

Ventilator Pocket Guide

Foundational Equations

Ohm's Law	$\Delta P = FR = P_{aw} - P_{alv} = P_{pl} - PEEP_{total}$
Equation of Motion	$P_{aw} = FR + \frac{V_t}{C} + PEEP_{total}$
Compliance	$C = \frac{\Delta V}{\Delta P}$
Natural Decay Equation	$V_i(t) = \frac{V_o}{e^{\frac{t}{RC}}} = \frac{V_o}{e^{\frac{t}{\tau}}}$
Calculating τ, General Case	$\tau = \frac{V_t}{F} \cdot \left(\frac{PIP - P_{plt}}{P_{plt} - PEEP_{total}} \right)$
Alveolar Gas Equation	$P_{AO_2} = F_{iO_2}(P_{atm} - P_{H_2O}) - \frac{P_{aCO_2}}{RQ}$, where $RQ = 0.80$

- [Vent Waveforms](#)

Alveolar Gas Equation

$$P_{AO_2} = F_{iO_2}(P_{atm} - P_{H_2O}) - \frac{P_{aCO_2}}{RQ}$$

substituting back in to RQ equation: $RQ = \frac{P_{aCO_2}}{\frac{V_{AP_{ACO_2}}}{kV_{O_2}} - \frac{V_{O_2}}{V_a}}$

$$V_T = V_A + V_D, \text{ where } V_A = 350 \text{ and } V_D = 150$$

Dead Space Fraction

$$\frac{V_D}{V_T} = \frac{P_{ACO_2} - P_{ECO_2}}{P_{ACO_2}}$$

Formal measurement of P_{ECO_2} requires volumetric capnography, which requires a capable ventilator or a dedicated measurement device.

Thankfull, $P_{ECO_2} \approx ETCO_2$, so an approximation would $\frac{V_D}{V_T} = \frac{P_{ACO_2} - ETCO_2}{P_{ACO_2}}$

Alveolar ventilation

$$P_{AO_2} = F_{iO_2}(P_{atm} - P_{H_2O}) - \frac{P_{AO_2}}{RQ}$$

$$\dot{V}_A = \frac{\dot{V}CO_2}{P_{ACO_2}} \implies \dot{V}CO_2 = \frac{\dot{V}_{AP_{ACO_2}}}{k}$$

To convert F_{ACO_2} into P_{ACO_2} , we have $F_{ACO_2}(P_{atm} - P_{H_2O}) = P_{ACO_2}$ Similarly, using F_{ECO_2} , we can show $P_{ECO_2} = F_{ECO_2}(P_{atm} - P_{H_2O})$

$$Volume_{expiredCO_2} = Volume_{producedAlvCO_2}$$

$$V_{TF_{ECO_2}} = V_{AF_{ACO_2}}$$

$$V_{TF_{ECO_2}} = (V_T - V_D)F_{ACO_2}, \text{ and we can convert } F_{ACO_2} \text{ into } P_{ACO_2}$$

PULM

Equation of Motion

$$P_{\text{delivered}} = P_{\text{resistive}} + P_{\text{elastic}}$$

$$P_{\text{aw}} = \dot{V}R + \frac{V_t}{C} + \text{PEEP}_{\text{total}} + P_{\text{musc}}$$

CARDS

$$\text{TPG} = \text{mPAP} - \text{PCWP}$$

$$\text{SVR} = \frac{\text{MAP} - \text{CVP}}{\text{CO}} \cdot 80$$

$$\text{CO} = \text{LVOT}_{\text{area}} \cdot \text{LVOT}_{\text{VTI}} \cdot \text{HR}$$

Swan-Ganz Equations

$$\text{CO} = \frac{\text{VO}_2}{C_a - C_v}, \text{ where } C_v = \text{ScvO}_2 \text{ (mixed venous oxygen content)}$$

From:

<https://ewrobbins.com/> - ewrobbins.com

Permanent link:

<https://ewrobbins.com/doku.php?id=resources:formulae&rev=1703276139>

Last update: **2023/12/22 20:15**

