ORIGINAL ARTICLE

Effectiveness of Epidural Volume Extension with Saline in Combined Spinal Epidural Anesthesia over Epidural Anesthesia for Patients Undergoing Elective Cesarean Section

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Abstract

Background: Epidural anesthesia and combined spinal epidural anesthesia are two popular regional anesthetic techniques for cesarean section. Epidural volume extension is a modification of the combined spinal-epidural anaesthesia (CSEA) technique. It can be an effective method for parturient undergoing elective cesarean section in terms of an adequate level of motor and sensory block and reduced incidence of adverse effects. This study aimed to evaluate the effectiveness of epidural volume extension (EVE) in combined spinal epidural anesthesia (CSEA) with saline over epidural anesthesia (EA) for full-term obstetric patients undergoing elective cesarean section.

Methods: This prospective observational study was carried out with 60 full-term parturient selected purposively from July 2021 to December 2022 who were scheduled for elective cesarean section under regional anesthesia in Dhaka Medical College Hospital. The study population was divided into two groups having 30 patients in each. Group A (Epidural anesthesia)- received 19ml 0.5% plain bupivacaine with 1ml or 50µg fentanyl that was infused in 5ml increments every 2 min through the catheter. Group B (Epidural volume extension in CSEA)- received 7.5mg of 0.5% hyperbaric bupivacaine with fentanyl 25µg intrathecally, immediately followed by 10 ml normal saline epidural volume extension via the epidural catheter. The onset & duration of sensory and motor block, perioperative hemodynamics, number of patients requiring rescue analgesia and possible adverse events were observed, recorded, and compared.

Results: No significant difference was found according to demographics, clinical status, and duration of surgery between the two groups. The patients of both groups showed no significant difference in the case of heart rate, but at 15 minutes and 20 minutes after epidural activation, the differences in blood pressure were observed significant ($p<0.05$). Time required for onset of sensory & motor block, maximum sensory level to T4, and maximum motor level (Bromage score ≤ 2) were less in group B & found statistically significant ($p<0.05$). However, the number of patients requiring rescue analgesia is more in group B which was also statistically significant ($p=0.017$). The time to regression of sensory block, motor block & motor recovery was longer in group A than that of group B all of which were statistically significant as $p<0.05$ in each comparison. Incidence of adverse events like nausea/vomiting (10.3%), hypotension (20.7%), dizziness ((17.2%), shivering (20.7%) and itching (24.1%) were higher in group A than in group B which were also statistically significant ($p<0.05$).

Conclusion: Epidural Volume Extension with saline in CSEA could facilitate earlier onset of sensory & motor block, earlier to achieve maximum sensory & motor level with earlier regression of motor block which also results in early ambulation of patients undergoing cesarean section.

Keywords: Epidural Anesthesia, Epidural Volume Extension, Combined Spinal Epidural Anesthesia (CSEA), Sensory block, Motor block.

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Introduction

Regional anesthesia is a preferred technique to provide adequate surgical anesthesia in elective cesarean section than general anesthesia[1]. With regional epidural anesthesia, the anesthetic is infused into the epidural space around the mother's spinal column, whilst with regional spinal anesthesia, the drug is injected as a single dose into the subarachnoid spinal column. With the two types of regional anesthesia, a parturient remains awake and participates in the birth of her baby without the risks of general anesthesia that could be fatal in difficult airway and aspiration[2]. Spinal and epidural anesthesia each have their advantages. In spinal anesthesia, it is simple and requires a small dose of local anesthetic to provide an intense and reliable block. On the other hand, an epidural gives better control of analgesia and can also be used with the catheter for postoperative pain[3].

Epidural opioid-local anesthetic combinations have proven beneficial in obstetric patients during labour. They are also reported to improve the quality of perioperative analgesia when establishing epidural anesthesia for non-obstetric surgery[4]. Epidural anesthesia has its side effects, for instance, being more time-consuming to perform and having a high incidence of insufficient or superficial block despite larger doses of local anesthetic[3].

