Dexmedetomedine Versus Fentanyl For Ultrasound Guided Caudal Block In pediatrics. A Randomized Controlled Study

Original Article

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ABSTRACT

Introduction: In pediatric urological surgeries, caudal anesthesia stands as a cornerstone for effective pain management. Extending the duration of the block and postoperative analgesia is crucial. This study aims to compare the efficacy of bupivacaine with either fentanyl or dexmedetomidine ultrasound-guided in achieving optimal intraoperative analgesia and prolonging postoperative pain relief.

Patients and Methods: This double-blind, randomized controlled trial involved 45 pediatric patients undergoing elective urological procedures. They were allocated into three groups: Group I received bupivacaine 0.25%, Group II received bupivacaine 0.25% with fentanyl, and Group III received bupivacaine 0.25% with dexmedetomidine. The duration of caudal analgesia and time to reach FLACC score ≥ 4 were recorded for comparison.

Results: Group III exhibited the longest duration of caudal analgesia (5.5 ± 0.7 hours), significantly longer than Group I (3.4 ± 0.5 hours) (*P-value* 0.000). Moreover, the time to achieve FLACC score ≥ 4 was significantly prolonged in Group III (8.2 ± 1.8 hours) compared to both Group I and II (*P-value* 0.002). Dexmedetomidine in Group III demonstrated superior efficacy in delaying the need for analgesia.

Conclusion: The addition of dexmedetomidine (1 µg/kg) to bupivacaine 0.25% in caudal block extends the duration of the block and postoperative analgesia. It reduces postoperative analgesic requirements without notable hemodynamic instability or complications. Dexmedetomidine emerges as a promising adjunct for pediatric caudal blocks in urological surgeries.

Key Words: Caudal block, dexmedetomedine, fentanyl, levobupivacaine.

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INTRODUCTION

One of the primary methods of postoperative analgesia in pediatric urological procedures is caudal block. Bupivacaine, levobupivacaine, and ropivacaine are local anesthetics that are frequently used in the caudal block[1].

The introduction of ultrasonography and real-time imaging of the needle and surrounding structures has made it possible to use smaller, safer doses of LAs, which is advantageous for younger children since it lowers the risk of LA toxicity[2]. Although caudal epidural is more frequently used, Ultrasound-guided caudal injection results in higher first puncture success and lower incidence of complications when compared to landmark technique. It should be noted that Ultrasound-guided caudal injection does not improve the success rate or time to perform the block[3]

Prolongation of caudal analgesia has been achieved by the addition of various adjuvants such as fentanyl, morphine, epinephrine, butorphanol, tramadol, clonidine, dexmedetomidine, and dexamethasone which are frequently added to boost their efficacy and prolongs its duration. [1]A member of the n-alkyl-substituted pipecoloxylidide drugs, bupivacaine is an amino-amide local anesthetic. Levobupivacaine is the S- enantiomer of this substance but with a lesser chance of cardiovascular and central nervous system damage, it has demonstrated comparable potency to bupivacaine[4].

The dextrorotatory S-enantiomer of medetomidine is called dexmedetomidine. A potent and highly selective alpha 2- adrenergic receptor (2-AR) agonist binds to G-protein-coupled 2-AR, of which there are three subtypes (2A, 2B, and 2C), each of which has distinct physiological functions and pharmacological activities. The central, peripheral, and autonomic nervous systems, as well as important organs and blood arteries, all include these receptor subtypes in varying numbers. The spinal cord and the locus coeruleus of the brain stem, both of which function through 2A, are the primary sites for the sedative and analgesic actions, respectively[4].

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In contrast to other agents, the sedation and analgesia produced by dexmedetomidine are achieved without significant respiratory or hemodynamic compromise[5].

One of the most often used adjuvants with caudal anesthesia is the lipophilic opioid fentanyl, which is commonly administered to the caudal block in pediatrics. It's common to experience side effects like nausea, vomiting, or respiratory depression[6].

This study aims to compare the effectiveness of bupivacaine plus fentanyl vs bupivacaine plus dexmedetomidine vs bupivacaine alone in caudal block in pediatric patients undergoing urological procedures regarding the achievement of acceptable intraoperative analgesia and lengthening of the duration of postoperative analgesia.

PATIENTS AND METHODS

This study, which was a double-blind, randomized clinical trial, was conducted in Zagazig University hospitals with informed written parental or caregiver consent after explaining the procedure, advantages, and consequences in their own language.

Inclusion criteria: Ages varying from 6 months to 5 years, with physical status ASA I and II and both genders were included.

