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COMPARATIVE STUDY BETWEEN DEXMEDETOMIDINE AND CLONIDINE USED AS ADJUNCTS TO ROPIVACAINE FOR CAUDAL ANALGESIA IN CHILDREN

Anaesthesiology

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ABSTRACT

BACKGROUND: Caudal anesthesia is one of the most used-popular regional blocks in children. This technique is a useful adjunct during general anesthesia and for providing postoperative analgesia after infra umbilical operations. The quality and level of the caudal blockade is dependent on the dose, volume, and concentration of the injected drug. This randomized prospective study was designed to assess and compare the efficacy of clonidine and dexmedetomidine used as adjuvants to ropivacaine for caudal analgesia in childrens. To Sedation was assessed by 4 point scale, pain assessed cries scale ,time of rescue analgesia and the complications.

METHODS: Sixty children aged between 1 to 6 years, undergoing elective infra umblical surgeries were randomized into two groups; Group RC: Received 1ml/kg of 0.25% ropivacaine and 1µg/ kg clonidine. Group RD: Received 1ml/kg of 0.25% ropivacaine and 1 µg/ kg dexmedetomidine. Postoperative analgesia was assessed by CRIES scale.

RESULTS: The mean duration of post-operative analgesia was 14.67±1.4 hours in group RD and 9.8 ±1.15 hours in group RC. The prolongation of duration of analgesia was significant in RD in comparison to group RC. The incidences of adverse effects were statistically insignificant between the two groups.

CONCLUSIONS: Dexmeditomedine added to ropivacaine in caudal analgesia appears to provide efficious pain relief and comfortability for longer duration than clonidine added to ropivacaine in children undergoing infraumblical surgeries without any significant side effects.

KEYWORDS

Ropivacaine, Dexmedetomidine, Clonidine, Caudal analgesia.

INTRODUCTION

Pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.[1] Pain is an unpleasant subjective sensation which can only be experienced and not expressed, especially in children who would seem to conceal their feelings when suffering from pain. The primary reason to treat or prevent pain is humanitarian and this becomes even more important in children who rely completely on their parents or care givers for their wellbeing. Acute pain is associated with a brief episode of tissue damage or inflammation such as that caused by trauma or surgery. In most of the cases the intensity of the pain diminishes steadily over a period of time. The various methods of pain relief have their own disadvantages which prohibit their use in children for e.g: narcotics in children because of their respiratory depression and other analgesics which cannot be given for some time after general anaesthesia due to the fear of vomiting and aspiration, the objection to the needles in the case of parenterally administered analgesics. The regional anesthetic techniques significantly decreases post-operative pain and systemic analgesic requirements.[2][3][4] Caudal route was chosen for this study as it is one of the simplest and safest techniques in pediatric surgery with a high success rate. Epidural space in children favours rapid longitudinal spread of drugs and makes it effective in treating postoperative pain In this study caudal block was done after the induction of general anaesthesia and was used as an adjunct to intraoperative anesthesia as well as postoperative analgesia in children undergoing surgical procedures below the level of the umbilicus. Caudal analgesia reduces the amount of inhaled and intravenous anaesthetic drug requirement attenuates the stress response to surgery, facilitates a rapid, smooth recovery and provides good postoperative analgesia. In order to decrease intra operative and postoperative analgesic requirements and to prolong duration of analgesia after single shot caudal epidural blockade, various additives such as morphine, fentanyl, clonidine and ketamine with local anaesthetics have been studied. [5]

Ropivacaine is a new long acting amino amide local anaesthetic agent. It is structurally related to bupivacaine and has been used for pediatric caudal analgesia. It provides pain relief with less motor blockade. Literature suggests that ropivacaine is less cardio toxic than bupivacaine; hence ropivacaine may be a more suitable agent for caudal epidural analgesia especially in day care surgery.[6]

Dexmedetomidine is a α2 adrenergic receptor agonist. It has increased affinity to α2 adrenergic receptors than clonidine and less α1 adrenergic receptor actions. The main advantage of the dexmedetomidine is it higher selectivity was compared in Clonidine for α2A receptor is responsible for analgesic, hypnotic and anxiolytic actions [8].