Compared with epidural anesthesia (EA), spinal anesthesia uses smaller doses of local anesthetic (eliminating the risk of local anesthetic toxicity) and achieves surgical anesthesia more rapidly. Potential disadvantages include a more rapid onset of hypotension and post-dural puncture headache (PDPH). Different strategies have been adopted to prevent spinal-induced hypotension (SIH) such as left lateral tilt of the mother and lower doses of hyperbaric bupivacaine, but they found limited significance[5,6]. Lowering the dose of the intrathecal anesthetic below the median effective dose (ED50) of the local anesthetic, combined with the administration of opioids, has been successful in mitigating SIH and other maternal and fetal complications. However, this technique has a few potential disadvantages, including an increased need for intraoperative pain supplementation, conversion to general anesthesia, incomplete motor blockade, and inadequate anesthesia. To enhance the efficacy of low-dose local anesthetic, placement of an epidural catheter as part of the CSE technique has been advocated, which allows for a top-up dose of local anesthetic or opioid[7].

Combined Spinal Epidural (CSE) anesthesia has gained favor, especially in the cesarean section, as it combines the reliability of spinal anesthesia with the flexibility of epidural anesthesia[8]. It provides quick onset, prolongs duration, and has a low incidence of local anesthetic toxicity and postoperative analgesia[9]. Epidural volume extension (EVE) is a modified method of the CSE technique. This approach incorporates normal saline, opioid, or a small amount of local anesthetic into the epidural space immediately after intrathecal injection of the local anesthetic. Theoretically, expanding the epidural space extends sensory blockade from spinal anesthesia. Although there are other proposed mechanisms of EVE, the widely accepted mechanism of action is thecal compression of the subarachnoid space due to the volume effect, which promotes cephalad displacement of local anesthetic in the cerebrospinal fluid. Thecal compression or a volume effect to explain block augmentation with EVE is not merely a hypothesis but is supported by imaging and clinical studies[10]. The local anesthetic effect when used epidurally for volume extension, another accepted mechanism of EVE, is due to leakage of the local anesthetic from the spinal needle hole and the diffusion of the local anesthetic into the thecal space. Both the volume and local anesthetic effects of EVE during CSE were examined in earlier studies in non-obstetric cases[11,12]. Stienstra et.al.(1999) found that EVE with normal saline and local anesthetic increased the sensory block height[11]. Furthermore, Takiguchi et.al.(1997)[12] reported that injecting 10 mL of saline in the epidural space immediately after subarachnoid block (SAB) increased the sensory blockade.

Published different articles have shown several benefits of EVE. Other than increasing the sensory block levels, The CSE technique using EVE produces a more rapid motor block regression time of approximately 60 minutes[13]. The faster motor recovery profile may have an impact on reducing or bypassing postanesthesia care unit (PACU) stay. This, in turn,

may imply better resource use & cost savings for both the patient & Hospital authority[13]. EVE also facilitates the use of lower intrathecal doses of local anesthetic. A study done by Azam et al.(2018)[14] showed that lower intrathecal local anesthetic dose is beneficial for maintaining the hemodynamic stability of parturient undergoing elective cesarean section. However, the results of different published trials examining the effectiveness and safety of CSE with EVE in elective cesarean delivery have been inconsistent. Moreover, no study to compare the effectiveness of EVE in CSE with epidural anesthesia in the elective cesarean section has been done before.

So, this study aims to evaluate the effectiveness of epidural volume extension with saline in combined spinal-epidural anesthesia compared to epidural anesthesia for patients undergoing elective cesarean section.

Methods

This prospective observational study was conducted at Operation Theatre under the supervision of the Department of Anesthesia, Analgesia, Palliative & Intensive Care Medicine in collaboration with the Obstetrics Department, Dhaka Medical College Hospital, Dhaka from March 2021 to February 2022. The full-term pregnant patients who opted for elective cesarean section requiring regional anesthesia were included as the study population. Patients were randomized into group A and group B achieved by computer-generated random number table. Group A-received 19 ml 0.5% plain bupivacaine and 1 ml or 50 µg fentanyl that would be infused in 5 ml increments every 2 minutes through the catheter. Group B-received 7.5mg of 0.5% hyperbaric bupivacaine & 0.5 ml or 25 µg fentanyl intrathecally immediately followed by 10 ml normal saline epidural volume extension (EVE) via the epidural catheter.

With the approval of the Ethical Review Committee, DMC this Prospective observational study was carried out in 60 term pregnant patients belonging to American Society of Anesthesiologist physical status II scheduled for elective cesarean section under regional anesthesia.

During pre-anesthetic visits, the patients were selected purposively based on inclusion & exclusion criteria. After being informed about the study purpose, advantages, and risks of the procedure, informed written consent was obtained.

On arrival in the operation theatre, monitors were applied to record the baseline heart rate, blood pressure, and oxygen saturation. An intravenous line was maintained with an 18G cannula and each patient was pre-loaded with 10ml/kg Ringer‘s Lactate. After taking aseptic measures, the skin was infiltrated with 3ml of 2% lignocaine in a sitting position in each group.

