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Another Method of Mixing Air and Oxygen

To the Editor:—We have read with interest the recent letter of Priano, Solanki, and Gloyna, concerning a simple method of mixing air and oxygen utilizing an Alligation Alternate.[1] Nomograms do exist,[2] but as correctly pointed out, usually are absent when needed. Calculation of flows to achieve the desired inspired oxygen concentration ($F_{I_{O_2}}$) when mixing oxygen with one other gas, *e.g.*, nitrous oxide or nitrogen, is simple.

We presume most persons delivering anesthesia have access to a simple hand-held calculator, and assume, for ease of calculation that room air is composed of 20% oxygen and 80% nitrogen. To mix air and oxygen we convert the air flow to the equivalent flow of pure nitrogen. This allows us to set the flow of air ($\dot{V}_{air}$), and by simple subtraction from the total flow ($\dot{V}_{total}$) set the flow of oxygen ($\dot{V}_{O_2}$) as follows:

$$\dot{V}_{total} = \dot{V}_{air} + \dot{V}_{O_2} \quad (1)$$

$$\dot{V}_{air} = \frac{\dot{V}_{total} \times (1 - F_{I_{O_2}})}{0.8} \quad (2)$$

thus,

$$\dot{V}_{O_2} = \dot{V}_{total} - \dot{V}_{air} \quad (3)$$

For example, assume one wishes a total flow of 10 l/min and a $F_{I_{O_2}}$ of 0.4:

$$\dot{V}_{air} = \frac{10 \times (1 - 0.4)}{0.8} = \frac{10 \times 0.6}{0.8} = 7.5 \text{ l/min}$$

and

$$\dot{V}_{O_2} = 10 - 7.5 = 2.5 \text{ l/min}$$

Equation 2 may be rewritten as:

$$\dot{V}_{air} = \dot{V}_{total} \times (1 - F_{I_{O_2}}) \times 1.25 \quad (4)$$

which allows one to obtain the answer without needing a calculator.

An inline, properly calibrated, oxygen analyzer gives a double check of one's calculations and its use is recommended.

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1. Priano L, Solanki D, Gloyna D: A simple method for mixing air and oxygen. ANESTHESIOLOGY 57:145–146, 1982
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