The objective of this study was to compare of the analgesic action of dexmedetomidine and clonidine combined with ropivacaine in caudal analgesia for children undergoing infra umblical surgical procedures.

MATERIALS AND METHODS

The study protocol was approved by the Institutional Ethical Committee and informed written consent was taken from the parents.This is Prospective, randomized, double blind, comparative study was done to compare the efficacy and safety of dexmeditomidine and clonidine as adjuvants to caudal ropivacaine in postoperative analgesia for children. The study was carried out in 60 children for surgeries of lower abdomen and perineum. The children's in the age group of 1-6 years, both sexes, ASA I and weighing 5-20Kgs were selected for the study. Patients with Known allergic to local anaesthetic, systemic and neurological diseases, bleeding disorders and skeletal deformities were excluded from the study.

Patients were randomly assigned to two groups .Group RC patients received 1ml/ kg of 0.25% ropivacaine and 1µg /kg clonidine (making a volume of 0.5 ml with addition of 0.9% saline using a tuberculin syringe).Group RD patients received 1ml/ kg of 0.25% ropivacaine and 1 µg /kg dexmedetomidine (again making a volume of 0.5 ml with addition of 0.9% saline with the help of a tuberculin syringe). Solutions were prepared by an anaesthesiologist, who was totally unaware of the nature of the study.

Children premedicated with 0.5mg/kg of oral midazolam 45 minutes before anaesthetic procedures. On arrival in the operation theatre, routine monitors (ECG, pulse oximetry, NIBP) were attached and baseline vital parameters like mean arterial blood pressure (MAP), heart rate(HR) and arterial oxygen saturation (SPO2) were recorded. Induction was done by increasing concentration of sevoflurane (3 -8 %) along with oxygen and nitrous oxide mixture (40:60) through Ayres T piece with Jackson Rees modification and facemask. After induction, an intravenous line was secured. Injection atracurium 0.5 mg / kg was administered to facilitate endotracheal intubation with appropriate size endotracheal tube.

Anaesthesia was maintained with 60%, nitrous oxide in40% oxygen and 0.6%.Sevoflurane using controlled ventilation. The patients were positioned in left lateral position. After aseptic draping, a 23G needle was introduced into caudal space and either ropivacaine with clonidine (Group RC) or ropivacaine with dexmedetomidine (group RD) was administered. Pulse rate, MAP and SPO2 were recorded throughout the operation at an interval of five minutes. Intraoperatively monitoring the Pulse rate, blood pressure, oxygen saturation. Decrease of mean arterial blood pressure and pulse rate more than 30% from the baseline values were defined as severe hypotension and bradycardia, respectively which were treated injection atropine sulphate 20mcg/kg.

At the beginning of skin closure anaesthesia was discontinued. At the end of the operation, residual neuromuscular block was reversed by appropriate doses of neostigmine 40µg/kg & atropine 10µg/kg and tracheal extubation was performed. Postoperatively they were monitored in post anaesthetic care unit vital parameters, severity of pain and sedation was recorded every 15 minutes for 3 hours and then every one hour.

The following parameters were assessed
1. Time from caudal block to end of the surgery.
2. Sedation was assessed by 4 point scale.
3. Pain was assessed by cries scale.
3. Duration of post-op analgesia.
4. Pulse rate, map and spo2 and Complications.

4 point sedation scale:
1. Barely arousable. (Sleeps Needs shaking or shouting to arouse).
2. Asleep. (Eyes closed arousable with soft voice or light touch).
3. Sleepy. (Eyes open but less active and responsive).
4. Awake.

