Anesthesiology
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An Aid in Arterial Cannulation

To the Editor:—Arterial cannulation for continuous blood pressure monitoring and blood sampling for blood-gas determinations is a commonplace procedure. Various catheter insertion techniques have been described.[1,2] With catheters of the Teflon®-over-the-needle design, one of the problems has been entering the artery, getting blood return in the catheter hub, threading the Teflon catheter off the steel needle only to find that the Teflon portion of the catheter was outside the vessel and the vessel was pushed off the steel needle in the threading attempt.

A technique that allows for more accurate placement of the Teflon catheter is to draw a small amount of sterile saline solution or water into the hub of the needle, allow a small air bubble to form, and follow this with enough saline solution or water to form a fluid level below the bubble. This allows a compressible bubble that is visible in the hub of the needle and may be watched as the lumen of the vessel is entered. The bubble pulsates only slightly as the first portion of the steel bevel enters the vessel. The pulsation increases in intensity as the entire bevel enters the lumen. As the bevel approaches or enters the posterior wall, the pulsations will dampen. This is the point at which the Teflon needle should be threaded off the steel needle, as maximum penetration of the arterial lumen by the steel needle has been accomplished.

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Calibration Curves of Enflurane Using the Beckman LB2® Gas Analyzer with the Halothane Head

To the Editor:—Considering the frequent clinical and laboratory use of enflurane and halothane, it would be advantageous for those who utilize the LB2 medical gas analyzer equipped with a halothane head detector to be able to monitor the enflurane concentration as well with the instrumentation at hand. Although infrared analysis of halothane[1] and enflurane[2–5] has been used in several investigations, a detailed description of the calibration curves and linearity responses is not currently available.

We have used a Beckman LB2® Medical Gas Analyzer with a halothane head and linearizer circuit. Seven concentrations of enflurane in oxygen, as well as in 50 per cent N_2O in oxygen (range 0.27–4.4 per cent) were prepared by introducing fixed amounts of liquid enflurane by a Hamilton microsyringe into a calibrated flask (1.094 l). In the calculation of the actual anesthetic concentration, ideal gas laws using room temperature, barometric pressure (barometric pressure in Denver is about 630 torr), enflurane molecular weight, and density were applied. A three-way stopcock in the flask's plastic cap was connected to a catheter inside the flask (5 cm long) and to the catheter input supplied with the halothane pick-up head. Readings from the digital display of the LB2 analyzer were stable several hours after calibration (less than 3 per cent change). Zero readings were obtained before each measurement of enflurane in O_2 or 50 per cent N_2O, by flushing the flask with 100 per cent O_2 or 50 per cent N_2O in O_2, respectively (digital O_2 analyzer, Model 101, Applied Technical Products). Care was taken to fill the chamber of the pick-up head with the appropriate gas in use (O_2 or 50 per cent N_2O). Halothane calibration was done for comparison, using the same procedure as for enflurane (six gas concentrations were used (0.31–3.75 per cent).

An important point to verify, before the calibration procedure is done, is to set the internal potentiometer

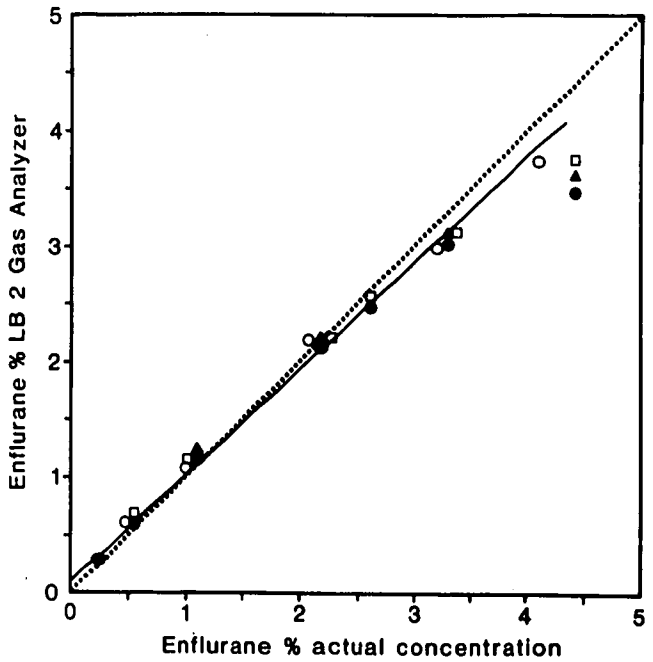

FIG. 1. Calibration curve for enflurane in oxygen (●, span setting 1.1 per cent and ▲, 2.2 per cent) and in 50 per cent nitrous oxide (□). Simultaneous measurements using a mass spectrometer are shown for comparison (○).

in the pick-up head so that test point 1 in the demodulator–buffer board shows 0.7 volts when a 3 per cent halothane–O_2 mixture is running through the input catheter. (This setting is the lowest value of the range suggested by the manufacturer, and was found to avoid saturation of the amplifier when enflurane was measured.) For enflurane in O_2, we used two levels of span setting (gain control), 1.1 per cent and 2.2 per cent (50 μl or 100 μl of liquid enflurane, respectively). For enflurane in 50 per cent N_2O we used only the 2.2 per cent level (fig. 1). The span setting used for halothane was 1.25 per cent (50 μl liquid halothane in either O_2 or 50 per cent N_2O).

