Randomized study of intravenous fluid preload before epidural analgesia during labour

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We performed a randomized controlled trial of the effect of intravenous fluid preload on maternal hypotension and fetal heart rate (FHR) changes in labour after the first epidural injection. Group 1 (49 women) received 1 litre of crystalloid preload. Group 2 (46 women) received no preload. No statistically significant difference was shown between the two groups for either of the outcomes. Hypotension was found in three women in group 1 and five in group 2 (P=0.4). Deterioration in FHR pattern was found in four women in group 1 and 11 in group 2 (P=0.08). This study has not shown a significant increase in the incidence of hypotension when intravenous preload is omitted before epidural analgesia using a low concentration of bupivacaine during labour. Because of the clinical importance of the difference in the rate of FHR deterioration between the two groups, we continue to administer preload for high-risk cases.

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In 1978, Collins and colleagues† demonstrated a significant reduction in maternal hypotension and fetal heart rate (FHR) changes when 1 litre of Hartmann’s solution was given intravenously as a preload before epidural analgesia with bupivacaine 0.375%. Epidural analgesia is now usually initiated with weaker solutions of local anaesthetic, which may produce less hypotension, so preloading may be unnecessary. We have investigated this hypothesis.

Methods and results

The study was approved by the United Bristol Healthcare Trust Medical Ethics Committee. Healthy labouring women with a singleton cephalic fetus and cervical dilatation ≤8 cm and requesting epidural analgesia were eligible. Women with hypertension, body mass >100 kg or fetal distress were excluded.

The size of the study was based on that of Collins and colleagues,† who studied 104 women. We recruited 100 women. Verbal consent for the study was gained after informing the women about epidural analgesia.

Intravenous access was obtained using a 14 G cannula. Allocation to one of two groups was determined on the basis of a computer-generated list. In group 1, 1 litre of Hartmann’s solution was infused rapidly before the epidural test dose. In group 2, the infusion was run at the slowest possible speed.

The cuff of an automatic blood pressure instrument (Dinamap; Johnson & Johnson, Ascot, UK) was placed on the left arm, and two baseline readings of systolic and diastolic pressure were taken between uterine contractions with the subject in the left lateral position. FHR was monitored continuously with an external ultrasonic transducer and recorded on a paper printout.

Fifteen millilitres of 0.1 or 0.2% bupivacaine containing fentanyl 50 μg was used to achieve analgesia. Bupivacaine 0.1% was usually used if the cervical dilatation was less than 5 cm, otherwise the 0.2% concentration was given. When the epidural catheter was in place, a test dose of either 8 ml of 0.1% or 4 ml of 0.2% solution was given. If there were no adverse effects after 5 min, the remainder of the 15 ml was injected. Blood pressure was measured between uterine contractions every 5 min for 30 min after the test.
dose. If the woman turned over during this period, the blood-pressure cuff was transferred to the dependent arm.

Hypotension was defined as a decrease, in the 30 min after the test dose, of greater than 20% from the lowest baseline systolic pressure. The baseline FHR trace was defined as the 30 min before the test dose, and FHR was then recorded for 60 min after the test dose. Traces were analysed and classified as normal, suspicious or abnormal, according to the scheme proposed by Steer and Daniell, by an obstetrician (MSM) blinded to whether the patient had received preload.

Statistical analysis was performed using the Mann–Whitney test, the chi-squared test, Fisher’s exact test or the t-test to compare physical and obstetric characteristics, the concentration of bupivacaine used, blood pressure changes and the FHR pattern. A probability of P<0.05 was taken as statistically significant.

Of the 100 women recruited, 51 were assigned to the preload group and 49 to the no-preload group. One woman from each group was excluded during the study. One had a placental abruption and Caesarean section, and the other delivered vaginally. One woman in group 1 and two in group 2 were excluded after completion of the study, as they were found to have had abnormal baseline FHR patterns before the epidural. Analysis was performed on a total of 49 women in the preload group and 46 in the no-preload group.

