COMPARATIVE CONTROLLED STUDY OF CAUDAL BUPIVACAINE-DEXAMETOMEDINE VERSUS CAUDAL BUPIVACAINE-MIDAZOLAM IN CHILDREN UNDERGOING LOWER ABDOMINAL SURGERY

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Abstract:

Background: Caudal analgesia (CA) has been considered as a common approach used in the subumbilical region in children. Fentanyl is a potent synthetic opioid drug, but usually associated with several adverse events. On the other hand, dexmedetomidine has sedative and hypnotic actions and doesn't have adverse events on respiratory or cardiovascular (CV) functions.

Objective: To evaluate safety and efficacy of caudal bupivacaine-dexametomedine and caudal bupivacaine-midazolam in ultrasound (US) guided caudal nerve block in pediatric herniorraphy.

Patients and Methods: This was a clinical prospective clinical trial conducted on a total of 105 cases who were undergone herniorraphy. All patients were divided into three equal groups; control group receiving 0.2% of bupivacaine (1 mg/kg), MB group receiving 0.2% of bupivacaine (1 mg/kg) and midazolam 0.05 mg/kg and DB group receiving 0.2% of bupivacaine (1 mg/kg) and dexametomedine 0.5 mic/kg.

Results: DB group and MB group were associated with significant increases in FLACC compared to the control group. DB group was accompanied by a significant increase in the time to first analgesic request and a significant decrease in total analgesic doses compared to MB group and control group. There were no statistically significant differences among the three studied group with regard to PONV.

Conclusion: In the context of CA, adding dexmedetomidine or midazolam combined with bupivacaine significantly prolonged the analgesic duration, however dexmedetomidine was superior over midazolam with regard to analgesic profile without an increase in adverse events in children undergoing lower abdominal surgery.

Keywords: Bupivacaine, Dexametomedine, Midazolam, Caudal analgesia, Lower Abdominal Surgery

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Introduction

The most frequently conducted inguinal surgeries in children involve inguinal hernia repair in presence or absence of orchidopexy and hydrocele repair. Pediatric inguinal herniorrhaphy is a frequent problem which needs surgical interference to avoid incarceration. It accounts for approximately 4% in full-term infants [(1-3)].

Pain has been considered as a misunderstood and untreated medical problem, in particular among pediatric population. It is reasonable to evade the onset of pain instead of alleviation of its presence [(4)]. Preemptive analgesia using local anesthesia (LA) in children has been considered as a promising idea following surgeries. In the context of postsurgical pain (PSP) with such operations, a regional analgesic approach which include caudal analgesia (CA), ilioinguinal and iliohypogastric nerve block (IL/IH), or even local infiltration is associated with a general anaesthesia (GA) in pediatrics as it is valid and safe [(5)]. In addition, it reduces intravenous (IV opioids needs and enhance the quality of PSP control with a subsequent increase in satisfaction. In comparison with IV opioids, regional approaches decrease the possibility of adverse events which include drowsiness, respiratory depression, vomiting, and abdominal pain [(2)].

Different multimodal approaches were planned in the context of pediatric pain relief which involve systemic and regional analgesia. CA has been considered as the commonest approach utilized in the subumbilical area among children. It has been demonstrated to be accompanied by excellent analgesic action in the intraoperative period as well as in the postoperative one [(6)]. Benefits of the CA are early extubation, ambulation, and reduction in the possibility of chest infections, reduction in postsurgical analgesic needs, and reduced the length of hospital stay [(4)]. II/IH nerve block has been considered as a common peripheral nerve block approach in the context of pediatric anesthesia that becomes easy and simple. The era of US utilization play an essential role with regard to RT visualization of needle tip with a subsequent reduction in the possibility of adverse events [(7)].

Fentanyl is a potent synthetic opioid drug, utilized broadly in the context of pain control. It has

been utilized to improve the analgesic actions of LA for caudal block. Unfortunately, it is usually accompanied by respiratory depression, pruritus, emesis [8]. Thus, trials to overcome such problems by combination of bupivacaine with different non-opioids agents, which include clonidine, ketamine, midazolam, dexmedetomidine and neostigmine, have met with different degrees of success, as reported by different investigators [4, 9].

On the contrary, dexmedetomidine is an α agonist having sedative, hypnotic, analgesic, and sympatholytic properties and doesn't have any side effects on respiratory or CV functions [4].

Aim of the Work

To evaluate safety and efficacy of caudal bupivacaine-dexametomedine and caudal bupivacaine-midazolam in ultrasound guided caudal nerve block in pediatric herniorraphy.