Exclusion criteria

Patients who underwent emergency procedures, parental refusal to participate in the study, patients with known allergy to study drugs, patients with anomalies or signs of a back infection, coagulopathies, developmental delay, hemodynamically unstable patients, or previous neurological or spinal diseases.

Sample size

The sample size was calculated using open epi according to the following mean dose of analgesic among the control group was 228.75+_57.76 and in the dexmetomedine group was 168.25+_45.66 [7] so at power 80 and ci 95% the sample size was calculated to be 36 cases 12 in each group, 15% of the total calculated sample was added to the study to overcome missed cases.

Methods

We achieved blindness by using identical syringes and labels for all groups, and we had a third party prepare and randomize the solutions without revealing their contents to the participants or the researchers. The solutions had the same color, smell, and viscosity, and the injections were given at the same site and volume for all groups. The third-party kept a record of the group allocation and revealed it after the data analysis was completed.

Group I: (Control group) received bupivacaine 0.25% 1 ml/kg, **Group II**: received bupivacaine 0.25 % 1 ml/kg and fentanyl 2µg/ kg, and **Group III**: received bupivacaine 0.25% 1ml/kg and dexmedetomidine1µg/ kg.

Intraoperative evaluation

In the operating room after obtaining the patient's weight and after patients were kept nil orally as per the standard NPO guidelines. the volume to be injected in the caudal block (1 ml/kg) in the form of used drugs according to each group and normal saline was prepared in syringes provided that the calculated dose of bupivacaine is below the toxic dose (2.5 mg /kg) and after connecting the patient to the monitors, baseline vital parameters: heart rate, blood pressure and oxygen saturation were recorded. After insertion of the intravenous cannula, general anesthesia was induced using intravenous anesthetic in the form of the standard dose of ketamine 1mg/kg, and endotracheal intubation was facilitated with a neuromuscular blocker using non-depolarizing muscle relaxant in the form of cis-Atracurium 0.16mg /kg and maintenance by isoflurane 1-1.5 %. After endotracheal intubation, patients were placed in the lateral decubitus position, and under complete sterile conditions, a single-dose caudal block was performed according to the group using the standard loss of resistance technique. The M-Turbo C® ultrasound machine from (SonoSite Inc., Bothell, Washington, USA) was used to visualize the sacral hiatus using an out-of-plane approach at the level of the sacral cornua. The depth and gain were adjusted for the best visual quality. To observe the sacral hiatus and the caudal epidural space, the ultrasonic transducer was initially positioned transversely at the midline to achieve a transverse view. An in-plane approach was used to advance a 5-cm short beveled 25-gauge needle at a 45° angle through the sacrococcygeal ligament and into the sacral canal to a distance of 1 cm. The study medication was then administered after looking for either CSF or blood. Care was always taken to look for signs of acute toxicity during the injection. The injection was never more than 10 ml/30 seconds, and the prepared volume was injected according to each group. A sterile gauze was put after removal of the needle then the patient was put in a supine position immediately after the caudal block for performing the surgical procedure. The skin incision was allowed strictly after 15 min of the block procedure. No other narcotics or analgesics were administered intraoperatively. Intraoperative fluid therapy was given in the form of a lactated ringer solution and was calculated for each patient according to body weight.

Adequate analgesia is defined by hemodynamic stability as the heart rate (HR) and mean arterial pressure (MAP) had been recorded before induction, after induction but before caudal anesthesia, and then every 5 minutes

after caudal block. Adequate analgesia was indicated by the absence of an increase in MAP or HR of more than 15% compared with the baseline values obtained just before the surgical incision if HR or MAP increased by more than 15%, analgesia was considered inadequate and children received rescue opioids during operation. The need for rescue opioids had been considered the first endpoint of the study and subsequent data obtained from those children had been no longer considered.

The occurrence of intraoperative hypotension requiring a fluid bolus and bradycardia requiring atropine had also been recorded. Then after the end of surgery, discontinuation of isoflurane and reversal of cis-atracurium with neostigmine 40μg/ kg and atropine 0.02 mg/kg were done and after extubation, patients were transported to the post-anesthetic care unit (PACU) when they could maintain a patent airway for observation. In the PACU, heart rate, spo2 using pulse oximetry, and blood pressure were observed until the patient was awake and cooperative.

The anesthesia time (the time from induction of general anesthesia to the end of surgery when the inhalation agent was discontinued), emergence time (the time from the end of surgery to opening the eyes on calling the patient's name), a delayed anesthetic emergence (defined as 20 min elapsing from the end of surgery to exiting the operating theatre) had been noted.

