FIGURE System components. See text for details.

ing its purpose quite simply. A PEEP unit to maintain oxygenation of the nondependent lung during surgery can be composed of a Boehringer PEEP valve, Rackow elbow with sampling port, 15 mm endotracheal tube adapter, oxygen tubing and tank, and optional IV tubing connector (Figure). The device functions well when positioned perpendicular to the surgical table, usually taped in place. An oxygen flow rate of $4 \text{ L} \cdot \text{min}^{-1}$ is usually sufficient to maintain the desired level of PEEP. Periodic inflation of the nondependent lung, if desired, may be performed by occluding the outlet of the PEEP valve with a thumb, similar to operating an Ayre's T-piece. One must, therefore, keep the valve in view so that the outlet is not unintentionally occluded, causing lung expansion into the surgical field, or possible barotrauma. We have used this device for several months and appreciate its utility and simplicity.

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Epidural test dose in obstetrics

To the Editor

I greatly admired the comprehensive review of this topic by Drs. Dain, Rolbin and Hew¹ and the supportive Editorial by Dr. Biehl.² I cannot, however, agree with them regarding the advisability of injecting a test dose before each top-up, especially in the context of topping up conducted by midwives or nurses, and equally definitely in regard to their advocacy of the use of hyperbaric lidocaine for the procedure.

To date (end 1987) we have provided a continuous epidural for over 31,500 labouring mothers. Approximately 126,000 top-ups will have been given by our midwives during the course of these procedures. Throughout this period we have encountered three occasions on which bupivacaine was, subsequent to the first formal dose (always given by the anaesthetist), directly injected into the blood stream (twice) or the CSF (once): incidences respectively of 1:63,000 and 1:126,000 maintenance top-ups.

The main concern displayed by Dain *et al.* appears to be with the danger of an inadvertent intrathecal injection, hence their tentative support of the advocacy that 1.5 per cent lidocaine in 7.5 per cent dextrose might be the ideal solution, although currently they consider 30-50 mg in a one to two per cent solution is the test dose of choice. Contrary to the opinions expressed by Dain *et al.* and by Biehl, I do not believe that the test doses they describe will inevitably afford evidence of an inadvertent intravascular injection. We have encountered cases of peri-oral tingling and other signs which have led us to re-insert the epidural catheter, but our one case of massive intravascular injection of bupivacaine given on the initial injection occurred despite the fact that a test dose of 2 ml, 1.0 per cent lidocaine five minutes previously had evoked no response.³ Incidentally, I whole-heartedly support those who decline to include epinephrine in the test dose, for reasons well presented by Dain *et al.*

If, then, hyperbaric lidocaine is to be used to define an inadvertent intrathecal injection, for obvious reasons the mother must be sitting upright during the injection and for several minutes after. Additional to the fuss involved in the inspection, identification (by a witness) and injection of two different solutions, such a procedure will inevitably make considerable extra demands upon midwifery time, as well as causing the mother some stress (she might well have to be helped from, and then back to, a lateral horizontal position). All to avoid a complication with an incidence of one in an eighth of a million.

Again, such a procedure is itself not free from potential hazard. We have administered approximately 1500 spinal anaesthetics in this hospital - admittedly a much smaller

experience than that of the majority of North American Obstetric Units. We invariably use five per cent lidocaine in six per cent dextrose 1.2–1.5 ml, injected whilst the mother sits upright. On two occasions the block has extended so far cephalad that tracheal intubation and assisted ventilation has been required. Why invite such a complication?

I agree that it is advisable to attempt to aspirate before injecting through the cannula (we never administer single shot epidurals via a needle), but, of greater importance, I emphatically support the advocacy of your contributors that top-ups must be given in increments. Our maximum volume of bupivacaine injected at any one time has, for several years, been 5 ml. It is somewhat anomalous that we impose that maximum irrespective of whether the solution is 0.25 per cent or 0.5 per cent, but that is another matter for debate. I believe that to be the most important safety measure in our practice – a limitation of potential hazard rather than an avoidance. We do still employ a test dose (2 ml, 1.0 per cent lidocaine plain) before giving the first formal dose of bupivacaine, but I doubt that it has much value, other than ensuring that the cannula is patent, and does not become clogged up with protein before all is ready to continue with the procedure.

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REPLY

We would like to thank Dr. Crawford for his compliments on our article. We agree with Dr. Crawford that appropriately trained nurses and midwives should be allowed to top up an epidural anaesthetic. We believe that it is prudent that these individuals should use a test dose, but the ideal test dose has yet to be defined. We were using 1 ml of five per cent lidocaine with 7.5 per cent dextrose but this proved unsatisfactory because of too profound a motor block.

Currently, we are using 2 ml of two per cent isobaric lidocaine HCL. This should be more effective in detecting intrathecal or intravenous injections than the dose used by Dr. Crawford. However, it is not sufficient to detect all cases of

intravascular injection. Thus we believe that nurses and midwives should give the local anaesthetic fractionated into small volumes.

The question, of single shot epidurals has been thoroughly reviewed in our recent reply in the May issue to a letter from Drs. Gambling and McMorland. We continue to practise and teach the use of the single shot epidural in those situations where we believe that it is indicated.

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REPLY

Dr. Crawford's chief concerns with the recommendations for epidural test doses in the article and editorial were: (1) the use of test doses prior to top-ups and (2) the use of hyperbaric lidocaine. Dr. Crawford's statistics concerning the safety of midwives doing top-ups are impressive and illustrate that with careful attention to technique both inadvertent subarachnoid and intravascular injections are indeed rare. Later on in his letter he mentions dividing the top-up doses into 5 ml aliquots and injecting with a time interval between each aliquot. This, in reality, accomplishes what a test dose would do, i.e., inject a small enough amount of local anaesthetic so that serious complications will not occur but will establish the type and degree of block. What the technique is called doesn't really matter. The objective is the same.

The suggestion of using hyperbaric lidocaine, I think, is still a good one on theoretical grounds at least. This does not mean that you would never get a high block, but rather that it would be less likely with a hyperbaric solution than an isobaric solution. The example quoted by Dr. Crawford was a high spinal block obtained after injection of 1.2–1.5 ml of five per cent lidocaine in six per cent dextrose. This represents 60–75 mg of lidocaine. We suggested a hyperbaric solution of 1.5 per cent lidocaine in 7.5 per cent dextrose with a volume of 2 ml for a test dose. This is 30 mg of lidocaine which, on theoretical grounds at least, would block fewer dermatomes and might not extend to any of the thoracic dermatomes if the mother was in a head up tilt of 15–20° – a common position in labour at least.

The last paragraph of Dr. Crawford's letter nicely illustrates the difficulty with the whole topic of test doses. He admits, despite all arguments against its usefulness, that anaesthetists in his unit still use a lidocaine test dose for labouring patients prior to injecting bupivacaine. Most of us, I think, practice in a similar fashion. Although we don't expect it to be foolproof, the test dose may partly reassure us that we are proceeding cautiously and trying to eliminate even rare complications. This is still a worthwhile goal.

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