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Original Research Article

Comparative Study between Clonidine and Dexmedetomidine as Adjuvant to Bupivacaine for Caudal Block in Children Undergoing Sub Umbilical Surgeries

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Abstract:

Aims: Caudal epidural block is one of the most popular, reliable and safe techniques in paediatric anaesthesia that can be used with general anaesthesia for intra and postoperative analgesia in patients undergoing various surgeries. A study was conducted to compare clonidine and dexmedetomidine as an additive to bupivacaine for caudal block in children.

Methods: Ninety children of ASA grade I and II in the age group of 2-8 years posted for elective infra-umbilical surgeries were included in the study. They were divided into three groups of 30 each. Group A received caudal epidural (CE) with 0.75ml/kg of 0.25% bupivacaine with 1ml NS, Group B received CE with 0.75ml/kg of 0.25% bupivacaine with clonidine 1mcg/kg diluted to 1ml with normal saline, Group C to receive CE with 0.75ml/kg of 0.25% bupivacaine combined with dexmedetomidine 1mcg/kg diluted to 1ml with normal saline. The main parameters studied were hemodynamic changes, duration and quality of postoperative analgesia, sedation and adverse effects if any.

Results: Both the groups were comparable with respect to age, sex and weight distribution. There was no significant difference between the two groups with respect to hemodynamic parameters like heart rate, systolic and diastolic blood pressure. The mean duration of post-operative analgesia was 4.2 ± 0.69 hrs in group A and 5.8 ± 0.88 hrs in group B and 9.1 ± 0.86 hrs in group C. The duration of sedation corresponded closely with the duration of analgesia. No increased incidence of any adverse effects was seen in all the three groups.

Conclusion: Caudal administration of bupivacaine 0.25% (0.75ml/kg) with clonidine (1 µg/kg) and dexmedetomidine (1 µg/kg) prolonged the duration and improved the quality of analgesia compared to 0.25% bupivacaine (0.75ml/kg) alone, without any significant difference in the hemodynamic parameters or increase in the incidence of side-effects in children undergoing lower abdominal surgeries.

Keywords: Caudal, Dexmedetomidine, Clonidine.

Introduction

Pain perception actually begins before birth. Surgical pain not only causes immediate nociceptive response but also results in changes in nociceptive activation pathways leading to hypersensitivity, hyperalgesia and allodynia [3]. In paediatric patients, optimum pain relief is a big challenge because it is difficult to differentiate restlessness or crying due to pain from that of hunger or fear. An effective therapy to block or modify the physiological responses to painful stimulus is an essential component of paediatric anaesthesia practice [4]. Regional anaesthetic techniques can reduce the requirement of inhaled anaesthetics and opioids, attenuate the stress response to surgery, facilitate a rapid, smooth recovery and provide good immediate postoperative analgesia with less systemic analgesic requirement [5]. Caudal epidural block is one of the most popular, reliable and safe techniques in paediatric anaesthesia that can be used with general anaesthesia for intra and postoperative analgesia in patients undergoing various surgeries. It is relatively simple technique with good success rate [5,6].

Methodology

Ninety children of ASA grade I and II in the age group of 2-8 years coming for various elective infra-umbilical surgeries were included in the study. They were divided into three groups of 30 each. Group A received caudal epidural(CE) with 0.75ml/kg of 0.25% bupivacaine with 1ml NS,

Group B received CE with 0.75ml/kg of 0.25% bupivacaine with clonidine 1mcg/kg diluted to 1ml with normal saline, Group C to receive CE with 0.75ml/kg of 0.25% bupivacaine combined with dexmedetomidine 1mcg/kg diluted to 1ml with normal saline. Patients underwent routine pre-anesthetic evaluation and were premedicated with Syp. Trichlofos 75mg/kg on the previous night of surgery and 30 min before the procedure. Patients attenders were explained about the procedure and informed / written consent obtained. Routine NPO protocols were followed. Intravenous cannula was secured in surgical ward and pediatric maintenance fluid was started and maintained as per standard protocol. After administration of Inj.atropine 15mcg/kg iv, Inj.Fentanyl (2µg/kg) iv was administered on arrival in pre induction room. Pre oxygenation done for 3 min. Anaesthesia induced with propofol 2mg/kg i.v and child intubated using Inj.Vecuronium. Child was maintained on oxygen nitrous oxide-sevoflurane and positioned for administration of caudal epidural block. With all aseptic precautions caudal block was performed in lateral decubitus position. The main parameters studied were hemodynamic changes, duration and quality of postoperative analgesia, sedation and incidence of side-effects. Standard monitoring included pulse oximetry, noninvasive blood pressure measurement, heart rate, and cardiac monitoring with ECG. At the end of procedure, child was extubated.