In patient with group A, receiving epidural anesthesia, an 18-G Tuohy needle (Perifix; B. Braun, Melsungen, Germany) was inserted in the epidural space at the L2-3 or L3-4 interspace using a loss-of-resistance technique in the sitting position. A 20-G epidural catheter was inserted in a cephalad direction 4–6 cm into the epidural space and 3ml of 2% lidocaine with 1:200000 epinephrine (0.005mg/ml) was given through the catheter as a test dose. After the patients lie supine & getting confirmation that the epidural was not inadvertently intrathecal or intravascular, the mixed solution (containing 19 ml 0.5% plain bupivacaine and 1ml or 50µg fentanyl) was infused in 5 ml increments every 2 minutes through the catheter.

Patient with group B was receiving CSEA in the sitting position at the L2–3 or L3–4 interspace with a 18-G Tuohy needle (Perifix; B. Braun, Melsungen, Germany) using loss-of-resistance technique, and 20-G epidural catheter was inserted in a cephalad direction 4–6 cm into the epidural space and 3ml of 2% lidocaine with 1:200000 epinephrine (0.005mg/ml) was given through the catheter as a test dose. After getting confirmation that the epidural test dose was not inadvertently intrathecal or intravascular, Spinal anesthesia was then performed using a 25-G Quincke-Babcock needle into a different lower interspace and observed for free flow of cerebrospinal fluid (CSF). Following this, an appropriate spinal solution (7.5mg of 0.5% hyperbaric bupivacaine with fentanyl 25µg) was injected over 20 seconds. The patients were then immediately helped into the supine position with a 15º left lateral tilt and 10 ml normal saline epidural volume extension via the epidural catheter was given.

In both groups Sensory block level was assessed bilaterally by using loss of sensation to pinprick at the mid-clavicular line beginning at the feet and moving in a cephalad direction at 2-minute intervals for 20 minutes. The lowest level below where the patient felt pain sensation to pinprick was determined as the sensory level. The onset of sensory block was recorded in minutes from the end of injection of the drug to the sensory block reached to anterior aspect below knee (L4). Motor block was assessed by using Bromage score at 2-minute intervals after the procedure for 20 minutes. The onset of motor block was recorded in minutes from the end of injection of drug to motor function by Bromage score ≤3. Duration of maximum Sensory level was determined in minutes from the end of injection of drug to sensory block reached to T4 level & maximum motor block was calculated in minutes when it achieved Bromage score ≤2. The skin incision was permitted after the sensory block level reached to T4 & motor block achieved Bromage score ≤2. At the end of 20 minutes, if the sensory block failed to reach the T4 level, Bromage score level of more than 2 or if the patient had pain due to inadequate block or even after rescue analgesia, it was considered as a failed block, and general anesthesia was given as per protocol.

Before starting of operation maternal blood pressure was measured every 2-minute intervals for 10 minutes and 5-minute intervals thereafter. Hemodynamic parameters (HR, SBP, DBP, and MAP) were recorded initially after block & at 5-minute intervals for the first 30 minutes then at 10-minute intervals thereafter for the next 60 minutes. The patient with hypotension was treated with fluid bolus & 5 mg incremental doses of intravenous ephedrine.

Intraoperative pain was assessed by the visual analogue scale (VAS), if intraoperative pain was more than 4 on the visual analogue scale (VAS), the epidural catheter was topped up with incremental 5ml boluses of 1% lidocaine as rescue analgesia.

At Post anesthesia care unit (PACU) regression of motor block was assessed again by Bromage score at 10-minute intervals & time for motor block regression (Bromage score >2) and time for motor recovery (Bromage score 4) were recorded in minutes. Sensory regression time to T8 was also assessed at 10-minute intervals by pinprick & recorded in minutes.

All the adverse events were assessed, documented & treated simultaneously (hypotension by fluid bolus & Inj. ephedrine, nausea/vomiting by reassurance & anti-emetics, shivering by Inj. pethidine & itching by anti-histamine).

Statistical analysis

All data were presented in suitable tables or graphs according to their affinity. A description of each table and graph was given to understand them clearly. All statistical analysis was performed using the SPSS 26.0 for windows (SPSS Inc., Chicago, IL, USA). Numerical data such as anesthesia readiness time was expressed as mean ±SD. They were analyzed by student‘s t test. Categorical data were expressed as frequency and percentage. They were analyzed with chi-square test. The significance of the results as determined in 95.0% confidence interval and value of $p<0.05$ was considered to be statistically significant.

