Title: TEFLOM MEMBRANES DO NOT ELIMINATE HALOTHANE INTERFERENCE WITH TRANSCUTANEOUS OXYGEN ELECTRODES

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Introduction: Continuing experience and technical improvements in transcutaneous oxygen (TCO₂) electrode systems have encouraged continuous tissue oxygen monitoring during general anesthesia. Since all commercially available TC-0₂ systems are polarographic and use a Clark electrode, however, they are subject to interference by gaseous molecules which can be reduced at the cathode. Careful choice of electrode membrane material and thickness could minimize interference by anesthetic gases. This study tested the concept that substituting Teflon for polypropylene membranes would eliminate halothane interference, previously described¹.

Methods: Two Narco-AirShield (Hatboro, PA) Model TC-075-1 Transcutaneous Monitor Systems were used for this in vitro study. Duplicate electrodes each with a 25 μm diameter platinum cathode and a 5.5 mm silver anode were used, one probe covered with a 20 μm polypropylene membrane and the other with a 25 μm Teflon PTFE membrane, both supplied by the manufacturer. Membranes were separated from the glass-covered electrode by a thin film of electrolyte solution. Electrode polarization was maintained at 600 mV and temperature at 44.4–44.5°C, with electrodes mounted in a test block and exposed to the same gas source simultaneously. Prior to each test, electrodes were polarized, zeroed, and calibrated with air after showing stability for a minimum of 24 hours. Gas mixtures were provided at flow rates of 1–3 l/min by an anesthesia machine with oxygen analyzer mounted at the fresh gas outlet. Indicated TC-0₂ readings were taken directly from the digital display of each monitor.

Results: Exposure of the polypropylene membrane system to halothane produced a rapid rise in indicated TCO₂ despite constant oxygen partial pressure within 20, 10, or 5 minutes after beginning 0.5%, 1%, and 3% halothane, respectively (figure). By 3 hrs., a rise of 25 mmHg was seen for 0.5%, 90 mmHg for 1%, and 300 mmHg for 3% halothane, all in 21% O₂, balance N₂O.

No change in indicated TCO₂ was seen with the Teflon system after 2 hours of 0.5% halothane in N₂O-O₂. However, TCO₂ rose by 25 mmHg after 30 minutes of 3% halothane and by 6 mmHg after 120 minutes of 1% halothane in 21% O₂, balance N₂O.

Discussion: Clinically useful transcutaneous oxygen monitoring during general anesthesia requires that indicated TCO₂ values reflect tissue PO₂. Although careful attention to polarization voltages appears to have eliminated TCO₂ artifacts caused by N₂O, our data indicated that halothane interference can give falsely high TCO₂ readings even with Teflon PTFE membranes. These in vitro findings suggest that properly designed TCO₂ systems may be used with confidence during general anesthesia with nitrous oxide, enfurane, or isoflurane. Sustained exposure to halothane in clinically-used concentrations at commonly encountered P0₂ values, however, may produce falsely elevated indicated TCO₂ when either Teflon or polypropylene membranes are used.

Reference:

Figure: