Comparison of epidural bolus administration of 0.25% bupivacaine and 0.1% bupivacaine with 0.0002% fentanyl for analgesia during labour

K. S. JAMES, E. McGrady, I. QUASIM and A. PATRICK

Summary
We have compared analgesia during labour provided by two epidural drug regimens, in a double-blind, randomized, controlled study. Group A received 10-ml bolus doses of 0.1% bupivacaine with fentanyl 2 μg ml⁻¹ while group B received 0.25% plain bupivacaine 10 ml. Analgesia provided by both techniques was similar, but women in group A retained motor power in their legs and 60% chose to get out of bed. Duration of labour and time from insertion of the epidural to delivery was similar in both groups, but in group A, duration of the second stage was significantly shorter (P=0.0003; 95% confidence interval (CI) −1.17, −0.27 h) and the incidence of forceps delivery was lower (P=0.032). Maternal satisfaction with epidural analgesia, as assessed by VAS, was higher in group A (P=0.04; 95% CI −0.001, 10.001). (Br. J. Anaesth. 1998; 81: 507–510).

Keywords: analgesia, obstetric; analgesic techniques, epidural; anaesthetics local, bupivacaine; analgesics opioid, fentanyl

Despite providing excellent pain relief during labour, epidural analgesia using local anaesthetic agents alone produces motor block in up to 85% of patients,¹ reduces maternal satisfaction with analgesia,² and is associated with a prolonged second stage and increased incidence of instrumental delivery.³ Epidural opioids offer the possibility of analgesia without motor block but when used alone do not provide satisfactory analgesia throughout labour.⁴⁵ Adding an opioid to local anaesthetic solutions can provide effective analgesia with bupivacaine sparing and a reduction in motor block.⁶⁻⁸ However, most investigators have used a high concentration of local anaesthetic (usually 0.25% bupivacaine) to initiate analgesia, or a larger test dose, for example 1.5–2% lidocaine (lignocaine) or 0.5% bupivacaine, both of which contribute to motor block.⁹ Similarly, the use of epidural infusions may hinder maternal mobility.

Collis and colleagues pioneered the “mobile” epidural using a combined spinal–epidural technique. Analgesia is established with intrathecal bupivacaine 2.5 mg and fentanyl 25 μg, and maintained with epidural top-ups of 0.1% bupivacaine and fentanyl 0.0002%⁹¹¹; almost 50% of women are able to get out of bed at some point during labour.¹⁰ However, problems associated with this technique include technical failure, post-dural puncture headache¹⁰¹¹ and chemical meningitis.¹²

The aim of this study was to compare, in a double-blind, randomized study, a mobile epidural using 0.1% bupivacaine and 0.0002% fentanyl with a conventional epidural using 0.25% bupivacaine throughout labour.

Patients and methods
After obtaining approval from the Hospital Ethics Committee and written informed consent, we studied 80 women requesting epidural analgesia in labour. Women who had been given systemic opioids within 4 h of epidural request were excluded, as were those with cervical dilatation greater than 4 cm.

I.v. access was secured but no i.v. fluid load was given. An epidural catheter was sited at the second lumbar interspace using a standard midline technique with an 18-gauge Tuohy needle. The study was double-blind, with randomization (computer-generated numbers) and preparation of the epidural drug solutions performed by the hospital pharmacy. Women were allocated randomly to one of two groups. In group A, analgesia was established with 15 ml of 0.1% bupivacaine with fentanyl 50 μg and maintained, on maternal request, with bolus doses of 10 ml of 0.1% bupivacaine with fentanyl 2 μg ml⁻¹. In group B, analgesia was established with 15 ml of 0.25% plain bupivacaine and maintained with 10-ml bolus doses of 0.25% plain bupivacaine.

Analgesia was measured using visual analogue scores (VAS) on a 100-mm line and a verbal scoring system (0=no pain or pressure, 1=aware of contraction but not painful, 2=aware of pressure or tolerable discomfort, 3=distressing pain or pressure). Measurements were performed every 10 min until analgesia was established (verbal score of 1), and at 30 min and 1 h after the initial dose. Thereafter, 2 hourly VAS were recorded until delivery.

Motor power was assessed using a modified Bromage score 30 min after each top-up and at each request to get out of bed (score 0=no weakness, able to straight leg raise against resistance, 1=not able to straight leg raise, able to flex knee, 2=unable to flex knee, able to flex ankle, 3=unable to move lower limb). If the mother could straight leg raise against resistance she was allowed to get out of bed. Mode of delivery was recorded, as were time intervals between top-ups, duration of first and second stages of labour, and time from insertion of the epidural until delivery.