On extubation patient was monitored for smooth recovery or any agitation. Smooth: calm and asleep, agitated: Restless, responds to tender care, Turbulent: Thrashing on bed, not responding to tender care. Later, patient was monitored in post-anaesthesia care unit for 2 hrs and Inj.Fentanyl1.5µg/kg and rectal diclofenac (1.5mg/kg) was given as a rescue analgesic in the event of inadequate analgesia as per CHEOPS scale. Quality of analgesia was assessed using CHEOPS score: 4-7= good, 8-10 = average,11-13 = poor. A 4 point sedation score was used as follows: 1- Asleep; not arousable by verbal contact, 2-Asleep; arousable by verbal contact, 3-Drowsy / not sleeping and 4-Awake / alert.

Results

Table 1: Demography of the patients

Parameters	Group 1	Group 2	Group 3	P value
No. of patients	30	30	30	-
Age (years)	4.53 ± 1.88	5.00 ± 2.22	4.87 ± 1.99	**0.92**
Sex(Male/Female)	28/2	28/2	27/3	**0.856**
Weight(kg)	13.9±3.5	13.7±4.0	13.3±3.3	**0.86**
Duration of surgery	38.7±12.5	39.1±10.3	40.2±8.3	**0.89**

Table 1 shows demographic data – age, gender, weight and duration of surgery which were comparable in the three groups.

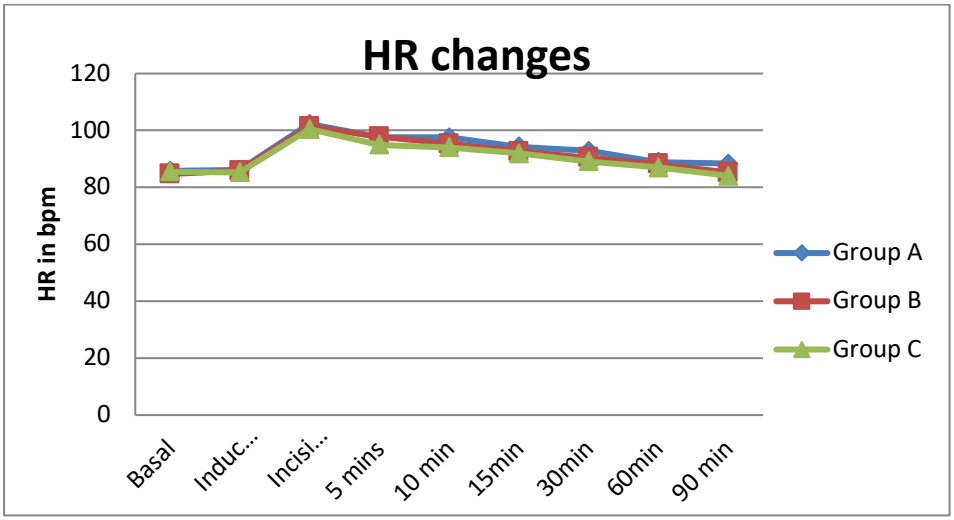

Figure 1: Changes in heart rate

Baseline heart rate was 85.8±6.9beats per minute in group A , 84.7±6.7 beats per minute in group B; and 85.5±6.5 beats per minute in group C. The difference was found to be statistically insignificant. At incision, heart rate in group A was 102.3±6.5 beats per minute, in group B was 101.4±7.4 beats per minute and in group C was 100.5±6.5beats per minute. This difference was not statistically significant. However there was a significant increase in heart rate at incision from basal values in all the three groups. At 15 minute after induction heart rate was 94.3±5.7 beats per

minute in group A, 92.6±5.7 beats per minute in group B and 91.9±8.3beats per minute in group C. The difference was statistically not significant. At 90 minutes there was reduction in heart rate in all three groups. Heart rate was 87.3±5.1 beats per minute in group A, 86.2±6.4 beats per minute in group B and 85.1 ±6.8 beats per minute in group C.

