Section: Anesthesia

Original Research Article

A COMPARATIVE STUDY OF BUPIVACAINE WITH DEXMEDETOMIDINE AND BUPIVACAINE ALONE FOR CAUDAL ANAESTHESIA IN PAEDIATRIC INGUINAL HERNIA SURGERIES

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Abstract

Background: Elective inguinal herniorrhaphy is one of the most prevalent surgical procedures in the pediatric age group. This study aimed to compare the effect of dexmedetomidine with bupivacaine combination versus bupivacaine alone for caudal anaesthesia in children undergoing inguinal herniorrhaphy. **Materials and Methods:** In this prospective randomised study, we studied 60 ASA class I and II patients aged between 2 to 10 years scheduled for inguinal herniorrhaphy. All patients were assigned randomly to two groups of 30 patients. Group B received [0.25% bupivacaine + Normal saline1 ml), and Group BD received [0.25% bupivacaine + 1 µg/kg dexmedetomidine in 1 ml normal saline]. FLACC score and 4-point 18 sedation score were assessed. Heart Rate, Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean arterial pressure (MAP), and SPO2 were serially monitored. **Results:** The mean FLACC postoperative score at all-time points from 1 hour to 12 hours was significantly higher in Group B. The mean 4 Point Sedation Score Immediate Postoperative among Group BD was 1.03 ± 0.18, statistically significant ($p<0.05$) compared to Group B 3±0. The mean sedation was statically significant among both groups at 1h and 2 hr time points. The mean heart rate postoperatively up to 9 hr was reported statistically significant ($p<0.05$). The mean postoperative SBP was found statistically significant ($p<0.05$) at an all-time point except for 12 hrs but mean DBP, MAP was reported statistically significant ($p<0.05$) at 2 and 3 hr time points. **Conclusion:** The present study concludes that the analgesic and sedative effects were superior when dexmedetomidine was added to bupivacaine than when administered alone owed high sensitivity to Meropenem followed by Amikacin and Piperacillin.

INTRODUCTION

One of the most common surgical procedures in the paediatric population is the repair of inguinal hernias.[1] Using the best analgesic regimen speeds up recovery from surgery, reduces postoperative stress response, and provides safe and effective analgesia. In paediatric inguinal hernia procedures, caudal anaesthesia is a reliable regional anaesthetic.[2] A caudal block is a central neuraxial block, most commonly used in Pediatrics to provide analgesia for surgeries up to the umbilicus and chronic low back pain management in adults.[3] Caudal blocks can be performed using the blind technique or with increasing accuracy via ultrasound or fluoroscopic guidance. Through this technique, the surgical operation is pain-free throughout. There is less intraoperative stress, less need for analgesic and anaesthetic agents, and good postoperative analgesia.[4] The idea of giving paediatric patients adequate postoperative analgesia has been well-established in recent years. Still, different techniques have adverse effects that prevent their widespread usage, such as respiratory depression with IV opioids. Caudal analgesia was demonstrated to be a

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straightforward and efficient therapy in children with a high success rate. Despite the use of long-acting local anaesthetics, the primary drawback of caudal analgesia remains its relatively brief duration of action.[5]

It is frequently necessary to administer local anaesthetic drugs at the appropriate dosage to establish a successful caudal block. Caudal bupivacaine may be used in conjunction with other medications such as epinephrine, clonidine, midazolam, ketamine, neostigmine, morphine, tramadol, fentanyl, and sufentanil to increase the effectiveness and prolong the duration of analgesia.[6] Both opioids and alpha-2 receptor agonists have advantageous effects in neuraxial anaesthesia. Fentanyl and sufentanil used intravenously not only enhance surgical analgesia but also enable a reduction in the dose of local anaesthetic. Intrathecal local anaesthetics with clonidine or dexmedetomidine added caused postoperative analgesia to last longer.[7] Dexmedetomidine is a particular α2 adrenergic receptor agonist that has sedative, anxiolytic, and analgesic qualities that make it possible for it to stop infants from becoming agitated upon waking up. Dexmedetomidine is an α2 agonist with a stronger affinity for α2A receptors, resulting in hypnotic, analgesic, and sympatholytic actions. The analgesic effect lasts longer with repeated use, with no discernible effects on respiratory or hemodynamic function.[8-9]

The current study aimed to examine whether supplementation of caudal bupivacaine with dexmedetomidine can improve efficacy and safety.

