Posterior column sensory impairment during ambulatory extradural analgesia in labour

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Summary
Ambulatory or “walking” extradural analgesia in labour has recently gained popularity because of preservation of motor function and subjective somatic sensation in the lower limbs, resulting in increased maternal satisfaction. This is produced by combining dilute concentrations (e.g. 0.1%) of bupivacaine with opioids. Detailed clinical neurological examination after mobile extradural analgesia has not been reported. We have investigated the effect of 0.1% bupivacaine 15 ml and fentanyl 2 μg ml⁻¹ on motor and sensory function in the lower limbs in 50 primigravidae requesting extradural analgesia in labour. This was performed before and 30 min after confirming placement of a lumbar extradural catheter. While power, coordination and reflexes in all lower limb muscle groups remained within normal limits, 66% (n = 33) developed abnormal distal proprioception, 44% (n = 22) had a positive Romberg’s sign and 38% (n = 19) had altered vibration sense. Moreover, 44% (n = 22) said that their legs felt different on standing and they did not feel confident walking unaccompanied. However, this subjective perception correlated poorly with the presence of posterior column sensory signs. Although there was a reduction in pain scores on a visual analogue scale after 30 min (mean 8.85 (SEM 0.3) vs 3.06 (0.3); P < 0.0001), pain increased within 60 min (5.77 (0.45); P < 0.001). (Br. J. Anaesth. 1994; 73: 540-542)

Key words
Anaesthesia, obstetric. Analgesia techniques, extradural.

Conventional extradural analgesia in labour using local anaesthetic solutions is associated with subjective numbness, motor block and a higher incidence of instrumental delivery, all of which tend to reduce maternal satisfaction [1]. Decreasing the amount of local anaesthetic has been made possible by the addition of opioids; this reduces the degree and incidence of motor block [1,2]. Recently, the concept of “walking” or mobile extradural analgesia in labour has arisen by adjustment of the extradural regimen using 0.1% bupivacaine 15 ml with fentanyl 2 μg ml⁻¹; this provides analgesia and allows the parturient to retain the ability to walk [3].

Although testing of motor function and spinothalamic mediated sensation has been documented during extradural analgesia [4], clinical examination of posterior column modalities (proprioception and vibration sense) has not been reported. This form ofafferent input is essential to the physiology of normal walking. The purpose of this study was to conduct a clinical, neurological examination in women before and during extradural analgesia in labour, to assess the effects of a combination of 0.1% bupivacaine 15 ml and fentanyl 2 μg ml⁻¹ on posterior column sensory modalities.

Methods and results
After obtaining local Ethics Committee approval and informed consent, we studied 50 consecutive primigravidae requesting extradural analgesia for labour. Patients with known neurological disease were excluded. All were in established first stage of labour, with 2-5 cm cervical dilatation. Before insertion of the extradural catheter, all patients were observed walking and tested for distal joint proprioception, vibration sense and Romberg’s sign. Arterial pressure values were also recorded, together with peak contraction pain on a visual analogue scale (VAS).

The extradural catheter was inserted at the L2-3 (n = 32) or L 3-4 (n = 18) interspace using an 18-gauge Tuohy needle under aseptic conditions, with patients in the left lateral position. Three minutes after a test dose of 0.5% bupivacaine 3 ml, each received 0.1% bupivacaine 7.5 ml with fentanyl 2 μg/ml⁻¹ in an equal side-to-side bolus (15 ml total). Thirty minutes after insertion of the catheter, the efficacy of the block were assessed by repeating VAS pain scores. With the patient now more comfortable, full neurological examination was performed. Power was graded using the MRC scale. Spinothalamic mediated sensation was tested by a cold ethyl chloride spray and an 18-gauge needle for pinprick
in dermatomal distribution. Co-ordination, tendon reflexes and posterior column modalities were assessed by standard clinical techniques [5]. A proprioception abnormality was defined as an incorrect response in three or more of six tests, while the best of three tests of Romberg’s sign was taken as the result. Vibration sense was tested at four bony prominences in the lower limbs. Standing and recumbent arterial pressure measurements and pain scores were repeated. If analgesia was incomplete, patients were given a side-to-side bolus of plain bupivacaine, as required. Non-normally distributed data were compared using Wilcoxon’s rank sum test and normally distributed data using Student’s t test. Spearman’s rank correlation coefficient was used as appropriate.

