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Research Article

Effectiveness of Neostigmine versus Dexamethasone as an Adjuvant to Bupivacaine for Caudal Epidural Analgesia Among Pediatrics Surgical Patients at Hospitals in Sodo Town: Cohort Study Design

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Abstract

Caudal epidural analgesia is one of the most commonly used analgesia techniques in pediatrics patients. The use of local anesthetics alone has short duration of action in caudal block. So adjuvants are usually added to prolong the duration of local anesthetics with minimum side effects. Neostigmine and dexamethasone are among commonly used adjuvants for caudal block.

Objective: This study aimed to assess effectiveness of neostigmine and dexamethasone with Bupivacaine on post caudal block analgesia.

Methods: A prospective cohort study design was employed. A consecutive sampling technique was used to select study participants. Data were collected from February 29, 2020 to May 30, 2020. Prior power analysis (G power version 3.1.9.4) statistical software was used to calculate the sample size. The data were entered into Epi info version 7 and transported to SPSS version 26 for analysis. For normally distributed data, an independent t-test was used to compare the mean between the groups. Skewed data were analyzed by the Mann-Whitney test. The difference in mean values was determined by considering a p-value less than 0.05 as a significant difference.

Results: The average duration of analgesia in the Dexamethasone Bupivacaine Group (DBG) was 808.00 ± 148.674 minutes, whereas in the Neostigmine Bupivacaine Group (NBG), it was 716.58 ± 116.503 minutes (p=0.002). Notably, the mean cost expense was higher in NBG (160.29 ± 37.360) compared to DBG (139.87 ± 34.439), with a p-value of 0.008. Additionally, the incidence of postoperative Pediatric Opioid-Induced (PONY) was observed to be higher in NBG compared to DBG. These findings suggest that the incorporation of dexamethasone into bupivacaine proved more effective than neostigmine bupivacaine for caudal epidural analgesia in pediatric surgical patients.

Conclusion: Our study concluded that the incorporation of dexamethasone with bupivacaine in caudal epidural analgesia for pediatric surgical patients offers superior pain relief compared to neostigmine bupivacaine. These findings suggest that dexamethasone bupivacaine may be a more effective and cost-efficient option for pain management in pediatric surgical procedures, emphasizing the need for further consideration and implementation in clinical practice.

Keywords: Bupivacaine; Neostigmine; Dexamethasone; Pediatrics; Analgesia; Caudal Epidural

Introduction

Various regional anesthetic techniques have gained popularity because of adequate postoperative analgesia and reduce the requirement of general anesthetics intraoperatively without significant side effects. Caudal epidural block is one of the most common regional anesthetic techniques employed in pediatric patients for intra- and postoperative pain management. It is commonly used for surgical procedures below the diaphragm, such as urogenital, rectal, inguinal and lower extremity procedures [1-8].

Adjuvants are drugs that are co administered with local anesthetics for the purpose of improving the onset of local anesthetics, prolonging the duration of analgesia and counteracting the adverse effects of local anesthetics. By adding these adjuvants, the dose of local anesthetics such as bupivacaine is often reduced, thereby reducing its side effects such as myocardial depression, hypotension, bradycardia, heart block and ventricular arrhythmias. They contribute in their own special manner to potentiate the analgesic effect of the local anesthetics [9,10].

Neostigmine is a cholinesterase inhibitor that causes an increase in the acetylcholine concentration. The role of neostigmine as pain relieving managed by the extradural course is presently well established in children and adults. It has been safely utilized in adults and children and is one of the added substances known for its prolonged pain relief; in addition, respiratory depression, sedation and pruritus ascribed to the use of caudal opioid are not encountered with caudal neostigmine [13-15].

Dexamethasone has anti-inflammatory effects and has been tested for its analgesic efficacy. It could mediate its analgesic effects by increasing the activity of K channels on nociceptive C- fibers [16-18].

Caudal block with a local anesthetic solution is one of the analgesic techniques used for postoperative analgesia, but there is a relatively short duration of postoperative analgesia (4-6 h) in a single shot with even long acting local analgesia. The results of certain studies show that more than 60% of children who receive a caudal block with local anesthetics alone during groin surgery require additional analgesics in the postoperative period. Therefore, the use of caudal infusion with a catheter is usually used for at least 48 h to overcome postoperative pain, but gradually, its use becomes limited due to the high risk of infection as a result of catheter contamination. However, most standard pediatric operations do not merit the utilization of such a sophisticated analgesic regimen as a continuous catheter technique; thus, practitioners have tried to seek out other ways to reinforce the efficacy of single injection caudal analgesia [24-26].

