Alveolar Air Equations

To the Editor — Story's letter1 raises interesting questions about the alveolar gas equations. Essentially, these indicate the alveolar partial pressures of oxygen and carbon dioxide in terms of barometric pressure, uptake, and alveolar ventilation. They are simply based on conservation of mass.

Alveolar gas equations exist in many versions for different purposes: some versions are accurate, some less accurate, and some only approximate. Accurate versions are required for determination of alveolar P02 in the calculation of venous admixture, for example. Perhaps the most satisfactory version for the anesthesiologist is that of Filley, Machinoshi, and Wright,2 which does not require inert gases, such as nitrous oxide, to be in equilibrium.

Some approximate versions give a clearer indication of the quantitative relevance of clinically important variables and so are a valuable teaching aid. For this purpose, I favor the following:

\[ P_{A02} = P_{A0} - P_{H2O} - P_{Aco2} \]

and no corrections are required. An opening parenthesis is missing from Story's equation (1) immediately before P02. This may have caused confusion.

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References


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Cerebral Oxygenation during Deep Hypothermic Cardiopulmonary Bypass: Is Hemoglobin Relevant?

To the Editor — I was fascinated by Dexter and Hindman's model of cerebral oxygen delivery.1 To examine the behavior of their model in more detail, I loaded the equations into a Hewlett Packard HP-48GX programmable calculator and examined their behavior under a variety of conditions, using the calculator's Equation Solver application.

This examination led me to conclude that it is not the shift in P02 alone that is responsible for the change in the relation between SV02 and CMR% (percentage of maximal CMRO2) seen with hypothermia, but rather the interaction between that shift and the relation between interstitial oxygen tension (PinO2) and CMR%. In brief, the target (or basal) CMR% determines the PinO2 (and therefore the P02) needed to support that CMR%. The authors chose a model (Michalis-Menten kinetics), eq. 9)2 which requires relatively high PinO2 to support high CMR%. As the P02 shifts left with hypothermia, it is not surprising to find that the high P02, which is determined

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