups (P-value>0.05).

Table 4 The distribution of Procedure performed between two intervention groups (n=68).

Procedure	Ropivacaine + Clonidine Group (n=34)		Ropivacaine Group (n=34)		P-value (Ropivacaine +Clonidine v Ropivacaine)
	n	%	n	%	
Bilat. Orchidopexy	3	8.8	0	0.0	0.008**
Bilat. Inguinal Hernia Repair	4	11.8	14	41.2	
Hypospadias Repair	27	79.4	20	58.8	
Total	**34**	**100.0**	**34**	**100.0**	

Values are n (% of cases) P-value by Chi-Square test. P-value <0.05 is considered to be statistically significant. *P-value<0.05, **P-value<0.01, ***P-value<0.001, NS: Statistically Non-Significant.

Comments

1) In both the intervention groups, the majority of patients had Hypospadias Repair (Ropivacaine + Clonidine Group – 27 patients and Ropivacaine Group –20 patients).
2) The distribution of procedure performed did not differ significantly between two intervention groups (P-value>0.05).

Table 5. The inter-group comparison of total duration of surgery

Duration of surgery (mins)	Ropivacaine + clonidine Group (n=34)		Ropivacaine Group (n=34)		P-value(Ropivacaine+ Clonidine v Ropivacaine)
	Mean	SD	Mean	SD	
Duration (mins)	111.0	14.7	108.4	10.9	0.401^{NS}

Comments

1) The distribution of average duration of surgery did not differ significantly between two intervention groups (P-value>0.05).

Table 6a. The inter-group comparison of intra-op and post-op heart rate at each time interval

Heart rate (Per min)	Ropivacaine + Clonidine Group		Ropivacaine Group (n=34)		P-value(Ropivacaine+ Clonidine vRopivacaine)
	Mean	SD	Mean	SD	
Intra-op					
Baseline	140.9	7.4	137.6	8.7	0.099^{NS}
After induction	138.0	5.3	135.1	6.6	0.051^{NS}
10-min After Induction	118.8	5.5	118.3	8.2	0.742^{NS}
20-min After Induction	104.5	6.7	113.8	6.9	0.001^{***}
30-min After Induction	94.7	8.1	111.9	7.7	0.001^{***}
60-min After Induction	93.9	9.0	110.9	7.6	0.001^{***}
90-min After Induction	92.5	8.2	110.2	7.4	0.001^{***}
120-min After Induction	81.6	2.2	107.0	8.8	0.001^{***}
Post-op					
After Extubation	114.3	8.7	132.5	6.8	0.001^{***}
1-Hr Post-op	104.2	4.9	119.1	7.4	0.001^{***}
2-Hr Post-op	110.9	8.1	118.4	8.0	0.001^{***}
3-Hr Post-op	113.1	7.2	119.4	7.4	0.001^{***}
6-Hr Post-op	114.6	6.8	121.6	7.4	0.001^{***}
9-Hr Post-op	115.6	6.6	124.5	7.2	0.001^{***}
12-Hr Post-op	121.2	5.4	127.1	5.1	0.001^{***}
15-Hr Post-op	117.1	7.1	129.9	4.4	0.001^{***}
18-Hr Post-op	123.1	5.1	132.3	4.8	0.001^{***}
21-Hr Post-op	122.1	6.1	130.4	4.4	0.001^{***}
24-Hr Post-op	126.3	4.4	132.2	4.9	0.001^{***}

Table 6b The intra-group comparison of intra-op and post-op Heart rate in each intervention group