Results

This prospective observational study was carried out during COVID-19 pandemic situation from 1st March 2021 to 28th February 2022 in the tertiary level hospital (DMCH) in Dhaka city. Sixty patients were enrolled in this study & they were randomly divided into two groups (group A & B); 30 patients in each group. But considering block failure: Four (4) patients were excluded from the study (1 from group A & 3 from group B). So, finally, data from 56 patients were calculated (29 patients in group A and 27 patients in group B).

Table I: Distribution of the patients by demographic and clinical status & duration of surgery (n=56).

Characteristics		Group A (n=29)	Group B (n=27)	p value
Age	20-24 Years	7(24.1%)	6(22.2%)	
	25-29 Years	15(51.7%)	13(48.1%)	
	30-34 Years	5(17.2%)	5(18.2%)	
	35 Years & above	2(6.9%)	3(11.1%)	
	Mean ±SD	25.7±3.6	24.2±3.5	0.263
Height(cm)		153.7±3.1	152.3±3.3	0.231
Weight(kg)		68.5±3.6	66.7±3.7	0.227
Gestational age (wks.)		40.2±2.3	39.6±2.4	0.321
Parity	Primiparous	11(38%)	10(37%)	0.326
	Multiparous	18(62%)	17(63%)	0.347
Duration of Surgery(min)		64.8±5.8	66.5±6.3	0.164

Values were expressed as Mean ± SD and within parenthesis percentage (%) over column in total. Student's t-test was performed to determine p value. p value <0.05.considered as significant.

Most of the patients were between 25-29 years range (51.7% vs 48.1%). The majority of parturient were multiparous in both groups (62% vs 63%). But no statistically significant difference was found in case of age & parity between the two groups. Considering other demographic variables like height (153.7±3.1 vs 152.3±3.3 cm), weight (68.5±3.6 vs 66.7±3.7 kg) & gestational age (40.2±2.3 vs 39.6±2.4 weeks), there was also no significant difference found as p values were not <0.05. The average duration of Surgery was (64.8±5.8 vs 66.5±6.3 min) with no significant difference between the two groups as p=0.164. (Table I)

Considering MAP there were significant statistical differences observed between the two groups at 15 min (81.36±7.87 vs 89.58±6.43 mmHg) & at 20 min (83.72±7.65 vs 91.41±6.91mmHg) as p values were 0.027 & 0.029 at those points of time respectively. In the case of other points of time, no statistical differences were observed. (Figure 1)

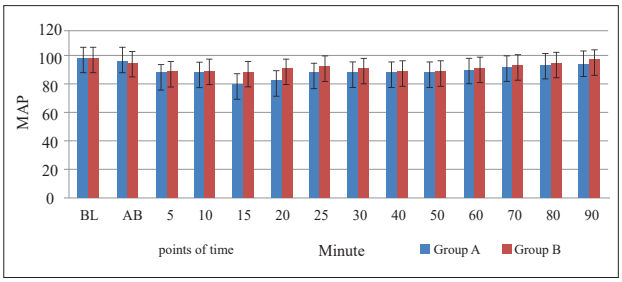

Figure 1: Perioperative mean MAP (mmHg) of the patients (BL= Baseline; AB= After Block; Number= Points of time in minutes).

Table II: Comparison of time of onset of sensory block and motor block between two groups (n=56).

Characteristics	Group A (n=29)	Group B (n=27)	p value
The onset of sensory block	4.8±0.8	2.6±0.2	0.013^{s}
The onset of motor block	8.4±1.3	4.2±0.9	0.014^{s}
The onset of maximun sensory level T4	16.7±2.6	6.6±1.5	0.008^{s}
The onset of maximun motor level (Bromage score ≤2)	17.4±2.9	12.7±1.8	0.007^{s}

Values were expressed as Mean±SD and within parenthesis percentage (%) over column in total. Student's t-test was performed to determine p value. p value <0.05 was considered as significant.

When the characters of the block were considered, there were statistically significant results found between the two groups (Table II). The onset of sensory block was 4.8±0.8 vs 2.6±0.2 min & motor block was 8.4±1.3 vs 4.2±0.9 min. The onset of maximum sensory level (T4) was 16.7±2.6 vs 6.6±1.5 min and maximum motor level (Bromage score ≤2) was 18.4±2.9 vs 12.7±1.8 min. Here all the p values were calculated by student's t-test and found <0.05. So, it was observed that the time required for the onset of sensory block, motor block, maximum sensory level (T4) and maximum motor level (Bromage score ≤2) were less in group B.

