Abdominal subcutaneous emphysema: an unusual complication of lumbar epidural block

To the Editor:

Subcutaneous emphysema is a rare complication of epidural anaesthesia. Laman and McLeskey first reported a case of cervical and supraclavicular subcutaneous emphysema associated with lumbar epidural block in a parturient.¹

We recently anaesthetized a healthy 20-year-old male who was admitted to the hospital after a road traffic accident. No signs of abdominal trauma were noted. The patient had an open fracture of the upper right tibia and fibula and a closed fracture of the right lateral malleolus. Pulmonary and cardiovascular examination were normal. The supine blood pressure was 120/70 mmHg and the pulse was regular at 92/min. In the Emergency Room the patient received morphine 10 mg IM for pain relief and was transferred to the Operating Room for open reduction of his fractures.

Lumbar epidural anaesthesia was initiated with the patient in the lateral position, after a "preload" of 1000 ml lactated Ringer's solution, to prevent arterial hypotension. The epidural space was identified at the L₃-L₄ level using the loss of resistance technique, with air. No blood, CSF or air was obtained on aspiration. No side effects were noted following injection of a test dose of 3 ml lidocaine one per cent. Twenty ml of bupivacaine 0.5 per cent with adrenaline 1/200,000 was injected through the needle and an epidural catheter was easily inserted cephalad, 3 cm beyond the tip of the needle.

After surgery was completed the anaesthetist palpated crepitus of the right abdominal wall, extending from right inguinal area to the upper abdomen, at the level of the 12th right rib. Physical examination of chest and abdomen was performed again. A chest x-ray confirmed absence of a pneumothorax, but free air was seen in the abdomen, in the region of the T₁₀-L₁ vertebrae. Because of suspected duodenal rupture, a CT scan was done, which confirmed subcutaneous air to be present in the epidural space around the bodies of T₁₀-L₃ and subcutaneous air predominantly in the lower abdominal wall.

With the use of the loss of resistance technique and the injection of 10-30 ml of air into the epidural space, air may possibly pass out through the patent intervertebral foramina present in young subjects, into the paravertebral spaces, along the spinal nerves, producing pockets of air around the bodies of the vertebra and the muscle inser-

tions on these bodies. The lateral limits of the epidural space, the pedicles of the vertebrae and the intervertebral foramina can be well recognized on a CT scan. This is the most probable route of spread of anaesthetic solutions and, occasionally, injected air.

Air-containing cavities of the body may initially be expanded by the entry of nitrous oxide.^{2,3} Expansion of distended gut, pneumothorax and air encephalograms will occur if nitrous oxide is used. N₂O is therefore contraindicated in these conditions.^{4,5} Appearance of subcutaneous emphysema during surgery, particularly after trauma, can produce diagnostic dilemmas. The use of N₂O to supplement epidural anaesthesia is likely best to avoid because of the danger of air expansion in the epidural space.

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REFERENCES

- 1 Laman EN, McLeskey C. Supraclavicular subcutaneous emphysema following lumbar epidural anesthesia. *Anesthesiology* 1978; 48: 219-21.
- 2 Collins VJ. Principles of anesthesiology. 2nd Ed., Philadelphia, Lea & Febiger, 1979.
- 3 Churchill-Davidson HC. A practice of Anaesthesia. 5th Ed., Lloyd-Luke Ltd., London, 1984.
- 4 Saidman LJ, Eger E. Change in cerebrospinal fluid pressure during pneumoencephalography under nitrous oxide anesthesia. *Anesthesiology* 1965; 26: 67-72.
- 5 Powner D, Snyder JV, Morris CW. Retroperitoneal air dissection associated with mechanical ventilation. *Chest* 1976; 69: 739-42.

"Single-shot" epidural anaesthetics

To the Editor:

In their recent review article on the epidural test dose in obstetrics,¹ Dain *et al.* discuss the safety of "single-shot" versus continuous epidurals. They state that the reported incidence of complications is the same whether an epidural catheter is used or not. This may be so, but our concern is whether there is anything to be gained from using a "single-shot" technique in the obstetric setting.

In patients undergoing Caesarean birth under epidural

anaesthesia, it is impossible, in our experience, to predict accurately the volume of local anaesthetic that any one patient will need in order to produce an adequate sensory level of analgesia. There is marked individual variation in the rate and extent of spread of anaesthesia which seems to bear little relationship to height or weight. Having an epidural catheter in place will allow suitable operating conditions using a minimal dose of local anaesthetic solution, by giving small incremental boluses. In addition, catheter placement provides a means of administering perioperative epidural narcotics, which enhance the quality of pain relief, both intraoperatively and postoperatively.