Postoperative evaluation: post-operative nausea and vomiting, respiratory depression (defined as respiratory rate < 10 breaths/min and spo2 < 92%), bradycardia (HR < 60 beats/ min in the child and HR <100 beat /min in infant), and hypotension (defined as a 20% decrease in MAP compared with preoperative values) had been recorded.

Using the pediatric observational face, legs, activity, cry, and consolability (FLACC) pain scale (Table 1) with its 0–10 score range[8] each study participant's pain intensity was assessed upon arrival in PACU and the time of discharge from it and then every 4 h for the first 12 h after operation. If the FLACC pain scale score had been noted at any time to be 4 or more, rescue analgesia in the form of paracetamol suppository 15 mg/kg had been administrated to achieve an FLACC scale score of 3 or less. The duration of adequate caudal analgesia (from the time of caudal injection to the first time the FLACC pain scale score will be noted to be 4 or more) had been also recorded.

Table 1: The FLACC pain scale[8]

	0	1	2
FACE	No particular expression or smile	Occasional grimace or frown, withdrawn, Disinterested	Frequent to constant quivering chin, clenched jaw
LEGS	Normal position or relaxed	Uneasy, restless or 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 complaints
CONSOLABILITY	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

Statistical analysis

All data were analyzed using SPSS version 19.0 for windows (SPSS Inc., Chicago, IL, USA). Data are summarized in terms of mean ± SD & median, frequencies (number of cases) as appropriate. For categorical qualitative data the appropriate test for dependency is Chi-square ($\chi 2$) test. For quantative data the appropriate test is One way ANOVA test that is used for more than two groups of normally distributed data while repeated measurement ANOVA test is used comparing within each group. With significance is determined in both side so we consider test result is significant (S) if P <0.05) & highly significant (HS) if *p value* less than 0.001.

RESULTS

This study is a double blind controlled randomized clinical trial that included 45 pediatric patients undergoing elective urological surgeries as hypospedius repair, herniorrhaphy and orchiopexy and scheduled to receive combined general anesthesia and caudal block. The patients were divided randomly in to three groups. The three groups were matched regarding age, sex, and weight *(p value*>0.05). as shown in (Table 2).

For heart rate (beats per minute) changes, there was no significant difference between the groups before and after caudal administration (*p-value* > 0.05). However, a significant decrease in heart rate was observed within each group, with no one group showing a more pronounced effect than the others (*p-value* < 0.0001), as presented in (Table 3).

In terms of mean arterial pressure (MAP, mmHg), changes before and after caudal administration revealed almost no significant differences between the groups (*p-value* > 0.05), except between Group I and Group III at 30 and 45 minutes. However, significant changes were observed within each group, with MAP tending to decrease across all groups, yet without any group having a more substantial effect than the others *(p-value* < 0.0001), as shown in (Table 4).

The anesthesia data revealed no significant differences between the groups regarding anesthesia time and emergence time (*p-value* > 0.05). However, there was a significant difference in the duration of caudal analgesia between the groups, with Group III having the longest duration and Group I the shortest (*p-value* < 0.0001), as shown in (Table 5).

No one of Group I and II suffer from nausea , vomiting or any of the mentioned complication but 3 patients in Group III suffered from bradycardia one patient suffered hypotension and one patient had delayed emergence from anesthesia .

The recorded FLACC scores indicate that the most common score at arrival was 0, with no significant difference between the groups. At discharge, the score generally increased to 2 across all groups, still with no significant differences. After 4 hours, the drugs administered to patients in Groups c and II had a similar effect on FLACC scores, while the effectiveness of the drugs in Group III began to emerge. After 8 hours, the effectiveness of all drugs started to wane, with Group III's drugs remaining more effective than those in Group I, but their effect became similar to those in Group II. Finally, after 12 hours, the effect of the drugs in all groups had diminished to nearly equal levels (*p-value* > 0.05), as shown in (Table 6)

Regarding the time to achieve a recorded FLACC score ≥ 4, there was a significant difference between Group I and Group III, and between Group II and Group III, with the drugs in Group III being the most effective. Patients in Group III had the longest time before achieving a FLACC score of 4 or more, indicating a need for additional analgesia (*p-value* < 0.002), as shown in (Table 7)

The frequency of required analgesia showed a significant difference between the groups, with patients in Group I more frequently requiring analgesia, while patients in Group III required it less frequently (*p-value* < 0.002), as demonstrated in (Table 8)