The difference between the groups was found to be statistically insignificant. (P = 0.127)

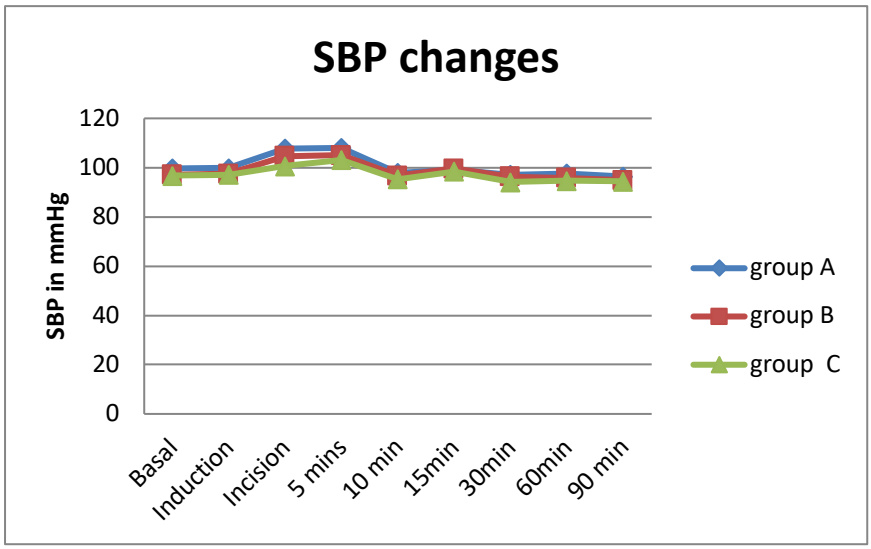

Figure 2: Systolic blood pressure changes

Baseline SBP was99.8±10.0 mmHg in group A ,97.1±7.4 mmHg in group B; and96.8±6.3 in group C. The difference was found to be statistically insignificant. At incision, SBP in group A was 105.8±11.3 mmHg, in group B was 104.7±7.9 mmHg and in group C was 103.6±8.1 mmHg. This difference was statistically insignificant.(p =0.113).The systolic blood pressure increased from basal values at incision in all the three groups which was found to be statistically significant. At 15 minutes after induction SBP was 99.2±9.4 mmHg in group A, 99.6±6.4 mmHg in group B and 98.4±6.4 mmHg in group C .The difference was statistically not significant. At 90 minutes SBP was 96.4±9.4 mmHg in group A, 94.9±6.2 mmHg in group B and 94.4±5.4 mmHg in group C. The difference between the groups was not found to be statistically significant.

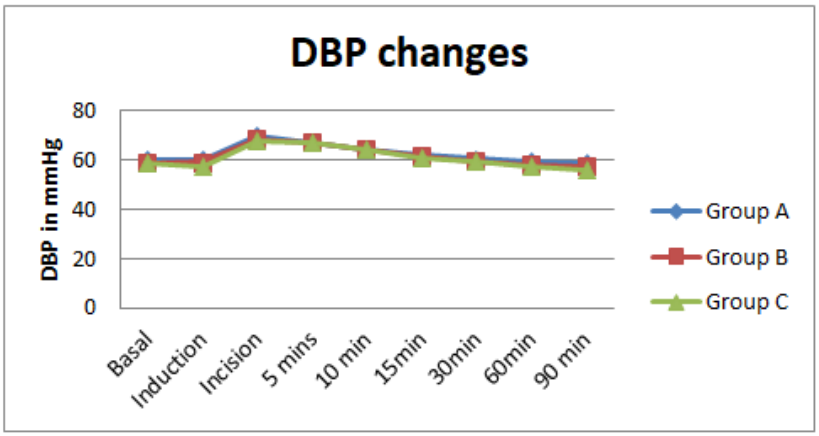

Figure 3: Diastolic blood pressure changes

Baseline DBP was 60.1±4.6 mmHg in group A, 58.9±6.0 mmHg in group B; and 58.7± 5.2 mmHg in group C. The difference was found to be statistically insignificant. At incision, DBP in group A was 69.9±6.1 mmHg, in group B was 68.5±8.6 mmHg and in group C was 67.5±7.4 mmHg. This difference was statistically insignificant. However the increase in diastolic blood pressure from basal values in all the three groups was found to be statistically significant.

At 15 minute after induction DBP was 61.9±5.7 mmHgin group A, 61.7±7.6 mmHg in group B and 60.6±6.5 mmHg in group C .The difference was statistically not significant. At 90 minutes DBP was 58.9±5.0 mmHg in group A, 57.2±6.2 mmHg in group B and 56.0±5.4 mmHg in group C. The

difference between the groups was not found to be statistically significant.