MATERIALS AND METHODS

This prospective, double-blinded study was conducted at the Department of Anaesthesiology, Government Thoothukudi Medical College, Thoothukudi. The written consent and ethical committee approval were taken before the start of the study.

Inclusion Criteria

Patients of either sex with American Society of Anaesthesiologists Physical status classes I and II, patients aged between 2 to 10 years of either sex and patient undergoing elective inguinal hernia surgery were included.

Exclusion Criteria

Patients with infection at the site of caudal block, skeletal deformities, suspected coagulopathy and history of liver disease, uncontrolled systemic disorders, neurological disease, history of developmental delay and known allergy to study drugs, and patients who refused to participate were excluded.

Methodology

Pre-Anaesthetic Assessment

All patients underwent a pre-anaesthetic check-up one day before the surgery. Patients were evaluated for any systemic disease. The routine laboratory parameters, ECG and other investigations were verified per surgical need. All patients were kept nil by mouth: light meal or formula feeds may be given up to 6 hours before induction, breast milk up to 4 hours, and clear fluids up to 2 hours before induction.

Conduct of Anaesthesia

Boyle's machine was checked, and appropriate size endotracheal tube, LMA, working laryngoscope-size 0,1 and 2 Millers blades and size 1,2 Macintosh blades, Jackson Rees circuit with 1,2 and 3 size masks, stylet and working suction apparatus were kept ready before the procedure. The emergency drug tray was kept ready.

Sixty patients were allocated randomly groups into two equal (30 in each group). The patient was connected to a non-invasive blood pressure monitor, ECG, pulse oximetry, and precordial stethoscope in the operating room. Basal parameters were noted, and the intravenous line was secured with a 22 G IV cannula onto a vein on the dorsum of the hand. The patient was premedicated with Inj Atropine 0.02mg/kg IM for 30 minutes. Anaesthesia was induced with propofol at 2-3mg/kg, with O2 fresh gas flow and sevoflurane. An appropriately sized LMA were positioned in situ, bilateral air entry was checked, and LMA was fixed. Anaesthesia was maintained with 50% N20 and 50% O2, and sevoflurane using Jackson Rees modifications of Ayre's 'T' piece with the patient in spontaneous respiration.

After induction of general anaesthesia

Group BD: According to the Armitage formula, the patient received a caudal epidural block with 1ml/kg of 0.25% bupivacaine and 1microgram /kg of dexmedetomidine in 1ml normal saline using a 23G IM needle. Group B: According to the Armitage formula, the patient received a caudal epidural block with 1ml/kg of 0.25% bupivacaine plus 1ml normal saline using a 23G IM needle.

Heart Rate, Blood Pressure, and Spo2 were recorded at an interval of 15 minutes. Children were extubated in a deep plane of anaesthesia. Children were shifted to the postoperative ward. Postoperative pain, postoperative sedation, heart rate, blood pressure, and spo2 were monitored for 12 hours. The pain was assessed by using FLACC (face, legs, activity, cry, consolability) pain scale.

FLACC pain score system[10]

Parameter	Finding	Point
Face	No particular expression or smile; disinterested	0
	Occasional grimace or frown, withdrawn	1
	Frequent to constant frown, clenched jaw, quivering chin	2
Legs	No position or relaxed	0
	Uneasy, restless, tense	1

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	Kicking, or legs drawn up	2
Activity	Lying quietly, a normal position, moves easily	0
	Squirming, shifting back and forth, tense	1
	Arched, rigid, or jerking	2
Cry	No crying (awake or sleep)	0
	Moans or whimpers, occasional complaint	1
	Crying steadily, screams or sobs, frequent complaints	2
Consolability	Content, relaxed	0
	Reassured by occasional touching, hugging, or talking to, distractible	1
	Difficult to console or comfort	2

Postoperative rescue analgesia of Paracetamol 30mg/kg suppository was given at a pain score of four or above. Postoperative Sedation was assessed using a 4-point sedation score: For 1: Asleep, not arousal by verbal contact; for 2: Asleep, arousal verbal contact; for 3: Drowsy or not sleeping; and for 4: Alert or awake.