Table 2: Patient characteristics among the studied groups

Items	Group I(n=15)	Group II(n=15)	Group III (n=15)	*P value*
Male/Female	13/2	14/1	13/2	0.79 $
Age (month)	33.5 ± 17.9	34.3 ± 18.3	32.4 ± 18.6	0.96 @
Weight (Kg)	15.9 ± 4.7	15.2 ± 4.2	14.5 ± 3.9	0.67@

$ Chi square test @ One way ANOVA test

Table 3: Change of heart rate (beat/min) with time

	Group I (n=15)	Group II (n=15)	Group III (n=15)	*P value* @
Before caudal	139.9 ± 18.3	144.1 ± 16.1	153.9 ± 15.4	0.073
After caudal				
5 min	137.8 ± 18.3	142.7 ± 16.5	150.8 ± 16.2	0.12
10 min	133.2 ± 17.4	139.9 ± 16.2	144.3 ± 15.4	0.186
15 min	131.5 ± 16.7	137.8 ± 15.8	138.07 ± 16.9	0.472
20 min	129 ± 16.8	135.6 ± 16.3	134.6 ± 17.1	0.513
25 min	125.5± 16.2	132.2 ± 16.8	131.5 ± 17.8	0.498
30 min	123.8 ± 16.2	130.6 ± 16.9	128.1 ± 20.4	0.579
35 min	120.8 ± 15.3	128.5 ± 14.9	125.8 ± 20.6	0.464
40 min	118 ± 14.8	127.2 ± 13.8	123.8 ± 20.7	0.323
P value #	0.023*	0.086	<0.001**	

@One way ANOVA test # Repeated measurement ANOVA test

Table 4 : Change of mean arterial pressure (mmHg) with time

	Group I(n=15)	Group II(n=15)	Group III (n=15)	*P value*@
Before caudal	61.8 ± 5.06	63.8 ± 5.7	66.2 ± 4.1	0.065
After caudal				
5 min	61.1 ± 5.4	63.1 ± 5.7	65.2 ± 4.6	0.114
10 min	59.2 ± 4.4	61.4 ± 5.8	62.07 ± 3.7	0.230
15 min	58.8 ± 4.2	59.9 ± 5.1	59.4 ± 3.9	0.794
20 min	55.6 ± 4.6	57.9 ± 5.3	59.07 ± 3.9	0.126
25 min	54.6 ± 4.2	56.5 ± 4.7	57.8 ± 4.07	0.139
30 min	52.6 ± 4.2	55.4 ± 4.4	56.4 ± 4.3	0.053
35 min	52.4 ± 4.3	54.2 ± 3.7	55.8 ± 4.2	0.085
40 min	51.7 ± 3.2	52.8 ± 3.5	55.6 ± 4.5	0.021*
P value#	<0.001**	<0.001**	<0.001**	

@One way ANOVA test # Repeated measurement ANOVA test

Table 5 : anesthesia data characteristics

Items	Group I (n=15)	Group II (n=15)	Group III (n=15)	*P value*
Anesthesia time (min)	100 ± 37.03	104 ± 42.2	99 ± 38.3	0.934
Emergence time (minute)	10.2 ± 3.02	14.3 ± 1.7	11.8 ± 5.01	0.009*
Duration of caudal analgesia (hours)	3.4 ± 0.5	4.4 ± 0.5	5.5 ± 0.7	<0.001**

One way ANOVA test

Table 6 : Recorded FLACC score at different time intervals:

		Group I(n=15)	Group II(n=15)	Group III (n=15)	*P value*
PACU arrival	0	13 (86.7 %)	15 (100 %)	11 (73.3 %)	0.687
	1	----	----	3 (20 %)	
	2	2 (13.3 %)	----	1 (6.7 %)	
PACU discharge	1	1 (6.7 %)	----	2 (13.3 %)	0.311
	2	12 (80 %)	8 (53.3 %)	9 (60 %)	
	3	2 (13.3 %)	7 (46.7 %)	4 (26.7 %)	
After 4 h	2	1 (6.7 %)	----	2 (13.3 %)	0.189
	3	3 (20 %)	6 (40 %)	12 (80 %)	
	4	8 (53.3 %)	8 (53.3 %)	1 (6.7 %)	
	5	3 (20 %)	----	----	
	6	----	1 (6.7 %)	----	
After 8 h	3	----	----	2 (13.3 %)	0.478
	4	4 (26.7 %)	5 (33.3 %)	4 (26.7 %)	
	5	----	1 (6.7 %)	6 (40 %)	
	6	10 (66.7 %)	8 (53.3 %)	3 (20 %)	
	7	1 (6.7 %)	----	----	
	8	----	1 (6.7 %)	----	
After 12 h	4	----	----	1 (6.7 %)	0.767
	5	----	----	1 (6.7 %)	
	6	4 (26.7 %)	6 (40 %)	2 (13.3 %)	
	7	4 (26.7 %)	2 (13.3 %)	3 (20 %)	
	8	6 (40 %)	4 (26.7 %)	7 (46.7 %)	
	9	----	3 (20 %)	1 (6.7 %)	
	10	1 (6.7 %)	----	----	