Patients and Methods

Study design:

This was a clinical prospective study conducted at Children hospital, Faculty of medicine Mansoura University within the period from January 2021 to January 2022.

All cases who were undergone herniorraphy were comprised in the study. Patients with CV diseases, clotting disorders, Patients with LA allergy and cases whose parents refuse to give an informed consent were ruled out in the current study.

Methods:

Entire children were subjected to complete history taking from parents who included age, sex, residency, past history of previous surgeries and past history of medical diseases. Full clinical examination also was performed which included general examination, abdominal examination, chest examination and cardiac examination. In addition, all cases were undergone laboratory investigations which included CBC, LFT, KFT, coagulation profile, blood glucose level, serum cortisol level and blood sugar and radiological examinations which included Ultrasound evaluation.

The procedure:

The patient was connected to traditional monitors comprising pulse oximetry, non-invasive BP, and ECG. Twenty two-G cannula was inserted into a peripheral vein. Entire cases had laryngeal mask airway, GA induced with propofol and maintained with isoflurane in 100% oxygen. Then, we put the patient in prone position, a 7 to 13MHz linear transducer could be positioned in a transverse manner in the middle of the sacrum. The transverse view demonstrates the superficial sacrococcygeal ligament in between 2 sacral cornua, and the deeper sacral bone. The probe was after that turned ninety degrees for the longitudinal view, as a result the needle could be inserted “in-plane” into the sacral hiatus. Unidirectional flow on color Doppler could play an essential role in the context of help the identification of caudal block success. After that, the cases were comprised in a random manner by a sealed envelope into three groups.

All cases were divided into three equal groups; control group (n=35) receiving 0.2% of bupivacaine (one mg/kg), MB group (n=35) receiving 0.2% of bupivacaine (one mg/kg) and midazolam 0.05 mg/kg and DB group (n=35) receiving 0.2% of bupivacaine (one mg/kg) and dexametomedine 0.5 mic/kg.

Postoperative recorded data:

The FLACC scale and Ramsay sedation score (Table 1 and 2) was utilized to properly evaluate the pain intensity and sedation degree at PACU and in the ward at: 30 min, 1h, 2h, 3h, 6h, 12h, 18h, and 24h [1, 10, 11].

Table (1): FLACC scale [11]:

Criteria	Score 0	Score 1	Score 2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, uninterested	Frequent to constant quivering chin, clenched jaw
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 complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

Table 2: Ramsay sedation score [1, 10]:

1	Anxious and awake completely
2	Awake completely
3	Awake and drowsy
4	Asleep and response to verbal commends
5	Asleep and response to touch
6	Asleep and no response to stimulus

Finally, the adverse effects of the blocks which include emesis, urine retention, and motor affection were evaluated.

Ethical considerations:

The study was approved from IRB of Faculty of Medicine at Mansoura University. The author explained the objective of the study to the parents whose children were included in the study. The author was assured maintaining confidentiality of subject's data. Parents of children were informed that they were allowed to leave the study at any time. Ethics, culture and beliefs of participants were respected.

Statistical analysis:

Data analysis was analyzed by SPSS software, version 25. Qualitative data were defined by utilizing number and percent. Quantitative data were defined by utilizing median in the context of non-normal distribution of data and mean±SD in terms of normal distribution of data following assessing the normality by utilizing Kolmogrov-Smirnov test. Significance of the obtained results was judged at the (≤0.05) level. Chi-Square test was utilized for comparison of qualitative data between groups. Kruskal Wallis test was utilized for comparison at least 3 studied groups, in the context of non-normally distributed data. One Way ANOVA test was utilized for comparison of at least three groups.

Results

Table (1) illustrates comparison of sociodemographic data in which there were no significant differences among the three studied groups in terms of all sociodemographic characteristics (P>0.05).

Table (2) reveals that there were no significant differences among the three studied groups in terms of O2 saturation at different follow up periods (P>0.05).

Table (3) illustrates that there were no statistically significant differences among the three studied groups in terms of heart rate at different follow up periods (P>0.05).

Table (4) illustrates that there were no statistically significant differences among the three studied groups in terms of systolic blood pressure at different follow up periods (P>0.05).

Table (5) illustrates that there were no statistically significant differences among the three studied groups in terms of diastolic blood pressure at different follow up periods (P>0.05).

Table (6) and figure (1) display that DB group and MB group were associated with a significant increase in FLACC compared to control group. In addition, there was a significant increase in FLACC in DB group compared to MB group at 6h and 24h postoperative.

Table (7) and figure (2) demonstrate that DB group was associated with a highly significant increase in Ramsay scale compared to MB group and control group. In addition, there was a highly significant increase in Ramsay scale in MB group compared to control group (P<0.001).