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The use of opioid infusions, Patient-Controlled Analgesia (PCA) and continuous IV infusions has become common in the management of postoperative pain. Although the use of opiod infusion can provide adequate analgesia after major surgery, there is limited application due to the absence of infusion tools, including in our setup and reports of an increased risk of respiratory depression [22].

Increasing the duration of local anesthetic action is usually desirable because it prolongs surgical anesthesia and analgesia. Adjuvants are often used with local anesthetics for their synergistic effect by prolonging the duration of sensory-motor block and limiting the cumulative dose requirement of local anesthetics. It has the potential to improve outcomes and is an important component of the perioperative care of children [27,28]. Prolongation of caudal analgesia employing a 'single-shot' technique has also been achieved by the addition of various adjuvants. The World Health Organization (WHO) pain management ladder, American Pain Society and American Society of Anesthesiology also recommend the use of adjuvants for different levels of pain management [2,31,32].

Although certain research has been done so far on the effectiveness of neostigmine and dexamethasone as adjuvants to bupivacaine for caudal epidural block, it is still a point of debate among scholars on which drug is more effective in prolonging the duration of analgesia. To our knowledge, there has been no published research comparing dexamethasone and neostigmine as adjuvants to bupivacaine in our country so that it can be used as baseline data for those who are going to conduct research on the same topic. This study aimed to compare the effectiveness of neostigmine versus dexamethasone as an adjuvant to bupivacaine for postoperative analgesia in pediatrics surgical patients by using the Wong Baker faces pain rating scale.

Hypothesis

H0: Post-operative duration of analgesia for neostigmine with bupivacaine and dexamethasone with bupivacaine are equivalent

Ha: Post-operative duration of analgesia for neostigmine with bupivacaine and dexamethasone with bupivacaine are not equivalent.

Materials and Method

An institutional-based prospective cohort study was conducted from February 29 to May 30, 2020 at Wolaita Sodo teaching referral hospital and Sodo Christian hospital. The source population was all pediatric patients who underwent surgery during the study period. Study population was selected pediatric surgical patients who underwent sub umbilical and lower extremity surgery during the study period. Any documented previous allergy to one of the study drugs and premedicated patients with opioids were excluded from the study.

Postoperative analgesia duration was one of our primary outcome indicators and preliminary data from Egypt showed that the mean duration of analgesia with conventional doses of bupivacaine alone, bupivacaine dexamethasone and bupivacaine neostigmine were 295.9, 521.3 and 792.7 minutes, respectively [17]. A consecutive sampling technique was used to select study participants, with the assumption of the study participant by itself being randomly admitted. The procedure was continued until the desired sample size was achieved.

Sampling Techniques

The sample size was done using G power version 3.1.9.4 statistical software. Substituting power 90%, type I alpha error 0.025 as it is two tailed test and effect size of 0.8 to the software, the calculated sample size is 82. Adding 10% contingency and considering equal allocation ratio of one the total sample size become 90.

Data Collection Tools and Procedure

This study compared the duration of postoperative analgesia, time to first analgesia request, total analgesia consumption, adverse effects of the study drugs and cost expense between the group over 24 h. On arrival of the operating theatre monitoring apparatus, BP, HR and Spo_2 were applied to the patients following positioning. The patients were positioned to lateral decubitus after GA with ETT or GA with LMA was fixed. Dexamethasone (0.1 mg/kg) with 0.25% bupivacaine or 2 μg neostigmine with bupivacaine was provided based on the preference of the anesthetist on duty. Throughout the intraoperative period, the data collector observed the whole procedure and reviewed the patient chart to collect the intraoperative variables, including sociodemographic variables.

Data Processing and Analysis

After the data were manually checked for completeness and coded, they were entered into Epi Info version 7 computer software. Then, it was transported to SPSS version 26 computer software for analysis and cleaning. Descriptive statistics were used to summarize the data, tables and figures. Outliers were checked and homogeneity was tested by Levene's test for equality of variances. Normally distributed continuous data were analyzed using independent t tests. Skewed data were analyzed using the Mann-Whitney test. The chi-square test was used for categorical data. The data are presented as the mean ± SD, median ± IQR and percentage for categorical data. The difference in mean values was determined by considering a p-value less than 0.05 as a significant difference.