Pulse rate, blood pressure, and spo2 were monitored and assessed for complications like nausea and vomiting, bradycardia, and hypotension. A decrease in mean arterial pressure >20% from the baseline was defined as hypotension and treated with intravenous fluids/injection ephedrine. A decrease in heart rate >20% from the baseline was considered bradycardia and treated with an injection of atropine 0.01 mg/kg.

Statistical Analysis

The data was gathered and entered into an Excel file. Frequencies mean percentages, standard deviations, chi-square coefficients of correlation, and p values were determined using the SPSS-18 software. The significance of a difference between two quantitative variables was calculated using the Chi-square test, and a p-value of < 0.05 was considered significant.

RESULTS

Male predominance was reported in both groups, and the mean age was comparable. In addition to parameters like mean weight, ASA classification distribution was comparable in both groups (Table 1).

Table 1: Observation of demographic, FLACC and Sedation score of patients

Parameters	Observation N (%)		P-value
	Group B (N=30)	Group BD (N=30)	
Gender			
Male	27 (90%)	28 (93.3%)	0.006
Female	3 (10%)	2 (6.7%)	
Age years, (mean± SD)	4.70± 1.93	4.37 ±1.85	0.479
Weight (kg) (mean± SD)	13.77 3.10	12.84 2.74	0.226
ASA Grade			
1	29 (96.66%)	29 (96.66%)	0.509
2	1 (3.33%)	1 (3.33%)	
FLACC Postop			
Immediate Postoperative (mean ± SD)	0.00 ±0.00	0.00 ±0.00	00
1 hr	1.00 ±0.00	0.77 ±0.43	0.006
2 hr	1.93 ±0.25	1.30 ±0.47	0.001
3 hr	2.27 ±0.45	1.97 ±0.18	0.002
4 hr	3.00 ±0.00	2.73± 0.45	0.003
6 hr	4.03 ±0.32	3.00± 0.00	0.001
9 hr	4.90 ±0.48	4.07± 0.25	0.001
12 hr	4.53± 0.73	4.90 ±0.40	0.020
4-Point Sedation Score Postop			
Immediate Postoperative (mean ± SD)	3.00± 0.00	1.03± 0.18	0.001
1 hr	3.93 ±0.25	3.00 ±0.00	0.001
2 hr	4.00± 0.00	3.13± 0.35	0.001
3 hr	4.00± 0.00	4.00± 0.00	-
4 hr	4.00± 0.00	4.00 ±0.00	-
6 hr	4.00± 0.00	4.00 ±0.00	-
9 hr	4.00 ±0.00	4.00 ±0.00	-
12 hr	4.00± 0.00	4.00± 0.00	-

The mean FLACC Immediate Postoperative score was 0 among both groups. The mean FLACC postoperative score at all-time points from 1 hour to 12 hours was statically significant ($p<0.05$) among both groups. However, the mean FLACC score was reported higher in Group B than in Group BD. The mean 4 Point Sedation Score Immediate Postoperative among Group BD was 1.03 ± 0.18) which was statistically significant compared to Group B 3±0. The mean sedation was statically significant among both groups at 1 hand 2 hr time point. At other time points (3, 4, 6, 9 and 12 hrs), both groups were the same (Table 1).

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The mean Intra-operative HR at Baseline among Group BD was 110.43± 3.55, which was statistically significant compared to 109.1 ± 3.52 in Group B. Mean heart rate before induction, after induction, during caudal block and up to 60 min was reported to be comparable in both groups. In comparison, the mean heart rate postoperatively up to 9 hr was reported as statistically significant ($p<0.05$) (Table 2, Figure 1).