Table (8) and figures (3 and 4) reveal that DB group was associated with a highly significant increase in the time to first analgesic request and a significant decrease in total analgesic doses compared to MB group and control group. In addition, there was a highly significant increase in the time to first analgesic request and a significant decrease in total analgesic doses in MB group compared to control group (P<0.001).

Table (9) demonstrates that there were no statistically significant differences among the three studied groups with regard to PONV (P>0.05).

Table (1): Comparison of sociodemographic data of the studied groups:

	Control group n=35	**MB group n=35**	**DB group n=35**	**Test of significance**
Age/years mean±SD	6.54±3.7	5.81±3.13	5.51±3.17	F=0.876 p=0.420
Sex Male Female	 20(57.1) 15(42.9)	 19(54.3) 16(45.7)	 24(68.6) 11(31.4)	 χ^2=1.67 p=0.435
ASA I II	 25(71.4) 10(28.6)	 16(45.7) 19(54.3)	 23(65.7) 12(34.3)	 χ^2=5.36 p=0.068

F:One Way ANOVA test , χ^2= Chi-Square test

Table (2): Comparison of O2 saturation among the studied groups:

O2 saturation	Control group n=35	MB group n=35	DB group n=35	Test of significance	Within group significance
5 min	98.26±1.59	98.51±1.92	98.11±1.92	F=0.435 P=0.648	P1=0.555 P2=0.743 P3=0.359
10 min	97.09±0.74	97.03±0.92	96.86±0.77	F=0.743 P=0.478	P1=0.770 P2=0.244 P3=0.382
15 min	97.94±1.28	97.91±1.31	97.77±1.19	F=0.185 P=0.831	P1=0.925 P2=0.572 P3=0.637
30 min	97.86±0.97	98.0±1.24	97.54±1.44	F=1.26 P=0.288	P1=0.629 P2=0.289 P3=0.124
45 min	97.66±1.71	97.86±1.78	97.63±1.54	F=0.192 P=0.826	P1=0.620 P2=0.943 P3=0.571
60 min	97.77±1.24	97.91±1.58	97.63±1.46	F=0.348 P=0.707	P1=0.677 P2=0.677 P3=0.406
75 min	98.29±1.89	97.74±2.05	98.34±1.97	F=0.989 P=0.375	P1=0.252 P2=0.904 P3=0.205
90 min	99.71±0.52	99.74±0.56	99.77±0.49	F=0.104 P=0.901	P1=0.820 P2=0.649 P3=0.820
105 min	99.85±0.46	99.96±0.19	99.90±0.40	F=0.657 P=0.521	P1=0.256 P2=0.590 P3=0.525
120 min	99.67±0.65	99.50±0.71	99.25±0.96	F=0.500 P=0.616	P1=0.768 P2=0.336 P3=0.697

F:One Way ANOVA test , p1: difference between control group&2 , p2: difference between group[1& 3 , p3: difference between MB group& 3 ,

Table (3): Comparison of heart rate among the studied groups:

Heart rate	Control group n=35	MB group n=35	DB group n=35	Test of significance	Within group significance
5 min	79.31±8.40	81.89±10.17	78.71±8.02	F=1.25 P=0.291	P1=0.230 P2=0.779 P3=0.140
10 min	80.03±11.21	78.11±7.87	78.46±13.07	F=0.305 P=0.738	P1=0.465 P2=0.549 P3=0.896
15 min	78.69±8.55	78.69±8.70	77.40±8.95	F=0.253 P=0.777	P1=1.0 P2=0540 P3=0.540
30 min	79.88±9.49	78.31±8.42	80.17±9.77	F=0.409 P=0.665	P1=0.479 P2=0.897 P3=0.403
45 min	84.57±11.09	84.17±10.39	81.52±8.48	F=0.926 P=0.399	P1=0.868 P2=0.212 P3=0.278
60 min	77.06±9.55	77.51±11.09	75.89±9.80	F=0.239 P=0.788	P1=0.851 P2=0.631 P3=0.504
75 min	74.34±10.33	74.06±11.27	71.60±10.80	F=0.681 P=0.508	P1=0.912 P2=0.291

					P3=0.344
90 min	72.62±10.75	70.74±10.62	68.60±9.99	F=1.29 P=0.277	P1=0.453 P2=0.110 P3=0.394
105 min	70.46±9.29	67.56±8.94	66.53±12.29	F=1.05 P=0.354	P1=0.311 P2=0.162 P3=0.711
120 min	66.33±9.73	58.50±12.02	63.0±4.55	F=0.724 P=0.501	P1=0.278 P2=0.536 P3=0.577