Table 1: CRIES pain scale

	0	1	2
Crying	No	High pitched	Inconsolable
Requires O2 for SPO2 >95%	No	< 30% of O2	> 30% of O2
Increased vital signs	No increase in HR and MAP	Increase in HR or MAP < 20%	Increase in HR or MAP > 20%
Expression	None	Grimace	Grimace/grunt
leepless	No	Wakes at frequent intervals	Constantly awake

CRIES pain scale (Table 1) Score 0- signifies excellent analgesia. Score 10- indicate ineffective analgesia. Rescue analgesia with syrup paracetamol (15mg/kg) was given when the pain score was 4 or more.

STASTISTICALANALAYSIS

Statistical analysis was done with the help of computer using Epidemiological Information Package (EPI 2010) developed by Centre for Disease Control, Atlanta. Using this software range, frequencies, percentages, means, standard deviations, chi square and p' values were calculated. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's chi square test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

OBSERVATION AND RESULTS

The two groups were compared in characteristics like demographic data and basic vital parameters (Pulse rate, MAP, Saturation) and duration of surgery, duration of postoperative analgesia, complications.

Table-2 Demographic Variables

Variable	Group RD	Group RC	P	Significance
Age (years)	3.47	3.73	0.5283	Not significant
Sex Male Female	 25 5	 24 6	0.7408	Not significant
Weight (kg)	14.77± 3.57	15± 3.73	0.7608	Not significant

The mean age of children in group RD was 3.47 years and in group RC was 3.73 years which is found not to be statically significant with P value of 0.5283. The sex distribution in group RD 25 males and 5 females and in group RC were compared and found 24 males and 6 females. Both group were compared and found not to be statistically significant. The mean weights of children were 14.77 ±3.57 kg in group RD and 15± 3.73 kg in group RC. Both group were compared and found not to be statistically significant (Table-2).The procedures done in group RC herniotomy for 14 children and circumcision for 16 children's. In group RD herniotomy for 15 children and circumcision for 15 children (**Table-3**). The mean duration of surgery in group RD was 31 minutes and RC 30 minutes, which was found not to be statistically significant **(Table-4).**

Table 3: Procedure

Procedure	Group RC		Group RD	
	No	%	No	%
Circumcision	16	53.3	15	50
Left Herniotomy	5	16.7	7	23.3
Right Herniotomy	9	30	8	26.7
Total	30	100	30	100

Table 4: Duration of surgery

Parameter	Duration of surgery (in minutes)	
	Group RC	Group RD
Range	20-45	20-45
Mean	31.0	30.0
SD	8.14	7.88
'p'	0.6244 Not significant	

Table 5: Duration of postoperative analgesia

Parameter	Duration of Post-Operative analysis (in hours)	
	Group RC	Group RD
Range	8-12	13-17
Mean	9.8	14.67
SD	1.4	1.15
'p'	0.0001 Significant	

The mean duration of post-operative analgesia was 14.67±1.4 hours in group RD and 9.8±1.15 hours in group RC. Both group were compared and found that dexmedetomidine group had a longer duration of postoperative analgesia, which is statistically significant (Table-5). The Sedation score was compared between GROUP RD & GROUP RC in postoperative periods and found not to be statistically significant (Table-6).

Table 6: 4 Point Sedation Score

TIME IN HOURS	GROUP RD				GROUP RC			
	1	2	3	4	1	2	3	4
1hr	30	0	0	0	30	0	0	0
3hr	30	0	0	0	25	5	0	0
6hr	24	6	0	0	18	10	2	0
12hr	0	20	10	0	0	15	12	3
17hr	0	0	10	20	0	0	8	22
	P VALUE 1.0 NOT SIGNIFICANT							

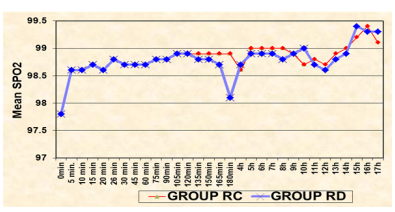
Table 7: CRIES Pain scale

Pain scale	Group RC		Group RD	
	No	%	No	%
0	14	46.7	20	66.7
1	15	50	10	33.3
2	1	3.3	-	-
Total	30	100	30	100
Range	0-2		0-1	
Mean	0.57		0.33	
SD	0.57		0.48	
'p'	0.1039 Not significant			