There was no difference in age, height, weight, parity and cervical dilation between the two groups. Hypotension occurred in three women in group 1 and five women in group 2 (Table 1; P=0.4). Hypotension was treated easily in all except for one woman in group 2. She had several episodes of hypotension for the first 40 min after starting the epidural despite treatment with 1.5 litre of Hartmann’s solution and ephedrine 15 mg.

After the epidural, in group 1 the FHR pattern was normal in 32 women, suspicious in eight women and abnormal in one woman; in group 2 the FHR pattern was normal in 24 women, suspicious in 14 and abnormal in two. There were no differences between the two groups with respect to the number of parturients with suspicious or abnormal traces after the epidural (P=0.21).

FHR data were also investigated to detect any change from before to after the epidural. Deterioration occurred if a normal trace became suspicious or abnormal, or if a suspicious trace became abnormal. Data from both before and after the epidural were available for only 72 women. There was no statistically significant difference between the two groups in FHR deterioration (Table 1; P=0.08).

Hypotension and FHR deterioration occurred with similar frequencies in women who received 0.1 or 0.2% bupivacaine.

### Discussion

Collins and colleagues showed a 2% incidence of hypotension in women who had a 1-litre preload versus 28% in a no-preload control group (P=0.005). Using the same definition, we found hypotension in 6% of women who had a 1-litre preload and 10% of women with no preload. The difference between groups was not statistically significant. Although the investigator was not blinded as to which group the woman belonged to, the use of automated blood pressure recording in our study minimized observer bias.

A power analysis of our results showed that 1530 women would have had to be included in a study to determine whether preloading reduces hypotension, with a power of 0.9 and significance level of 0.05. Given that hypotension is infrequent, usually not severe and easily treated, such a study does not seem to be indicated.

Collins and colleagues demonstrated a significant protective effect of preloading on the risk of FHR abnormalities after epidural. These occurred in 12% of preloaded women versus 34% with no preload. We did not show a statistically significant increase in the risk of a deterioration in FHR pattern when preloading was omitted. However, our proportion of cases (11 and 30%) was similar to that of Collins and colleagues. Twenty-three women had FHR traces that were inadequate for interpretation, reducing the power of our trial to demonstrate a significant difference between the two groups. On the basis of our results, we would have to study 200 women to demonstrate a real difference in FHR deterioration with a power of 0.9 and significance of 0.05.
Intravenous preload during labour

Early studies suggested a link between maternal hypotension after the use of labour epidurals and FHR abnormalities, but women were managed supine, leading to aortocaval compression. More recently, Collins and colleagues and Palmer and colleagues did not find a relationship between hypotension and FHR abnormalities. Only one of the women in the present study who developed hypotension had a worsening FHR pattern.

The manner in which preloading might protect against FHR changes is not clear. Steiger and Nageotte found that an increase in uterine baseline tone and contraction frequency after epidural analgesia, rather than hypotension, was associated with subsequent FHR abnormalities. As Cheek and colleagues demonstrated a reduction in uterine contraction frequency after a 1-litre preload, the administration of a preload might balance a tendency towards an increase in contractility of the uterus after regional analgesia.

The clinical importance of the majority of FHR changes after epidural block is also uncertain. Although the method of FHR analysis used by Collins and colleagues is not directly comparable with that which we used, very few cases from either group in their study had unquestionably pathological features. We found only one abnormal trace in our preload group and two in the no-preload group. Spencer and colleagues noted that the use of epidural analgesia was associated with an increased rate of FHR abnormalities, but not with fetal acidosis.

In summary, we found that omitting intravenous fluid loading before epidural analgesia in normotensive labouring women did not increase the incidence of hypotension significantly compared with women given a 1-litre preload. However, fluid administration before epidural may protect against FHR deterioration, possibly through a transient tocolytic action. Until further data are available, we suggest that intravenous preloading is used before epidural analgesia in labour when there is suspected or actual fetal compromise.

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References
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