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SCIENTIFIC ARTICLE

Combined Spinal-Epidural Anesthesia with Epidural Volume Extension causes a Higher Level of Block than Single-Shot Spinal Anesthesia

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Abstract
Background and objectives: We evaluated the effects of epidural injection with levobupivacaine or serum physiologic, epidural volume extension (EVE), when using combined spinal-epidural anesthesia (CSEA) for cesarean delivery.
Methods: One-hundred and thirty-eight patients with a full-term pregnancy of 37-42 weeks that were scheduled for cesarean delivery were included. Group 1 (n = 48) received single-shot spinal anesthesia (SSS), group 2 (n = 45) received CSEA-EVE with saline, group 3 received CSEA-EVE with levobupivacaine. The characteristics of motor and sensory block, the effects on maternal hemodynamic changes and the effects on the newborn were compared.
Results: Time to reach maximum sensory block was significantly shorter in groups 3 than in group 1 and 2 ($p < 0.05$). Two-segment regression time of sensory block was significantly shorter in group 1, whereas it was significantly longer in group 3 than in group 2 ($p < 0.05$). Time to onset of motor block was significantly longer in group 1 than in groups 2 and 3 ($p < 0.05$). Time to reach maximum motor block was significantly shorter in group 3 than in groups 1 and 2 ($p < 0.05$). Time to recovery of motor block was significantly longer in group 3 than in groups 1 and 2 ($p < 0.05$). The time to first analgesic was significantly longer in group 3 ($p < 0.05$).
Conclusions: Sufficient and rapid motor and sensory block was achieved in all the patients in the present study; however, motor and sensory block had faster onset, lasted longer, and was of a higher level in groups 2 and 3; these effects were more pronounced in the group 3.

Introduction

Combined spinal epidural anesthesia (CSEA) is the preferred method for cesarean delivery. The spinal component provides rapid onset of anesthesia and the drugs that are administered through the catheter placed in the epidural space maintain analgesia during the postoperative period [1]. The epidural volume extension (EVE) technique is a modification of CSEA in which the level of sensory analgesia obtained via subarachnoid block is increased by a small volume of saline or local anesthetic administered through the epidural catheter [2-6]. The level of sensory block obtained is not only related to

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the analgesic effect of the local anesthetic administered into the epidural space, but to the effect of the volume of the epidural solution causing cephalic movement of the local anesthetic in the subarachnoid space [5,7-9].

Researchers have reported that epidural administration of saline increases the level of sensory block without altering the intensity of spinal anesthesia; however, epidural injection of plain bupivacaine caused more intense motor block of longer duration for sensory and motor block, as well as analgesia, when used for volume extension during cesarean delivery [10]. Another study reported that when saline was used for EVE, the level of the spinal block obtained using hyperbaric bupivacaine did not increase; however, the maximum level of sensory block increased significantly in spinal block obtained using plain bupivacaine [11].

In the present study we hypothesized that, in comparison to single-shot spinal anesthesia (SSS), an increase might be observed in intrathecal local anesthetic distribution when CSEA is administered in combined EVE. The purpose is to assess whether we can achieve more potent and more rapid onset of anesthesia this way.

Methods

The study included patients that had cesarean delivery. The Ethical Committee of Akdeniz University approved this study and all the participants provided informed consent. In total, we included in this study 138 ASA I-II patients aged 18-40 years with a full-term pregnancy of 37-42 weeks that were scheduled for cesarean delivery. Exclusionary criteria included history of allergy to local anesthetics, diabetes mellitus, height < 155 cm or weight > 100 kg, pre-eclampsia, placenta previa, fetal anomalies, fetal bradycardia, neurologic or psychiatric disorders. All patients received 1,000 mL of Ringer's lactated intravenously before spinal anesthesia. Patients were monitored for non-invasive blood pressure, ECG, and peripheral oxygen saturation. We evaluated fetal heart rate prior to anesthesia.

The patients were randomly assigned to one of three groups using sealed opaque envelopes: each envelope contained one of the three codes: SSS, CSEA-EVE with saline, and CSEA-EVE with levobupivacaine. Care providers in the labour room generated the random allocation sequence. Group 1 (n = 48) received SSS anesthesia; Group 2 (n = 45) received CSEA (EVE with 5 mL saline); Group 3 (n = 45) received CSEA (EVE with 5 mL of 0.5% levobupivacaine).