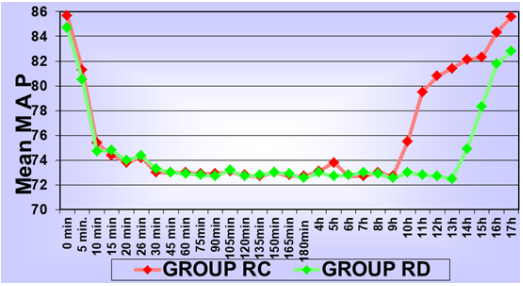
The CRIES pain scale was compared between two groups and found not to be statistically significant (Table-7). The hemodynamic changes of Pulse rate and mean arterial pressure between both groups were compared in preoperative, intra operative and postoperative periods and significant changes were found only at 9th to 17th hours. The saturation was compared between both groups pre-operative, intra operative and post-operative period were compared and found not to be statistically significant **(**graph 1, 2 & 3**)**. The complications in two groups were compared and found not to be statistically significant (Table-8).

Table 8: Complications

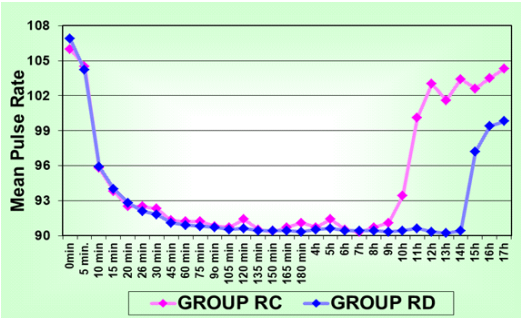
Complications	Group RC		Group RD	
	No	%	No	%
Nausea	1	3.3	2	6.7
Nausea & Vomiting	1	3.3	-	-
Pruritis	1	3.3	1	3.3
Nil	27	90	27	90
Total	30	100	30	100
'p'	1.0 Not significant			



Graph 1:SPO2



GRAPH 2: Mean arterial pressure



GRAPH 3: Changes in pulse rate

DISCUSSION

Postoperative analgesia provides not only pain relief but also inhibits trauma induced nociceptive impulses to blunt autonomic reflexes. It allows the patients to breath and move freely to enhance early restoration of function. Untreated postoperative pains produce the several detrimental acute and chronic effects. Neuroendocrine responses to pain result in increases sympathetic tone, increased catecholamine and catabolic hormone secretions and decreased secretion of the anabolic hormones. The neuroendocrine stress response may potentiate to other detrimental physiological effects like hypercoagulability, immunosuppressant, and delay in return of gastrointestinal function. Decreased postoperative respiratory function is markedly especially after abdominal and upper thoracic surgeries. Children with poor postoperative pain control may breathe less deeply have an inadequate cough and be more susceptible to the development of post-operative pulmonary complications. Inadequate postoperative pain relief produces the long term consequences like that eating disturbance, altered the sleeping pattern and Increased pain perception during subsequent painful experiences. [9][10]

The benefits of paediatric regional analgesia for children include safety, and efficacy with no increased risk when compared with general anaesthesia alone but requires technical expertise. Children should faster recovery, shorter hospital ICU stay, and reduced ventilator requirement when supplemented with regional anaesthesia .the spectrum of autonomic, hormonal, metabolic, immunologic/ inflammatory, and neurobehavioral consequences caused due to surgical stress can be decreased by regional anaesthesia. Benefits of regional anaesthesia is not only pain relief it also reduction of general anaesthetic requirement ,may reduce the toxicity of general anaesthetic agents, reduce the neurohormonal stress responses ,improve the gastrointestinal functions, reduction of intraoperative blood loss and improve the defense mechanisms. Enteral and parenteral analgesics used in postoperative analgesia, are associated side effects like gastrointestinal bleeding, nausea and vomiting, sedation, precipitation of asthma tic attack, respiratory depression, thrombocytopenia and nephrotoxicity, hepatotoxicity, etc.

