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Comparison of the maternal and neonatal effects of epidural block and of combined spinal–epidural block for Cesarean section

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Abstract

Background: Combined spinal–epidural block (CSEB) has aroused increasing interest, as it combines the reliability of a spinal block and the flexibility of an epidural block (EB). We have conducted a comparative investigation of the maternal and fetal effects of CSEB and of EB administered for Cesarean section.

Methods: Eighty pregnant women at term were randomized into two groups. Women in the CSEB group ($N = 40$) were each given 1.5–1.8 mL 0.5% hyperbaric bupivacaine intrathecally, followed by 10 mL 0.25% bupivacaine and 50 μg fentanyl through the epidural catheter 10 min later. Women in the EB group ($N = 40$) received 14–16 mL 0.5% bupivacaine and 100 μg fentanyl. The quality and side effects of surgical anesthesia and the hemodynamic parameters, Apgar scores, and postoperative duration of pain were compared between the two groups.

Results: The time for the block to reach the T-4 level differed significantly between the two groups (8.02 ± 3.4 versus 18.34 ± 4.6; $P < 0.01$). More women in the CSEB group achieved complete motor blockade (Bromage score 3), and it was reached earlier than in the EB group ($P < 0.05$). Muscle relaxation and motor block were better in the CSEB group than in the EB group ($P < 0.01$). Apgar scores were 7 or more in almost all newborns in both groups. There were no significant differences between the groups in the incidences of adverse effects such as hypotension or nausea and vomiting, but the patients in the EB group experienced more shivering ($P < 0.001$). The time to postoperative pain was significantly shorter in the CSEB group.

Conclusion: We decided that CSEB, and more specifically spinal anesthesia with supporting epidural anesthesia, has greater efficacy and fewer side effects than EB when administered for Cesarean section.

Keywords: Combined spinal–epidural block; Epidural block; Surgical procedure; Cesarean section

1. Introduction

Increasing numbers of pregnant women scheduled for elective Cesarean section wish to remain conscious while it is going on. The most common anesthetic modes used for this operation are spinal and epidural lumbar block. Spinal lumbar block is a simple and economical method, requiring only a small amount of local anesthetic to produce an effective block with complete muscle relaxation. The disadvantages of spinal lumbar anesthesia, such as the risk of an extensive block, the fixed duration of anesthesia, hypotension, and the risk of postdural puncture headache (PDPH), have given rise to the use of epidural anesthesia as an alternative method. In this procedure, the exact level the block will extend to can be targeted and maintained with supplementary doses, and it is possible to use the catheter placed for surgical anesthesia subsequently for postoperative pain relief. However, epidural anesthesia is more time consuming and involves a higher incidence of insufficient or superficial block, especially of the motor roots, despite

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larger doses of the local anesthetic agent used. Hence, the idea of combining these two methods seemed attractive [1,5].

Combined spinal–epidural block (CSEB) is becoming increasingly more popular in obstetric surgery. CSEB combines the rapid onset and intensity of subarachnoid block and the flexibility of having an epidural catheter in place, which allows intraoperative extension of anesthesia and also postoperative epidural analgesia. In the present study, we compared the effects of CSEB and EB on maternal and neonatal outcomes [6,9].

2. Methods

Eighty healthy (ASA grade I–II) 18- to 40-year-old pregnant women at term were randomized to two groups. This population included both women who were pregnant for the first time and multiparous women; all were unpremedicated and scheduled for elective Cesarean section, and all wished to be conscious during the surgery. All were experiencing uncomplicated singleton pregnancies. Any women, whose pregnancies were complicated, such as those expecting twins and those with placenta previa or pregnancy-induced hypertension, were excluded from the study. The study was approved by the Ege University Hospital Ethics Committee, and informed consent was obtained from each woman. In each study case the estimated fetal weight was at least 2500 g.

