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ORIGINAL ARTICLE

A comparison of epidural ropivacaine 0.75% and bupivacaine 0.5% with fentanyl for elective caesarean section

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Background: Early studies suggested that ropivacaine had clinical advantages over bupivacaine with respect to cardiotoxicity and motor block, and that it was suitable for epidural caesarean section. This study was set up to compare epidural 0.75% ropivacaine with a popular bupivacaine/fentanyl mixture for elective caesarean section.
Methods: Eighty women having elective caesarean section under epidural anaesthesia were randomly allocated to receive 20 mL of either 0.75% ropivacaine or 0.5% bupivacaine plus fentanyl 100 μg. Supplementation with 2% plain lidocaine was used where necessary. Times were recorded for onset of sensory block, density and duration of motor block, and the need for supplementation.
Results: There was no difference between the groups in the time (mean [SD]) to achieve sensory blockade to cold to T4 (ropivacaine 15.8 [5.6] min, bupivacaine/fentanyl 18.7 [9.1] min, $P = 0.13$) or to S1 (ropivacaine 18.3 [4.6] min, bupivacaine/fentanyl 17.4 [7.6] min, $P = 0.59$), or in the need for supplementation. However, ropivacaine produced a motor block that was denser (median Bromage score ropivacaine 3, bupivacaine/fentanyl 1.5, $P = 0.0041$), and of longer duration (ropivacaine 237 [84] min, bupivacaine/fentanyl 144 [76] min, $P < 0.0001$).
Conclusions: This study suggests that epidural 0.75% ropivacaine without opioid may be used as an alternative to bupivacaine 0.5% with fentanyl for elective caesarean section, but it does not induce anaesthesia any faster and may result in a denser, more prolonged, motor block.

Keywords: Anaesthesia, obstetrical; Anaesthesia, epidural; Caesarean section; Anaesthesia, local: bupivacaine; Anaesthesia, local: ropivacaine

INTRODUCTION

Regional anaesthesia is widely considered the technique of choice for caesarean section, and although *de novo* epidural anaesthesia is currently much less popular than spinal anaesthesia, it is still an important technique.[1]

Of all the solutions in use for providing *de novo* epidural anaesthesia in the UK, the most popular is probably a mixture of 0.5% bupivacaine with fentanyl 50–100 μg. Lidocaine 2% plain or with epinephrine (popular in North America) is rarely used as a first line agent in the UK. However, any mixture of bupivacaine and fentanyl is unlicensed, and since it is not commercially available, needs to be made up on an individual basis. This task is time-consuming and increases the risks of contamination or drug administration errors.

Ropivacaine 0.5% has been shown to be an effective agent for providing epidural anaesthesia for caesarean section, providing similar, satisfactory conditions to 0.5% bupivacaine.[2–4] Other workers have used 0.75% ropivacaine and also found it to be effective.[5–6] Irestedt and colleagues showed that 20 mL of 0.75% ropivacaine was enough to provide satisfactory conditions for caesarean, and preferable to the higher dose of 25 mL that produced excessively high sensory blockade.[5]

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This study was set up to investigate how plain 0.75% ropivacaine (licensed for epidural use in the UK), compared to the popular (unlicensed) bupivacaine-fentanyl mixture when establishing *de novo* epidural block for elective caesarean section. The primary aim was to ascertain if there was any difference in speed of onset between the two solutions, and secondary aims were to compare the success and quality of sensory blockade, and the extent and duration of motor blockade.

METHODS

Following ethics committee approval, this double-blind randomised controlled trial was undertaken at Homerton Hospital. Statistical advice had been sought in the planning stage and power analysis suggested that 32 patients were required in each group to detect a 5-min difference in onset time of sensory blockade (80% power, $P < 0.05$). Eighty pregnant women booked for elective caesarean section were recruited and gave written informed consent. All women were ASA I or II, at $\geqslant 36$ weeks of gestation with a singleton fetus, and over 18 years old. Women in labour, those unable to communicate in English, those who had had significant back surgery, injury or scoliosis, and those known to have an allergy to amide local anaesthetics were excluded. Women in whom there was any concern about fetal well-being were also excluded.