F:One Way ANOVA test , p1: difference between control group&2 , p2: difference between group[1& 3 , p3: difference between MB group& 3 ,

Table (4): Comparison of systolic blood pressure among the studied groups:

SBP	**Control group n=35**	**MB group n=35**	**DB group n=35**	**Test of significance**	**Within group significance**
5 min	135.20±15.38	138.31±14.33	132.74±14.88	F=1.23 P=0.295	P1=0.383 P2=0.491 P3=0.120
10 min	120.11±14.83	121.0±14.53	117.60±12.13	F=0.565 P=0.570	P1=0.790 P2=0.450 P3=0.308
15 min	114.51±11.82	116.48±12.56	115.40±11.88	F=0.233 P=0.792	P1=0.497 P2=0.760 P3=0.708
30 min	113.37±12.73	115.97±11.34	114.06±10.36	F=0.479 P=0.621	P1=0.347 P2=0.804 P3=0.488
45 min	114.42±9.99	119.60±11.78	114.34±9.64	F=2.87 P=0.06	P1=0.05* P2=0.973 P3=0.04*
60 min	112.94±8.94	117.06±10.22	115.54±13.84	F=1.21 P=0.303	P1=0.127 P2=0.334 P3==0.573
75 min	114.74±8.64	119.71±10.96	119.23±8.79	F=2.89 P=0.06	P1=0.03* P2=0.052 P3=0.832
90 min	117.97±9.26	118.97±8.26	117±7.28	F=0.492 P=0.613	P1=0.616 P2=0.626 P3=0.323
105 min	119.23±10.13	120±8.95	121.73±9.81	F=0.501 P=0.608	P1=0.772 P2=0.336 P3=0.500
120 min	125.50±9.89	123.0±4.24	119±5.35	F=0.814 P=0.462	P1=0.717 P2=0.224 P3=0.610

F:One Way ANOVA test , p1: difference between control group&2 , p2: difference between group[1& 3 , p3: difference between MB group& 3 ,

Table (5): Comparison of diastolic blood pressure among the studied groups:

DBP	**Control group n=35**	**MB group n=35**	**DB group n=35**	**Test of significance**	**Within group significance**
5 min	79.86±13.45	80.14±10.76	74.26±9.30	F=3.02 P=0.053	P1=0.916 P2=0.04* P3=0.032*
10 min	72.34±12.56	75.06±9.12	69.94±8.02	F=2.25 P=0.111	P1=0.263 P2=0.322 P3=0.036*

15 min	66.11±11.24	70.60±11.12	70.89±11.73	F=1.94 P=0.149	P1=0.102 P2=0.082 P3=0.916
30 min	68.17±11.31	68.86±11.77	70.48±10.75	F=0.388 P=0.679	P1=0.800 P2=0.393 P3=0.547
45 min	66.40±11.28	71.11±12.08	69.03±11.96	F=1.41 P=0.249	P1=0.097 P2=0.353 P3=0.461
60 min	73.20±10.66	71.91±7.38	72.09±8.54	F=0.570 P=0.567	P1=0.627 P2=0.289 P3=0.563
75 min	71.91±7.38	71.80±10.15	72.09±8.54	F=0.009 P=0.991	P1=0.957 P2=0.935 P3=0.892
90 min	70.31±8.85	72.97±7.94	73.11±9.86	F=1.09 P=0.339	P1=0.216 P2=0.192 P3=0.947
105 min	70.07±11.78	74.85±5.69	75.07±7.77	F=2.87 P=0.063	P1=0.048* P2=0.034* P3=0.926
120 min	77.50±5.46	81.50±9.19	80.50±7.05	F=0.610 P=0.556	P1=0.406 P2=0.409 P3=0.853

F:One Way ANOVA test , p1: difference between control group&2 , p2: difference between group[1& 3 , p3: difference between MB group& 3 ,

Table (6): Comparison of FLACC among the studied groups:

FLACC score	Control group n=35	MB group n=35	DB group n=35	Test of significance	Within group significance
30 MIN	0(0-2)	0(0-1)	0(0-1)	KW=14.35 P=0.001*	P1=0.012* P2=0.001* P3=0.175
1 H	0(0-2)	0(0-1)	0(0-1)	KW=8.87 P=0.01*	P1=0.083 P2=0.005* P3=0.115
2 H	0(0-3)	0(0-2)	0(0-2)	KW=6.79 P=0.03*	P1=0.181 P2=0.01* P3=0.168
3 H	1(0-5)	0(0-3)	0(0-3)	KW=10.82 P=0.004*	P1=0.005* P2=0.004* P3=0.974
6 H	2(1-5)	2(0-5)	1(0-3)	KW=7.54 P=0.02*	P1=0.533 P2=0.008* P3=0.047*
12 H	4(0-6)	2(0-6)	3(0-6)	KW=0.268 P=0.875	P1=0.586 P2=0.875 P3=0.772
18 H	3(0-5)	3(0-5)	2(0-6)	KW=5.98 P=0.05*	P1=0.712 P2=0.025* P3=0.051
24 H	4(2-6)	4(1-6)	3(1-5)	KW=8.38 P=0.015*	P1=0.513 P2=0.008* P3=0.024*

KW: Kruskal Wallis test , p1: difference between control group&2 , p2: difference between group[1& 3 , p3: difference between MB group& 3 , parameters described as median (min-max).

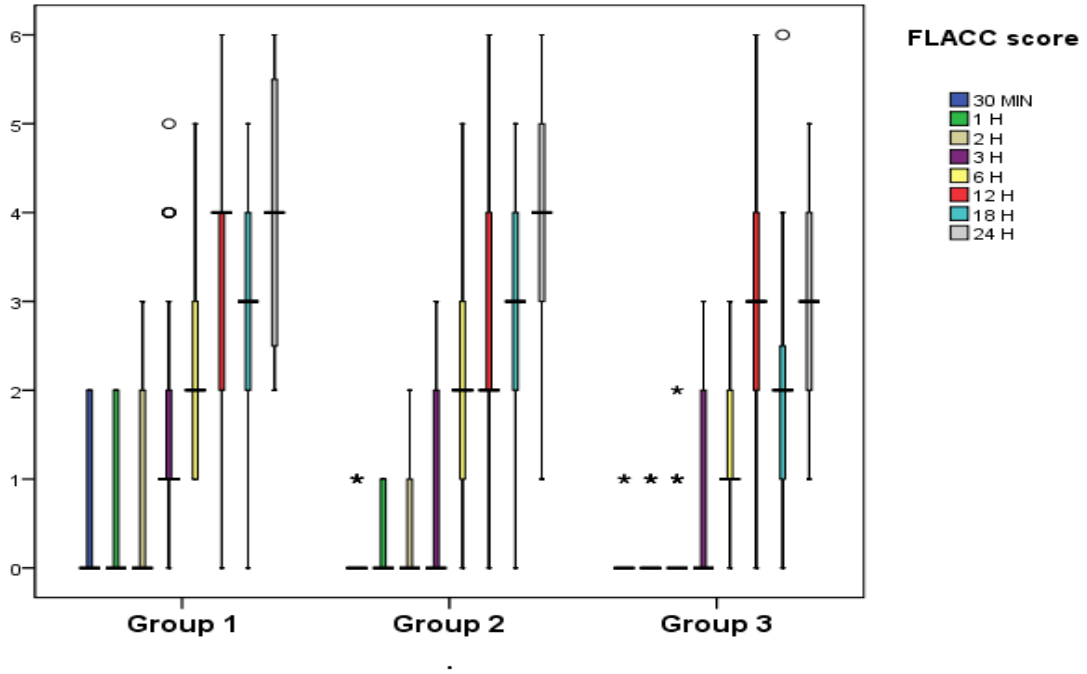

Figure (1): Box &Whisker plot showing median FLACC score.

Table (7): Comparison of Ramsay scale among the studied groups:

Ramsay scale	Control group n=35	MB group n=35	DB group n=35	Test of significance	Within group significance
30 MIN	4.14±0.36	4.09±0.28	4.17±0.38	F=0.567 P=0.569	P1=0.487 P2=0.728 P3=0.298
1 H	4.49±0.56	3.77±0.73	3.46±0.78	F=19.99 P<0.001*	P1<0.001* P2<0.001* P3=0.062
2 H	4.37±0.55	3.71±0.82	2.80±0.83	F=39.07 P<0.001*	P1<0.001* P2<0.001* P3<0.001*
3 H	1.26±0.61	1.34±0.54	1.40±0.65	F=0.499 P=0.608	P1=0.552 P2=0.323 P3=0.692
6 H	1.34±0.64	1.89±0.79	1.66±0.76	F=4.79 P=0.01*	P1=0.003* P2=0.08 P3=0.197
12 H	1.37±0.69	2.37±0.69	2.11±0.90	F=16.08 P<0.001*	P1<0.001* P2<0.001* P3=0.163
18 H	1.43±0.69	2.23±0.84	2.29±0.79	F=13.25 P<0.001*	P1<0.001* P2<0.001* P3=0.760
24 H	1.40±0.69	1.63±0.84	2.09±0.88	F=6.47 P=0.002*	P1=0.242 P2=0.001* P3=0.02*