Table 2: observation of intra-operative mean SBP, DBP, MAP, SpO2 and Hear rate

Parameters	Observation N (%)		P-value
	Group B (N=30)	Group BD (N=30)	
SBP (mmHg) (mean ± SD)			
Baseline	115.00 ±5.09	112.67 ±4.50	0.065
Before Induction	110.53 ±3.29	109.53 ±4.55	0.333
After Induction	105.57± 4.65	105.43± 4.77	0.913
During Caudal Block	102.87 ±4.40	102.50± 3.87	0.733
15 min	99.67± 2.68	100.07 ±3.89	0.644
30 min	96.90± 3.04	97.67 ±4.09	0.413
45 min	94.97± 3.19	94.17± 4.35	0.420
60 min	92.70 ±3.08	93.10 ±3.0	0.612
75 min	92.57 ±3.92	90.73± 2.65	0.038
DBP (mmHg) (mean ± SD)			
Baseline	72.67 ±5.21	72.00 ±6.64	0.667
Before Induction	67.07± 5.82	67.70 ±4.47	0.638
After Induction	64.50± 4.97	63.70± 5.32	0.550
During Caudal Block	60.90 ±4.60	60.53± 4.87	0.765
15 min	59.07± 4.46	57.63 ±4.00	0.195
30 min	56.27 ±2.45	56.93 ±3.14	0.363
45 min	56.40 ±3.39	56.33 ±3.00	0.936
60 min	55.20± 3.04	55.17 ±2.28	0.962
75 min	54.43 ±2.97	54.17± 2.23	0.695
MAP (mmHg) (mean ± SD)			
Baseline	86.37 4.30	84.63 5.43	0.176
Before Induction	82.17 4.48	82.03 3.99	0.904
After Induction	80.13 3.70	78.97 4.24	0.261
During Caudal Block	77.60 3.41	77.20 3.74	0.667
15 min	75.73 2.65	74.70 3.06	0.168
30 min	73.53 1.89	73.17 2.88	0.562
45 min	72.17 1.95	71.87 2.27	0.585
60 min	70.73 2.33	70.80 2.81	0.921
75 min	69.93 3.46	68.53 3.15	0.107
SpO2 (%) (mean ± SD)			
Baseline	99.00 ±0.00	99.00 ±0.00	-
Before Induction	99.27± 0.45	99.13 ±0.35 0	0.203
After Induction	99.10 ±0.31	99.23 ±0.43	0.172
During Caudal Block	99.13± 0.35	99.03± 0.18	0.168
15 min	99.03± 0.18	99.10± 0.31	0.310
30 min	99.03± 0.18	99.07 ±0.25	0.561
45 min	99.07 ±0.25	99.10 ±0.31	0.647
60 min	99.03 ±0.18	99.03 ±0.18	1.00
75 min	99.00± 0.00	99.00 ±0.00	-
Heart Rate (beats per min) (mean ± SD)			
Baseline	109.10± 3.52	110.43± 3.55	0.149
Before Induction	107.20± 3.44	108.40 ±3.54	0.188
After Induction	104.97 ±3.23	105.73 ±2.80	0.330
During Caudal Block	102.87 ±2.89	103.33 ±2.60	0.513
15 min	99.90 ±2.87	100.43 ±2.80	0.469
30 min	97.37 ±2.72	97.77 ±2.36	0.545
45 min	95.23 ±2.50	95.03± 2.46	0.756
60 min	93.20 ±2.54	92.50± 2.60	0.295
75 min	91.70 ±2.02	89.57 ±2.79	0.001

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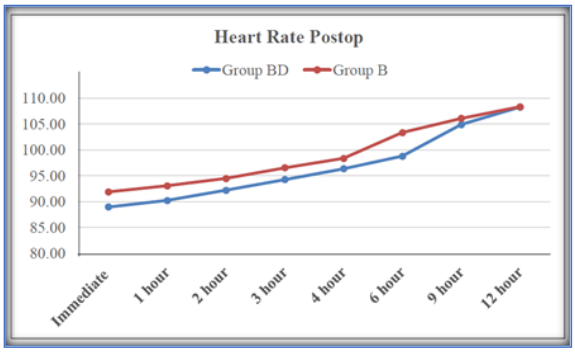