Maternal satisfaction with analgesia was assessed using a VAS, 24 h after delivery.

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Statistical analysis was performed using Minitab 9.2. VAS pain scores for each patient were averaged to give one value, allowing comparison of the overall effect of the analgesic regimens throughout labour. Averaging eliminated differences in the length of labour. The calculation was time-weighted to eliminate bias resulting from shorter time intervals between VAS scores initially as analgesia was being established. A standard time interval of 1 h was used. All VAS were multiplied by the fraction of a 1-h time interval they covered (e.g. 30-min time intervals were multiplied by 0.5 and 2 h intervals by 2.0). These derived values were totalled and divided by the length of labour. Results were analysed using a t test for parametric data.

Duration of labour, second stage of labour, time interval from insertion of the epidural until delivery, time interval between top-ups and maternal satisfaction with analgesia were analysed using the Mann–Whitney U test. Chi-square test was used to compare mode of delivery between groups.

Visual analogue scores for pain during labour, obtained using a standard technique of on-demand bolus administration of 0.25% plain bupivacaine (measured from other work) have a mean of approximately 20 mm (so approximately 9 mm). We can assume that if VAS were increased to 30 mm (50% increase), this would be clinically important. To compare the two groups with a power of 0.9 to detect a difference at a significance level of less than 0.05, the sample size required was 35 patients in each group. We studied 40 patients in each group to allow for withdrawals from the study during labour.

Results
Seven women (five in group A, two in group B) were excluded from the study despite good analgesia initially. The threshold for removal was low (women requesting more than two top-ups within 1 h). The length of time in the study before withdrawal for the five women in group A was 2 h 25 min to 7 h 30 min. The two women in group B were withdrawn at 4 h.

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Discussion
We have demonstrated that with an epidural top-up technique using 0.1% bupivacaine with fentanyl 2 μg ml⁻¹, analgesia was similar to that using 0.25% plain bupivacaine, but motor power was retained allowing women to mobilize. There also appear to be beneficial effects on the progress of labour, with a clinically important reduction in the length of the second stage and instrumental delivery rate.

With this technique, 39 of 40 women retained adequate motor power to be judged able to walk and 60% chose to get out of bed during labour. Reduction in motor block allowing independent movement and awareness of contractions without pain has been shown to be popular with mothers. Retention of pelvic floor sensation and motor function may allow appropriate coordinated pushing during the second stage, improving rotation and descent of the fetal head through the pelvis. Epidural local anaesthetic may attenuate endogenous oxytocin production reducing uterine contractility during the second stage. The significantly lower dose of bupivacaine required by women in group A may allow better uterine function and explain the shorter second stage of labour and reduced instrumental delivery rates observed in this study. These are important clinical findings because both a long second stage and instrumental delivery have associated morbidity for the mother, and negatively influence the experience of labour. Although epidural analgesia produces excellent analgesia, this does not automatically produce maternal satisfaction with labour, and less effective methods of analgesia have produced higher satisfaction scores. We demonstrated high maternal satisfaction with both epidural solutions, which was significantly greater in the bupivacaine–fentanyl group.

Analgesia was established (verbal score = 1) by 30 min in all women. Establishing analgesia with an epidural bolus is effective but takes longer than a combined spinal–epidural technique, which has been described widely. However, it avoids the complications of deliberate dural puncture. The time difference between establishing spinal rather than epidural analgesia should be viewed in the context of the duration of labour and the potential complications of the spinal component of a combined technique.

Comparing the two epidural solutions, we showed that the duration of analgesia provided by each top-up was significantly shorter in group A than in group B (table 1). This influences the management of the epidural with more frequent top-ups and care in recognizing block regression to avoid loss of analgesia. However, the benefits of this solution are evident and PCEA or continuous infusion may prevent this potential problem.

In summary, we have shown that establishing epidural analgesia in labour with 15 ml of 0.1% bupivacaine combined with fentanyl 50 μg, followed by top-ups of 10 ml of 0.1% bupivacaine with 0.0002% fentanyl, produced similar analgesia to that obtained from the same volume of 0.25% bupivacaine alone, but motor block was minimized. This may influence the progress of labour, decreasing the duration of the second stage and incidence of instrumental delivery, and produce high maternal satisfaction with the experience of labour.

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References
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