Table 2: Mean duration of analgesia

GROUPS	Mean duration(hrs) ±SD	P value
Group A	4.2 ±0.69	0.001
Group B	5.8±0.88	
Group C	9.1±0.89	

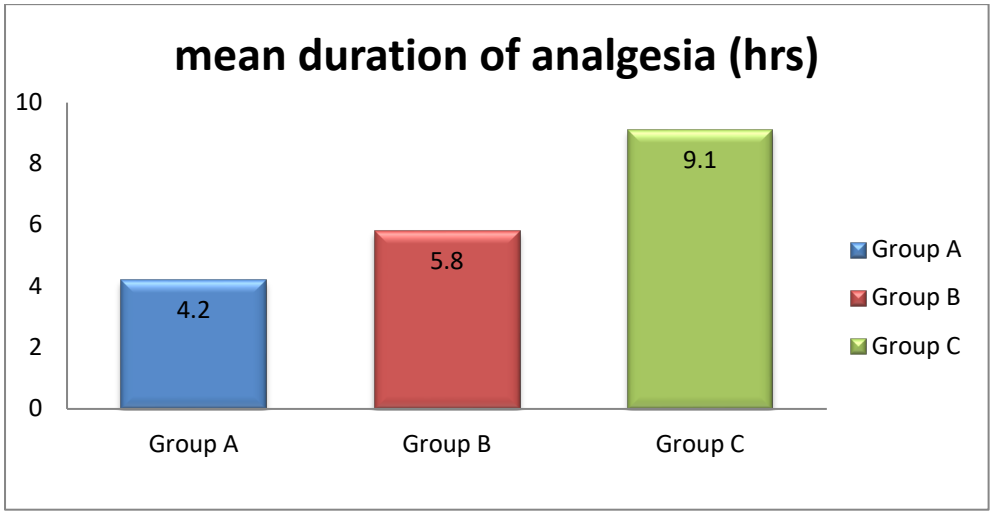

Figure 4: mean duration of analgesia (hrs)

The mean duration of analgesia in group A was 4.2± 0.69 hrs, whereas mean duration of analgesia in group B was 5.8±0.88 hrs and group C was 9.1±0.89 hrs. This difference between the three groups was found to be highly significant (p =0.001) with the duration in group C being longer than in group B.

Table 3: Quality of analgesia

Quality of Analgesia	Groups	Good	Average	Poor	P value
At end of 4th hour	Group A	15	10	5	0.001
	Group B	30	00	00	
	Group C	30	00	00	
At end of 5th hour	Group A	00	18	12	0.04
	Group B	25	03	02	
	Group C	30	00	00	
At end of 9th hour	Group A	00	18	12	0.001
	Group B	00	21	09	
	Group C	14	10	06	

All the patients in all three groups had good analgesia until 3 hrs whereas 15patients in group A had good analgesia at end of 4 hrs, whereas all 30 patients in group B and group C had good analgesia at end of 4 hrs. This difference was found to be statistically significant.(p=0.001)

Table 4: Sedation

Duration with score of 4	Group A	Group B	Group C	P value
<3hrs	0	0	0	
3 - 4 hrs	12(40.00%)	0	0	
4 – 6 hrs	18(60.00%)	21(70%)	0	P= 0.01
6 – 8 hrs	0	9(30.00%)	10(33.33%)	P=0.001
8 – 10 hrs	0	0	20(66.66%)	

Sedation of the patient is assessed using 4 point sedation score. Score </=3 was considered sedated. All the patients in all three groups were sedated for first 3 hrs whereas all patients in group A (100%) were awake at the end of 6 hrs only 21 patients(70.00%) in group B and 0 patients(0%) in group C were awake. This difference was found to be statistically significant. While all the patients(100%) in group B were awake at the end of 8 hrs, only 10patients(33.33%) in group C were

awake. This difference was found to be statistically significant (p=0.001). Majority of patients (66.67%) in group C were sedated for 8-10hours. There was no significant sedation in the post-operative period leading to respiratory depression. The sedation score was either 2 or more in all the patients at all times.

