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Combined spinal–epidural analgesia in labour: comparison of two doses of intrathecal bupivacaine with fentanyl

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We have compared intrathecal bupivacaine 1.25 mg and fentanyl 25 μg (group A) with bupivacaine 2.5 mg and fentanyl 25 μg (group B), for combined spinal–epidural analgesia in 49 labouring parturients in a prospective, randomized, double-blind study. Onset and quality of analgesia were similar in both groups, with median visual analogue scale pain scores of 0 achieved in 5–10 min. Median duration of analgesia was longer in group B (median 120 (range 90–120) min) compared with group A (75 (75–105) min) (P=0.013). Median upper sensory level was higher in group B compared with group A at 15 min (T6–7 *vs* T11, P=0.003) and at 30 min (T6 *vs* T11–12; P=0.001). Motor block was greater in group B: seven patients had a modified Bromage score ⩾1 compared with none in group A at 15 min (P=0.017). Group B also had a greater decrease in arterial pressure. Patient–midwife satisfaction scores and other side effects were similar. We conclude that intrathecal bupivacaine 1.25 mg with fentanyl 25 μg provided analgesia of similar onset and quality compared with bupivacaine 2.5 mg and fentanyl 25 μg. Although the duration of analgesia was shorter, the incidences of motor block and hypotension were less with the smaller dose.

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Combined spinal–epidural analgesia is an effective method of analgesia in labour. Intrathecal administration of a combination of local anaesthetic and lipophilic opioid provides rapid analgesia but the optimum dose combination has not been determined.

Collis and colleagues[1 2] popularized the use of bupivacaine 2.5 mg and fentanyl 25 μg. However, in our practice, we observed a substantial incidence of undesirable sensory and motor neural block with this dose which suggested that a smaller dose of local anaesthetic may be better. Therefore, we conducted a prospective, randomized, double-blind study to compare bupivacaine 1.25 mg and fentanyl 25 μg, with bupivacaine 2.5 mg and fentanyl 25 μg, for combined spinal–epidural analgesia in the first stage of labour. Analgesic efficacy, extent of sensory and motor block, side effects and patient/midwife satisfaction were compared.

Patients and methods

After obtaining approval from the Institutional Ethics Committee and with written informed consent, we studied 50 ASA I and II parturients in established labour with cervical dilatation less than 5 cm. Patients who had received i.m. opioids or had pregnancy-induced hypertension, cardiac disease or known fetal abnormality were excluded. Baseline measurements of pain were made using a 100-mm visual analogue scale (VAS) (0=no pain, 100=worst imaginable pain) at the peak of a uterine contraction, and baseline arterial pressure (AP) and heart rate (HR) were recorded.

After i.v. preload with Hartmann's solution 500 ml, combined spinal–epidural was performed at the L2–3 or L3–4 intervertebral space with the patient in the left lateral position. Using a single-space, needle-through-needle technique, the epidural space was first identified with a 16- or 18-gauge Tuohy needle using loss of resistance. A 12-mm 25-gauge Whitacre spinal needle was then passed through the Tuohy needle and the correct position of the tip in the intrathecal space was confirmed by observation of free flow of cerebrospinal fluid (CSF). Patients were allocated randomly, by drawing shuffled sealed envelopes, to receive intrathecal injection of bupivacaine 1.25 mg (0.25% bupivacaine 0.5 ml) with fentanyl 25 μg (group A, n=25) or bupivacaine 2.5 mg (0.25% bupivacaine 1 ml) with fentanyl 25 μg (group B, n=25), both made up to a total volume of 2 ml with saline. Injection of intrathecal drugs was completed over 10 s and patients were turned

Table 1 Patient characteristics (mean (SD or range) except VAS pain scores (median (interquartile range))). $P>0.05$ except*. CI=Confidence interval

