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Original Research Article

Comparison of 0.25% Bupivacaine and 0.25% Bupivacaine with Dexmedetomidine Added as An Adjuvant in Caudal Analgesia for Elective Pediatric Herniotomies

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Abstract

Background: Caudal block is the most safe and effective method of postoperative analgesia in pediatric population. Local anesthetics when used alone for caudal epidural block are associated with the shorter duration of action, hence addition of adjuvant helps prolong the duration of action and provide effective postoperative analgesia in children undergoing various infraumbilical surgeries. Many adjuvants like opioids, alpha-2 agonists, magnesium sulphate etc have been used along with local anesthetics for increasing the duration of caudal analgesia. We have designed a study to assess the safety and efficacy of adding dexmedetomidine to 0.25% bupivacaine in caudal epidural block. This study aims at comparing the duration of post-operative analgesia in caudal blocks in groups with 0.25% bupivacaine alone and 0.25% bupivacaine with dexmedetomidine.

Methods: This study was conducted in 60 children of American Society of Anesthesiologists (ASA) physical status I and II, aged 1– 6years, undergoing elective herniotomies. The patients were randomly allocated into two groups of 30 each, Group B receiving (0.25%) bupivacaine 0.75 ml/kg + normal saline (NS) 1 ml and Group BD receiving (0.25%) bupivacaine 0.75 ml/kg + 1 µg/kg dexmedetomidine in 1 ml NS. General anesthesia was induced in all children with insertion of Laryngeal mask airway. Caudal block was then performed and the children were observed for hemodynamic stability and duration of postoperative analgesia using FLACC pain score.

Results: our study revealed that the mean duration of analgesia in Group B receiving (0.25%) bupivacaine 0.75 ml/kg + normal saline (NS) 1 ml was 4.59±0.47 hrs and that in group BD receiving (0.25%) bupivacaine 0.75 ml/kg + 1 µg/kg dexmedetomidine in 1 ml NS was 9.05±0.85 hrs with a p value of ≤0.001 which was Significant according to Student t Test.

Conclusion: we hereby conclude that the addition of dexmedetomidine in the dosage of 1 µg/kg along with (0.25%) bupivacaine significantly prolongs the duration of postoperative analgesia with no significant side effects making it a safe and effective adjuvant for caudal epidural block.

Keywords: Caudal Block, Bupivacaine, Dexmedetomidine.

Introduction

Postoperative analgesia using caudal epidural block is the most commonly employed technique of providing analgesia in paediatric infraumbilical surgeries[1]. Technical ease of performing caudal epidural block has made it the most safe

and effective method of postoperative pain management in paediatric population. General anesthesia when combined with caudal block helps to reduce the requirement of volatile anesthetic agents and opioids allowing rapid recovery[2].

Local anaesthetics when used alone are associated with limited duration of action making it a disadvantage in a single shot caudal epidural block[3]. Addition of adjuvants to local anesthetics to prolong caudal analgesia has been achieved with drugs like epinephrine, opioids and alpha 2 agonists, neostigmine etc [4].

α2-Adrenergic receptors are G-Protein-coupled receptors having 3 subtypes (α2A, α2B, and α2C) which are widely distributed in the central, peripheral, and autonomic nervous systems and also in vital organs and blood vessels. α2-Adrenergic receptor agonists act on these receptors to produce its various clinical effects like sedation, analgesia, anxiolysis, perioperative sympatholysis and reduced anesthetic requirement[6]. Analgesia produced by alpha2 agonists is achieved by activating spinal cholinergic neurons resulting in acetylcholine release hence its addition to local anesthetics produces prolongation of caudal analgesia[5].

Dexmedetomidine is 8 to 10 times more selective towards α2-Adrenergic receptors with the selectivity ratio of 1600:1 than clonidine[6]. In the spinal cord dexmedetomidine reduces transmission of nociceptive signals like substance P and has significant opioid sparing effect making it useful in intractable neuropathic pain[7].