Table III: Identification of the number of patients required rescue analgesia during per-operative period.

Characters (min)	Group A (n=29)	Group B (n=27)	p value
The to regression of sensory block	119.4±11.8	92.7±8.7	0.009[$]
The to regression of motor block	104.7±8.5	76.8±6.4	0.013[$]
Time for Motor recovery	140.8±9.3	92.6±5.8	0.008[$]

Values were expressed as Mean±SD and within parenthesis percentage (%) over column in total. Student's t-test was performed to determine p value. p value <0.05 was considered as significant.

Number of patients required rescue analgesia during per-operative periods were 3.45% in group A and 14.8% in group B which was statistically significant as the p value was 0.017 (Table III).

Table IV: Comparison of regression time of the blocks between two groups (n=56).

Characters (min)	Group A (n=29)	Group B (n=27)	p value
The to regression of sensory block	119.4±11.8	92.7±8.7	0.009[$]
The to regression of motor block	104.7±8.5	76.8±6.4	0.013[$]
Time for Motor recovery	140.8±9.3	92.6±5.8	0.008[$]

Values were expressed as Mean±SD. Student's t-test was performed to determine p value. p value <0.05 was considered as significant.

The time to regression of sensory block (119.4±11.8 vs 92.7±8.7 min) and motor block (104.7±8.5 vs 76.8±6.4 min) were longer in group A than group B. Those were both statistically significant as p=0.009 & 0.013 respectively. Again when considering the time for Motor recovery (140.8±9.3 vs 92.6±5.8 min) was also prolonged in the case of group A which was also statistically significant (p=0.008).So, it was observed that Group A provided prolonged analgesia and motor block than Group B (Table IV).

T**able V:** Peroperative adverse events of the patients between two groups. (n=56).

Complication	Group A (n=29)	Group B (n=27)	p value
Nausea/Vomiting	3(10.3%)	1(3.7%)	0.026[$]
Hypotension	6(20.7%)	2(7.4%)	0.014[$]
Dizziness	5(17.2%)	3(11.1%)	0.031[$]
Shovering	6(20.7%)	3(11.1%)	0.024[$]
Itching	7(24.1%)	2(7.4%)	0.006[$]

Values are expressed within parenthesis percentage (%) over column total. Chi-squared Test was performed to determine p value. p value <0.05 was considered as significant.

Adverse events like nausea/vomiting (10.3%), hypotension (20.7%), dizziness (17.2%), shivering (20.7%), and itching (24.1%) were higher in group A than group B. The p value was determined by chi-squared Test and was found significant (p <0.05) in respect of all events. (Table V)

Discussion

Considering the demographic data most of the patients in both groups were between 25 and 29 years range & the majority of participants were multiparous but showed no statistical significance. In the case of other demographic characteristics like height, weight, gestational age, and duration of surgery there were also no significant differences found between the two groups. Similar observations were found by other authors[15,16]. There were significant difference regarding hemodynamic parameters (SBP & DBP & MAP) found at 15 min & at 20 min after epidural activation in between the two groups (p<0.05) & no significant differences at all other points of time were found. Regarding mean heart rate values, there were no significant differences observed.

A couple of study findings were consistent to this study regarding maternal hemodynamic stability achieved by using a Low dose of intrathecal hyperbaric bupivacaine followed by EVE with saline[14,17]. A randomized double-blinded study by Azam et al.(2018))[14] concluded that 4.5mg hyperbaric bupivacaine was able to provide consistent, reliable, and effective stability of hemodynamic variables compared to 5.5mg and 6mg hyperbaric bupivacaine. In all the groups they used 10ml epidural installation of saline immediately after intrathecal bupivacaine administration. In a couple of studies in which different volumes of saline and no saline were compared for epidural volume expansion, vital signs did not differ between the groups[18,19]. But Gupta et al.(2012)[17] concluded that an intrathecal dose of 6 mg hyperbaric bupivacaine with 25 mcg fentanyl is adequate for cesarean section when used in CSE with the EVE technique using 0.9% saline or 6% hydroxyethyl starch. However, EVE with hydroxyethyl starch provides an optimal hemodynamic profile as compared to EVE with saline. But in this study, we observed that intrathecal 7.5 mg bupivacaine followed by EVE with 10 ml normal saline provides

better hemodynamic stability compared to epidural anaesthesia. So, it can be postulated that using a low dose of intrathecal LA & EVE with saline results in better haemodynamic control over EA where higher doses of LA were used.