Chi square test

Table 7 : Recorded FLACC score ≥ 4 achieve time (hr)

	Group I(n=15)	Group II(n=15)	Group III (n=15)	*P value*
Mean ± SD	5.1 ± 1.8	6.5 ± 2.06	8.2 ± 1.8	<0.001**

One way ANOVA test

Table 8 : frequency of required analgesia

	Group I (n=15)	Group II (n=15)	Group III (n=15)	*P value*
Mean ± SD	2.6 ± 0.507	2.0 ± 0.534	1.3 ± 0.48	<0.001**

One way ANOVA test

DISCUSSION

Post-operative pain management in pediatric surgeries has become one of the most needed interventions nowadays. Opioids, for example, have been used for postoperative pain relief, but their usage in pediatrics is constrained by the possibility of major side effects.[9] The regional anesthesia significantly reliefs the postoperative pain and reduces the needs for systemic analgesics[10]. Caudal block is a frequently used regional route. It is risk-free, easy to use and very effective. The primary drawback, though, is the duration of action. Due to this, several adjuncts such as fentanyl, neostigmine, clonidine, dexamethasone and dexmedetomidine, have been introduced to the caudal block to prolong its postoperative analgesic time[11].

Our study, which was a double-blind, randomized clinical trial, was conducted in Zagazig university hospitals included 45 pediatric patients scheduled for elective urology randomly divided into three groups double blind according to the drugs given in caudal block. Group I: received bupivacaine 0.25% 1 ml/kg, Group II: received bupivacaine 0.25 % 1 ml/kg and fentanyl 2µg/ kg and Group III: received bupivacaine 0.25% 1 ml/kg and dexmedetomidine1µg/ kg.

Regarding demographic characteristics, there was no statistically significant difference between studied groups as regards gender, age and weight (*p*- 0.79, 0.96 and 0.67 respectively).

Regarding change in heart rate (beat/min) and MAP (mmHg) there was no significant difference between groups (*p- value*>0.05) but there was significant change within the same group where heart rate and MAP declined significantly (*p-value*>0.000).

Our results correlate with Ram G, *et al*., 2020 who reported in their study which included 90 patients scheduled for elective infraumbilical surgeries and was divided into three groups receiving levobupivacaine 0.25%, levobupivacaine 0.25% with ketamine 0.5 mg.kg and levobupivacaine 0.25% with dexmedetomidine 1 µg.kg and results showed that heart rate and MAP changes was not statistically significant between different groups (*p-value* 0.079 and 0.321 respectively)[12].

Also, in agreement with our results And Elmaaboud MA, *et al*., 2016 who conducted a study on 60 patients and randomly divided them into 3 groups, levobupivacaine group, levobupivacaine with dexmedetomidine group and morphine with levobupivacaine group. Their results showed that there was a reduction in both heart rate and MAP in all groups but there was no significant statistical difference between any of them[13].

Moreover, Haque M. M., *et al*., 2023 in his study including 60 patients divided into group A (dexmedetomidine + bupivacaine) and group B (bupivacaine only) reported that there was decline in both groups regarding heart rate and MAP but without any statistical significance[14].

On contrary, Nasreen F, *et al.*, 2019 who conducted a prospective randomized study on 60 children divided into 2 groups receiving bupivacaine alone or bupivacaine with dexmedetomidine respectively and reported that there was significant difference between the 2 groups regarding heart rate and MAP starting 15 minutes following caudal block in bupivacaine with dexmedetomidine group continued throughout the operation up to 1 hour postoperative (*p-value* <0.001)[2].

In agreement with our results, Sibel B.*et al.*, 2003 in his study reported that MAP and HR decreased after caudal block in all groups, the blood pressure was higher in the bupivacaine group than the other groups through the perioperative period which may be explained by the systemic action of fentanyl[15].

