the three dressing groups is shown in Figure 1, with associated values for median and inter-quartile range. Patients in groups T and F had less 'directional' movement than those in group N (P < 0.01: analysis of variance). Only patients in group F displayed less MOVA than those in group N (P < 0.05: analysis of variance).

In patients in group F, MOV A of the epidural catheter tended to be higher in those of greater body mass index (R = 0.27; P < 0.01). No significant correlation was identified between MOVA (groups T and N), or MOV D (any dressing group), and the patient's body mass index.

Comment

The ideal method of fixing catheters would encompass optimal security of the catheter, ease of inspection and maintenance of sterility at the site of insertion. Not only must an application function in dry conditions, but it must retain this efficacy after exposure to blood, perspiration and epidural solution. Placement of a Tegaderm over a loop of catheter (group T) is the routine method of catheter fixation in our hospital. Fixation of a particulate filter (group F) was undertaken to examine whether this stabilized the catheter further. The Niko Epi-Fix (used in group N) is a fixation device that has been introduced recently, specifically for securing an epidural catheter. The cost of this device is comparable to that of the Tegaderm dressing (£1.50 and £1.24 respectively; September 2000).

Outward movement of the epidural catheter was greatest when a Niko Epi-Fix dressing was used to secure the catheter, and was associated with significantly more failures in analgesia. However, when attempting to minimize movement of the catheter irrespective of direction, only the Tegaderm dressing with additional filter fixation confers a significant advantage over the Niko Epi-Fix.

We identified no correlation between epidural catheter movement and the duration of catheter presence, a finding in concordance with earlier work. Additionally, we showed that neither the use of a small skin incision at the site of catheter insertion, nor the selected inter-vertebral level affected movement of the epidural catheter. A previous study demonstrated that body mass index is related to amount of catheter movement. Our data confirmed this association in group F but was unable to show this in the remainder of the patients, perhaps because inadequate numbers of people were studied.

References

1 Bishton IM, Martin PH, Vernon JM, Liu WHD. Factors influencing epidural catheter migration. Anaesthesia 1992; 47: 610–2
3 Philip JH, Brown WU. Total spinal anesthesia late in the course of obstetric bupivacaine epidural block. Anesthesiology 1976; 44: 340–1
5 Hogan Q. Epidural catheter tip position and distribution of injectate evaluated by computed tomography. Anesthesiology 1999; 90: 964–70
The combined spinal–epidural (CSE) technique for initiation of mobile analgesia in labour is now used widely in obstetric anaesthetic practice. It is said to offer the advantages of rapid onset of analgesia via the spinal route with the flexibility of epidural top-ups later in labour or for obstetric procedures. We decided to investigate the possibility of replacing the intrathecal fentanyl usually used with diamorphine to attempt to prolong the analgesic effect without increasing the incidence of side-effects.

**Methods and results**

Local ethics committee approval was granted for this study. Over a 3 month period, all women attending our delivery suite in labour and requesting epidural analgesia were informed about the project. Sixty-two women were recruited. All had singleton pregnancies, were at more than 36 weeks of gestation and had a cephalic presentation. Those who had received opioids within 4 h were excluded.

After i.v. access had been secured, the epidural was sited at L2/3 or L3/4 with the patient sitting. Patients were allocated to one of two groups: group F received isobaric bupivacaine 2.5 mg plus fentanyl 25 μg, total volume 1.5 ml (n=32); group D received isobaric bupivacaine 2.5 mg plus diamorphine 250 μg, total volume 1.5 ml (n=30). The appropriate mixture was injected intrathecally through a 26 G Whitacre needle using a needle-through-needle technique. Cerebrospinal fluid aspirates were tested before and after injection, and the time of injection was noted. The attending midwife was unaware of the group allocation. Pulse, blood pressure and cardiotocograph recordings were carried out as normal.

The times to the first comfortable contraction (freedom from pain regardless of block height; t1) and to first top-up request (t2) were recorded by the midwife. Patients were told to inform their midwife as soon as the pain of contractions recurred. Maternal hypotension (systolic blood pressure less than 90 mm Hg or a reduction of more than 20 mm Hg from baseline or symptomatic), nausea, vomiting, pruritis and fetal bradycardia (less than 100 beats min⁻¹) were recorded and treated if necessary. Proprioception and lower limb power were assessed 30 min after injection using hallux positioning and modified Bromage scoring respectively. All patients were observed every 4 h for 24 h after treatment for evidence of respiratory depression. A respiratory rate greater than 9 b.p.m. was taken as adequate. All subsequent top-ups were opioid-free (0.2% ropivacaine 10–15 ml) to avoid worsening any potential respiratory depression resulting from the intrathecal opioid.

The two groups were similar in terms of age, parity and induction and augmentation rates. Cervical dilation was similar in the two groups (group D, mean 4.0 cm, five patients >5 cm dilated; group F, mean 4.1 cm, seven patients >5 cm dilated). Two women were withdrawn from group D (one anaesthetic failure, one delivery) and one from group F (anaesthetic failure). Results from the remaining 59 patients were analysed using the t test, the χ² test, the Mann–Whitney U-test and the Kruskal–Wallis test as appropriate. The results are summarized in Table 1. A P value less than 0.05 was taken as significant.