This study showed that both the onset of sensory block and the onset of motor block were early in the EVE (B) group. The time required for maximum sensory level (T4) and maximum motor block (Bromage ≤2) were less in EVE (B) groups, where the p values were found <0.05 in all the comparisons. Again In this study, the time to regression of sensory block was longer in group A than in group B both of which were statistically significant.

The block profile achieved by EVE with saline can be explained by decreased intrathecal dose requirements during pregnancy & epidural volume effect causing cephalad spread of the existing intrathecal drug. Other studies showed similar findings with the exception of sensory regression time which was more in EVE group than non EVE group[15,16]. This result was probably due to they used either higher doses of intrathecal local anesthetics than this study &/or EVE with local anesthetic other than using normal saline.

However, some studies were inconsistent with this present study regarding block profile[1,20]. That was also probably because they used either EVE with a higher dose of epidural LA (10 ml of 0.25% Bupivacane) which produces better surgical anaesthesia1 or a very low dose (2mg) of intrathecal LA which could not produce any significant effect even after EVE with 10ml saline[20].

In this study, more patients of Group B than Group A required supplementary rescue analgesia during peroperative period which was statistically significant as p value was <0.05.

A couple of studies consistent with this present study had shown reduced intrathecal dose of bupivacaine to be associated with a higher risk of intraoperative analgesic supplementation[10] & the number of patients supplemented with general anesthesia was greater in the EVE group than in the SCSE group[21]. In this study, it has been suggested that the reason for using a lower intrathecal dose of local anaesthetic & EVE with saline is associated with more peroperative requirement of rescue analgesia.

However inconsistent with this study, some authors found that the requirement for ketamine supplementation was significantly more in the NEVE group as compared to EVE groups[17]. In the NEVE group, they used a lower dose of intrathecal LA without opioids. In this study apart from sensory block, motor block regression was significantly shorter in group B than that of group A (p=0.013). Time for motor recovery was longer in Group A than in Group B, which was also statistically significant (p=0.008). As compared to this present study some authors showed similar results[1,13,22]. That might be achieved due to Epidural saline extending the block height by a mechanical 'volume effect' & did not prolong the block duration1. CSF flow dynamics might play a role[23]. They explained two possible mechanisms for the antagonistic effects of epidural saline on intrathecal local anesthetic. First, compression of the intrathecal space by increased epidural pressure may have diluted any remaining local anesthetic in the cerebrospinal fluid to subanesthetic levels. Second, the increased epidural pressure may have increased the uptake of local anesthetic into the spinal cord vasculature and thus hastened clearance. However, the finding was not consistent with other studies and it may be due to their observation in different non-obstetrics surgery (TURP)[19].

In this study, peroperative adverse events were significantly more in group B than in group A. Possibly because of very slow injection of low dose intrathecal LA, lower dose of intrathecal opioid than epidural, denser motor block by intrathecal LA. Choi et.al.1 compared combined spinal epidural anesthesia (CSEA) and epidural anesthesia (EA) for cesarean section. Significantly more women in the EA group had shivering. They also had more nausea and vomiting but the differences were not significant.

In this study, it could be assumed that CSEA with EVE decreases spinal dose (7.5mg of 0.5% hyperbaric bupivacaine with fentanyl 25µg) that facilitates earlier onset of anesthesia and faster regression of spinal block due to low dosage, which results in faster mobilization.

So, Epidural Volume Extension with saline in CSEA over EA could facilitate earlier onset of sensory & motor block, earlier to achieve maximum sensory & motor level with earlier regression of motor block which also results in early ambulation of patients undergoing cesarean section.

Conclusion

From this study it is observed that Epidural volume extension with saline in Combined Spinal-Epidural anesthesia is more effective than Epidural anesthesia for obstetric patients undergoing elective cesarean section. So, Combined Spinal-Epidural anesthesia using Epidural volume extension with saline can be used apart from Epidural anesthesia during elective cesarean section.

Declaration

Ethics approval

The study was approved by the DMCH Ethical Review Committee (Memo No. ERC-DMC/ECC/2021/138).

Author contributions

Conception and development of the idea:
AKMNK, MIA
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Data analysis: RA, MMH, MIA
Data collection: AKMNK, AMH, NB
Review and Editing: MMK, AKMNK

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