Operational Definitions

Adverse effects: Defined as any unwanted effects happened to the patients within 24 h after providing the study drugs to the patients.

Effectiveness: Defined the degree to which neostigmine versus dexamethasone something is successful in producing a desired result as adjuvant to bupivacaine in terms of prolonging postoperative analgesia time, reducing total analgesia consumption, prolonged time of first analgesia request, reducing adverse effects and reducing cost expense.

Postoperative pain: Defined as discomfort sensation with different severity, the patient feels at the site of operation or elsewhere postoperatively and in need of analgesia 24 hours.

Time to first analgesia request: It is defined as the first time in minutes at which the first analgesia is given postoperatively within 24 hours.

Total analgesia consumption: Defined as total medication provided to the patients in mg to relieve pain within 24 h after surgery.

Cost expense: Defined as the amount of money in ETB used by the patients for the purpose of purchasing medication for treatment over 24 hrs.

Results

Sociodemographic Characteristics of Patients

Comparing the two groups in terms of age and weight, the bupivacaine-dexamethasone group had a slightly lower mean age (8.38 ± 3.525 years) compared to the bupivacaine-neostigmine group (8.53 ± 3.409 years). However, these differences are relatively small. In terms of weight, the mean weight score for the bupivacaine-dexamethasone group was 30.93 ± 12.447, while the bupivacaine-neostigmine group had a slightly higher mean weight of 31.29 ± 12.343. Again, the differences in mean weight between the two groups are minimal. Both groups demonstrated a majority of male patients, indicating a balanced gender distribution in both the bupivacaine-dexamethasone and bupivacaine-neostigmine groups. Overall, while there are some slight variations in age and weight between the two groups, these differences may not be clinically significant, as detailed in Table 1.

Variables	DBG(n=45)	NBG(n=45)
	Frequency (%)	**Frequency (%)**
Age in years		
3-5 years	13(14.4%)	10(11.1%)
6-11 years	18(20%)	19(21.1%)
12-14 years	14(15.5%)	16(17.7%)
mean ± SD	8.38 ± 3.525	8.53 ± 3.409
Sex		
Male	37(41.1%)	39(43.3%)
Female	8(8.8%)	6(6.6%)
Weight in Kg mean ± SD	30.93 ± 12.447	31.29 ± 12.343

Table 1: Sociodemographic characteristics for patients who underwent sub umbilical and lower extremity surgery at WSUTRH and SCH, from February 29,2020 to May 30,2020 G. C, n=90.

Anesthesia and Surgery-Related Patient Characteristics

In comparing the dexamethasone bupivacaine group to the neostigmine bupivacaine group, both cohorts exhibited surgical diversity with a focus on lower extremity orthopedic procedures. In the dexamethasone bupivacaine group, 20% of patients underwent lower extremity orthopedic surgery, while the neostigmine bupivacaine group had 12.2% of surgical procedures in the same category. Furthermore, both groups included patients undergoing specific surgical interventions such as hypospadia repair in the dexamethasone bupivacaine group (2.2%) and PPV ligation in the neostigmine bupivacaine group (4.4%). While there are variations in the percentages, indicating the specific surgical landscape for each group, the similarities lie in the shared emphasis on lower extremity orthopedic procedures and the inclusion of distinct interventions within each cohort. Additionally, the mean durations of surgery and anesthesia, although slightly different, highlight comparable procedural timelines between the two groups, as detailed in Table 2.

Variables	DBG (n=45) Frequency (%)	NBG (n=45) Frequency (%)
Types of Surgery		
Hypospadia (n, %)	2(2.2%)	6(6.6%)
PPV ligation (n, %)	9(10%)	4(4.4%)
Hernia (n, %)	6(6.6%)	9(10%)
Orchiopexy (n, %)	4(4.4%)	5(5.5%)
Lower extremity	18(20%)	11(12.2%)
orthopedic surgery (n, %)	6(6.6%)	10(11.1%)
Others (n, %)		
Duration of surgery in minute, (mean ± SD)	55.18 ± 25.307	58.47 ± 21.108
Duration of anesthesia in minute, (mean ± SD)	64.76 ± 26.410	69.04 ± 21.547

Table 2: Anesthesia and surgery characteristics of patients who underwent sub umbilical and lower extremity surgery at WSUTRH and SCH from February 29, 2020 to May 30, 2020 GC, n=90.