Comparisons	Ropivacaine + Clonidine Group (n=34)	Ropivacaine Group (n=34)
Baseline v After Induction	0.013^{*}	0.071^{NS}
Baseline v 10-min After Induction	0.001^{***}	0.001^{***}
Baseline v 20-min After Induction	0.001^{***}	0.001^{***}
Baseline v 30-min After Induction	0.001^{***}	0.001^{***}
Baseline v 60-min After Induction	0.001^{***}	0.001^{***}
Baseline v 90-min After Induction	0.001^{***}	0.001^{***}
Baseline v 120-min After Induction	0.001^{***}	0.001^{***}
Baseline v After Extubation	0.001^{***}	0.001^{***}
Baseline v 1-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 2-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 3-Hr Post-op	0.001^{***}	0.001^{**}
Baseline v 6-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 9-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 12-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 15-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 18-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 21-Hr Post-op	0.001^{***}	0.001^{***}
Baseline v 24-Hr Post-op	0.001^{***}	0.001^{***}

Values are P-values obtained by repeated measures analysis of variance (ANOVA). P-value <0.05 is considered to be statistically significant. *P-value<0.05, **P-value<0.01, ***P-value<0.001, NS: Statistically Non-Significant.

Comments

Inter-Group Comparisons

1) The average heart rate at baseline and after induction, 10-min after induction did not differ significantly between Ropivacaine + Clonidine and Ropivacaine groups (P-value>0.05 for all).
2) The average heart rate 20-min, 30-min, 60-min, 90-min and 120-min after induction, after extubation, 1-Hr post-op, 2-Hr post-op, 3-Hrs post-op, 6-Hr post-op, 9-Hr post-op, 12-Hr post-op, 15-Hr post-op, 18-Hr post-op, 21-Hr post-op and 24-Hr post-op is significantly lower in Ropivacaine + Clonidine group

compared to Ropivacaine group compared (P-value<0.001 for all).

Intra-Group Comparisons

1) The average baseline heart rate is significantly higher compared to average intra-op and post-op heart rate in Ropivacaine + Clonidine group (P-value<0.001 for all).
2) The average heart rate after induction did not differ significantly compared to baseline heart rate in Ropivacaine group (P-value>0.05). The average baseline heart rate is significantly higher compared to average intra-op and post-op heart rate in Ropivacaine group (P-value<0.001 for all).

Table 7a The inter-group comparison of intra-op and post-op systolic BP at each time interval

Systolic BP (mmHg)	Ropivacaine + Clonidine Group (n=34)		Ropivacaine Group (n=34)		P-value (Ropivacaine+ Clonidine v Ropivacaine)
	Mean	SD	Mean	SD	
Intra-op					
Baseline	93.5	4.6	93.2	5.0	0.840^{NS}
After induction	90.2	4.2	89.1	3.1	0.249^{NS}
10-min After Induction	84.5	3.7	86.6	3.1	0.014^{*}
20-min After Induction	78.8	3.3	84.8	2.7	0.001^{***}
30-min After Induction	80.2	2.2	84.0	2.3	0.001^{***}
60-min After Induction	80.2	4.1	83.4	2.2	0.001^{***}
90-min After Induction	78.8	2.3	82.8	2.6	0.001^{***}
120-min After Induction	80.6	1.9	86.0	2.4	0.001^{***}
Post-op					
After Extubation	90.4	3.3	87.7	4.1	0.005^{**}
1-Hr Post-op	86.4	3.0	89.4	3.3	0.001^{***}
2-Hr Post-op	87.5	2.9	90.5	2.6	0.001^{***}
3-Hr Post-op	88.1	3.2	90.1	2.8	0.001^{***}
6-Hr Post-op	86.8	3.6	91.0	2.2	0.001^{***}
9-Hr Post-op	88.2	3.1	92.4	2.5	0.001^{***}
12-Hr Post-op	86.7	1.9	93.3	2.2	0.001^{***}
15-Hr Post-op	89.6	3.0	94.1	2.4	0.001^{***}
18-Hr Post-op	89.9	2.9	92.9	2.0	0.001^{***}
21-Hr Post-op	91.0	2.2	93.0	1.7	0.001^{***}
24-Hr Post-op	93.1	1.9	93.7	2.6	0.218^{NS}