In Group 1 (SSS), following identification of the L3-4 or L4-5 intervertebral space while in the right lateral recumbent position, the following doses of 0.5% levobupivacaine were injected in addition to 20 μg of fentanyl over the course of 30 seconds using a 27G spinal needle (Quincke, Egemen, Izmir, Turkey): 10 mg in patients with a height ≤ 160 cm, 12 mg in those 161-164 cm in height, 14 mg in those 165-169 cm in height, and 15 mg in those with a height ≥ 170 cm.

In Group 2 (CSEA-EVE with 5 mL saline), we identified the epidural space using an 18G Tuohy needle and performed dural puncture using a 27G spinal needle (Combifix, Egemen, Izmir, Turkey). Spinal anesthesia doses according to patient height in Group 2 were the same as described for Group 1, and a 20-G epidural catheter was inserted 4 cm into the epidural space. Five minutes after insertion of the epidural catheter, 5 mL of saline was administered through it for EVE.

In Group 3 (CSE-EVE with 5 mL of 0.5% levobupivacaine), after identification of epidural space, we performed dural puncture (Combifix, Egemen, Izmir, Turkey). Spinal anesthesia doses according to patient height in Group 3 were the same as described for Groups 1 and 2, and a 20G epidural catheter was inserted 4 cm into the epidural space. Five minutes after insertion of the epidural catheter, 5 mL of % 0.5 levobupivacaine (Chirocaine, Abbott Laboratories, Istanbul, Turkey) was administered through it for EVE. Following the anesthetic procedure, all patients were placed in the supine position and their right hip was elevated with a pillow to prevent aortocaval pressure. We allowed surgery to proceed after a sensory height block of T4-5 was achieved.

To avoid inter-operator variability, the principal author performed all the blocks. At the end of each regional technique, an anesthesiologist who was unaware of the technique and drug received by each patient recorded hemodynamic status and block profile. Systolic blood pressure, diastolic blood pressure, mean blood pressure (MBP), heart rate, and oximetry (SpO_2) levels were periodically monitored during surgery. In order to evaluate the characteristics of the block, the Bromage scale was used for motor block (0 = normal motor function, 1 = loss of motor function at the hip, 2 = loss of motor function at the hip and knee, and 3 = loss of motor function at the hip, knee, and ankle) and the pinprick test was used for sensory block. We recorded time to onset of sensory block, time for sensory block to reach T10, the level of maximum sensory block, time to reach maximum sensory block, 2 segment-regression time of sensory block, and regression of sensory block to T10, time to onset of motor block, time to reach maximum motor block, time to recover from motor block. We scored the quality of intraoperative anesthesia as follows: 0: unsuccessful block; 1: insufficient block (insufficient anesthesia, insufficient relaxation, need for adjuvant therapy, need for general anesthesia); 2: sufficient block. The need for the first postoperative analgesia was determined using the visual analogue scale (VAS), and the first analgesic was administered if the VAS score was > 3.

We administered prophylactic ephedrine 5 mg intravenously on all patients immediately following the anesthetic procedure in order to prevent hypotension. We administered an additional 5 mg of ephedrine when blood pressure dropped to 20% below the baseline value, noting the total dosage. New-born were also noted Apgar scores (1^{st} and 5^{th} min).

We used SPSS (Statistical Package for Social Sciences) v.13.0 for Windows for statistical analysis of the obtained data. Quantitative data were analyzed using One-Way ANOVA. Qualitative data were analyzed using Pearson Chi-square test. Statistical significance was set at $p < 0.05$. When aiming to detect a time to reach maximum sensory block, with a power 99.7%, and $\alpha = 0.05$, each group required a sample size of 45.

Results

In total, we included in the study 138 patients that met the inclusion criteria. The 3 groups were compared in terms of demographic data, such as age, gestational age, height, weight, body mass index (BMI), and parity, but there were not any significant differences between the groups ($p > 0.05$) (Table 1). Inter-group comparison of block characteristics (Table 2) showed that time to onset of sensory block was