Several local anaesthetic agents like lidocaine, bupivacaine and ropivacaine have been used for caudal block. Adjuvants like opioids , clonidine, dexmedetomidine, midazolam and ketamine are added to local anaesthetic agents to the duration of analgesia was increased, decrease the individual dose of the drug and thereby decreasing the side effects. [11][12][13][14]

Dexmedetomidine and Clonidine is an effective adjuvant to local anaesthetic agents when administered for caudal block. Addition of both has been found to increase the duration of analgesia without any increase in the side effects. When administered caudally, both produce analgesia by interacting with alpha 2 adrenergic receptors. These receptors are located on the superficial laminae of spinal cord and brain stem nuclei implicated in pain, so analgesia can be produced at peripheral, spinal and brain stem sites. Ideal anaesthetic technique should be targeted at three sites periphery, sensory flow in nerves and cells in the central nervous system. The administration of an analgesic before any tissue damage takes place could interfere with and reduce the magnitude of nociception and thereby prevent a state of hypersensitization.

The various methods of providing pain relief have some side effects which prohibit their use for narcotics in children, because of their respiratory depression, the objection to needles in the case of parenterally administered analgesics. Caudal anaesthesia was chosen for this study as it is the simplest and safest techniques in paediatric surgery with a success rate of single shot caudal epidural injection of local anaesthetic agents and additives that prolong the postoperative analgesia. By this regional technique, problems and complications of intubation and polypharmacy due to general anaesthesia are avoided.

In this study, we used clonidine and dexmedetomidine was used in the dose of 1µg /kg along with 0.25% ropivacaine and did not observe significant incidence of adverse effects like hypotension, bradycardia and respiratory depression, Lee et al. This study administered clonidine dose of 2µg / kg along with bupivacaine in children undergoing lower limb orthopedic surgery in their study. They observed higher incidence of bradycardia and hypotension associated with 2µg /kg dose of clonidine added to bupivacaine.[15]

The two groups were compared with respect to weight, sex, age, and, duration of post-operative analgesia, duration of surgery, complications. The pre-operative, intra and postoperative pulse rate, mean arterial pressure and saturation and complication were also compared. Sedation and hence patient comfortability as assessed from 4 point sedation score. It was not significant in both groups.

Pain intensity was assessed in this study by CRIES scale. This scale is a reliable and a sensitive tool for evaluations of postoperative pain in children. The mean duration and SD of analgesia for caudal RC was 9.8 ± 1.4hours. In group RD mean duration and SD of analgesia was 14.67± 1.15 hours.[17][18] The results of the study done by Mausumi Neogi et al. the mean duration of analgesia was 6.32±0.46 hours in group ropivacaine, 13.17±0.68 hours in group Clonidine and 15.26±0.86 hours in group dexmedetomidine. The prolongation of duration of analgesia was significant in both group clonidine and dexmedetomidine was compared to group ropivacaine. [5]

Vijay anand et al, the study duration of postoperative analgesia in ropivacaine combined with dexmedetomidine is14.5±0.5hours than ropivacaine group is 5.5±0.5 hours and less emergence agitation following sevoflurane inhalation anaesthesia. [16]

Elwahab et al, studied 60 patients age between 6 months to six years for infra umbilical surgeries. It is divided into two groups. Group C received bupivacaine 0.25% 1ml/kg with clonidine 2 mcg/ kg and Group D received bupivacaine 0.25% 1ml/ kg added with dexmedetomidine 2 mcg/ kg in caudal anaesthesia. This study showed that dexmedetomidine group had prolonged duration of post operative analgesia than the clonidine group, without any significant side effects.[19]

In our study both the groups there was not significant alteration in the intra operative and Postoperative pulse rate, mean arterial pressures and saturation. The difference found at 9th to 17th hours of post-operative period pulse rate, mean arterial pressures was significant because of group RD was increase duration of analgesia and comfortability better than clonidine group. But both groups do not cause any hypotension bradycardia and respiratory depression. There were no significant complications in both groups were noted.