Table 5: Recovery

Recovery	Groups			P value
	Group A	Group B	Group C	
Smooth	25 (83.3%)	27 (90.0%)	27 (90.0%)	0.66
Agitated	05 (16.7%)	03 (10.0%)	03 (10.0%)	
Turbulent	00	00	00	
Total	30 (100%)	30 (100%)	30 (100%)	

25patients (83.3%) in group A had a smooth recovery whereas 5 patients were agitated. In group B and group C 27 patients (90.0%) had a smooth recovery whereas 3 patients were agitated after extubation. This difference between the three groups was found to be statistically insignificant (p =0.66)

Adverse effects

None of the patients in group A and group B had any adverse effect whereas 2 patients in group C (2.2%) had adverse effects. 1 of them had bradycardia whereas the other had hypotension which was effectively treated. None of the patients in any three groups had respiratory depression. This difference between the three groups was not statistically significant (p = 0.39).

Discussion

Caudal epidural blockade is one of the most popular regional blocks used in paediatric anaesthesia. Caudal block is safe and reliable technique, easy to perform and has been found to be very effective in children, especially in infra-umbilical surgeries when combined with general anaesthesia [4].

In our study, there was no significant difference between the three groups with respect to hemodynamics (heart rate, SBP, DBP) however there was a rise in heart rate and blood pressure at incision in all the three groups which can be because of surgical stimulus, inadequate analgesia as the duration between caudal block and incision was less than the time taken for caudal epidural block to act. These results were similar to the study conducted by Saadawy et al.[4] and Arunaparameshwari et al [5].

The mean duration of analgesia in group A was 4.2±0.69 hrs , whereas mean duration of analgesia in group B was 5.8±0.88 hrs and group C was 9.1± 0.89 hrs. This difference between the three groups was found to be highly significant (p =0.001) with the duration in group C being longer than in group B which was similar to study conducted by El-Hennawy AM et al [6]. Dipak L Raval et al [7] in their study concluded that the mean duration of post-operative analgesia in dexmedetomidine group (14.16±1.65 hrs)was longer than clonidine group(11.24± 2.48 hrs). Although results differ widely, the duration of analgesia provided ranged from14-16 hours for 1 µg/kg to 16 hours for 2 µg/kg of dexmedetomidine and from 11-16 hours for 1 µg/kg to 3-21hrs for 2 µg/kg of clonidine. The wide variation in the duration of action of clonidine and dexmedetomidine in the various studies could be due to many reasons: dose of drug used, differences in pre-medication and volatile anaesthetic used, type of surgery, indications for rescue analgesia, assessment of pain, and statistical analysis.

With respect to sedation, there was no significant difference in the post-operative period leading to respiratory depression. The sedation score was either 2 or more in all the patients at all times. The duration of sedation corresponded closely with the duration of analgesia. It was difficult to distinguish between sedation and analgesia as we found that all the subjects were asleep provided they were comfortable and became restless or awake only when they were in pain and required analgesia. This result was supported by the study by J J Lee et al [8] who found that the duration of sedation was very similar to the respective duration of caudal analgesia in both groups who received caudal bupivacaine and caudal clonidine bupivacaine mixture.

In group A, 25 patients had a smooth recovery whereas 6 patients were agitated. In group B and group C 27 patients had a smooth recovery whereas 3 patients were agitated after extubation. This difference between the three groups was found to be statistically insignificant.

Whereas Ghosh SM et al [9] and Saadawy et al [4] in their study concluded that addition of caudal clonidine (1µg/kg) and caudal dexmedetomidine (1µg/kg) resulted in smoother recovery after sevoflurane induction compared to plain bupivacaine group respectively.

Adverse effects observed were one child had bradycardia requiring Inj.atropine 0.02mg/kg and other had hypotension and bradycardia requiring

fluid bolus and Inj. Mephentermine. This difference between the three groups was not statistically significant (p = 0.39). This was similar to the studies conducted by Arunaparameshwari et al [5], El-Hennawy AM et al [6] who also concluded that there was no significant increase in adverse effects with addition of clonidine and dexmedetomidine to caudal bupivacaine respectively.

Conclusion

Caudal administration of bupivacaine 0.25% (0.75ml/kg) with clonidine (1 μg/kg) and dexmedetomidine (1 μg/kg) prolonged the duration and improved the quality of analgesia compared to 0.25% bupivacaine (0.75ml/kg) alone, without any significant difference in the hemodynamic parameters or increase in the incidence of side-effects in children undergoing lower abdominal surgeries.

Dexmedetomidine did offer significant advantage over clonidine as regards the duration and quality of analgesia.

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