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Original Article

A comparison of spinal and epidural anesthesia for cesarean section following epidural labor analgesia: A retrospective cohort study

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ABSTRACT

Introduction: This study aimed to investigate different types of regional anesthesia for cesarean section (CS) following epidural labor analgesia that could lead to various perioperative and postoperative outcomes.

Methods: We retrospectively included those parturients who received epidural labor analgesia but needed subsequent CS under regional anesthesia in our institution from January 2008 to June 2012.

Results: In all, 2341 of 6609 parturients underwent painless labor, and 334 of them converted to CS. Spinal anesthesia (SA) was used with 163 parturients, and epidural anesthesia (EA) with 96; the two groups were then compared. No high-level block or total SA was noted. The primary outcome revealed that the time from anesthesia to surgical incision and the total anesthesia time were shorter, hypotension episodes were more frequent, the rate of perioperative ephedrine administration was higher, and the rate of midazolam was lower in the SA group. With regard to secondary outcomes, the Apgar scores of the neonates recorded at 1 minute and 5 minutes and maternal satisfaction were similar. The neuraxial morphine dose was converted to parenteral morphine equivalent dose (MED), which revealed that the parturients in the spinal morphine group had lower dosages and visual analog scale (VAS) pain scores on postoperative Day 1.

Conclusion: For parturients with labor epidural analgesia needing CS, the use of SA led to shorter anesthetic time and lower postoperative pain scores, with lower morphine doses compared with EA. However, the high failure rate with both neuraxial techniques needs to be addressed.

1. Introduction

Although epidural analgesia (EA) itself does not increase the risk of cesarean section (CS),[1,2] about 10–11% of parturients with epidural painless labor need emergency CS.[1] Epidural labor analgesia may complicate emergency CS compared with scheduled CS. Most anesthesiologists prefer the method of leaving the epidural tube *in situ* for emergency CS in parturients with epidural labor analgesia who failed to deliver vaginally. Some anesthesiologists still use spinal anesthesia (SA) instead of EA not only for its rapid onset and adequate motor blockade but also because of the high failure rate of EA in scheduled CS (EA 23.5% vs. SA 2.7%).[3,7,8] However, SA following EA might result in an unexpected high-level blockade or even total SA,[4,5] although there is no statistical difference compared to SA only.[6] There has been no study investigating the advantages of either spinal or epidural neuraxial anesthesia for parturients with epidural labor analgesia who failed to deliver vaginally. In our hospital, SA is frequently chosen for scheduled or emergency CS in order to circumvent the higher failure rate of EA, even if there is an epidural catheter *in situ*. This study aimed to retrospectively investigate two different neuraxial anesthetic techniques for parturients with EA needing CS and compared the induced perioperative and postoperative events.

2. Methods

After obtaining Institutional Review Board approval, we retrospectively reviewed the database of parturients who had been

Conflicts of interest: All authors declare no conflicts of interest.

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admitted for vaginal deliveries at Changhua Christian Hospital, Changhua, Taiwan from January 2008 to June 2012. The inclusion criterion was that the patients had received epidural labor analgesia but needed subsequent CS under regional anesthesia (SA or EA). The exclusion criterion was an inadequate epidural labor analgesia function in the parturients. The definition of improper epidural placement included unsatisfactory analgesia [visual analog score (VAS) $\geq$ 4] or unilateral blockade needing catheter manipulation or re-insertion during labor, catheter occlusion, or technical failure due to difficulty. We also excluded the use of an epidural catheter or intrathecal catheter for labor analgesia in cases of accidental dural puncture.

Epidural catheterization was performed only by attending physicians or senior residents using an 18-gauge Tuohy needle and a 20-gauge catheter (Perifix® B. Braun Melsungen AG, Melsungen, Germany). Epidural painless labor was maintained by continuous infusion and patient-controlled epidural analgesia (PCEA) using 0.125% bupivacaine with fentanyl 1.25 μg/mL. For our standard dose of EA for CS, 2% lidocaine only is added or mixed with 0.5% bupivacaine to a total of 20 mL. Whether to combine additional agents such as sodium bicarbonate, epinephrine, or opioid is determined by the attending anesthesiologist. When SA was performed, a standardized dose of hyperbaric bupivacaine 10–12 mg with or without 100–300 μg morphine was administered through a 26-gauge spinal needle (Quincke type point; B. Braun, Spain).

We collected patient data from medical records and divided them into EA and SA groups. The selection of EA or SA was not randomized; it was decided based on the anesthesiologist's experience and the urgency of surgery in different circumstances. If the first attempt of regional anesthesia failed to achieve or maintain adequate sensory blockade, the patient underwent a second anesthesia procedure, such as repeated EA by epidural catheter replacement, repeated SA, or converted to general anesthesia (GA). Patients with successful EA and SA were then compared with each other.

