Laboratory Note

Vapor Pressure Tables

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DEVELOPMENT of an improved technique to assay volatile anesthetics in body fluids[1] was hampered at our institution by the lack of tables listing anesthetic vapor pressures at room temperature. Such tables would serve a variety of other needs as well, one instance being computation of output from an anesthetic vaporizer.

While suitably detailed vapor pressure tables are not readily available, empirical formulas relating vapor pressure to temperature (using the computer as a curve-fitting tool) have been published.[2-4] Curve-fitting yields the appropriate constants for the Antoine equation:

$$\log_{10}(P) = A + B/(C + \text{temp})$$

where P is the vapor pressure in mm Hg, A, B, and C are constants, and temp is the temperature in degrees Celsius.

Using these equations, I wrote a FORTRAN IV program that tabulates the vapor pressures of five common volatile anesthetics at 0.1 C intervals in the range of 15 to 25 C. Computation is straightforward, comprising substitution of the appropriate constants in the Antoine equation and obtaining the antilog by exponentiating ten. The FORTRAN source program (available on request) features simple modification of the lower and upper temperature limits as desired by the user. Other workers, for example, might wish to have access to graded vapor pressures at body temperature.

The program will run even on a small computer (PDP-15, for instance) supplied with a FORTRAN compiler; for the larger computers found on most campuses, the program presents

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VAPOR PRESSURE OF ETHER

T E M P	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
18	405.9	407.6	409.2	410.9	412.5	414.2	415.9	417.5	419.2	420.9
19	422.6	424.3	426.0	427.7	429.4	431.1	432.9	434.6	436.3	438.1
20	439.8	441.6	443.3	445.1	446.8	448.6	450.4	452.2	454.0	455.8
21	457.6	459.4	461.2	463.0	464.8	466.6	468.5	470.3	472.2	474.0
22	475.9	477.7	479.6	481.5	483.4	485.3	487.1	489.0	490.9	492.9

FIG. 1. One of five tables outputted by the program. Vapor pressures of ether (mm Hg) are shown at 0.1 C intervals in the range of 18 to 22 C.

no problem. The tables just fit the standard 72-character width of a Teletype—the usual output device in a small installation. The program can be keyed directly onto FORTRAN cards from the source listing; comment labels (identified by a "C" in the left-hand margin) may be omitted.

Program output consists of five tables that list the vapor pressures of ether, halothane, methoxyflurane, trichloroethylene, and chloroform. The vapor pressures are tabulated in mm Hg, and the temperatures in degrees Celsius. The base temperature appears in the left-hand margin, one integer value per row (fig. 1). The table is divided into ten vertical columns, each representing a 0.1 C increment of the base temperature. The third row from the top in the figure, for instance, lists from left to right ether vapor pressures at 20.0, 20.1 . . . 20.9 C.

To alter the temperature limits, merely change the indexing parameters in statement #300 from the present 15 and 25 to the desired lower and upper limits. The only restriction on the temperature range is that the index parameters must be positive non-zero integers.

Fortran source program and/or tables will be available from the author on request.

References

1. Fink BR, Morikawa K: A simplified method for the measurement of volatile anesthetics in blood by gas chromatography. ANESTHESIOLOGY 32:451–455, 1970
2. Hill DW: Physics applied to anesthesia. V: Cases and vapours. Brit J Anaesth 38:476–481, 1966
3. Herchl R: An equation for the calculation of the saturated vapour pressure of methoxyflurane (Penthrane). Canad Anaesth Soc J 17: 541–543, 1970
4. Bottomley GA, Seiflow CHF: Vapour pressure and vapour density of halothane. J Appl Chem 13:399–402, 1963

Obstetrics and Pediatrics

PARACERVICAL BLOCK Questionnaires were sent to 150 maternity units in Germany requesting that each unit provide information about maternal and infant complications associated with paracervical block anesthesia. Replies were received from 107 units, comprising a total of 32,625 patients. The incidence of fetal complications was appreciably greater when bupivacaine was used than when lidocaine or mepivacaine was used. There were 31 fetal deaths in 19,907 mothers given bupivacaine (20 ml of 0.5 per cent solution); one fetal death in 4,132 mothers given mepivacaine (20 ml of 1 per cent solution); no fetal deaths in 400 mothers given lidocaine (20 ml of 1 per cent solution). There were no maternal deaths, but two patients had transitory convulsions from overdoses of mepivacaine. The highest safe dose of bupivacaine is 50 to 60 mg, or 1 mg/kg body weight. (*Beck, L., and Martin, K.: Hazards Associated with Paracervical Block in Obstetrics, Germ. Med. Monthly 15: 81 (Feb.) 1970.*)

SUSTAINED LEFT UTERINE DISPLACEMENT Relief of inferior vena caval occlusion by left uterine displacement is the most valuable method for correcting maternal hypotension prior to vaginal delivery or during cesarean section under spinal anesthesia. A stainless steel instrument now available can be attached to the operating table and will maintain continuous left uterine displacement prior to delivery without interfering with the performance of cesarean section. In a small "control" series of patients, 83 per cent became hypotensive. This group did not receive large intravenous infusions of fluids or prophylactic vasopressors. When the instrument was used for continuous left uterine displacement in another group of similar patients, 42 per cent developed hypotension. Of these, half responded to fluids and the other half to ephedrine. (*Kennedy, R. L.: An Instrument to Relieve Inferior Vena Cava Occlusion, Amer. J. Obstet. Gynec. 107: 331 (May) 1970.*) ABSTRACTER'S COMMENT: This instrument deserves further evaluation and may well prove to be a useful adjunct to prevent arterial hypotension during obstetrical spinal or epidural anesthesia.