Women were randomized by means of a computerized number sequence to receive either single-space CSEB or EB. None of them was told which anesthetic technique was used in her case or any other. All received metoclopramide 10 mg and 10 mL kg^{-1} warmed (37 °C) Ringer lactate solution i.v. before the induction of anesthesia. The urinary bladder was catheterized. Oxygen, 6 L/min, was administered through a transparent face mask. Electrocardiogram, heart rate, and peripheral oxygen saturation were monitored continuously, and blood pressure was measured at 2-min intervals using an automatic cycling device (Hewlett-Packard, Viridia 24 °C); after the delivery blood pressure was measured at 5-min intervals.

The anesthetic procedures were performed by qualified anesthetists who are well experienced in the application of these methods. The lumbar puncture was performed at the L2–3 or L3–4 interspace with the women in a sitting position. In the CSEB group, the dural puncture was made with a 27-G pencil-point needle after the introduction of an 18-G Tuohy needle (Portex, Minipack, UK) and identification of the epidural space. Once correct placement of the spinal needle had been confirmed by the aspiration of cerebrospinal fluid, 1.5–1.8 mL of 0.5% hyperbaric bupivacaine was given (varying with each patient's height: 1.5 mL for patients under 1 m 65 cm tall; 1.8 mL for those 1 m 65 cm tall or taller) over 30 s. Time zero was defined as the conclusion of the spinal injection. A 20-G epidural catheter was inserted 3–4 cm into the epidural space and secured in place after withdrawal of the spinal needle, and each patient was positioned supine with a 15° left lateral tilt achieved by placing a wedge under her right hip. In the CSEB group, if the block had not reached the T-4 level when it was assessed after 10 min, 10 mL 0.25% plain bupivacaine plus 50 μg fentanyl (top-up) was given epidurally in addition.

Women in the EB group were placed in the sitting position and the lumbar punctures were made with an 18-G Tuohy needle at the L2–3 or L3–4 interspace. An epidural catheter was introduced, and 3 mL 2% lidocaine was injected as a test dose. The epidural solution was prepared was follows: 16 mL 0.5% bupivacaine mixed with 100 μg fentanyl. After an initial dose, an additional 2 mL 0.5% bupivacaine per unblocked segment was given until a sensory block extending to the T-4 level was achieved. Time zero was defined as the point at which the epidural injection was concluded.

Hypotension, defined as a 20% fall in blood pressure from preinduction levels or a systolic blood pressure lower than 100 mmHg, was treated immediately by injecting 5–10 mg ephedrine i.v. The level of sensory block was then assessed by pin-prick at 2-min intervals during the 30 min after epidural injection, and the highest level of sensory block (S_{max}) and the time taken to reach S_{max} were recorded. Motor block of the lower extremities was assessed at 5-min intervals for 30 min with the aid of the Bromage score (BS): BS 0, full flexion of knees and feet; 1, just able to move knees; 2, able to move feet only; 3, unable to move feet and knees. Complete motor block was defined as BS 3.

The time intervals from the induction of regional block to the start of surgery and to delivery were recorded, as were the time intervals from skin incision to delivery and from uterine incision to delivery.

Muscle relaxation was assessed by surgeons blinded to the groups to which the pregnant women had been allocated groups when the peritoneum was retracted before closure, and it was rated as poor, fair, good, or excellent (score of 1, 2, 3, or 4). Intraoperative pain was assessed on a visual analogue scale (VAS, 0–100). If a woman complained of pain (VAS $\geq$ 40) during surgery, fentanyl was given i.v. in 50-μg increments. The requirement for these supplementary drugs before and after delivery was noted. Adverse effects during the operation, such as hypotension, nausea, vomiting, and shivering, were also recorded.

All neonates were evaluated by a pediatrician who was also unaware of the mothers' group assignments. Neonatal Apgar scores at 1 and 5 min and any need for neonatal oxygen therapy were noted.

Finally, we evaluated the recovery of the women in the postanesthesia care unit. Times from the first injection of the intraspinal anesthetic to BS 0 of motor block and to the start of postoperative pain were recorded. Postoperative pain relief was provided by epidural morphine as needed in both groups. We visited every parturient on postoperative days 1–3 to check for PDPH.