F:One Way ANOVA test , p1: difference between control group&2 , p2: difference between group[1& 3 , p3: difference between MB group& 3 ,

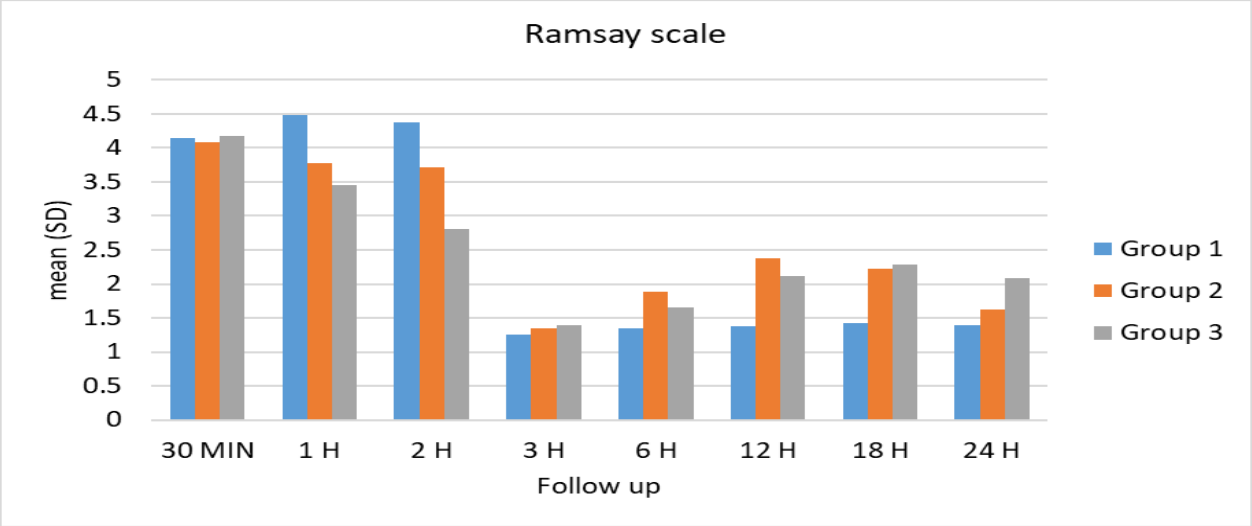

Figure (2): Mean Ramsay score among studied groups

Table (8): Comparison of analgesic characters among the studied groups:

	Control group n=35	**MB group n=35**	**DB group n=35**	**Test of significance**	**Within group significance**
Time to first rescue analgesic (hours)	8.06±3.19	15.40±4.31	19.60±4.91	F=67.82 P<0.001*	P1<0.001* P2<0.001* P3<0.001*
Total analgesic doses	50(15-90)	30(15-50)	15(5-30)	KW=57.40 P<0.001*	P1<0.001* P2<0.001* P3<0.001*

F:One Way ANOVA test , KW: Kruskal Wallis test , p1: difference between control group&2 , p2: difference between control group& 3 , p3: difference between MB group& 3 ,