Also, Hamamsy, M.E, *et al*., 2012 who found that MAP and heart rate decreased in all groups by 10–15% during anesthesia and increased by 5–15% during recovery but there were no significant differences in MAP and heart rate after a dexmedetomidine was added to bupivacaine 25% in pediatric patients receiving a caudal block[6].

Also, Soliman F. I, *et al*., 2021 who studied 60 children scheduled for elective lower abdominal surgery and found that heart rate and blood pressure during perioperative period dexmedetomidine group showed more stable hemodynamics than that of fentanyl especially at postoperative period with no significant difference between them except after 60 and 65 minutes there was a significant difference where hypotension occurred in dexmedetomidine which may be attributed to a bloody operation[16].

As regards anesthesia data reveal almost no significant difference regarding anesthesia and emergence time (*p-value*>0.05) which correlates with results of the study conducted by Hamamsy, M.E, *et al*., 2012[6].

As regards postoperative complications there was 3 cases of bradycardia and 1 case of hypotension but with no significant difference in between groups (*p-value*> 0.05) which matches with the results found by Soliman F. I, *et al*., 2021 who reported that incidence of complications was similar in both groups (*P-value* 0.157 (hypotension), 1 (nausea) and 0.149 (vomiting)[16].

However, in contrary to our results, Bajwa S.J.S, *et al*., 2012 who found When fentanyl or dexmedetomidine were added to epidural analgesia for lower limb procedures, postoperative nausea and vomiting were shown to be substantially more common in the fentanyl group. Which also goes in run with, Elham M. El-Feky, *et al*., 2015 who reported that postoperative adverse effects especially vomiting and itching occurs significantly with fentanyl[17,18].

All of the patients in our study had appropriate caudal analgesia for up to 4 hours after surgery (FLACC scale score: 4) without the requirement for analgesics, according to our findings. The number of patients with sufficient caudal analgesia eventually decreased over time in all three groups, but it did so more quickly in group I than in groups II or III, as well as in group II than in group III. Patients in group I received significantly higher FLACC scores than those in groups II and III, while those in group II received higher FLACC scores than those in group III.

Our findings are consistent with those of Ishrat R, *et al.*, 2013 who evaluated postoperative FLACC score and found that patients who received dexmedetomidine and bupivacaine had higher-quality analgesia than those who just received bupivacaine[10].

According to Xiang, *et al*., 2013 dexmedetomidine added to bupivacaine anesthesia could produce greater satisfaction degrees of postoperative sedative action than bupivacaine alone. Additionally, Saadawy, *et al*., 2009 discovered that caudal dexmedetomidine 1 g/kg added to bupivacaine 2.5 mg/kg was related with longer duration of sedation, which aids in reducing the parent's concern because the child remains peaceful and sedated[19, 20].

Vijay G Anand *et al*., 2011 who also used FLACC score for postoperative pain assessment, although this study used ropivacaine 0.25% rather than bupivacaine in addition to dexmedetomidine 2 µg/Kg and found that patients received ropivacaine alone achieved significantly higher FLACC score compared with patients received ropivacaine with dexmedetomidine[21].

As regards recorded FLACC score ≥ 4 achieve time reveal significant difference in between group I & III and between group II & III and the most effective drugs are that used in group III as these patients have the longest time before achieve score 4 or more (need analgesia) *(p-value*> 0.002) which goes in run with Hamamsy, M.E, *et al*., 2012 who found that mean duration of analgesia was significantly longer in patients the who received additives compared with control group: (245 ± 10) minutes in control group, (347 ± 13) minutes in dexmedetomidine group and (275 ± 15) minutes in fentanyl group ($P < 0.05$) and it was longer in group received dexmedetomidine than fentanyl group. Also, these results match Madhava R. and Ranjith G., 2014 who found that duration of analgesia in dexmedetomidine group was (555.6± 20.58) minutes[6,22].

These findings corroborate a study by Anand, *et al*., 2011 that assessed the effects of dexmedetomidine added to caudal ropivacaine in pediatric lower abdominal surgeries and discovered that the dexmedetomidine group experienced significant postoperative pain relief, better sleep quality, and a longer duration of sedation.[23]

However, Dutt, *et al*., 2014 found that the dexmedetomidine group's sedation score was substantially greater when evaluating caudal fentanyl to dexmedetomidine. However, the high dose of dexmedetomidine (2 g/kg) was the cause of this disparity[24].

In agreement with our results Gautam, B, *et al*., 2020 who reported that addition of dexmedetomidine 1 g/kg added to bupivacaine 2.5 mg/kg prolongs analgesic duration more than bupivacaine group (413 ± 101 minutes vs. 204 ± 40 minutes). Also, correlates with Nasreen F, *et al*., 2019 who reported a statistically significant difference between both groups (1299 ± 145 minutes vs. 348 ± 36 minutes) (p-*value* < 0.001)[25, 2].