The induction agents and airway management strategies in both the dexamethasone bupivacaine group (DBG) and the neostigmine bupivacaine group (NBG) exhibited notable similarities. A majority of patients in both groups, specifically 60%, received ketamine as their induction agent, emphasizing a consistent approach in anesthesia induction between the two cohorts. Conversely, a minimal percentage of patients, 3.33% in each group, were induced with halothane, highlighting a shared infrequency of this particular agent in both DBG and NBG (Fig. 1).

Regarding airway management, in DBG, 30% of patients received General Anesthesia (GA) with Endotracheal Tube (ETT), while 20% received GA with Laryngeal Mask Airway (LMA). Similarly, in NBG, 33.3% received GA with ETT and 16.16% received GA with LMA (Fig. 2). These comparable distributions underscore the parallel utilization of airway management techniques across both groups, contributing to the overall consistency in anesthesia practices between DBG and NBG.

Perioperative Vital Sign of the Patients

In the dexamethasone bupivacaine group, the majority of Mean Arterial Pressure (MAP) values (24.4%) fell within the range of 66-75 mmHg, while the lowest MAP values were observed in the 45-55 mmHg range. The overall mean MAP was recorded at 62.00 ± 7.693 mmHg. The average heart rate in this group was 116.67 ± 7.167 beats per minute.

In contrast, the neostigmine bupivacaine group exhibited a distribution of MAP values, with 22.2% falling within the 45-55 mmHg range and 10% within the same range. The mean MAP for this group was slightly higher at 63.56 ± 8.049 mmHg. The mean heart rate for the neostigmine bupivacaine group was 116.56 ± 6.930 beats per minute (Table 3).

These findings suggest comparable trends in MAP distribution between the two groups, with dexamethasone bupivacaine demonstrating a slightly lower mean MAP compared to neostigmine bupivacaine. Additionally, heart rate values were consistent across both groups, emphasizing stability in cardiovascular parameters within the studied patient populations, as detailed in Table 3.

Variables	DBG (n=45) Frequency (%)	NBG (n=45) Frequency (%)
Preoperative MAP in mm Hg		
45-55 mm Hg	11(12.2%)	9(10%)
56-65mm Hg	12(13.3%)	16(17.7%)
>66-75 mm Hg	22(24.4%)	20(22.2%)
mean ± SD mm Hg	62.00 ± 7.693	63.27 ± 8.049
Preoperative heart rate	116.67 ± 7.167	116.56 ± 6.930
beats/min(mean ± SD)		

Table 3: Perioperative vital sign of patients who underwent sub umbilical and lower extremity surgery at WSUTRH and SCH from February 29, 2020 to May 30, 2020 GC, n=90.

Perioperative Blood Loss and Fluid Replacement of the Patients

Comparing the two groups, both exhibited a similar distribution of intraoperative blood loss, with a substantial proportion experiencing blood loss in the 50-500 ml range. The mean intraoperative blood loss and fluid balance were slightly higher in the neostigmine bupivacaine group but maintained overall comparability with the dexamethasone bupivacaine group (Table 4). These findings suggest comparable intraoperative hemodynamic outcomes between the two anesthetic approaches as detailed in Table 4.

Variables	DBG (n=45) Frequency (%)	NBG (n=45) Frequency (%)
Estimated intraoperative BL in ml		
50-500ml	42(46.6%)	40(44.4%)
>500	3(3.3%)	5(5.5%)
mean ± SD	230.67 ± 272.725	255.78 ± 267.577
Intraoperative fluid balance in ml		

100-500ml	39(43.3%)	37(41.1%)
>501-1000ml	6(6.6%)	8(8.8%)
mean ± SD ml	490.22 ± 573.119	535.56 ± 530.182

Table 4: Perioperative characteristics of patients who underwent sub umbilical and lower extremity surgery at WSUTRH and SCH from February 29, 2020 to May 30, 2020 GC, n=90.

Postoperative Patient Outcomes

The independent t-test results reveal both similarities and differences in key parameters between the DBG and the NBG for patients undergoing subumbilical and lower extremity surgery. While both groups had similar tramadol consumption, the dexamethasone bupivacaine group demonstrated superior pain relief with a prolonged duration of analgesia and delayed time to the first analgesia request. Additionally, the cost analysis favored the dexamethasone bupivacaine group. These findings collectively suggest that the dexamethasone bupivacaine regimen may provide more effective and cost-efficient pain relief compared to neostigmine bupivacaine in patients undergoing subumbilical and lower extremity surgery, as detailed in Table 5.