	Group A ($n=24$)	Group B ($n=25$)	P	Difference/odds ratio (95% CI)
Age (yr)	28.5 (21–35)	29.1 (20–36)	0.67	–0.58 (–3.30 to 2.15)
Height (cm)	158.8 (5.9)	155.2 (7.5)	0.07	3.58 (–0.30 to 7.45)
Weight (kg)	70.2 (8.3)	65.0 (7.0)*	0.02	5.21 (0.82 to 9.59)
Parity (n)				
P0	20	19	0.73	1.58 (0.39 to 6.48)
P≥1	4	6	0.73	1.58 (0.39 to 6.48)
Gestation (weeks)	40 (1.0)	40 (1.9)	0.15	0.64 (–0.24 to 1.5)
Cervical dilatation (cm)	1.8 (0.8)	2.0 (0.9)	0.39	–0.21 (–0.69 to 0.27)
Baseline VAS pain scores (mm)	83 (77–91)	80 (64–94)	0.41	4 (–5 to 15)
Syntocinon augmentation (n)	17	17	N.S.	0.88 (0.26 to 2.96)

supine onto a wedged pillow after the epidural catheter was secured and dressed. VAS pain scores were recorded by a blinded observer (B. B. L. or a research nurse) every 5 min for 15 min and then every 15 min for 2 h or until the next request for analgesia.

The upper sensory level was determined by loss of discrimination of cold sensation using ice at 15 and 30 min after injection. Motor block was assessed simultaneously using a modified Bromage score (0=able to straight leg raise the whole lower limb at the hip, 1=able to flex the knee but unable to straight leg raise, 2=able to move the foot but unable to flex the knee, 3=no movement of the lower limb). AP, HR and the presence of sedation, pruritus, nausea or vomiting were recorded. All patients were monitored with continuous cardiotocography throughout the study.

At the patient's next request for analgesia, a VAS pain score was recorded and the study was terminated. Continuation of epidural analgesia was at the discretion of the attending anaesthetist. Patients received a follow-up visit after 24 h when a satisfaction score was recorded (verbal rating scale 0–10) and any complications such as post-dural puncture headache were noted. The attending midwives were also interviewed after completion of the study for their satisfaction scores (verbal rating scale 0–10) with combined spinal–epidural analgesia.

Non-parametric data were analysed using the chi-square or Mann–Whitney U tests, and parametric data were analysed with the Student's t test, using SPSS (version 8.0). Pain scores in the first 30 min were analysed by comparing the calculated area under the curve ($AUC_{30\ min}$)[3] of VAS pain scores. $P\leq0.05$ was considered statistically significant.

Results

Forty-nine patients completed the study. One patient in group A was excluded because she required urgent Caesarean section for fetal bradycardia 10 min after starting the study. There were no failures in locating the epidural space or obtaining CSF in any patient. Patients in group A were slightly heavier (mean weight 70.2 (SD 8.3) kg) than those in group B (65.0 (7.0) kg) ($P=0.02$). Other patient characteristics were similar (Table 1).

VAS pain scores in the first 30 min were similar between groups (Table 2). Onset of analgesia was rapid, with median pain scores of 0 achieved within 5–10 min in both groups and there was no difference in the respective $AUC_{30\ min}$ values.[3] Using repeated measures ANOVA for serial measurements, there was no difference in VAS pain scores in the first 30 min between groups ($P=0.47$). Median time to first request for additional analgesia was longer in group B (120 (inter-quartile range 90–120) min) compared with group A (75 (75–105) min) ($P=0.013$).