During labour we can not envisage a clinical situation where a "single-shot" technique would have an advantage over a catheter-administered dose. On the contrary, having an epidural catheter in place allows pain management throughout the whole of labour, providing a means of correcting "missed segments" and persistent low back pain. It also allows the anaesthetist to provide analgesia for operative procedures which may be necessitated during the second and third stages of labour.

While Dain *et al.* feel comfortable with this technique, we feel that the "single-shot" epidural has no place in modern obstetric practice. Although we acknowledge reported catheter-related complications, there have been no serious complications from epidural catheter insertions in our hospital, and we regard it as a safe and versatile technique.

Finally, if time is so critical a factor that the short delay caused by a test-dose is unacceptable, we wonder whether an epidural block is the anaesthetic technique of choice. If the anaesthetist feels that an extra few minutes of labour pain is too high a price to pay for giving a test-dose, then by increasing the pH of the local anaesthetic solution the analgesia onset time can be almost halved.²

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REFERENCES

- 1 Dain SL, Rolbin SH, Hew EM. The epidural test dose in obstetrics: is it necessary? *Can J Anaesth* 1987; 34: 601-5.
- 2 McMorland GH, Douglas MJ, Jeffery WK *et al.* Effect of pH-adjustment of bupivacaine on onset and duration of epidural analgesia in parturients. *Can Anaesth Soc J* 1986; 33: 537-41.

REPLY

Thank you for the opportunity to reply to the letter from Drs Gambling and McMorland.

Like everyone, we are concerned that the procedure of epidural anaesthesia be as safe as possible. The critical question is whether or not a single shot epidural is as safe as an epidural administered via catheter. We believe the burden of proof is on those experts who advocate the use of epidural catheter in all circumstances and teach the abandonment of the single shot epidural technique. We know the single-shot technique has a proven record of safety.^{1,2} In fact, Mount Sinai Hospital, in Toronto, never had a significant neurologic complication until we began using epidural catheters.

Epidural catheters introduce complications that are not inherent with the single-shot technique. They kink, they knot, they cause paresthesiae and may "wrap-around" nerve roots. They traumatise blood vessels and sometimes fail to thread at the most inconvenient times. They may also migrate into the subarachnoid space after we have been lulled into a false sense of security. It seems obvious that if the single-shot epidural technique provides equally good anaesthesia, and is as safe as the catheter technique, it should be used when clinically indicated.

Epidural catheters should only be inserted if their use improves safety (we maintain that this is not proven) or introduces a new dimension for the technique, e.g., it allows the use of post operative epidural narcotics.

Those experts who advocate abandoning the single-shot technique do themselves and the profession a disservice, since the technique has a proven safety record. They should recognize that there is room for the opinion of colleagues whose clinical experience is at least equal to their own.

The single-shot epidural technique may be used with advantage in short surgical procedures - e.g., haemorrhoids, orthopedics and in gynaecology. Its use in obstetrics is being questioned by Gambling and McMorland for two reasons: (1) "it is impossible to accurately predict the volume of local anaesthetic that any patient will need" and (2) "during labour we cannot envisage a clinical situation where a 'single-shot' technique would be an advantage over a catheter technique."

We beg to disagree that it is impossible to predict the level of analgesia that any one patient will need for a Caesarean delivery. Sharrock and Greenridge showed a positive linear correlation between volume of local anaesthetic injections and anaesthetic levels in both pregnant and non-pregnant patients.³ Sharrock suggests that rather than calculate the volume to be injected, one should choose a unitary value, e.g., 20 or 25 ml which always provides complete analgesia. Also, Santos *et al.* found a correlation between vertebral length and volume of local anaesthetics required to produce epidural anaesthesia in parturients.⁴ This is further evidence that allows one to predict the volume of anaesthetic required to predictably provide a required level of analgesia.

Our experience has shown that 25 ml of lidocaine two per cent with 1:200,000 epinephrine or an equivalent drug will provide adequate pain relief for Caesarean section. If the patients are short (less than 5'2") then we decrease the volume by 25 per cent. This technique has been used successfully and safely in thousands of patients at Mount Sinai Hospital, Toronto. Recently we have started to introduce catheters (after the single-shot dose) to allow the use of epidural morphine for postoperative pain relief.