For enflurane concentrations below 3.3 per cent (far above MAC), a significant linear regression was found between actual anesthetic concentration in the flask and readout values ($y = 0.12 + 0.91x$, $r = 0.998$, $P < 0.0001$; fig. 1). Readout values were the mean of six determinations at each level (highest coefficient of variation 2 per cent). Although the slope was different from the identity line ($P < 0.0002$), the difference between actual concentrations of enflurane and LB2 analyzer data was very small (0.04 ± 0.03 per cent SEM) and nonsignificant.

Enflurane calibration shows a nonlinear trend above 3.3 per cent (fig. 1); however, differences were not too far from predicted values, and correct readings may be obtained easily by reading off the diagram. The linear and nonlinear tendencies were similar for O_2 (even when changing to two levels of span calibration) and for the 50 per cent N_2O mixture.

Similar data were obtained when this instrument was compared with simultaneous measurements of enflurane–O_2 mixtures using a mass spectrometer (Perkin-Elmer, MGA-1100; fig. 1).

A decrease in flask pressure (−15 torr) during a 15-sec sampling period did not change the enflurane measurements even after the flask had been open to the atmosphere for 30 sec.

Readings were virtually unchanged when 7 per cent CO_2 or water vapor (saturated, 37 C) was added to a continuous flow of enflurane in oxygen (1 per cent and 2 per cent, monitored by a mass spectrometer).

Losses through the sampling catheter provided with the equipment were not specifically measured; however, from data in figure 1 it seems that losses (diffusion and/or solubility) are of small magnitude within the linear range (simultaneous values from the LB2 analyzer and the mass spectrometer were not significantly different).

Accurate correlations, in the entire range of concentrations, were obtained both for halothane–O_2 and for N_2O mixtures fitting the identity line. Switching from one anesthetic gas to the other apparently did not influence the results.

These findings show that the response curve of the LB2 analyzer equipped with a halothane detector can be easily applied, without modification, to the measurement of enflurane, and validate its use as a practical alternative to more complicated and expensive equipment for continuous monitoring during clinical anesthesia.

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Avoiding Intravascular Injections during Epidural Anesthesia

To the Editor:—The recent editorial by Albright[1] provides a timely reminder of the seriousness of the risk of accidental intravascular injection during caudal epidural block. The point is also made that this serious complication can occur following a negative aspiration test.

In a prospective audit of 188 caudal epidural blocks performed at St. Vincent's Hospital, there were 21 (11.2 per cent) bloody taps and one (0.53 per cent) intravascular injection.

As the epidural veins are thin-walled and relatively valveless, a negative pressure can lead to collapse of the vein wall onto the bevel of the needle. This leads to a negative aspiration test.

A test has been evolved to overcome this. Following placement of the needle and aspiration, 2 ml of the local analgesic solution are injected and the syringe removed. After a 15-second delay, the interior of the needle hub is inspected. Blood is easily detected by inserting a wick of absorbent paper or cloth swab into the hub. Any blood staining of the wick is taken as evidence of intravascular placement of the needle. This can often be seen even following negative aspiration.

Finally, the 2 ml volume injected acts as a test dose, as it is sufficient to produce symptoms of mild toxicity when injected intravascularly.

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A Further Modification of Endotracheal Tubes for Laser Microsurgery

To the Editor:—We have found modification of the endotracheal tube for laser microsurgery of Patil *et al.*[1] useful in adults. We have added a further modification. This is placing an epidural catheter along side the tube and then wrapping it in muslin. Holes are made along the catheter's distal 4 inches with a needle. A saline-filled syringe is attached to the other end of the catheter. This allows us to keep the muslin moist by injecting 1 ml of saline solution every 5–7 min. This guards against drying out of the muslin in a prolonged procedure.

The muslin does add considerable bulk to the tube. We find this unsatisfactory for children at this time because it permits us to use only tubes of very small diameter. A finer cotton material may work better for children.

For very long procedures, a Harvard pump may be useful for the constant infusion of saline solution although we have not tried this.

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