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ORIGINAL ARTICLE

Minimum local analgesic concentrations of ropivacaine and levobupivacaine with sufentanil for epidural analgesia in labour

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ABSTRACT

Background: Sufentanil is often added to ropivacaine and levobupivacaine to provide epidural analgesia in labour. The aim of this study was to compare the analgesic potencies of epidural ropivacaine and levobupivacaine in combination with sufentanil 0.5 μg/mL, using the minimum local analgesic concentration (MLAC) model with up-down sequential allocation.

Methods: In this prospective study parturients with cervical dilation ⩾ 3 cm who requested epidural analgesia between 0800 and 1500 were enrolled. They were randomly allocated to receive 20 mL of either ropivacaine (group R) or levobupivacaine (group L) both with sufentanil 0.5 μg/mL. Thirty minutes after initial injection a continuous infusion was started and maintained until delivery. The numbers of additional doses of 0.2% ropivacaine and 0.25% levobupivacaine needed to maintain the visual analogue pain score <10/100 mm were recorded. The median effective concentrations were estimated from up-down sequential allocations and overall dose requirements of ropivacaine and levobupivacaine were compared.

Results: 53 women were recruited to the study. The MLAC of ropivacaine was 0.023% w/vol (95% CI, 0.005-0.041) compared with levobupivacaine which was 0.020% w/vol (95% CI, 0.008-0.032). The hourly dose of ropivacaine was 13.3 (SD 5.8) mg/h which was similar to levobupivacaine 14.4 (SD 9.7) mg/h. The total doses used for labour analgesia were 56.1 (SD 32.3) mg of ropivacaine (n = 26) and 58.6 (SD 27.5) mg of levobupivacaine (n = 26).

Conclusion: When sufentanil 0.5 μg/mL was added to either ropivacaine or levobupivacaine for labour analgesia, no significant difference in analgesic potency was observed.

Keywords: MLAC; Epidural analgesia; Ropivacaine; Levobupivacaine; Sufentanil

Introduction

Ropivacaine, levobupivacaine and bupivacaine can each provide effective epidural analgesia during labour. The relative analgesic potencies of ropivacaine and levobupivacaine have been extensively evaluated using the MLAC model with up-down sequential allocation.[1–5] Levobupivacaine has been shown to be similar or slightly less potent than bupivacaine, and ropivacaine less potent than bupivacaine.[1–5]

Motor blockade is an unwanted side effect during labour analgesia. Several studies have reported less motor blockade with ropivacaine than bupivacaine, and this difference has been attributed to pharmacological differences rather than differences in potency.[6–8] Motor block is more frequent when high concentrations of local anaesthetics are used, so the addition of an opioid allowing a lower concentration to be used is beneficial during labour analgesia.[9–11]

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In our institution sufentanil 0.5 μg/mL is added to either ropivacaine or levobupivacaine for labour analgesia, as it has been shown to reduce local anaesthetic requirement and minimise motor block.[12] However, the same study demonstrated MLAC values of epidural bupivacaine, ropivacaine and levobupivacaine when given alone that were considerably higher than those previously reported. This may be explained by the lower epidural volume 10 mL compared to previously published studies using 20 mL.[1–5,13] Consequently we designed a randomized study to compare the MLAC of epidural ropivacaine and levobupivacaine in combination with sufentanil 0.5 μg/mL (10 μg) in parturients requesting relief of labour pain. We used the MLAC model with up-down sequential allocation with a bolus volume of 20 mL.

Methods

The study was conducted at the University Hôpital Maison Blanche of Reims, France, from January to December 2006. After ethical approval by our

institutional review board and written informed consent, parturients in spontaneous labour requesting epidural analgesia were enrolled in this randomized study. Women were eligible if they were 18-40 years of age, American Society of Anesthesiologists class I or II, more than 36 weeks of gestation, cephalic presentation, cervical dilation 3-7 cm, and visual analogue pain score (VAPS) $\geqslant$ 30 mm (0 = no pain, 100 mm = worst pain) before insertion of the epidural catheter. Exclusion criteria were multiple pregnancy, preeclampsia, fetal abnormality, height <150 cm, weight >100 kg,[14] hypersensitivity to local anaesthetics or sufentanil, contraindication to epidural analgesia, or if they had received opioids or sedatives during the previous 12 h. All parturients were included in the study from Monday to Friday between 0800 and 1500. Before insertion of the epidural catheter, a baseline VAPS was recorded during a uterine contraction. Only parturients with a VAPS $\geqslant$ 30 mm during two consecutive measurements within 30 min were eligible for the study.