Obviously a "single-shot" technique is not used in the first

stage of labour, but towards the end of labour when delivery is anticipated in 20 minutes, and the patient is judged to be "at the end of her tether," a single-shot technique may be used. We submit that the "catheter and test dose technique" significantly delays the onset of relief in these patients and thus causes unnecessary pain and distress, without the proven benefit of an increase in safety margin.

There are occasions as well when because of technical difficulty we are thankful to have identified successfully the epidural space with the Tuohy needle. At this point, some of us would not wish to risk traumatising a blood vessel in the epidural space prior to injection of a dose of local anaesthetic sufficient to provide pain relief.

We are reluctant therefore to completely abandon an otherwise excellent technique. The incidence of complications when a test dose is given is similar to the incidence when a "single-shot" epidural technique is used. We will continue to practise and to teach the use of the single-shot epidural in those situations where we believe that they are indicated.

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REFERENCES

- 1 Eisen SM, Rosen N, Winesanker H *et al.* Routine use of lumbar epidural anaesthesia in obstetrics; a clinical review of 9,532 cases. *Can Anaesth Soc J* 1960; 7: 280-9.
- 2 Hellman K. Epidural anaesthesia in obstetrics: a second look at 26,127 cases. *Can Anaesth Soc J* 1965; 12: 398-403.
- 3 Sharrock NE, Greenridge J. Epidural dose responses in pregnant and non-pregnant patients. *Anesthesiology* 1979; 51: S224.
- 4 Santos D, Jieja N, Denson D, Nicholson C, Bridenbaugh P. Is there a correlation between vertebral length and volume of local anaesthetic required to produce epidural anaesthesia? SOAP (Presented at 1986 meeting).

The epidural test dose and the identification of rare events

To The Editor:

In the review article, "The epidural test dose in obstetrics: is it necessary?", Dain *et al.*¹ evaluated the use of epinephrine 15 µg as a test for inadvertent intravascular injection during the performance of an epidural anaesthetic. The false positive rate was quoted as 12 per cent (i.e., specificity = 88 per cent). Dain *et al.* then concluded that "this implies that in 12 per cent obstetrical patients, the catheter would be removed unnecessarily." This statement is wrong; in fact a much higher percentage of

patients would be misdiagnosed as having an intravascular injection.

The correct analysis using the data given in the review article is as follows. The incidence of intravascular placement of an epidural catheter is 0.01 to 4 per cent. Using the midpoint figure, the probability of intravascular placement in any one patient is two per cent, in the absence of any information from test doses.

In a random group of 100 patients, then, only two will have intravascular placement. Since the sensitivity of the test is 50 per cent (given in the article), one of the two will test positive. On the other hand, of the 98 patients with correct epidural placement, 12 will have a positive test (because of the false positive rate).

This means that in 100 patients, 13 will have a positive response to testing for intravascular placement. However, in only one of these thirteen will the positive test actually predict a real catheter misplacement, i.e., the positive predictive value of this test is 1/13, or only 7.7 per cent.

In contrast, 12 of 13 patients, or 92.3 per cent, will have had their catheters removed unnecessarily. This figure, which is much higher than that of Dain *et al.*, implies that the routine use of a test dose for intravascular injection is even less useful than they suggest.

Note that this conclusion is for the use of a test dose as a means of detecting intravascular injection. For test doses to detect subarachnoid injections, the predictive value can be shown to be much higher, and therefore to be more useful.

The above analysis suggests several interesting points regarding the use of a clinical test as an indicator or predictor of the occurrence of an event. Firstly, the sensitivity or specificity of the test is commonly confused with its positive predictive value. Sensitivity can be defined as the probability of obtaining a positive test result if the event under test is already known to have occurred; similarly, specificity is the probability of getting a negative test if the event is known to have not occurred. Since the occurrence or non-occurrence of an event is not known in clinical settings, sensitivity and specificity are not parameters with direct interpretations at the bedside. On the other hand, the positive predictive value is the probability of the occurrence of the event if the test is positive; this is obviously of more immediate clinical relevance. The three parameters are related, as the previous calculations showed, or more elegantly by use of Bayes' theorem.

Secondly, unlikely occurrences remain unlikely even in the face of a positive test, unless the test has a specificity close to 100 per cent. In the case of epidural test doses, the pre-test probability of intravascular injection, two per cent, increases only to 7.7 per cent after a positive test response.