Discussion

Pain is emotional and sensory experience that occurs due to transmission of nociceptive stimuli from the peripheral nervous system through the spinal cord to the cerebral cortex.[4] Children should not experience pain due to administration of analgesics; hence the intramuscular and subcutaneous routes should preferably not be used. Caudal block is one of the most common regional anesthetic techniques in children being used to supplement general anesthesia for a wide variety of lower abdominal surgeries. The various adjuvants are opioids, epinephrine, clonidine, and newer adjuvants like neostigmine and dexmedetomidine. Caudal block is safe, easy to perform in children after general anesthesia, requires no expensive or special equipment. Because of use of adjuvants it can prolong the duration of analgesia so can be used as a single shot caudal epidural. The advantages of single shot caudal with adjuvants are it prevents the necessity of indwelling epidural catheter which indirectly prevent complications associated with use of epidural catheter in children like soiling (proximity to anal area), displacement due to position.

In 2002[5-6] Sanders survey reported that the use of adjuvants was so popular that majority of British Pediatric Anesthetics (58%) used an adjuvant while performing caudal block. Most commonly used adjuvants are ketamine, clonidine, fentanyl and diamorphine, although the choice of opioids as

adjuvants has been questioned because of high incidence of side effects associated with their use.

Ravi Berde, Neelesh Nema, Bhuvneswar Minj, Mahendra Mujalde, Nandkishore, Amit, Nidhi. "Comparative Study of Caudal Ropivacaine and Ropivacaine-Clonidine Combination in Pediatric Urogenital Surgeries for Post-Operative Analgesia".

Conducted study was to compare the post-operative pain relieving quality of ropivacaine (0.2%) and clonidine mixture to that of plain ropivacaine (0.2%) following caudal block in children's. In this study quality of, post-operative analgesia and hemodynamics effects in children when clonidine is added to ropivacaine for urogenital surgeries in caudal anesthesia.

In this clinical trial, 30 children's aged 1-10 years who were candidates for elective urogenital surgeries were studied. Induction and maintenance of anesthesia were achieved using propofol, sevoflurane and nitrous oxide. Children were randomly divided into 2 groups in double blind fashion, and were given caudal block with 0.2% ropivacaine (1ml/kg) alone and ropivacaine plus clonidine 2µg/kg. Haemodynamic parameters were observed before, during and after the surgical procedure. Post-operative analgesia evaluated using FLACC score and sedation was assessed using Ramsey sedation scale. Paracetamol was given orally for cases with FLACC score 4 or more.[7]

Our study is well compared with the above study. In our study the efficacy of caudal epidural clonidine 1 µg/kg with 0.75 ml/kg ropivacaine 0.2% in prolonging post-operative analgesia between Group (ropivacaine with clonidine) and Group (ropivacaine) were statically significant at various points. The age, weight and duration of surgery were compared and there is no statistical significant difference between both the groups. (pvalue 0.340^{NS} 0.126, p value 0.176^{NS} 0.524, p value 0.401^{NS} 0.41 respectively).

In our study, postoperative objective pain score is significantly lower in Group (ropivacaine with clonidine) at after extubation ($p < 0.001$) 3, 6, 9, and 12, 18, 21 hours which is statistically significant ($p < 0.001$). There is no statistical significant difference between Group ropivacaine with clonidine and Group ropivacaine plain at postoperative 1 and 2 hours ($p>0.05$). This might be because the analgesic effect of ropivacaine plain in Group was continuing till postoperative period of 3 to 6 hours.

The OPS is started increasing in Group ropivacaine plain so 32 children received rescue analgesia and the mean duration of analgesia was 9 hours. In Group ropivacaine with clonidine , 30 children required rescue analgesia and mean duration of analgesia is 15 hours which was statistically significant ($p <0.001$) when compared to Group ropivacaine.

In our study the sedation score significantly higher in Group ropivacaine with clonidine at after extubation and up to 15 hours post-operatively compared to Group ropivacaine is statistically significant($p <0.001$). We have not used any intraoperative sedatives in our study. The mean duration of analgesia in Group ropivacaine with clonidine is 15 hrs, is well contributed by sedative and analgesic effect of clonidine.