Hence, we decided to conduct a clinical comparative study of 0.25% bupivacaine alone and 0.25% bupivacaine with dexmedetomidine added as an adjuvant in caudal analgesia for paediatric herniotomies.

Aims and Objectives of the study

To assess the safety and efficacy of adding dexmedetomidine as an adjuvant to 0.25% bupivacaine in caudal analgesia.

To compare duration of analgesia in both the groups.

Materials

1. Sample size- 60
2. Source – In-patients in the department of surgery SIMS, Shivamogga.
3. Sampling method - Purposive sampling
4. Study design – Randomized comparative study
5. Duration of study- 6 months

Inclusion Criteria

1. Pediatric patients 1 - 10years.
2. Both genders (male & female).
3. ASA I & ASA II patients.
4. Children scheduled for elective herniotomies

Exclusion Criteria

1. Refusal of regional block by parents.
2. Patients requiring emergency procedures.
3. Bleeding disorders.
4. Skin lesions or wounds at site of proposed needle insertion.
5. Cutaneous anomalies (angioma, hair tuft, nevus or a dimple) near the puncture site.
6. Progressive neurological disorders.
7. Patients with congenital heart disease.
8. Patients with Allergies to used drugs

Methods

This study was conducted in 60 children of American Society of Anesthesiologists (ASA) physical status I and II, aged 1–6years, undergoing elective herniotomies.

All the children underwent a thorough preanaesthetic check-up the day before surgery, and all the routine and specific investigations were noted respectively.

The children were kept nil by mouth for 6 hours. Before surgery a written and informed parental consent was obtained.

After shifting the child to operation theatre an intravenous line of 22G or 24G was secured and connected to IV fluid ringer lactate. Standard monitors such as electrocardiogram, pulse oximeter, and noninvasive blood pressure (BP) were connected and baseline hemodynamic parameters were noted accordingly. Premedication with injection glycopyrrolate 4mcg/kg and ondansetron 0.1mg|kg was given and General anesthesia was induced with injection fentanyl 2mcg/kg and propofol 2mg/kg and then laryngeal mask airway of appropriate size was inserted and position was confirmed by auscultation. Anesthesia was maintained using O2 + N2O + sevoflurane. Ventilation was maintained by assisted ventilation. The children were randomly assigned into 2 groups by computer generated chits to receive either (bupivacaine + saline) or (bupivacaine + dexmedetomidine). Caudal block was performed with full aseptic precautions with the child in the left lateral position.

According to the drug administered the children were randomly allocated into two groups

- Group B: (0.25%) bupivacaine 0.75 ml/kg + normal saline (NS) 1 ml
- Group BD: (0.25%) bupivacaine 0.75 ml/kg + 1 µg/kg dexmedetomidine in 1 ml NS.

Heart rate (HR) was recorded every 10 min after caudal block till the end of the surgery and every 15 min thereafter. At the end of the surgery once the child started to breathe spontaneously, LMA was removed after thorough suctioning, and the child was observed in the postoperative recovery area.

Analgesia was assessed using FLACC (face, legs, activity, cry, consolability) scale[8]. Rescue analgesia with paracetamol suppositories 20mg/kg was given with the FLACC score of 4 and above. Total duration of analgesia (time from caudal block to the first dose of rescue analgesic) was then recorded.

Flacc Scale

Table 1

Categories	0	1	2
Face	No particular expression or smile	Occasional grimace or frown; withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs; frequent complaint
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to; distractible	Difficult to console or comfort
Each category is scored on the 0-2 scale, which results in a total score of 0-10. **0:** Relaxed and comfortable **1-3:** Mild discomfort **4-6:** Moderate pain **7-10:** Sever discomfort or pain or both			

Table 2: Age distribution in two groups of patients studied

Age in Years	Group B	Group BD	Total
1-2 YRS	20	30	25
2-3 YRS	26.7	26.7	26.7
3-4 YRS	20	23.3	21.7
4-5 YRS	33.3	20	26.7
Total	100	100	100