There was a high incidence of abnormal findings of posterior column signs, while surprisingly, less than one-third of patients had analgesia on pinprick testing, despite having adequate analgesia for labour. Minimal motor block was observed and all patients had normal (grade 5) or near normal (grade 4) assessments on formal muscle power testing (Table 1). Predictably, there was a significant correlation between the presence of impaired proprioception and a positive Romberg’s sign \((r = 0.6, P < 0.05); 44 \% (n = 22)\) subjectively said that their legs felt “different” on standing and that they would not feel confident walking unaccompanied. However, patients’ subjective perception of their own capability and confidence in standing correlated poorly with the absence of posterior horn sensory impairment \((r = -0.26, \text{ns})\). Vibration sense was impaired more markedly at proximal bony sites (anterior superior iliac spine and tibial tuberosity) in 14 of 19 patients. Arterial pressure values were unchanged. Although initial mean pain scores \((8.85 (8.0 M 3.3))\) were lower 30 min after administration of this regimen \((3.06 (0.32); P < 0.0001)\), they had changed towards their original levels \((5.77 (0.45); P < 0.001)\) within 1 h.

Comment

An extradural regimen of 0.1% bupivacaine with fentanyl 2 \(\mu\)g ml\(^{-1}\) combined with intrathecal 0.25% bupivacaine 1 ml alone, has been found to provide adequate analgesia in labour and allow retention of the ability to walk [3]. In our study, using the same extradural regimen but, without the intrathecal component, we found significant clinical signs of posterior column sensory impairment. This afferent pathway conducts proprioception and vibration sense, which are vital to the mechanism of normal walking, and its impairment may seriously undermine safe mobilization. Moreover, patients’ subjective reports that their legs felt normal on standing correlated poorly with absence of posterior column signs \((r = -0.26)\), suggesting that women may have a false sense of security because of preservation of motor function (grade 4 or 5 in all patients).

Motor impulses are conducted by alpha motor neurones at 70–120 m s\(^{-1}\). Proprioceptive fibres are also rapidly conducting A beta or A alpha fibres, which have a greater baseline rate of discharge, and the frequency of the discharge rate has been shown to be a major determinant of sensitivity to local anaesthetics [6]. Thus proprioceptive fibre conduction is impeded by local anaesthetics while motor fibre conduction is unchanged, despite the fibres being of similar size. We did not find that postural hypotension was a problem.

Pain scores on the VAS were reduced significantly at 30 min relative to pre-extradural values \((P < 0.001)\), but analgesia was consistently suboptimal and pain scores had reverted close to original values within 1 h. This is consistent with the findings of Collis and colleagues [3] who found a mean time between top-ups of 52 min with this regimen. Most of our primigravidae required further top-ups to achieve satisfactory analgesia.

Although the mean sensory level was T10 (range T5–L1), testing to pinprick was normal in a surprisingly high number of patients at 30 min, even when a significant reduction in pain scores was achieved. Uterine pain is transmitted by A delta and C fibres. The former are more sensitive to local anaesthetics, while C fibres tend to conduct pathological pain [7]. The pain of normal uterine contractions may therefore be more readily blocked than pain caused by pressure or distention and may explain the relative preservation of pinprick sensation in the presence of at least partial relief of labour pain.

It is well recognized that preservation of lower limb motor function increases maternal satisfaction with extradural analgesia and labour [1, 2]. However, the combined spinal–extradural approach is associated with a relatively high incidence of postdural puncture headache and a short interval between top-ups [3].

It is desirable that parturients in labour be mobile or at least be able to stand vertically during the first stage of labour. We recommend the sitting or standing position as safer than walking when using this regimen.

We conclude that 0.1% bupivacaine 15 ml with fentanyl 2 \(\mu\)g ml\(^{-1}\) is not safe for mobile extradural analgesia because it caused significant posterior column sensory impairment.

References