Before insertion of the epidural catheter, women were allocated to one of two groups by a random allocation table. Group R received 20 mL of ropivacaine (Naropeine®, Lab. Astra Zeneca, Rueil Malmaison, France), and group L 20 mL of levobupivacaine (Chirocaine®, Lab. Abbott, Rungis, France). In both groups sufentanil 10 μg (Sufenta®, Lab Janssen-Cilag, Issy les Moulineaux, France) was added to the local anaesthetic solution. In all cases, a physician who did not participate in the evaluation of epidural analgesia prepared the solutions.

Maternal heart rate, non-invasive blood pressure and pulse oximetry were monitored and a peripheral venous cannula inserted. Epidural analgesia was performed with the parturient sitting. After infiltration with 1% lidocaine, the epidural space was located at L2-3 or L3-4 using loss of resistance to saline (less than 3 mL), with an 18-gauge Tuohy needle. A 20-gauge catheter was advanced 3-5 cm into the epidural space and secured. Parturients were then placed supine with uterine displacement. After negative aspiration of the epidural catheter a 20-mL bolus of the test solution was injected.

The first parturient in each group received a solution of ropivacaine or levobupivacaine at 0.08% w/vol, the lowest MLAC values previously published for these agents. The efficacy of the local anaesthetic solution was assessed 30 min after epidural injection using a 100-mm VAPS scale, then every 30 min until delivery.

- If VAPS decreased to <10 mm at 30 min after epidural injection, the concentration was deemed to be effective and decreased by 0.01% for the next parturient (and by 0.005% if 0.01% was effective).
- When VAPS remained >10 mm 30 min after epidural injection due to no localizing pain, the patient received 8 mL of 0.2% ropivacaine or 0.25% levobupivacaine as rescue, and the concentration was deemed to be ineffective. The next parturient allocated to that local anaesthetic received a concentration increased by 0.01%.
- When patients remained unresponsive to rescue, or had localized pain, the result was rejected and the next patient received the same concentration.
- Those in whom the cervix became fully dilated before 30 min were excluded from the study.

When the concentration of solution was effective 30 min after epidural injection (VAPS < 10 mm), the same solution was continued until delivery at a constant rate of 14 mL/h, and the number of additional boluses as rescue (8 mL of 0.2% ropivacaine or 0.25% levobupivacaine) required to maintain VAPS <10 mm until delivery was recorded. When the concentration of solution was considered ineffective 30 min after epidural injection, a 0.08% solution of the same local anaesthetic was continued until delivery at a constant rate of 14 mL/h, and the number of additional boluses as rescue (8 mL of 0.2% ropivacaine or 0.25% levobupivacaine) required to maintain a VAPS <10 mm until delivery was recorded.

The extent of sensory and motor block was recorded on both sides at 15 and 30 min, and then every 30 min thereafter. The extent of sensory block was assessed by pinprick with a blunted needle in the mid-clavicular line from upper thoracic to lumbar dermatomes. Motor block was evaluated 30 min after epidural injection using the modified Bromage scale (0 = no paralysis; 1 = inability to raise extended legs but ability to move knees; 2 = inability to flex knees but ability to flex ankle; 3 = inability to move lower limbs). Heart rate and blood pressure were recorded every 15 min during the first hour, then at 30-min intervals until delivery.

Maternal satisfaction with labour analgesia was evaluated the following day using a visual analogue score (VAS) scale from 0 to 100 mm (0 = not at all satisfied with pain management, 100 = extremely satisfied with pain management).

Statistical analysis

Demographic and obstetric data were collected and presented as mean (SD) or median (range) as appropriate. The median effective concentrations of ropivacaine and levobupivacaine were estimated from the up-down sequential allocation using the Dixon and Massey formula,[15] from which MLAC values with 95% confidence interval (CI) were determined. We chose a sample size identical to those of the previously published studies of MLAC for labour analgesia. In the second part of the study, the mean hourly doses of ropivacaine and levobupivacaine were calculated in both groups and compared using Student's t test. For comparisons