P=0.641, Not Significant, Chi-Square test

Table 3: ASA- Frequency distribution in two groups of patients studied

ASA	Group B	Group BD	Total
1	73.3	80	76.7
2	26.7	20	23.3
Total	100	100	100

P=0.764, Not Significant, Chi-Square Test

Table 4: Comparison of Heart rate variations in two groups of patients studied

Variables	Group B	Group BD	Total	P Value
HR	124.4±15.55	124.93±13.56	124.67±14.47	0.888
10min	122.83±15.79	122.83±13.04	122.83±14.36	1.000
20min	117.87±14.09	119.8±11.15	118.83±12.64	0.558
30min	115.03±14.39	117.37±11.3	116.2±12.88	0.488
40min	112.43±14.2	115.23±10.77	113.83±12.58	0.393
60min	111.4±13.41	112.9±10.15	112.15±11.81	0.627
75min	108.93±11.86	112.13±10.23	110.53±11.1	0.268
90min	107.57±12.67	111.07±10.46	109.32±11.65	0.248
105min	107.27±11.26	109.93±10.56	108.6±10.91	0.348
120min	107.37±11.67	108.9±10.4	108.13±10.99	0.593
135min	107.13±11.35	108.13±9.74	107.63±10.5	0.716
150min	106.87±11.29	107.07±10.26	106.97±10.7	0.943
165min	106.9±9.6	106.73±10.44	106.82±9.94	0.949
180min	105.93±10.26	105.83±9.9	105.88±10	0.969
195min	106.17±10.42	105.93±9.72	106.05±9.99	0.929
210min	106.77±10.52	105.67±10.13	106.22±10.25	0.681
225min	106.87±10.25	104.8±10.07	105.83±10.13	0.434
240min	106.8±11.36	104.67±10.12	105.73±10.72	0.446

Table 5: Total duration of analgesia- Frequency distribution in two groups of patients studied

Total duration of analgesia	Group B	Group BD	Total
<5.0	22(73.3%)	0(0%)	22(36.7%)
5.0-7.0	8(26.7%)	0(0%)	8(13.3%)
>7.0	0(0%)	30(100%)	30(50%)
Total	30(100%)	30(100%)	60(100%)
Mean ± SD	4.59±0.47	9.05±0.85	6.82±2.35