Demographic characteristics, including age, height, weight, nullipara or multipara, cervical os, and data on the American Society of Anesthesiologists (ASA) physical status when performing epidural labor analgesia were collected. The primary outcomes were perioperative events, including time from anesthesia to surgical incision, total anesthetic time for cesarean delivery, hypotension episodes during induction, which is defined as a systolic blood pressure decrease of >20% from baseline, and the amount of perioperative intravenous drug administration, such as ephedrine, adjuvant analgesics (meperidine, fentanyl), and sedatives (midazolam, ketamine, propofol). The secondary outcomes were postoperative events, including the Apgar scores of the neonate recorded at 1 minute and 5 minutes, maternal satisfaction, postdural puncture headache (PDPH) rate, and visual analog scale (VAS) pain scores on postoperative Day 1, if neuraxial morphine was administrated. Maternal satisfaction ranged from 1 point to 5 points, in which 1 point represented extremely unsatisfied and 5 points represented very satisfied. Neuraxial morphine was converted to parenteral morphine equivalent dose (MED) for analysis.[9]

Parametric data are presented as mean ± SD (standard deviation). Statistical analysis was performed using SPSS version 11.0 (SPSS Inc., Chicago, IL, USA); the Student *t* test and Chi-square test were used to compare continuous and categorical variables, respectively. A *p* value <0.05 was defined as a significant difference.

3. Results

This retrospective study recruited 6609 parturients, 2341 of whom had undergone painless labor (35.4%). One hundred and forty parturients were excluded due to an inadequate epidural situation (50 had accidental dural puncture; 50 needed catheter manipulation; 25 needed catheter replacement; and 15 failed to establish epidural painless labor); 334 of the remaining parturients underwent cesarean delivery (15.2%) due to prolonged labor or decreased fetal heartbeat, and 36 of this group who had received primary GA for CS were also excluded from the study. Of the 190 parturients who received SA, 26 were converted to GA, and one received repeated SA. Of the 108 parturients who received EA from an inserted epidural analgesia catheter for EA, 11 were converted to GA, and one received subsequent SA after suboptimal EA. The failure rate for first-time SA and EA was 14.2% and 11.1%, respectively; there was no statistical difference between groups ($p = 0.48$). The final analysis included 163 parturients who had received SA and 96 who had undergone EA (Fig. 1).

The demographic characteristics of age, body height, weight, nullipara or multipara, and cervical os at the time of EA were compared; there was no statistical difference between groups (Table 1).

The time from anesthesia to surgical incision in the SA group was shorter than in the EA group ($p < 0.001$). The total anesthesia time in the EA group was significantly longer than in the SA group (90.72 ± 17.48 minutes versus 84.72 ± 16.04 minutes, respectively). Hypotension episodes were more frequent in the SA group (38.7% vs. 11.1%, $p < 0.001$). The perioperative administration rate of ephedrine was higher in the SA group (65.6% vs. 10.4%, $p < 0.001$), and the administration rate of midazolam was lower in the SA group (2.5% vs. 11.5%, $p < 0.001$). Incidence of perioperative administration of ketamine, propofol, fentanyl, and meperidine were similar between groups (Table 2).

With regard to secondary outcomes, the Apgar scores of the neonates recorded at 1 minute and 5 minutes were similar in both groups ($p > 0.05$). Maternal satisfaction in the SA and EA groups was also similar (3.92 ± 0.45 vs. 3.92 ± 0.43, respectively, $p > 0.05$). One parturient in the SA group developed PDPH (incidence 0.6%), but none was noted in the EA group ($p = 0.44$). One hundred and fifty-one parturients received neuraxial morphine in the SA group, and 84 in the EA group. The neuraxial morphine dose revealed 0.24 ± 0.05 mg in the spinal morphine group and 2.99 ± 0.77 mg in the epidural morphine group. The VAS pain scores in the spinal morphine group on postoperative Day 1 were lower than in the epidural morphine group (1.97 ± 1.14 vs. 2.63 ± 1.49, respectively, $p < 0.001$) (Table 3).

4. Discussion

Regional anesthesia has been demonstrated to be superior to GA for scheduled cesarean delivery.[10,11] In this study, we focused on parturients who received epidural labor analgesia for a period but needed subsequent CS and documented that SA required less time from anesthesia to surgical incision, and less total anesthetic time as compared with EA. However, the SA group presented more blood pressure decrease from baseline and more ephedrine administration and the EA group needed more intraoperative adjunctive medications although only midazolam showed statistical significance. Our findings are similar to those of previous studies comparing primary SA and EA in scheduled CS: a large review of the Cochrane Collaboration reported that SA achieved a faster onset of anesthesia than EA, but that SA required more treatment for hypotension.[12]

In terms of the primary outcomes in our study, we found a propensity toward intraoperative use of fentanyl and midazolam in the EA group, although fentanyl use was not significantly different from that in the SA group. In our hospital, anesthesiologists do not routinely use neuraxial lipophilic opioids with CS parturients to