REPLY

Drs. Smelt, de Lange and Booij have written in regard to changes in end-tidal carbon dioxide following both air embolism and alterations in cardiac output. In Figure 1, they have shown a decrease in $ETCO_2$ and a marked rise in PAP, without change in either CVP or arterial pressure. Figure 2 shows a minor decrease in $ETCO_2$ and a marked fall in systemic pressure. It is unfortunate that they make no comment regarding:

(i) volumes of air required to give the pattern seen in Figure 1, and

(ii) any alterations in cardiac output.

The change in cardiac output is obviously the important aspect of this whole question.

Small emboli may be sufficient to cause local changes to PA pressures without significantly altering central venous or systemic pressures or affecting cardiac output. Conversely, larger emboli may cause changes in both PA pressure and cardiac output, with secondary alterations in central venous and arterial pressures. The time course for resolution of haemodynamic insult and return to "normal" of $ETCO_2$ may be quite different, as was evident in our original article.

The possibility of imprecise placement of the precordial doppler probe has been raised; however, it did detect the changes in heart sounds, but only where arterial pressure and presumably cardiac output were falling. The difficulties in reliably placing the doppler in all instances (e.g. prone or sitting) should make one hesitant about its sole use to detect embolism. I would suggest an end-tidal monitor is both easier to place and more consistently reliable.

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Epidural morphine for postoperative analgesia

To the Editor:

We read with interest the paper by Writer *et al.*,[1] which reported the results of a multicentre study of epidural morphine for postoperative analgesia. We are in entire agreement with their hypothesis that continuing analgesia from longer acting local anaesthetic agents, such as bupivacaine, allows time for epidural morphine to reach peak effect. Bupivacaine (0.5%) and lidocaine (with 1:400,000 epinephrine) are the local anaesthetic agents most frequently used in epidural anaesthesia for Caesarean section, in our institution. Only very rarely is any request made for analgesia as the epidural block regresses.

We are interested in their observation that 2 of the 103 patients (2%) who had abdominal surgery and 2 of the 35 patients (7%) who had lower limb orthopedic surgery developed clinically significant bradypnea. It would be of interest to know the nature of the abdominal surgery done on the 2 patients, in that group, who developed bradypnea; and whether they had received any other medication. The protocol in our institution requires that the anaesthetist on duty be informed of any patient with a respiratory rate of less than 10/minute, after receiving epidural morphine. We have used this technique for post-Caesarean section analgesia in over 3000 patients, only 2 of whom developed bradypnea. Neither of these patients was distressed, cyanosed or exhibited any other signs of hypoventilation or hypoxia. One patient was noted to have a respiratory rate of 9/minute about 5 hours after receiving 5 mg epidural morphine. She received 2.5 mg droperidol intra-operatively and 3 mg perphenazine (in 1 mg doses) in the recovery room. She was given naloxone 0.15 mg I.V. on two occasions, with no immediate change in respiratory rate; suggesting a droperidol and/or perphenazine effect.

The other patient was observed by the nurse, on a routine visit, to have a respiratory rate of 8/minute, while asleep, 12 hours after epidural morphine (5 mg) had been administered. Again there was no other clinical evidence of hypoventilation or hypoxia. She was easily roused and in no distress. However, she was given 0.1 mg naloxone I.V., with immediate and sustained increase in her respiratory rate. She was noted to have received dimenhydrinate for nausea, 1 hour prior to the bradypnea.

It would appear that parturients, who are young, are generally in good health and tend to receive little intercurrent medication, are less prone to develop delayed respiratory depression after receiving epidural morphine. They do seem to have a higher incidence of pruritus (mainly in the distribution of the trigeminal nerve), but this is usually mild.

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