A Simple Device for Oxygen Insufflation with Continuous Positive Airway Pressure during One-lung Ventilation

To the Editor—Hypoxemia is a significant clinical problem in approximately 20% of patients for whom a one-lung ventilation (OLV) anesthetic technique is utilized. Oxygen insufflation to the upper, nonventilated lung with continuous positive airway pressure (CPAP) is reported to increase \( \text{PaO}_2 \) during OLV. We have constructed an inexpensive, reusable, and readily available device that provides \( \text{O}_2 \) insufflation with variable CPAP to the upper, nonventilated lung during OLV (fig. 1).

A modified Ayre's T-piece (essentially a Mapleson E system) is connected to the lumen of a double-lumen endotracheal tube that supplies the nonventilated lung. The fresh gas port of the T-piece is connected to an oxygen source, either a tank or a wall outlet, via an appropriate flowmeter. A reusable valve designed to produce positive end-expiratory pressure (Boehringer Laboratories, Wynnewood, Pennsylvania) is connected to the corrugated tubing at the end of the T-piece assembly. Using this system clinically, we have observed

**Fig. 1.** A modified Mapleson "E" open-ended anesthesia circuit is connected to an oxygen source via a flow meter, and to a Boehringer "PEEP" valve at the distal end. When the system is connected to the nonventilated lung with an oxygen flow rate of 8 l·min\(^{-1}\), this circuit will provide oxygen insufflation; the level of CPAP is indicated on the valve, provided the valve is fixed in the vertical position.

**Fig. 2.** Arterial oxygen tension (\( \text{PaO}_2 \)) measured after 20 min of OLV without CPAP/\( \text{O}_2 \) is shown compared with similar data obtained 20 min after starting CPAP/\( \text{O}_2 \) to the nonventilated lung. Open symbols show mean values for each group with brackets to indicate one standard deviation.
airway pressure in the nonventilated lung to vary less than 1 cmH2O from the 10 cmH2O indicated on the valve (with an 8 l·min⁻¹ oxygen flow rate). Other O₂ flow rates were not tested clinically; however, bench testing of the circuit with O₂ flow rates varying from 1 to 10 l·min⁻¹ produced less than 10% (1 cmH2O) variation from the indicated pressure at all O₂ flow rates tested. Clinically, use of this circuit to provide CPAP and O₂ insufflation to the nonventilated lung during continuous OLV significantly improved Pao₂ in patients undergoing thoracotomy, as shown in figure 2.

Capan et al.¹ have described a similar system to provide CPAP and O₂ insufflation to the nonventilated lung during which they used an adjustable pressure relief valve to limit the escape of oxygen from the insufflation circuit. This system has the disadvantage that an inadvertent occlusion of the valve or an increase in flow rate could create high airway pressures. The system we describe utilizes reusable materials that are readily available within most anesthesiology departments, which gives it the combined advantages of availability and simplicity. Over-pressure is highly unlikely, since 10 cmH2O pressure relief (independent of O₂ flow rate from 1 to 10 l·min⁻¹) is designed into the system. We observed no difficulty with the circuit; furthermore, 10 cmH₂O CPAP does not appear to interfere with surgical exposure and may even facilitate intralobar dissection.

**REFERENCES**

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Does Isoflurane Really Preserve Baroreflex Responsiveness Better than Halothane or Enflurane?

To the Editor:—Kotrlý et al. assert that “the data indicate isoflurane preserves baroreflex regulation of heart rate better than either halothane or enflurane” and suggest that isoflurane may be the preferred inhalational anesthetic in clinical situations where baroreflex responsiveness would be important, e.g., acute hypovolemia or position changes under anesthesia.¹ There are four reasons why I believe these conclusions to be premature.

First, if the pressor slopes (R-R interval vs. blood pressure) for isoflurane from Duke et al.² are plotted versus MAC multiples as in figure 6 of reference 1, the line for isoflurane can be superimposed on the halothane–N₂O one and is parallel to those for halothane, enfurane, and enfurane–N₂O. Even if the concentration of isoflurane is reduced but the level of anesthesia maintained with N₂O, the isoflurane–N₂O line can be superimposed on the isoflurane one. Thus, the data of Duke et al. do not show the degree of sparing of baroreflex responsiveness that Kotrlý observed.

Given the above, the question is raised as to how comparable are the experimental methods from the two different laboratories. Duke controlled ventilation to keep the arterial Pco₂ about 35 mmHg.³ It is not clear from Kotrlý’s article whether ventilation was controlled and what the actual arterial Pco₂ were. A statement is made that “all subjects resumed spontaneous ventilation prior to the tests carried out during anesthesia.”¹ Thus, the arterial Pco₂ may have been 50 mmHg.⁴ An elevated CO₂ tension could increase sympathetic outflow from the vasomotor center, one component of the baroreflex arc.

Thirdly, in two elegant studies in dogs, Kampine’s group determined that both halothane and isoflurane, with a thiopental background, attenuated in a dose-related manner all the individual components of the baroreceptor reflex arc except the baroreceptor itself, which was sensitized.⁵,⁶ When the intact reflex arc was studied, isoflurane at 1 MAC appeared to be less depressant than halothane at 1 MAC. However, the control slopes (R-R interval in ms vs. mean BP in mmHg) in the conscious dogs are so different (12.38 ± 3.6 ms/mmHg for halothane and 59.4 ± 16.5 ms/mmHg for isoflurane). If the halothane data were normalized to the same