P≤0.001**, Significant, Student t Test

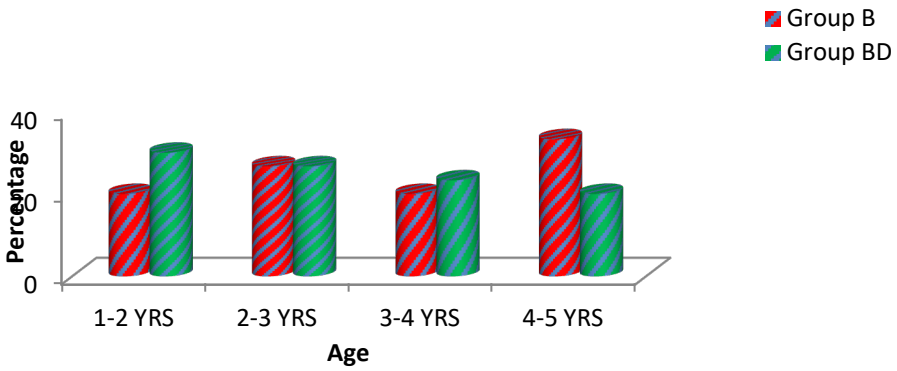

Figure 1: Age distribution in two groups of patients studied

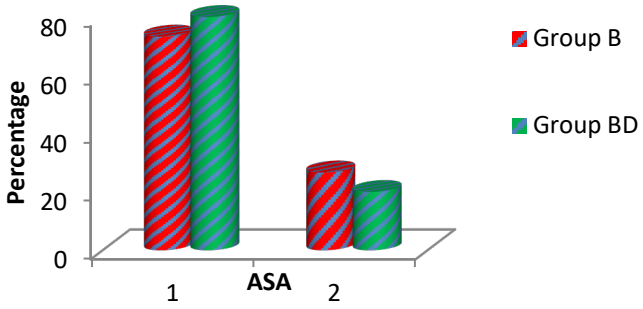

Figure 2: ASA- Frequency distribution in two groups of patients studied

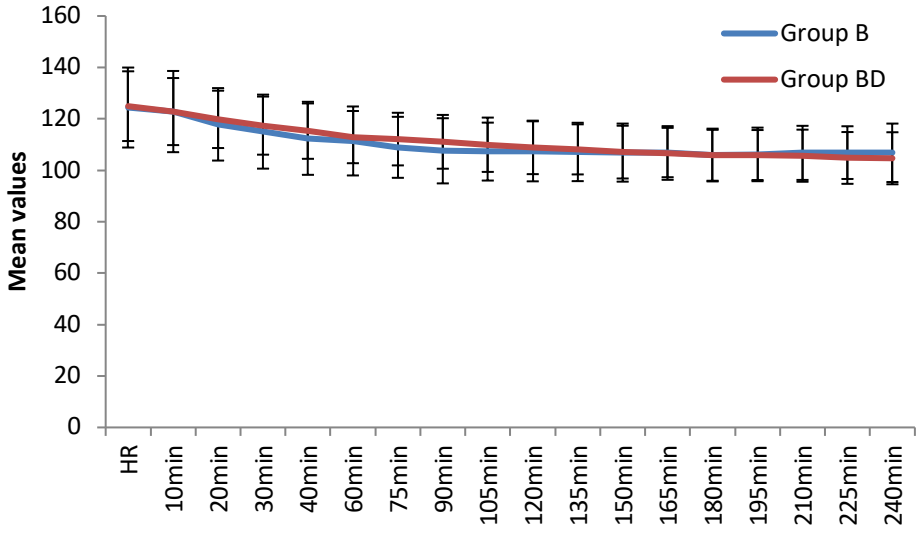

Figure 3: Comparison of Heart rate variations in two groups of patients studied

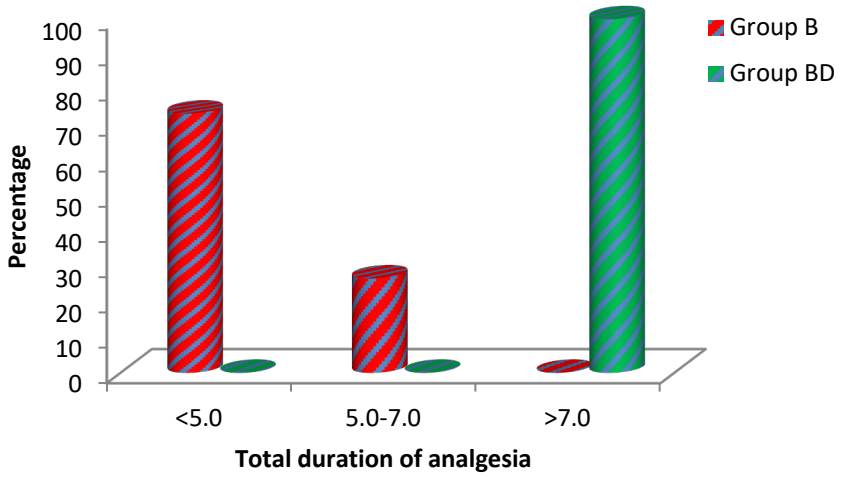

Figure 4: Total duration of analgesia- Frequency distribution in two groups of patients studied

Results

This study is a prospective randomized double blinded comparative study which was conducted in 60 male children of (ASA) physical status I and II, aged 1 to 6 yrs undergoing elective herniotomies.

Table 2 Age distribution in two groups of patients studied

Figure 1 Age distribution in two groups of patients studied

The above table showed that the age distribution in both the groups were similar with a p value of 0.641 which was not significant making it comparable in both the groups

Table 3: ASA- Frequency distribution in two groups of patients studied

Figure 2 ASA- Frequency distribution in two groups of patients studied

The ASA physical status distribution in both the groups was comparable with a p value of 0.764 which was insignificant as indicated by the above table and graph.