Variables	DBG (n=45)	NBG (n=45)	t-value	P-value
Analgesia duration in min, (mean ± SD)	808.00 ± 148.674	716.58 ± 116.503	3.247	0.002
Time till first analgesia request in min, (median ± IQR	733 ± 133	700 ± 233	3.5	0.002
Cost expense in ETB	139.87 ± 34.439	160.29 ± 37.360	-2.696	0.008

Table 5: Postoperative analgesia duration, analgesia consumption, time until first analgesia request, cost expense and pain rating scale for patients who underwent sub umbilical and lower extremity surgery at WSUTRH and SCH from February 29,2020 to May 30,2020 G. C, n=90.

Total Postoperative Rescue Analgesia Consumption

The absence of a statistically significant difference in mean postoperative tramadol consumption between DBG and NBG suggests that both cohorts achieved comparable pain relief using this opioid analgesic. This similarity underscores the effectiveness of tramadol in meeting the analgesic needs of patients in both groups. While there was a statistically significant difference in paracetamol consumption between DBG and NBG, it's important to highlight that both groups utilized this medication. The observed variance in consumption may reflect individualized pain management strategies rather than a significant divergence in overall pain relief efficacy. The lower diclofenac consumption in DBG compared to NBG, with a statistically significant difference, suggests that patients in DBG required less of this medication (Table 6). However, it's noteworthy that both groups utilized diclofenac, indicating that patients received analgesics within the moderate range. The observed difference may reflect individual patient responses to pain rather than a substantial divergence in pain relief effectiveness, as detailed in Table 6.

Variables	mean ± SD		t-value	P-value
	DBG (n=45)	NBG (n=45)		
Analgesia consumption in mg				
Tramadol	65.56 ± 49.477	66.22 ± 52.279	-.062	.951
Paracetamol	98.89 ± 133.454	161.11 ± 162.260	-1.987	.050
Diclofenac	47.22 ± 37.803	70.53 ± 31.194	-3.191	.002

Table 6: Total rescue analgesia consumption for patients who underwent subumbilical and lower extremity surgery at WSUTRH and SCH from February 29, 2020 to May 30, 2020 G. C, n=90.

Postoperative Wong Baker Faces Pain Rating Scale

The mean score of postoperative pain using the Wong Baker faces rating scale was proportionally increased with time. In the neostigmine bupivacaine group, pain intensity was higher than that in the dexamethasone bupivacaine group (Fig. 3).

Incidence of Postoperative PONY and Sedation

The chi-square results showed a significant difference regarding the occurrence of nausea and vomiting between the patients in the Bupivacaine dexamethasone group and the Bupivacaine Neostigmine group (P=0.009). A significant difference was not observed regarding the occurrence of sedation between the patients in the Bupivacaine dexamethasone group and the Bupivacaine Neostigmine group (P=0.271), as detailed in Table 7.

Nausea and Vomiting	Yes	No	X2	P-value
Bupivacaine Dexamethasone Group	2(2.2%)	43(47.7%)	6.852	.009
Bupivacaine Neostigmine Group Sedation	12(13.3%)	33(36.6%)		
Bupivacaine Dexamethasone Group	19(21.1%)	26(28.8%)	1.212	.271
Bupivacaine Neostigmine Group	13(14.4%)	32(35.5%)		

Table 7: Incidence of PONY and sedation for patients who underwent subumbilical and lower extremity surgery at WSUTRH and SCH from February 29, 2020 to May 30, 2020, n=90.

Discussion

In our study, we compared the effectiveness of dexamethasone and neostigmine as adjuvants to caudal epidural analgesia for pediatric patients. Sonography was not included in our study, which allows easy identification of sacral anatomy to ease the degree and proper site of local anesthetic injection [47]. The current study shows that the mean duration of analgesia was 808.00 ± 148.674 in the dexamethasone bupivacaine group, whereas in the neostigmine bupivacaine group, it was 716.58 ± 116.503 with a p value of .002, which is shorter than that in the study conducted in IGMC Shimla, India, with a mean duration of 1410.84 ± 37.7543 in the dexamethasone ropivacaine group and in the neostigmine ropivacaine group, it was 943.12 ± 32.5376. The relatively prolonged mean duration of analgesia in their study was due to sonographic guidelines, which increased the accuracy of the injection site [43]. The results of systematic review and meta-analysis show that the duration of analgesia was significantly prolonged in dexamethasone as an adjuvant compared to placebo after caudal block, which is also the same result as our study [42].