Also, Hamamsy, M.E, *et al.*, 2012 who used Observational Pain/discomfort Scale (OPS) for assessment of postoperative pain and found that with assessment of analgesia there was a tendency for earlier analgesic requirements in group received bupivacaine alone rather than other groups either with dexmedetomidine or with fentanyl[6].

While in contrary to our results the study of Sibel B. *et al*., 2003 who assessed postoperative pain in children undergoing unilateral inguinal herniorrhaphy using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) and found that there was no significant difference in postoperative pain scores with or without adding fentanyl to bupivacaine in caudal block, the explanation being that because 0.25% bupivacaine alone provided sufficient analgesia, no benefit was found with addition. According to these results, bupivacaine 0.75 ml/kg was effective at reducing discomfort during inguinal herniorrhaphy and masking the effects of additives[15].

CONCLUSION

We draw the conclusion from the study's findings that the addition of dexmedetomidine (1 mg/kg) to local anesthetic (bupivacaine 0.25%) in caudal block has longer duration of anesthesia with less pain score, more stability of hemodynamics and least postoperative adverse effects of anesthesia compared to caudal local anesthetic alone or added to caudal fentanyl in pediatrics undergoing abdominal surgeries. Also, prolonged postoperative analgesia and reducing the need for postoperative analgesics.

CONFLICT OF INTERESTS

There are no conflicts of interest

REFERENCES

1. Vakkapatti, M., Shenoy, T., & Bhat, S. (2019). Comparison of a Combination of Caudal Levobupivacaine with Fentanyl and Levobupivacaine Alone for Alleviating Postoperative Pain During Infraumbilical Procedures in Children Under 3 Years. The Open Pain Journal, 12, 19-25.

2. Nasreen, F., Khalid, A., & Rashid, H. (2019). Comparison of 0.125% levobupivacaine with dexmedetomidine and 0.25% levobupivacaine in ultrasonography-guided pediatric caudal block: A prospective, randomized, double-blinded study. Indian Journal of Pain, 33, 86 - 93.

3. Jain, D., Hussain, S. Y., & Ayub, A. (2022). Comparative evaluation of landmark technique and ultrasound-guided caudal epidural injection in pediatric population: A systematic review and meta-analysis. Paediatric anaesthesia, 32(1), 35–42. https://doi.org/10.1111/pan.14332

4. Ram, G. K., Dubey, P. K., Akhileshwar, P., & Ranjan, A. (2020). Dexmedetomidine and Ketamine as an Adjuvant to Levobupivacaine for Pediatric Caudal Analgesia: A Randomized, Controlled Study. Anesthesia, essays and researches, 14(2), 253–258.

5. Lee S. (2019). Dexmedetomidine: present and future directions. Korean journal of anesthesiology, 72(4), 323– 330.

6. Hamamsy, M.E., Abd-Elrahman, A.H., Essa, M., & Zakaria, D. (2012). Prolongation of Caudal Analgesia in Pediatric Surgery: Comparison between Dexmedetomidine , Clonidine , Tramadol, and Fentanyl.

7. Mahmoud, M.K. *et al*. (2021) 'Comparison between Caudal Dexmedetomidine and Morphine for Postoperative Analgesia in Pediatric Infraumbilical Surgeries,' the Egyptian Journal of Hospital Medicine, 84(1), pp. 1901–1907. https://doi.org/10.21608/ejhm.2021.178601

8. Nilsson, S., Finnstrm, B., & Kokinsky, E. (2008). The FLACC behavioral scale for procedural pain assessment in children aged 5-16 years. Pediatric Anesthesia, 18(8), 767–774. https://doi. org/10.1111/j.1460-9592.2008.02655.x

9. Hassan, P. F., Hassan, A. S., & Elmetwally, S. A. (2018). Caudal Analgesia for Hypospadias in Pediatrics: Comparative Evaluation of Adjuvants Dexamethasone and Dexmedetomidine Combination versus Dexamethasone or Dexmedetomidine to Bupivacaine: A Prospective, Double-Blinded, Randomized Comparative Study. Anesthesia, essays and researches, 12(3), 644–650.

10. Ishrat R, Khairat M, Mohamad O, *et al* (2013): A prospective randomized double blind Study of the effects of caudal clonidine and dexmedetomidine as an adjunct to caudal bupivacaine for postoperative analgesia in paediatric patients undergoing subumblical surgery. Journal of Dental and Medical Sciences (IOSR-JDMS); 9 (2): 42-48.