The dose of clonidine for epidural administration is 1 – 5 µg/kg. We chose a dose of 1 µg/kg of clonidine in our study as there were studies showing that increasing the dose from 1 to 2 µg/kg did not enhance the analgesic efficacy of clonidine[8] and the incidence of adverse effects like respiratory depression, bradycardia and hypotension increased with increasing dose.[9]In children the hemodynamic effects of extradural clonidine are less pronounced than in adults.[11, 12, 13]

Epidural administration of clonidine can cause bradycardia due to parasympathetic predominance and hypotension as a result of inhibition of preganglionic sympathetic fibres. Eisenach et al.[14] reported decrease in mean arterial pressure and heart rate within 15–30 min after injection of clonidine in the epidural space. In our study, the mean arterial pressure and heart rate in the clonidine group were less compared to plain

ropivacaine. However, none of the children required intervention as the hemodynamic parameters were not below the defined criteria.

Some studies have also shown that the incidence of vomiting is higher with caudal clonidine, [15]none of the children in our study, who had received clonidine, had post-operative vomiting.

In 1993 Kimo K, Ludin S, Elam M studied action of epidural clonidine on sympathetic nervous activity. They found that the mechanism of hypotention following epidural administration of α -2 aderinergic agonist clonidine is because of supraspinally evoked general decrease in sympathetic outflow.[16]

In our study systolic and diastolic blood pressure and heart rate are comparable at base line and after induction , there is no statistical difference between Group ropivacaine with clonidine and Group ropivacaine plain ($p>0.05$). The systolic blood pressure in Group ropivacaine with clonidine is significantly lower than Group ropivacaine plain at post-caudal 10 min (p value 0.014), 20 min(p value 0.001), 30 min (p value 0.001), 60 min(p value 0.001), 90 min (p value 0.001) and the diastolic blood pressure is also lower at post caudal 10 min (p value 0.007), 20 min(p value 0.001), 30 min(p value 0.001), 60 min(p value 0.014), 90 (p value 0.001), 120 min(p value 0.001) and postoperatively upto 18 hrs which is statistically significant.

In our study we found that heart rate is significantly lower in Group ropivacaine with clonidine than in Group ropivacaine plain at post caudal 20min (p value 0.001) uptopost operative 24 hours (p value 0.001) which is statistically significant .In our study we haveused sevoflurane as volatile anesthetic agent so inhalational agents like halothane which causes bradycardia is not a contributing factor for bradycardia and decrease in heart rate in Group ropivacaine with clonidine. We concluded that the intraoperative hemodynamic stability in Group ropivacaine with clonidine is due to action of clonidine through α -2 adrenergic receptor by supraspinal mechanism.

In 1994 M Gentili et al studied incidence of urinary retention after spinal morphine or clonidine. At 12 hr all patient in morphine group but only 5 in clonidine group had bladder distention, and at 24 hrs this was present in 7 patient in morphine group and 1 patient in clonidine group respectively ($p<0.001$).They conclude that spinal clonidine impaired bladder function to a lesser extent than morphine.[17] In our study most of the surgeries are hypospadias so children are catheterized intraoperatively so retention of urine or time of void cannot be assessed in them. In other surgeries we do not find urinary retention.

Conclusion

Single shot caudal epidural analgesia was of longer duration in ropivacaine plus clonidine group than plane ropivacaine group. There were statistically significant lower values of objective pain score at various points in ropivacaine plus clonidine group. The sedation score was significantly higher in ropivacaine plus clonidine group. This prolonged duration of analgesia was partly due to sedative and partly due to analgesic effect of clonidine when used with ropivacaine. The SBP, DBP and HR were significantly on lower side in ropivacaine with clonidine group. Intraoperative and postoperative bradycardia or hypotension was not observed in any group. Postoperative nausea vomiting was not observed in any group. Hence clonidine added to ropivacaine for single shot caudal epidural was efficient in prolonging duration of analgesia compared to ropivacaine only with minimum or no side effects.

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