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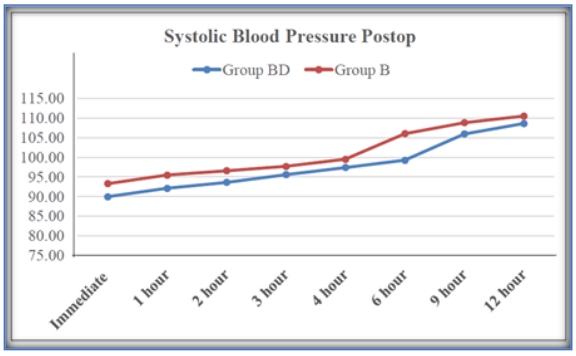

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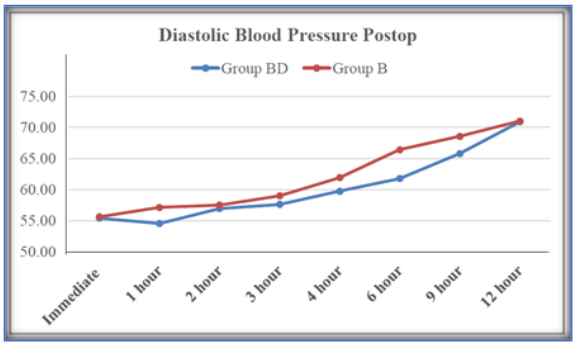

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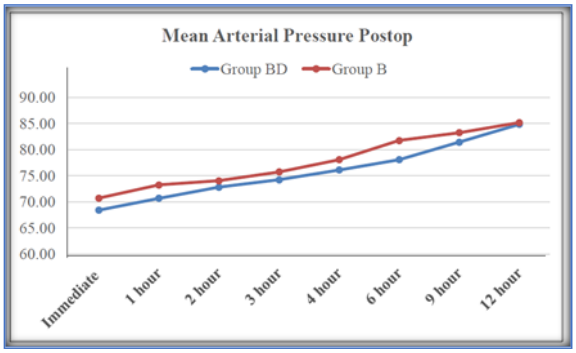

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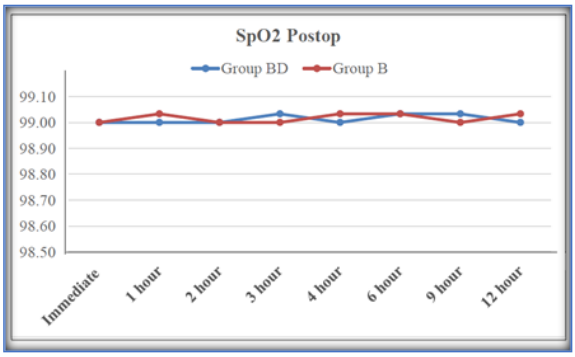

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Figure 1: Observation of postoperative mean heart rate, SBP, DBP, MAP and SpO2

The mean Intra-operative SBP, DBP, MAP, and SpO2 at baseline, before induction, after induction, during caudal block and up to 75 min were found comparable in both groups. However, mean postoperative SBP was found statistically significant ($p<0.05$) at all-time points except for 12 hrs, but mean DBP was reported statistically significant ($p<0.05$) at 2 and 3 hr time points between both groups. In comparison, mean MAP postoperative was statistically significant ($p<0.05$) at 2, 3 and 12 hr among both groups. The mean postoperative SpO2 was reported comparable at all-time points (Table 2, Figure 1).

DISCUSSION

The study's main objective is to assess caudal epidural administration of dexmedetomidine 1 µg/kg with 0.25% bupivacaine vs 0.25% bupivacaine for providing postoperative pain relief in children undergoing inguinal hernia surgeries. Among the subjects, 30 (50%) were allocated to Group BD who received caudal epidural block with 1ml/kg of 0.25% Bupivacaine and 1microgram /kg of dexmedetomidine in 1ml normal saline using 23G IM needle and 30 (50%) were allocated to Group B who received caudal epidural block with 1ml/kg of 0.25% bupivacaine plus 1ml normal saline using 23G IM needle. Male predominance was reported in both groups, and the mean age was comparable. In addition, parameters like mean weight and ASA classification distribution were comparable in both groups. These findings in the present study follow earlier reported studies.[11]