Table 2 VAS pain scores after injection of intrathecal drug (median (interquartile range)). CI=Confidence interval. Repeated measures ANOVA, $P=0.47$

Time (min)	Group A	Group B	P	Difference (95% CI)
0	83 (77–91)	80 (64–94)	0.41	4 (–5 to 15)
5	0 (0–52)	9 (0–30)	0.69	–20 (–44 to 0)
10	0 (0–12)	0 (0–1)	0.42	–10 (–48 to 0)
15	0 (0–6)	0 (0–4)	0.93	–10 (–60 to 0)
30	0 (0)	0 (0)	0.64	0 (0)

Sensory and motor changes, and side effects are summarized in Table 3. Median upper sensory level was higher in group B compared with group A at 15 min (T6–7 *vs* T11, $P=0.003$) and at 30 min (T6 *vs* T11–12; $P=0.001$). Motor block was greater in group B at 15 min, with seven patients having a Bromage score of 1 or greater compared with none in group A ($P=0.017$). At 30 min, more patients in group B had evidence of motor block compared with group A, but the difference was not significant. The decrease in AP at 10 min was greater in group B (Fig. 1) with a mean decrease in systolic AP of 16 mm Hg compared with 7 mm Hg (group A) ($P=0.024$). Other side effects such as sedation, pruritus and nausea–vomiting were similar. There were no differences in patient or midwife satisfaction scores ($P=0.95$, 0.95, respectively). No patient experienced a post-dural puncture headache or adverse neurological sequelae.

Discussion

Several different drugs and combinations have been described for combined spinal–epidural analgesia in labour. The principal drug providing the intrathecal component of analgesia is the lipid-soluble opioid. Opioids alone, injected intrathecally in the first stage of labour, have variable results

Table 3 Effects of the two different intrathecal drug doses (median (interquartile range)). CI=Confidence interval

	Group A ($n=24$)	Group B ($n=25$)	P	Difference/odds ratio (95% CI)
Median duration of analgesia (min)	75 (75–105)	120 (90–120)	0.01	–15 (–30 to 0)
Median upper sensory level				
15 min				
Right	T11 (T12–T8)	T7 (T9–T4)	< 0.01	4 dermatomes (1 to 5)
Left	T11 (L1–T8)	T6 (T8–T5)	< 0.01	4 dermatomes (2 to 6)
30 min				
Right	T11 (L2–T7)	T6 (T8–T5)	< 0.01	4 dermatomes (2 to 7)
Left	T12 (0–T7)	T6 (T8–T5)	< 0.01	5 dermatomes (2 to 9)
No. of patients with Bromage motor block >0				
15 min				
Right	0	7	0.02	1.39 (1.09 to 1.77)
Left	0	7	0.02	1.39 (1.09 to 1.77)
30 min				
Right	0	3	0.24	1.14 (0.98 to 1.31)
Left	0	3	0.24	1.14 (0.98 to 1.31)
Satisfaction score				
Patient	8 (7.6–9.7)	8 (7.3–10)	0.95	0 (–1 to 1)
Midwife	8.5 (7.6–10)	9 (7–10)	0.95	0 (–1 to 1)

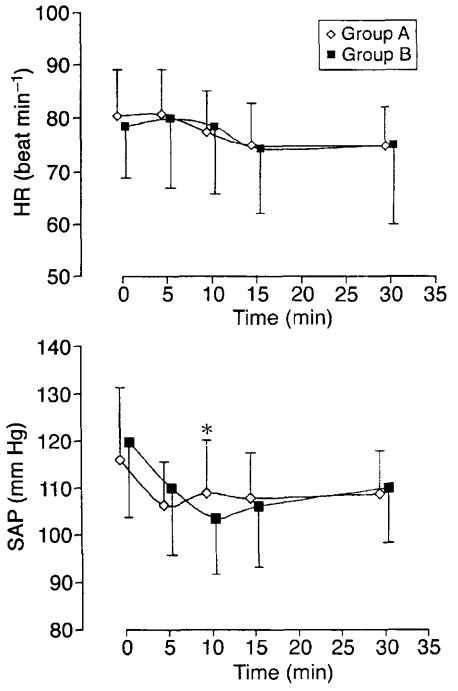

Fig 1 Comparison of the haemodynamic changes between groups at 0–30 min. Changes in maternal heart rate (HR) (top) and maternal systolic arterial pressure (SAP) (mean (SD)). Group A=bupivacaine 1.25 mg and fentanyl 25 μg; group B=bupivacaine 2.5 mg and fentanyl 25 μg. *$P=0.02$.