Our results show a clear increase in time to first top-up request in group D compared with group F, with no significant difference in onset times. All episodes of fetal bradycardia were transient and required no treatment. All three episodes of maternal hypotension resolved with 500 ml of crystalloid and, in one case, a 6 mg bolus of ephedrine. Pruritis was more common with fentanyl, but only one patient of the five with pruritis required treatment with i.v. naloxone 200 μg. There were no instances of nausea or vomiting requiring treatment. Proprioceptive deficits were uncommon in both groups but modified Bromage scores revealed significantly greater motor loss in the fentanyl

<table>
<thead>
<tr>
<th>Table 1 Results for groups D and F. Data for t₁ and t₂ are mean (SD). Proprioception data are numbers of patients failing x out of 8 attempts (x=0, 1–3, 4+). Modified Bromage score data are numbers of patients in each scoring category (0, 1, 2, 3). *Significant at (P&lt;0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group F</strong> (n=31)</td>
</tr>
<tr>
<td>t₁ (min)</td>
</tr>
<tr>
<td>t₂ (min:s)</td>
</tr>
<tr>
<td>Pruritis (n)</td>
</tr>
<tr>
<td>Fetal bradycardia (n)</td>
</tr>
<tr>
<td>Maternal hypotension (n)</td>
</tr>
<tr>
<td>Proprioception</td>
</tr>
<tr>
<td>Modified Bromage score</td>
</tr>
</tbody>
</table>
group. There were no cases of respiratory depression detected in the 24 h after drug administration in either group.

Comments
This study shows that the use of 250 μg diamorphine, when compared with fentanyl 25 μg, given intrathecally with bupivacaine 2.5 mg does not produce a significant increase in side-effects and carries benefit in terms of prolongation of analgesic action. The onset time is similar in the two groups, the difference being 1.5 min or at most one contraction. A difference was noted in power assessment statistically, but clinically all patients were able to mobilize safely.

The CSE is a technique commonly used to initiate labour analgesia. There is ongoing debate in the literature about whether the benefits offered by this approach to the labouring woman above those seen with a low-dose epidural outweigh the perceived small increase in risk associated with deliberate dural puncture.1-6 This argument has yet to be resolved, but it is clear that an increase in the duration of action of the initial dose results in less breakthrough pain during labour, a factor registered as important in studies of maternal satisfaction.7 The ultimate aim may be a single-intervention method of complete analgesia throughout childbirth, and our study indicates a possible step in the right direction. Decreasing the need for top-ups and associated medical/midwifery interventions may also result in a decrease in staff workload.

The dose of diamorphine used in this study was deliberately low because of worries regarding side-effects, principally pruritus and respiratory depression. Diamorphine was chosen in place of morphine because of its much higher oil/water partition coefficient (morphine 1.4, diamorphine 280, fentanyl 816).8 Doses of 500 μg diamorphine alone have been reported for intrathecal labour analgesia without respiratory depression occurring.9 Morphine has been reported to cause delayed respiratory depression and even apnoea with doses as low as 1 mg intrathecally.8 10 and thus, as a dose of 1-2 mg is reported to be necessary for significant benefit,10 11 it cannot be used reliably and safely in labour. Although we have found no evidence of respiratory depression with diamorphine 250 μg intrathecally, we have not proved conclusively that it will never occur. Care must always be taken in the post-delivery monitoring of these patients.

Recent studies have shown effective analgesia with doses of intrathecal opioid lower than those commonly used.12 It may be that the prolongation of action seen with diamorphine requires less than this 250 μg dose. It may also be that this extension of time to first top-up is increased with a higher intrathecal dose. It seems likely that we have detected an enhanced bupivacaine-sparing effect and that extension of this effect is dependent on local anaesthetic concentration at the effector site combined with improved or prolonged spinal opioid receptor stimulation. To what degree further extension of time to first top-up is possible remains to be elucidated, as does the minimum dose of diamorphine required to produce this effect.

References
1 Collis RE, Davies DW, Aveling W. Randomised comparison of combined spinal epidural and standard epidural analgesia in labour. Lancet 1995; 345: 1413-6
9 Kestin IG, Madden AP, Mulvein JT, Goodman NV. Analgesia for labour and delivery using incremental diamorphine and bupivacaine via a 32 gauge intrathecal catheter. Br J Anaesth 1992; 68: 244-7
10 Abouleish E. Apnoea associated with the intrathecal administration of morphine in obstetrics. Br J Anaesth 1988; 60: 592-4
12 Lo WK, Chong JL, Chen LH. Combined spinal epidural for labour analgesia—duration, efficacy and side effects of adding sufentanil or fentanyl to bupivacaine intrathecally vs. plain bupivacaine. Singapore Med J 1999; 40: 639-43