11. Engelman, E., & Marsala, C. (2012). Bayesian enhanced meta-analysis of post-operative analgesic efficacy of additives for caudal analgesia in children. Acta anaesthesiologica Scandinavica, 56(7), 817–832.

12. Ram, G. K., Dubey, P. K., Akhileshwar, P., & Ranjan, A. (2020). Dexmedetomidine and Ketamine as an Adjuvant to Levobupivacaine for Pediatric Caudal Analgesia: A Randomized, Controlled Study. Anesthesia, essays and researches, 14(2), 253–258.

13. Abd Elmaaboud, M. A., Seleem, T. A., & Abd Elsalam, Y. M. (2016). The effect of adding dexmedetomidine or morphine sulphate as adjuvant to levobupivacaine in pediatric caudal block.

14. Haque, M. M., Banik, D., Akhtaruzzaman, A. K., Bhowmick, D. K., Kader, M. A., Reza, R., Morshed, M. M., Hasanuzzaman, M., Azad, A. K., Mariom, M. L., Hossain, M. S., Masud, M., & Sultana, N. (2023). Dexmedetomidine as an Adjuvant to Bupivacaine in Caudal Analgesia in Children Undergoing Infra-Umbilical Surgery. Mymensingh medical journal: MMJ, 32(3), 833–840.

15. Sibel B., Deniz K., Ebru K., *et al* (2003): Comparison of fentanyl–bupivacaine or midazolam–bupivacaine mixtures with plain bupivacaine for caudal anaesthesia in children. Paediatric Anaesthesia; 13: 126–131.

16. Soliman, F. I., & Abdel-hady, A. H. A. H. (2021). Dexmedetomidine Versus Fentanyl in Caudal Block for Postoperative Pain Relief in Pediatric Surgery. The Egyptian Journal of Hospital Medicine, 85(1), 3347-3353.

17. Bajwa, S. J. S., Arora, V., Kaur, J., Singh, A., & Parmar, S. S. (2011). Comparative evaluation of dexmedetomidine and fentanyl for epidural analgesia in lower limb orthopedic surgeries. Saudi journal of anaesthesia, 5(4), 365.

18. Elham M. El-Feky & Ahmed A. Abd El Aziz (2015) Fentanyl, dexmedetomidine, dexamethasone as adjuvant to local anesthetics in caudal analgesia in pediatrics: A comparative study, Egyptian Journal of Anaesthesia, 31:2, 175-180, DOI: 10.1016/j.egja.2014.11.005

19. Xiang Q, Huang DY, Zhao YL, Wang GH, Liu YX, Zhong L Luo T. (2013). Caudal dexmedetomidine combined with bupivacaine inhibit the response to hernial sac traction in children undergoing inguinal hernia repair. Br. J. Anesth. Mar, 110(3): 420-4.

20. Saadawy I, Broke A, Eshahawy MA, Almazoora A, abdelatif AA, Afifi W. (2009). Effect of dexmedetomidine on the characteristics of bupivacaine in a caudal block in pediatrics. Acta Anesthesiol Scand;53:251-6.

21. Vijay G, Kannan M, Thavamani A, *et al* (2011): Effects of dexmedetomidine added to caudal ropivacaine in paediatric lower abdominal surgeries. Indian J Anaesth.; 55(4): 340–346.

22. Madhava R. and Ranjitha G. (2014): A comparative clinical study between equal volumes and concentrations of clonidine and dexmedetomedine as adjuvants to 0.25% ropivacaine in pediatric caudal block for circumcision. Journal of Evolution of Medical and Dental Sciences; 3 (10): 2470-2477.

23. Anand V, Kannan M, Thavamani A *et al*. (2011): Effects of dexmedetomidine added to caudal ropivacaine in pediatric lower abdominal surgeries. Indian J Anaesth., 55 (4): 340–6.

24. Dutt, B., Parmar, N. K., Shrivastava, M., Dhama, V., Tyagi, V., & Asad, M. (2014). Comparison of caudal dexmedetomidine and fentanyl for postoperative analgesia: a randomized double blinded study. J Adv Res Biol Sci, 6, 51-7.

25. Gautam, B., , Piya, B., , & Karki, D., (2020). Study of Dexmedetomidine in Caudal Block for Children Undergoing Inguino-scrotal Surgery. Kathmandu University medical journal (KUMJ), 18(69), 68–73.

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