in terms of onset, efficacy, duration of analgesia and side effects.[4–6] Synergism has been demonstrated when a local anaesthetic is administered together with an opioid,[7] allowing enhanced pain relief with fewer adverse effects. Local anaesthetics are very effective for relieving pain of somatic origin. This is particularly important in late first and second stages when the visceral pain of the early first stage of labour gives way to somatic pain. The ability of spinal opioids alone to effectively control this somatic pain is limited.[5,8] It is not uncommon for intrathecal opioid alone to fail to provide adequate analgesia when cervical dilatation is more than 5 cm, and the parturient complains of unrelieved perineal discomfort. It has been demonstrated that addition of local anaesthetic significantly improves analgesia, with a faster time to onset, greater efficacy and longer duration of analgesia.[9–11]

Collis and colleagues[1,2] described combined spinal–epidural analgesia using a combination of bupivacaine 2.5 mg with fentanyl 25 μg and found it to be superior in terms of faster onset, less motor block and greater maternal satisfaction compared with epidural analgesia maintained with intermittent boluses of 0.25% bupivacaine. They reported a 12.2% incidence of motor block with their intrathecal drug combination.[2] Most published studies of combined spinal–epidural analgesia report the use of sufentanil or fentanyl with bupivacaine 2.5 mg intrathecally,[1,2,12–16] with variable incidences of motor block. We have been using a lower dose of bupivacaine (1.25 mg) combined with fentanyl 25 μg in our local Chinese population to avoid motor block. We have shown in this prospective, randomized, double-blind study that equally effective analgesia was achievable using the smaller dose, with the added benefits of lower incidences of motor block and hypotension.

The rapid onset of analgesia is one of the major advantages of combined spinal–epidural analgesia and is associated with increased maternal satisfaction.[2] The onset of analgesia was equally rapid with both doses of bupivacaine and the two groups achieved median VAS pain scores of 10 mm or less by 5 min (0 mm for group A and 10 mm for group B). Duration of analgesia was longer in patients who received the larger dose of bupivacaine. This was associated with higher dermatome levels of sensory block which was reflected in a corresponding longer time for regression of the block. However, as all patients still required the subsequent use of their epidural catheter to

continue analgesia, the difference in duration of analgesia from the initial intrathecal dose is probably of limited clinical importance. This is supported by our finding of no difference in maternal or nursing satisfaction between the two groups. Epidural analgesia with minimal motor block can be administered with dilute local anaesthetic–opioid mixtures (e.g. 0.1% bupivacaine with fentanyl 2 μg ml^{-1}), given as intermittent boluses or as a continuous infusion.

Preservation of motor power reduces the nursing workload of midwives and the incidence of deep venous thrombosis. Maternal satisfaction with labour analgesia has been demonstrated to be enhanced when mobility is preserved, whether or not they were allowed to walk.[1] A dense motor block has also been implicated to prolong the first and second stages of labour, and to lead to a higher incidence of instrumental and operative delivery.[17] Because we found a lower incidence of motor block with bupivacaine 1.25 mg compared with bupivacaine 2.5 mg, we postulate that the ability of parturients to walk might be improved with the smaller dose. Unfortunately, we were unable to test our patients' ability to walk in this study as ambulation during labour is not encouraged by our obstetricians.

Our results also showed a significantly smaller decrease in arterial pressure with bupivacaine 1.25 mg. This is important clinically as maternal hypotension affects uteroplacental perfusion and may also preclude ambulation.

In summary, we found that bupivacaine 1.25 mg was as effective as bupivacaine 2.5 mg when added to fentanyl 25 μg for combined spinal–epidural analgesia in the first stage of labour, with less motor and sensory block, and hypotension. Onset of analgesia was as rapid and was achieved within 5–10 min. Avoidance of motor block may be beneficial to those parturients who prefer to remain ambulatory, and also to those who may deliver early.

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