Table 4: Comparison of Heart rate variations in two groups of patients studied

Figure 3 Comparison of Heart rate variations in two groups of patients studied

The above table shows the distribution of heart rate variability in children in both the groups and was noted that there were no significant differences in both the groups in terms of heart rate variability indicated by the p values in the table.

Table 5: Total duration of analgesia- Frequency distribution in two groups of patients studied

Figure 4 Total duration of analgesia- Frequency distribution in two groups of patients studied

The above table showed that the duration of analgesia in group B was 4.59±0.47 hrs and that in group BD was 9.05±0.85 hrs with a p value of ≤0.001 making it significant.

Discussion

Caudal epidural blocks are an efficient way to provide postoperative analgesia and to reduce the intraoperative requirement of opioids and other systemic anesthetic agents, there by producing hemodynamic stability and early postoperative recovery in children undergoing infraumbilical surgeries[9].

In our study, we have used 0.25% bupivacaine 0.75ml/kg in one group which revealed the total duration of analgesia to

be 4.59±0.47hrs, the volume chosen was similar to a study conducted by D D Akpoduado10 et al wherein they compared two different volumes of bupivacaine 0.5 ml/kg (Group 1) and 0.75 ml/kg (Group 2) among 56 children of 1 and 6 years scheduled for unilateral inguinal herniotomy. They demonstrated that 0.75ml/kg 0.25% bupivacaine was superior to the use of 0.5 ml/kg with the duration of analgesia of 249 ± 23.7 min in group 2 compared to 126 ± 34.2 min in Group 1 with a significant p value of < 0.0001.

To overcome the limitation associated with having a limited duration of action when local anesthetics are used alone in caudal epidural block, many adjuvants like opioids, alpha 2 agonists, dexamethasone, neostigmine etc are added to local anesthetics to enhance the duration of analgesia.

Since dexmedetomidine is a highly selective alpha 2 agonist with a varying clinical effect ranging from sedation, anxiolysis, hemodynamic stability and analgesia we decided on adding dexmedetomidine to 0.25% bupivacaine and study its effect on prolonging the duration of analgesia.

Our study revealed that addition of dexmedetomidine in the dosage of 1mcg/kg to 0.25% bupivacaine of 0.75ml/kg significantly increased the duration of postoperative analgesia which was 9.05±0.85 hrs compared to 4.59±0.47 hrs in the group where 0.25% bupivacaine of 0.75ml/kg was used alone. It was significant with a p value of ≤0.001. The result obtained in our study was similar to a study conducted by Vigya Goyal et al[11] in 100 children undergoing elective herniotomies, duration of analgesia studied in their Group A patients receiving (0.25%) bupivacaine 1 ml/kg + normal saline (NS) 1 ml was 4.33 ± 0.98 h compared to Group B receiving (0.25%) bupivacaine 1 ml/kg + 1 µg/kg dexmedetomidine in 1 ml NS was 9.88 ± 0.90 h which was clinically significant.

The dose of 1mcg/kg of dexmedetomidine added to 0.25% bupivacaine in our study did not produce significant hemodynamic variations, which was observed in terms of heart rate variability in comparison to the group where 0.25% bupivacaine was used alone. No significant side effects were noted on adding dexmedetomidine to bupivacaine in our study. Our results were in consensus with the study conducted by Khaled R Al-Zaben et [12] in 91 children undergoing infra-umbilical surgery who were randomly allocated in 3 groups of caudal block, where Group B received 0.25% bupivacaine 2 mg/kg of 0.8 ml/kg and Groups BD1 and BD2 received dexmedetomidine of 1 and 2 µg/kg respectively along with bupivacaine 2 mg/kg in a volume of 0.8 ml/kg. This study concluded that 1µg/kg of dexmedetomidine produced lesser side effects like postoperative sedation, bradycardia and hypotension compared to 2 µg/kg of dexmedetomidine when combined with bupivacaine in caudal epidural block.

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