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Title : HOW RELIABLE IS TRANSCUTANEOUS PO_2 DURING ANESTHESIA?

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Introduction. Accurate regulation of FiO_2 during neonatal anesthesia has become increasingly important with appreciation of the alternate risks of hypoxia and hyperoxia (retrolental fibroplasia)[1]. Transcutaneous oxygen monitoring has been recommended, but errors from the reduction of anesthetics by similar polarographic electrodes have been reported.[2] Because these errors could lead to inadvertent hypoxia, we studied various means of avoiding such effects.

Method. The calibration unit (TCM 101) of a Radiometer transcutaneous oxygen monitor was modified to permit the passage of an exogenous gas supply through one of the two heated water baths used for calibration. The electrode was assembled, placed in the chamber and calibrated by bubbling air through the water (at 44°C). The PO_2 value was recorded on a chart recorder and observed for stability for 30 minutes before the addition of either halothane or enflurane for 90 to 120 minutes. The procedure was repeated to demonstrate the effects of halothane and enflurane (1) with either a polypropylene or teflon membrane; (2) with or without a cuprophane spacer; and (3) with the polarizing voltage either 630 mV or 575 mV. Similar experiments were performed with nitrous oxide.

Results. Figures (1) and (2) are representative records of the effects of halothane on (1) a polypropylene membrane; and (2) a teflon membrane. The table shows the average change in PO_2 values 90 minutes after addition of the anesthetic, expressed as a percentage of the initial calibration value.

TABLE I

Anesthetic	Polarizing Voltage	Polypropylene Membrane		Teflon Membrane	
Halothane 2%	565 mV	35°	7*	+2°	+4*
	630 mV	32°	9*	-2°	-1*
Enflurane 2%	565 mV	0°	0*	0°	0*
	630 mV	0°	-3*	0°	-4*
N_2O 50%	565 mV	0°	0*	0°	0*
	630 mV	0°	0*	0°	0*
N_2O 100%	565 mV	0°	0*	0°	0*
	630 mV	0°	0*	0°	0*

° with spacer
* without spacer

Discussion. Halothane caused a significant increase in the apparent PO_2 when polypropylene membranes were applied to the electrode, regardless of the polarizing voltage. The increase followed a variable lag phase of 20-40 minutes, and persisted when the halothane was discontinued and the water in the chamber was changed. Replacement of the membrane was the only measure that reduced the elevated PO_2 to the appropriate calibration value in our experience. This halothane effect was reduced by removing the cuprophane spacer that is usually used with polypropylene membranes, and was abolished by the use of a teflon membrane. Neither enflurane nor nitrous oxide affected the electrode. We therefore recommend use of a teflon membrane with the Radiometer transcutaneous oxygen monitor. In the absence of a teflon membrane, removal of the cuprophane spacer should reduce the drift attributable to the halothane effect described.

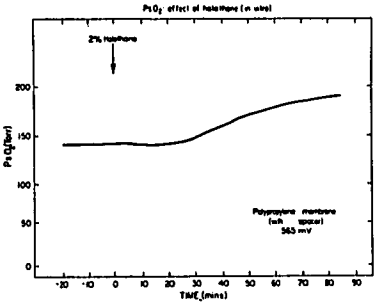

Figure 1

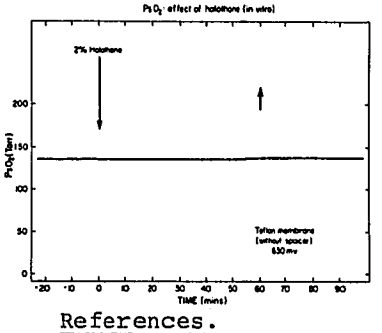

Figure 2

References.

1. Betts EK, Downs JJ, Schaffer DB, Johns R: Retrolental Fibroplasty and Oxygen Administration During General Anesthesia. Anesthesiol 47:518-520, 1977.

2. Gothgen I, Jacobsen E: Transcutaneous Oxygen Tension Measurement II. The Influence of Halothane and Hypotension. Acta Anaesth Scand 1978, Suppl 67, 71-75.