

Economy is Not a Major Benefit of Closed-system Anesthesia

To the Editor:—Recent publications¹ and lectures* on the benefits of closed-system anesthesia have created a new myth, that closed-system anesthesia is less expensive than is semi-closed-circle-system anesthesia. The factors to consider are not only the savings of anesthetic gases, but also the expenses of extra equipment such as O₂ analyzers and increased soda lime utilization. (Since it can be argued that an O₂ analyzer should be used with all techniques, I do not consider that a cost factor against closed systems.)

We are left, then, with the cost of increased CO₂ absorption less the savings from decreased gas utilization. At a fresh gas flow of 5 l/min in a 72-kg man, we collected approximately 190 ml/min of CO₂ from the pop-off valve. Thus, at least 75 per cent of his expected CO₂ production was not absorbed. In a closed system, 100 per cent would be expected to be absorbed, resulting in a four- to fivefold increase in soda lime utilization. In our experience, one 1.13-kg canister lasts approximately four hours when a 70-kg person is receiving closed-system anesthesia. This results in hourly soda lime costs of \$0.88 for closed-system and \$0.22 for semi-closed system anesthesia. During semiclosed-system anesthesia at a flow of 5 l/min, our canisters are changed after 18–25 hours.

Gas savings depend on the anesthetic used. Our gas costs are:

O ₂	\$0.000095/l
N ₂ O	\$0.0019/l
Enflurane	\$0.188/ml of liquid or 184/ml of gas, which is \$0.00102/ml gas
Halothane	\$0.000187/ml of gas

If the semiclosed-system fresh gas flow is held constant, the savings of a closed system will increase with time. If we compute the savings for one hour of anesthesia from 30 to 90 min after induction, the results are:

* Hamilton WK: Low flow and closed circuit systems. American Society of Anesthesiologists, Refresher Course Lectures, 1979, Lecture #116

Semiclosed System		
	Amount	One-hour Cost
66 per cent N ₂ O	3 l/min	34 cents
33 per cent O ₂	2 l/min	1 cent
1 per cent halothane	50 ml/min	56 cents
		91 cents
Closed System		
	Amount	One-hour Cost
66 per cent N ₂ O	180 ml/min	0.2 cents
33 per cent O ₂	220 ml/min	0.0 cents
1 per cent halothane	620 ml	11.6 cents
		11.8 cents

This results in a savings of \$0.79 in gases; however, you have spent \$0.66 more for soda lime, for a net savings of \$0.13. For 2 per cent enflurane with a 3 l/min fresh gas flow, one would save \$1.78 by switching to a closed system. Balanced anesthesia would result in a loss of \$0.42.

If, during semiclosed-system anesthesia, one were to cut back to 0.5 per cent halothane and 1 per cent enflurane for 60 min from 90 to 150 min after induction, the savings by switching to closed system are calculated to be +\$0.56 for enflurane, -\$0.13 for halothane, and -\$0.41 for balanced anesthesia. These figures are based on military costs. Current civilian costs double the savings for enflurane and double the loss for balanced anesthesia.

Therefore, let's promote closed-system anesthesia for its real benefits, which are: increased understanding of uptake and distribution, forced close observation of the patient, increased humidification, decreased pollution, and decreased heat loss.

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REFERENCE

1. Aldrete TA, Lowe HJ, Virtue RW: Low flow and closed system anesthesia. New York, Grune and Stratton, 1979, pp. 103–108

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