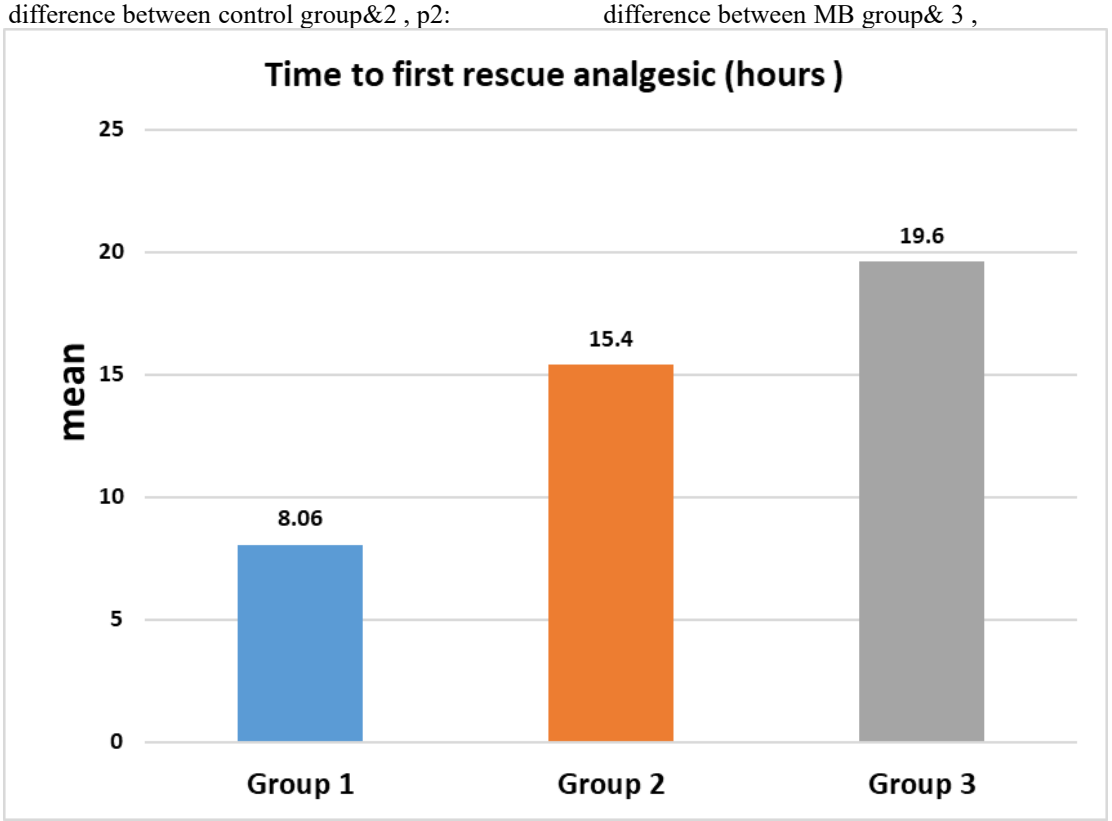

Figure (3): Mean time to first rescue analgesic among studied groups

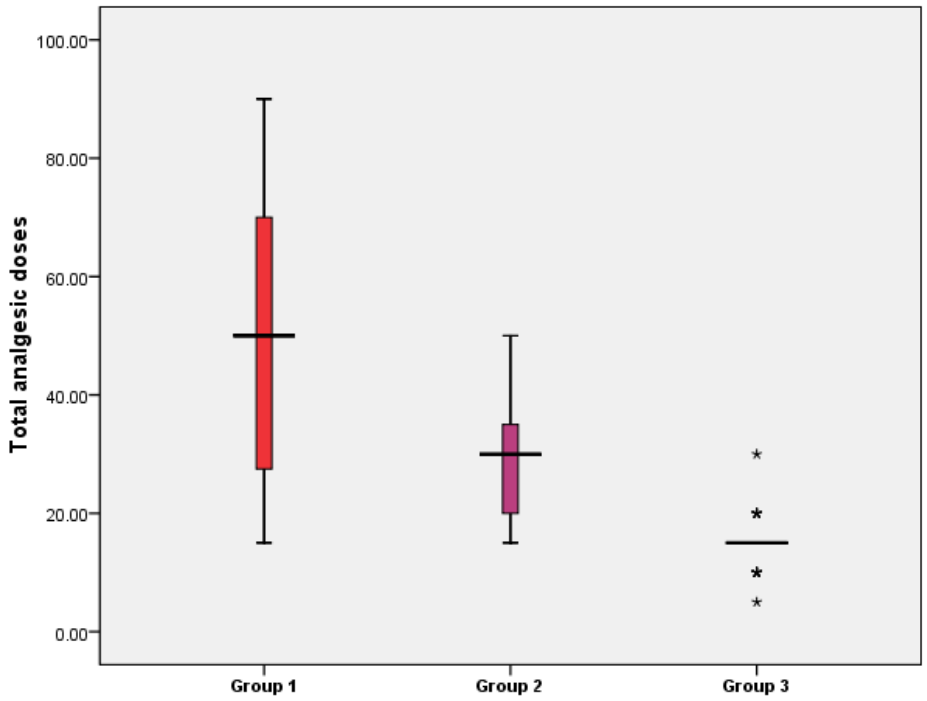

Figure (4): Shows total analgesic dose among the studied groups.

Table (9): Incidence of post-operative nausea and vomiting among studied groups:

	Control group n=35(%)	**MB group n=35(%)**	**DB group n=35(5)**	**Test of significance**	**Within group significance**
Incidence of PONV	4(11.4)	2(5.7)	2(5.7)	χ^2=1.08 P=0.582	P1=0.393 P2=0.393 P3=1.0

χ^2=Chi-Square test

p1: difference between control group&2 , p2: difference between control group& 3 , p3: difference between MB group& 3

Discussion

To the best of our knowledge, Most of the previous researches compared between bupivacaine versus combined bupivacaine +dexametomedine only, this study, therefore, was performed to assess whether dexametomedine has extra advantage over midazolam as regards postoperative analgesia with minimal adverse effects.