CONCLUSION

From this study it is concluded that dexmeditomedine added to ropivacaine in caudal anaesthesia appears to provide efficious pain relief and comfortability for longer duration than clonidine added to ropivacaine in children undergoing infraumblical surgeries without any significant side effects.

REFERENCES

1. International association for the study of pain, Subcommittee on Taxonomy. Pain terms: a

list with definitions and notes on usage. Pain 1979; 6: 249-52.
2. Neural blockade in clinical anaesthesia and management of pain- Michael. J. Cousins &Phillip.O. Briden baugh: 3rd edition. Page:323-342.
3. H. S. El-Ozairy et al, addition of clonidine or dexmedetomidine to bupivacaine prolongs caudal analgesia in children: br j anaesth 2009; 103: 268–74.
4. Schnaider TB, Vieira AM, Brandao ACA, Lobo MVT. Intraoperative analgesic effect of epidural ketamine, clonidine or dexmedetomidine for upper abdominal surgery. Rev Bras Anestesiol 2005; 55: 525 –31.
5. Mausumi Neogi et al,A Comparative Study Between Clonidine and Dexmedetomidine used as Adjuncts to Ropivacaine for Caudal Analgesia in Paediatric Patients.J Anaesth Clin Pharmacol 2010; 26(2): 149-153.
6. Ropivacaine - J.H McCLURE et al. British journal of Anaesthesia1996, 76: 300-7.
7. Millers Anaesthesia- Ronald D. Miller. 7th edition.
8. Clonidine in peadiatrics- Sujatha basker et al.Indian joural of anaesthesia 2009; 53 (3):270-80.
9. Lloyd-Thomas AR. Pain management in paediatric patients. Br J Anaesth 1990; 64: 85 – 104.
10. Gehdoo RP. Postoperative Pain Management in Paediatric Patients. Indian J Anaesth 2004; 48: 406-11.
11. Gupta SD, Mandal S, Naskar C, Mukherjee S, Kundu KK. Caudal eidural bupivacaine alone versus bupivacaine- low dose morphine combination in paediatric infra umbilical surgeries for Post-operative analgesia. J Anaesth Clin Pharmacol 2009; 25(2): 183-186.
12. Deng XM, Xiao WJ, Tang GZ, Luo MP, Xu KL. The minimum local anesthetic concentration of ropivacaine for caudal analgesia in children. Anesth Analg 2002;94:1465-8.
13. Ray M, Mondal SK, Biswas A. Caudal analgesia in paediatric patients: Comparison between Bupivacaine and Ropivacaine. Indian J Anaesth 2003;47:275-8.
14. El-Hennawy AM, Abd-Elwahab AM, Abd-Elmaksoud AM, Addition of clonidine or dexmedetomidine to bupivacaine prolongs caudal analgesia in children. Br J Anaesth 2009;103:268-74.
15. Lee JJ, Rubin AP. Comparison of a bupivacaine– clonidine mixture with plain bupivacaine for caudal analgesia in children. Br J Anaesthesia 1994; 72: 258 – 62.
16. Vijay anand et al .Effects of dexmedetomidine added to caudal ropivacaine in paediatric lower abdominal surgeries. Indian journal of anaesthesia 2011: 55: 4:340-346.
17. Yildiz TS, Korkmaz F, Solak M, Toker K. Clonidine addition prolongs the duration of caudal analgesia. Acta Anaesthesiol Scand. 2006;50:501–4.
18. Yoshitomi T, Kohjitani A, Maeda S, Higuchi H, Dexmedeto- midine enhances the local anesthetic action of lidocaine via an alpha 2A Adrenoceptor. Anesth Analg 2008;107:96-101.
19 AM Abd Elwahab et al, British journal anaesthesia 2009, 103(2) .268-274.