Title : TEMPERATURE CORRECTION OF G.L.C. DETERMINED BLOOD ENFLURANE

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Introduction. A simple method for the measurement of volatile anesthetics in blood by gas chromatography was published by Fink and Morikawa. (1). Since the anesthetic uptake in blood is at the patient temperature but the equilibration of the blood and air for G.L.C. measurement is at room temperature, a temperature correction coefficient calculated by the authors must be used. In the process of evaluating this method we decided to test the calculated temperature correction coefficient against an experimentally derived coefficient.

Method. Summary of the method by Fink and Morikawa.

1.) 2ml Blood anaerobically drawn into a gas tight 10 ml syringe.
2.) 8ml air added to blood and equilibrated at room temperature in the syringe (equilibration).
3.) Gas phase injected into G.L.C. = P_1.
4.) Excess air is expelled.
5.) Repeat of step 2 = P_2.
6.) Original partial pressure $P_0 = (P_1)^2/P_2$.
7.) The partial pressure at the original blood temperature is obtained by multiplying P_0 by a temperature correction factor. Blood was tonometered in a TET Tempette Tonometer at an exact temperature (NBS Thermometer). Two approaches to the verification of the published temperature correction factor were used.

1.) Blood-air mixture was equilibrated at room temperature (24°C) and at the temperature of the Tonometer. The temperature correction factor was the ratio of P_0 at tonometer vs. room temperature.
2.) Possible incomplete saturation was evaluated by first saturating blood at 2% enflurane for 30 min. Then using blood of 0% enflurane in a second flask, both were equilibrated in parallel with 1% enflurane. Samples were taken at 0 time and every 5 minutes until both bloods had reached the same P_0 (<15 minutes). A temperature correction factor could be calculated from the ratio of gas phase partial pressure of enflurane/P_0 obtained at equilibration temperature (always 24°C).

Results. Both experimental approaches resulted in the same temperature coefficient. Method 2 was used to establish coefficients for 10, 24, 28, 30, 34, 37 and 40°C, comprising ΔT of -14, 0, 4, 6, 8, 10, 13 and 16°C. Our experimental findings and the calculated temperature correction coefficients are graphically represented in Figure I. The use of saline instead of blood for tonometry resulted in the same deviation of the experimental from the calculated coefficient. All points except 24°C are significantly different from calculated values by unpaired T at less than 0.05.

Discussion. The results indicate a progressive deviation of the experimental temperature coefficient from the calculated value with increasing temperature. The deviation can not be accounted for by the experimental error, including humidification of the anesthetic gas. Since the calculations of the temperature coefficient are based on the assumption that the anesthetic behaves as an ideal gas, the experimentally derived temperature coefficient reflects the deviation of the anesthetic from ideal gas behavior and/or the inaccurate molar heat of evaporation on which the coefficient is based. The fact that saline and blood gave the same temperature correction factor implies that the deviation from expected is not related to the presence of macromolecules. The application of this method (1) must be checked with tonometer at the experimental conditions.

Reference: (1) Fink, B.R., Morikawa, K., Anesthesiology 32, 451, 1970.

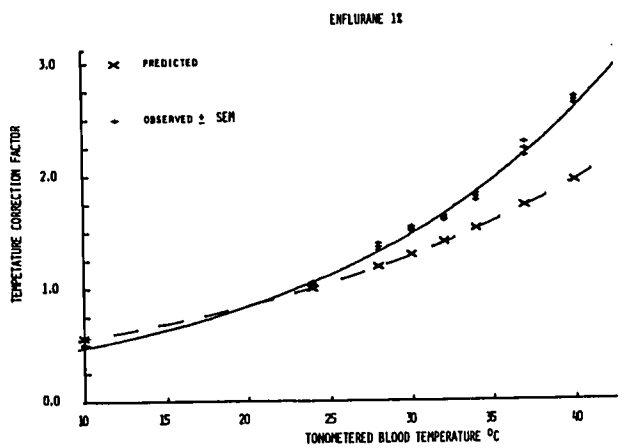

Figure I