$$\text{Isoflurane } P > 0.452 \frac{\dot{V}CO_2}{\dot{V}},$$

which is 0.018% using the above assumptions

It can be seen that for enflurane and isoflurane, the total cost will always be an increasing function of fresh gas flow, because their critical concentrations are far below clinically useful concentrations.

Leonard B. Eisen MD FRCPC
Joseph A. Fisher MD FRCPC
University of Toronto
Mount Sinai Hospital Department of Anaesthesia
Toronto, Ontario

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REPLY

I am most grateful for this letter. The authors have taken a formula strictly limited to the calculation of the cost of the halogenated agents and used it to ask another question. What is the cheaper way to prevent rebreathing of CO_2, run rapid flows of fresh gas, or mop it up with soda lime and reduce vapour costs?

At equivalent MAC levels, halothane, enflurane, and isoflurane cost in the ratio of 1, 19, and 22. The authors have found that for the two more expensive agents, it is always cheaper to run low flows and consume soda lime. They have elegantly calculated that if you run the cheapest agent, halothane, at 1/3 MAC or lower, you can save money by having a flow rate equivalent to the minute ventilation.

All of us have ignored the cost of oxygen and nitrous oxide. I ignored it because I was mainly interested in comparing narcotic versus vapour costs, where the nitrous and oxygen costs would be similar.

In the extended analysis above, it is interesting to consider the oxygen and nitrous costs.

Oxygen is cheap. At about 20 to 25 cents per thousand litres, in the hypothetical anaesthetic given above, even at 5 $L \cdot min^{-1}$, the oxygen cost would be only two or three cents.

I have been surprised to discover that nitrous oxide is actually quite expensive, costing some 50 to 60 dollars for about 30 kilograms of liquid. This works out to about one third of a cent per litre of gaseous nitrous oxide. If 200 of the 300 litres of fresh gas flow in the hypothetical example above were nitrous oxide, this would cost 67 cents roughly, in other words, the nitrous oxide would cost as much as the halothane (even at 0.77%).

So what Drs. Eisen and Fisher might add is another linear term to their total cost CT, which would be CN, the cost of the nitrous oxide, where

$$CN\ (cents) = FTPn/3$$

and Pn is the proportion of fresh gas that is nitrous oxide, usually about 0.7 in most anaesthetics.

This is a big term. It lowers the "critical concentration" of halothane, below which a negative slope for $F < \dot{V}$ is seen, to about 0.03%, away below a clinically useful concentration.

Hence putting all this together, we see that to save money, it is cheaper to run gas flows as low as possible, in essentially all situations, and to use halothane.

P. Dion
Department of Anaesthesia
St. Catherine's General Hospital
Ontario

An accidental subdural injection of a local anaesthetic resulting in respiratory depression

To the Editor:

Accidental subdural block is a rare complication of epidural anaesthesia. The most common feature is an unexpectedly wide spread of sensory block, which is not usually accompanied by apnoea.[1] We report a case in which life-threatening respiratory depression was observed immediately after large doses of a local anaesthetic had been injected accidentally into the subdural space.

A 19-year-old, 81-kg man was scheduled for a knee ligament reconstruction under a lumbar epidural anaesthesia. He had no anaesthetic history. A 17-ga Tuohy needle was inserted at $L_{2/3}$, and a closed-ended multi-orifice catheter was passed although slight resistance was noted. After a negative aspiration and a negative test dose of a 3 ml lidocaine 1.5% with epinephrine, 12 ml of the solution was injected which produced an area of analgesia from T_6 to T_{12}. Fifteen minutes later, 10 ml lidocaine 2% were added. Since the area of sensory loss did not extend to the lumbar dermatome, the patient was placed into the decubitus position for a spinal anaesthesia, but then he complained of dyspnoea. In the supine position, his lips and nails showed signs of cyanosis. Ventilation with O_2 was started and the cyanosis disappeared, but he was still unable to breathe or phonate. The BP did not decrease below 100 mmHg at any stage although 5 mg of ephedrine was administered prophylactically. Because the events seemed to be compatible with an accidental subtotal spinal block, general anaesthesia was induced and the trachea was intubated. The operation

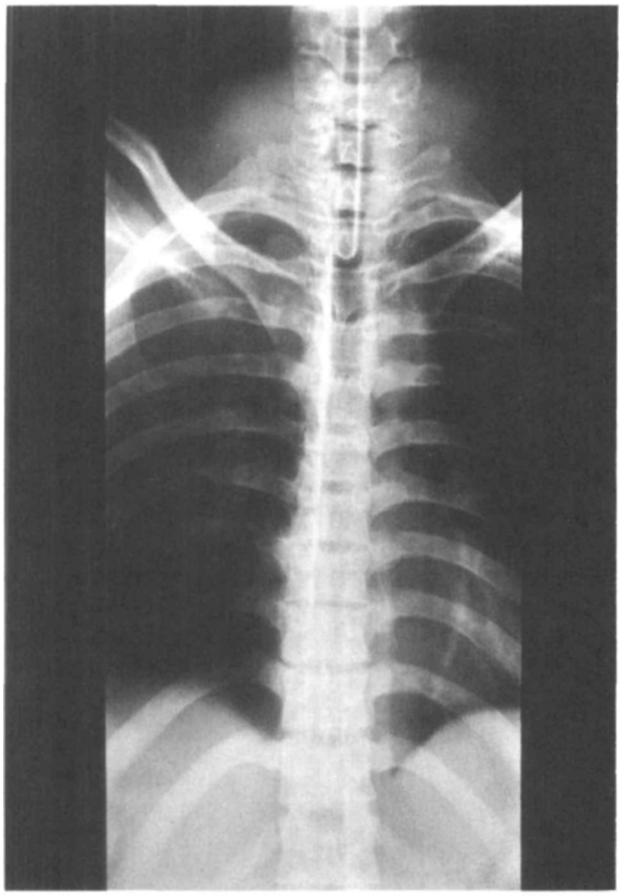

FIGURE Spread of contrast medium up to the right, sixth, cervical vertebra.

took 230 min, and he recovered completely from both the regional and general anaesthesia. Later anteroposterior *x*-rays suggested spread of contrast medium in the subdural space from C_6 to L_5 (Figure).

The respiratory depression was probably caused by a total thoracic block due to subdural injection of local anaesthetic. Additionally, a paralysis of the phrenic nerves might have contributed to the depression. The disposable epidural needle we used has a sharper bevel than a reusable Tuohy needle, which might have caused the unintended subdural puncture. We should have suspected that the patchy analgesia was a sign of accidental subdural block, and speculated that repeated injections of local anaesthetic might potentiate a high-level motor block.

Two radiographically confirmed cases of subdural block requiring tracheal intubation for respiratory depression have been reported.[2,3] The case report from Abouleish *et al.*[2] is unique in that an epidural catheter migrated into the subdural space three days after its insertion. In the other,[3] respiratory depression associated with hypotension was observed after the sixth injection of local anaesthetic. In contrast, the present case manifested respiratory depression without hypotension immediately after the second injection. Thus, repeated subdural injections of a local anaesthetic may predispose to serious respiratory depression, either with or without hypotension.

Kazuyuki Mizuyama MD
Shugi Dohi MD
Department of Anaesthesiology
Institute of Clinial Medicine
University of Tsukuba, Tsukuba, Japan

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Anaesthetic management of a parturient with thrombocytopenia using thrombelastography and sonoclot analysis

To the Editor:

Thrombelastography (TEG) and sonoclot analysis are whole blood viscoelastic coagulation tests that provide complete, reliable, cost-effective and rapid coagulation data which are often needed in the obstetrical patient for optimal obstetric and anaesthetic management.[1,2] The following case illustrates the *iv* use.

A 26-yr-old woman with idiopathic thrombocytopenia was admitted for induction of labour. No bleeding problems were reported. No petechiae, ecchymoses or overt bleeding were observed. Platelet count was $73{,}000 \cdot \mu l^{-1}$. Bleeding time, TEG and sonoclot analysis were obtained to evaluate platelet function before placement of an epidural catheter. The results were: bleeding time – 7 min (2.0–8.0 min); TEG – R: 6.0 min (8.0–12.5 min), RK: 10.0 min (12.5–17.3 min), K: 4.0 min (3.7–5.9 min), $\alpha°$: 46° (36.4–46.4°), MA: 58.0 mm (50.0–59.0 mm); sonoclot – onset: 120 sec (80–130 sec), rate ↑: $22\% \cdot min^{-1}$ ($15–30\% \cdot min^{-1}$), peak: 10 min (<15 min), rate ↓: $5\% \cdot min^{-1}$ ($<2\% \cdot min^{-1}$). All three tests showed the