Since F and P are directly proportional, P can be substituted for F.

$$\dot{V}_{eff}P_{AT} = \dot{V}_1P_{A_1} + \dot{V}_2P_{A_2} \quad (5)$$

in which $\dot{V}_{eff}$ is the product of respiratory frequency times tidal volume minus anatomic deadspace, P_{AT} is alveolar nitrogen tension, $\dot{V}_1$ and $\dot{V}_2$ are effective ventilation of slowly and fast ventilated compartments, and P_{A_1} and P_{A_2} are nitrogen tensions of gas exhaled from slowly and fast ventilated compartments. Late in nitrogen clearance, between times t and f, equation (5) becomes:

$$\dot{V}_{eff}\Delta P_{AT} = \dot{V}_1\Delta P_{A_1} + \dot{V}_2\Delta P_{A_2}, \quad (6)$$

in which $\Delta P = P_f - P_t$

Assume that alveolar equals end-tidal nitrogen tension ($P_{AT} = P_{ET}$). If the fast ventilated compartment is completely cleared between times t and f ($P_{A_2} = 0$) and if there is no diffusion limitation for oxygen ($P_A = Pc$ and $Pc_2 = 0$) and if the water vapor and carbon dioxide tensions remain constant ($\Delta P_{A_{N_2}} = \Delta P_{A_{O_2}}$), then equation (4) reduces to:

$$\Delta Pa = \frac{\dot{Q}_1}{\dot{Q}c}\Delta Pc \quad \text{or} \quad Pc = \Delta Pa\,\frac{\dot{Q}c}{\dot{Q}_1},$$

and equation (6) reduces to:

$$\dot{V}_{eff}\Delta P_{ET} = \dot{V}_1\Delta Pc \quad (7)$$

Substituting for Pc in equation 7, we obtain,

$$\dot{V}_{eff}\Delta P_{ET} = \dot{V}_1 \times \Delta Pa\,\frac{\dot{Q}c}{\dot{Q}_1}$$

or

$$\frac{\dot{V}_1}{\dot{Q}_1} = \frac{\dot{V}_{eff}}{\dot{Q}c} \times \frac{\Delta P_{ET_{N_2}}}{\Delta Pa_{O_2}} \quad (8)$$

The validity of the assumptions was discussed by Finley,[3] who stressed that the fractional perfusion calculated by this method occurs under the condition of ventilation with 100 per cent oxygen. Division of the lung into only two compartments does not preclude a spread of the ventilation-perfusion ratio within each compartment; therefore, this method of analysis does not give an indication of the true degree of variation of the ventilation–perfusion ratios within the lungs.

CNS Function

HYPERBARIC OXYGEN AND ORGANIC BRAIN SYNDROME The effect of repeated exposures to a hyperbaric oxygen environment on intellectual deficits was studied in elderly patients diagnosed as having diffuse brain damage (chronic brain syndrome). The clinical estimates of severity ranged from mild to severe, with durations of impairment ranging from two to five years. The patients were treated with 100 per cent oxygen by mask at 2.5 atmospheres pressure for 90 minutes twice daily, for accumulated exposures of at least 41 hours. Only ten of 16 patients completed the course of therapy. Of these, only one showed a slight, but not significant, improvement in memory testing, and this patient was believed to be suffering chiefly from a depressive reaction rather than organic brain syndrome. The Tiens' Organic Integrity Test results, if valid and reliable, suggested that the treatment might actually have had a deleterious effect. The authors conclude that within a general hospital setting, hyperbaric oxygen treatment has no value for unselected patients with the chronic organic diffuse brain damage. (*Goldfarb, A. I., and others: Hyperbaric Oxygen Treatment of Organic Mental Syndrome in Aged Persons, J. Gerontol. 27: 212–217, 1972.*) ABSTRACTER'S NOTE: If the symptoms reflect anatomic loss of functioning cells, there is little theoretical reason to suspect that hyperbaric oxygen would benefit such a patient.