Concerning pain assessment using FLACC score, the current study demonstrated that; DB group and MB group were associated with a significant increase in FLACC compared to control group. In addition, there was a significant increase in FLACC in DB group compared to MB group at 6h and 24h postoperative. In addition with regard to Ramsay scale, DB group was associated with a highly significant increase in Ramsay scale compared to MB group and control group. In addition, there was a highly significant increase in Ramsay scale in MB group compared to control group (P<0.001). In the same line, **Oruobu-Nwogu and his colleagues** conducted their study on 66 subjects who were divided into three group; group A received 1 ml/kg 0.20% bupivacaine and 1.5µg/kg dexmedetomidine (1 ml), B received one ml/kg 0.20% bupivacaine in addition to 50µg/kg midazolam (1 ml) while C received one ml/kg 0.20% bupivacaine and 0.9% NaCl (1 ml), via the caudal space. They have displayed that; the corresponding p values across the three groups, p=0.13, 0.0, 0.0, 0.0 and 0.03, demonstrate significant difference in the scores at 2h, 4h, 6h and 12h. Significant increase in FLACC score was recorded from 2h postoperatively in Group C, indicating abrupt declining in analgesic action of caudal bupivacaine alone **(12)**.

Likewise, **Goyal and his colleagues** carried out their study on 100 children who were divided into two groups; group A who received (0.25%) bupivacaine one ml/kg+NaCl one ml and group B who received (0.25%) bupivacaine 1 ml/kg + 1 µg/kg dexmedetomidine in one ml normal saline. They have displayed that; the difference in mean FLACC score of the two groups was statistically significant, 7.21±0.76 and 6.49±1.72 in Group A (bupivacaine only) and Group B (bupivacaine

+dexmedetomidine), respectively [(4)]. In addition, **Fares and his colleagues** carried out a comparable research in the context of pediatric abdominal cancer operations and have reported the same outcomes [(13)].

With regard to analgesic requirement, the current study revealed that DB group was accompanied by a significant increase in the time to first analgesic request and a significant decrease in total analgesic doses compared to MB group and control group. In addition, there was a statistically significant increase in the time to first analgesic request and a significant decrease in total analgesic doses in MB group compared to control group. Such considerable significant superiority in analgesic profile of group A over B is related to a higher intrinsic analgesic property possessed by dexmedetomidine than might be present in midazolam. This came in the same line with **Oruobu-Nwogu and his colleagues** who have displayed that; the time to first analgesic request was longest in group A (14.4±2.36), followed by group B (12.0±3.69), and lastly in group C (5.6±1.45) (p=0.01). As a result, they concluded that; caudal dexmedetomidine or midazolam combined with bupivacaine significantly increased the analgesic duration, with superiority of dexmedetomidine over midazolam group [(12)].

In accordance, with regard to intrathecal bupivacaine, **Samantaray and his colleagues** have displayed that; the duration of effective analgesia was significantly prolonged in the dexmedetomidine group (P<0.01) in comparison with midazolam group and the control group [(14)]. In agreement, **Goyal and his colleagues** have demonstrated that; the mean duration of efficient analgesia in group A (bupivacaine only) patients was 4.33±0.98h Vs 9.88±0.90h in group B (bupivacaine +dexmedetomidine) patients [(4)].

Of note, it has been demonstrated that; while the midazolam affinity toward GABA receptors is recorded as twice that of diazepam, the recorded affinity of dexmedetomidine toward α2 adrenoceptors is eight times that of clonidine [(18)].

With regard to PONV, the present study demonstrated that; there were no significant differences among the three studied group concerning PONV. In accordance, **Oruobu-Nwogu and his colleagues** have displayed that there were no significant differences among the three studied groups in terms of vomiting and fever [(12)]. Similarly, **El-Hennawy and his colleagues** have displayed that no significant difference was noticed in the incidence of hemodynamic changes or adverse events [(19)].

Conclusion:

In the context of caudal analgesia, adding dexmedetomidine or midazolam combined with bupivacaine significantly prolonged the analgesic duration, however dexmedetomidine was superior over midazolam with regard to analgesic profile without an increase in adverse events in pediatrics undergoing lower abdominal surgery.

Despite the promising results, small sample size is considered the main limitation, so, it is recommended to conduct additional studies on large number of cases to confirm our results. In addition, we recommend utilization of combined dexmedetomidine and bupivacaine in the context of CA.

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