All women were premedicated with oral ranitidine 150 mg and metoclopramide 10 mg. On arrival in the theatre suite they were given 25 mL of 0.3 M sodium citrate orally. Hartmann's solution 1000 mL was given intravenously. The epidural was performed by either a consultant anaesthetist or a trainee with the patient in the sitting or lateral position. The epidural space was identified according to normal practice in the L2-3 or L3-4 interspace with a 16-gauge Tuohy needle, bevel cephalad, using a midline approach, with loss of resistance to either air or saline. An epidural catheter was inserted with 3 cm left in the epidural space, and subjects were then positioned supine with approximately 15° uterine tilt to the left (ensuring that the abdominal bump *looked* displaced), and 5° head-up.

A second anaesthetist, not involved in the study, prepared and administered the study solution according to instructions found within a pre-randomised, sealed, numbered envelope. Subjects were randomly allocated to receive either 20 mL of 0.75% ropivacaine (group R) or 20 mL of 0.5% bupivacaine plus fentanyl 100 μg (group BF). The hubs of the 20-mL syringes were covered with opaque tape to prevent the investigators detecting the difference in volumes administered (20 mL vs. 22 mL). Five minutes after a 3-mL test dose of 2% plain lidocaine had been given by the investigator, the study solution was given by the second anaesthetist who then left the theatre and took no further part in the case. The solution was given slowly over 2 min whilst maintaining verbal communication with the patient. All assessments (preoperative, intraoperative and postoperative) were made by the investigators who were unaware of which epidural solution had been administered. The timing period for the study began once all the study solution had been given.

Electrocardiogram (ECG) and pulse oximetry were started upon arrival in theatre. An automated sphygmomanometer recorded maternal arterial pressures every 5 min. All women received a further 1000 mL of Gelofusin during surgery. Hypotension (systolic pressure <100 mmHg, or a 20% drop from baseline, or symptoms of nausea, dizziness or faintness) was treated using additional fluids and/or ephedrine 3–6 mg boluses.

The extent of sensory blockade was determined using ethyl chloride spray and checked every two minutes until surgery began. Recorded times included the time to achieve bilateral T4 to S1 sensory blockade, and the time the anaesthetists considered the patient ready for surgery ('ready for surgery' time). In line with clinical practice, surgery was not allowed to start until bilateral T4 to S1 sensory blockade and bilateral sympathetic blockade (warm, dry feet) were demonstrated.

If the sensory block was inadequate 20 min after the study solution had been given, or if the patient required intraoperative supplementation of the block, 2% plain lidocaine was given via the epidural route to a maximum of 10 mL. However, if more than 10 mL of 2% lidocaine was required for supplementation the subject was withdrawn from the study and received either spinal or general anaesthesia.

Bilateral motor block was assessed immediately before surgery, at the end of surgery and every 30 min postoperatively until full regression had occurred. A modified four-point Bromage scale was used (grade 0 = able to move hips, knees, feet and lift legs up, grade 1 = able to move knees and feet, grade 2 = only able to move feet, grade 3 = unable to move hips, knees or feet).

During surgery, all women received oxygen ($6\ L\ min^{-1}$) via a Hudson mask until delivery of the baby, whereupon Syntocinon 10 units (in two divided doses) and a single dose of antibiotics (co-amoxiclav 1000 mg/200 mg) were given intravenously. Assessment of the baby, according to obstetric protocol, included routine preoperative fetal heart monitoring using a cardiotocograph, Apgar scores at 1, 5 and 10 min after delivery and umbilical cord gas analysis.

The postoperative analgesic regimen used for all women was standard for this hospital at the time of the study. This comprised intravenous morphine via a patient-controlled device (bolus morphine 1 mg, lockout time 5 min, no background infusion), as well as