The mean FLACC Immediate Postoperative score was 0 among both groups. The mean FLACC postoperative score at all-time points from 1 hour to 12 hours was statically significant ($p<0.05$) among both groups. However, the mean FLACC score was reported higher in Group B than in Group BD. Kumar N et al. showed that in group Bupivacaine and Dexmedetomidine, the FLACC score at the initial four hours and the 12th hour was significantly less ($P < 0.05$).12 Kamar AK et al. showed a significant reduction in FLACC score in group Levo-Bupivacaine and Dexmedetomidine at 4, 8, and

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12 hours postoperatively compared to group bupivacaine. At 24 hours, there was no significant difference. They discovered a statistically significant increase in group Levo Bupivacaine and Dexmedetomidine postoperative analgesic duration compared to group bupivacaine (p-value 0.001). There was a statistically significant reduction in the number of doses of analgesia (Paracetamol 15ml/kg/dose) needed postoperatively in group Bupivacaine and Dexmedetomidine.[13] Sayed et al., among 120 children, showed that FLACC scores were significantly higher in the bupivacaine group alone compared to the other study groups by the early 2nd, 4th, and 6th postoperative hours.[14]

The mean 4 Point Sedation Score Immediate Postoperative among Group BD was 1.03 ± 0.18) which was statistically significant compared to Group B 3±0. The mean sedation was statically significant among both groups at 1 hand 2 hr time point. At other time points (3, 4, 6, 9 and 12 hrs), both groups were the same. Jarineshin et al. showed that the lowest pain scores were found in the BD group at all-time points. The sedation scores were higher in the BD group than in the other two groups at all-time points ($P < 0.001$).[15] Abd-Al-Eziz et al. showed that the duration of postoperative analgesia was longer in group A (Dexmedetomidine and Bupivacaine) than in group B (Ketamine), and the sedation score was lower in group B than in group A, which was statistically significant.[16] Al-Zaben et al. also showed that the dexmedetomidine groups had significantly higher ($p<0.001$) postoperative sedation scores compared to the plain bupivacaine group.[17] Shaama et al. also demonstrated longer periods of analgesia and sedation were detected in Group Bupivacaine and Dexmedetomidine.[18]

The mean Intra-operative HR at Baseline among Group BD was 110.43± 3.55, which was statistically significant compared to 109.1 ± 3.52 in Group B. Mean heart rate before induction, after induction, during caudal block and up to 60 min was reported to be comparable in both groups. Whereas mean heart rate postoperatively up to 9 hr was reported as statistically significant ($p<0.05$). Goswami et al. showed a statistically significant decrease in mean intraoperative heart rate, systolic blood pressure, diastolic blood pressure, postoperative pulse rate, and systolic and diastolic blood pressure in Group BD ($p<0.001$).[19]

The mean Intra-operative SBP, DBP, MAP, and SpO2 at baseline, before induction, after induction, during caudal block and up to 75 min were found comparable in both groups. However, mean postoperative SBP was found statistically significant ($p<0.05$) at all-time points except for 12 hrs, but mean DBP was reported statistically significant ($p<0.05$) at 2 and 3 hr time points between both groups. In comparison, mean MAP postoperative was statistically significant ($p<0.05$) at 2, 3 and 12 hr among both groups. The mean postoperative SpO2 was reported comparable at an all-time point. These findings of hemodynamic parameters in the present study were found according to earlier reported studies.[19,20]

Limitations

The present study was performed on a small population; hence, the degree of generalisation on dexmedetomidine's effect on patients could not be made. The present study did not study confounding factors like comorbidities or duration of analgesia. Hospital-based studies in a tertiary care setting will cause bias as complicated hernia needing a longer duration of surgery might have been included among samples.

CONCLUSION

The mean FLACC score was significantly higher at the 12th hour in Bupivacaine and Dexmedetomidine group. The 4 Point Sedation Score Postop after 2 hours was four among the groups with no difference. The mean HR, SBP, DBP, and MAP didn't differ much during intraoperative. The mean HR, mean SBP, mean DBP and mean MAP postoperatively showed a significant increase in the bupivacaine alone group. The mean SPO2 during intraoperative and postoperatively didn't differ much among groups. The findings demonstrate that in the paediatric group examined here who underwent elective inguinal hernia repair, the analgesic and sedative effects were superior when dexmedetomidine was added to bupivacaine than when bupivacaine alone was administered alone without complications.

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