Similar to our results, the study conducted in Madani Hospital Tabriz, Iran, declares that the addition of 8 mg dexamethasone to bupivacaine for epidural analgesia significantly prolongs the duration of analgesia [48]. Another comparative study also explains that the addition of dexamethasone to local anesthetics significantly prolongs the duration of analgesia for caudal epidural analgesia after unilateral inguinal herniography [49].

The incidence of nausea and vomiting was high in the neostigmine bupivacaine group compared to the dexamethasone bupivacaine group. This result is similar to the study conducted in Egypt, Tanta University [50]. In contrast, the study conducted in Severance Hospital at the Yonsei University Health System shows that the incidence of postoperative nausea and vomiting was not found in the dexamethasone bupivacaine group, but two cases were found in our study, which was due to opioid-based postoperative pain management [40].

In our study, two cases of nausea and vomiting were reported in the dexamethasone bupivacaine group, which is closest to the comparative study conducted in government General Hospital, Kakinada, India [6]. Another study also shows that neostigmine with bupivacaine is associated with postoperative nausea and vomiting when compared with bupivacaine alone [51].

The mean duration of analgesia in our study was prolonged when compared to the comparative study conducted in Nepal, on dexamethasone versus neostigmine as adjuvant to lidocaine with adrenaline for brachial plexus block, in which the mean duration of analgesia was higher in the dexamethasone group (454.2 ± 110.7 minutes) compared to the neostigmine group (225.7 ± 53.3 minutes) [52]. The short mean duration of analgesia in their study was due to the use of lidocaine and the brachial plexus area by itself is highly vascularized and uptake of local anesthesia is high.

Postoperative rescue analgesia consumption was low in the dexamethasone bupivacaine group in our study. Similar to our finding, the study conducted in Sawai Man Singh Medical College Hospital, India, on analgesia requirements explains that there was less need for analgesic requirements during the 24-hour post-operative period in patients who received dexamethasone as adjuvants when compared to local anesthetics alone [25]. On the other hand, a study conducted at Tanta University, Egypt, showed that postoperative analgesia consumption was lower in the neostigmine bupivacaine group than in the bupivacaine alone group [39].

The duration of the first analgesia request in our study was prolonged in the dexamethasone bupivacaine group. Another study, Sri Ramachandra University, India, showed that the duration of first analgesia request was higher in the dexamethasone bupivacaine group for patients who underwent infraumbilical surgery, which is similar to our study results [41]. The results of a comparative study also found that neostigmine bupivacaine has lower rescue postoperative analgesia consumption than bupivacaine alone [53].

The incidence of postoperative sedation was not significantly different between the dexamethasone bupivacaine group and the neostigmine bupivacaine group in our study. In line with our study, a comparative study conducted at Zagazig University, Egypt, revealed that postoperative sedation was not significant in dexamethasone after caudal epidural analgesia [54]. Strength of the study: Both the exposed and unexposed groups were selected from the same source population. No patients were lost to follow-up, which resulted in missing data.

Limitation

One of the limitations of this study was the failure to assess the adverse effects of the study drugs beyond 24 hours.

Conclusion

The results of our study show that there was a significant difference between the dexamethasone bupivacaine group and the neostigmine bupivacaine group in the duration of analgesia. Time until first analgesia request was higher in the dexamethasone bupivacaine group than in the neostigmine bupivacaine group. There was no significant difference in postoperative rescue tramadol consumption, but diclofenac and paracetamol consumption was significantly different. The incidence of postoperative nausea and vomiting was marked in the neostigmine bupivacaine group compared to the dexamethasone bupivacaine group. However, postoperative sedation was insignificant in the dexamethasone bupivacaine group and neostigmine bupivacaine group. Cost expense was higher in the neostigmine bupivacaine group than in the dexamethasone bupivacaine group.

Conflict of Interests

The authors have no conflict of interest to declare.

Availability of Data and Materials

Data will be available with reasonable request from the corresponding author.

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Author Contributions

NG contributed to the conception, design of the study, data acquisition, data entry, analysis and interpretation of the data and drafted and revised the manuscript. MS, RO and AD contributed to the conception and assisted in the initial design of the study, analyzed and interpreted the data and critically revised the manuscript. Both authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

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