Classic Shunt Equation

1. Given the following information, calculate the % shunt
   Hb 10 gm%, PB 750 torr, PaO_2 80 torr, SaO_2 92%, PvO_2 36 torr, SvO_2 65%
   $PaCO_2$ 40 torr, FiO_2 .40
   CaO_2=(Hbx1.34xSaO_2)+(PaO_2x.003)=(10x1.34x.92)+(80x.003)=12.57
   CvO_2=(Hbx1.34xSvO_2)+(PvO_2x.003)=(10x1.34x.65)+(36x.003)=8.82
   PAO_2=[(P_B-47)xFiO_2]-($PaCO_2$x1.25)=[(750-47)x.4]-(40x1.25)=231.2
   $C\acute{c}O_2$=(Hbx1.34)+(PAO_2x.003)=(10x1.34)+(231.2x.003)=14.09
   $$\frac{cc'O_2 - CaO_2}{Cc'O_2 - CvO_2} = \frac{14.09 - 12.57}{14.09 - 8.82} = \frac{1.52}{5.27} = .288 = 28.9\%$$

2. Given the following information, calculate the Physiological Deadspace (Vd).
   Vt 600 mL, $PaCO_2$ 55, P_ECO_2 44
   $$V_d = \frac{PaCO_2 - PECO_2}{PaCO_2} \times V_t = \frac{55 - 44}{55} \times .600L$$ **=.12L or 120 mL**

3. Given the following information, calculate the Vd/Vt ratio.
   $PaCO_2$ 49mm Hg, P_ECO_2 30 mm Hg
   $$\frac{V_d}{V_t} = \frac{PaCO_2 - PECO_2}{PaCO_2} = \frac{49 - 30}{49} = .39$$

4. Given an alveolar ventilation of 4 L/min and a cardiac output of 2 L/min, calculate the V/Q ratio.**2**
   A. Is this a high, low or normal ratio? **HIGH**
   B. What type of V/Q ratio is this? **DEADSPACE (RELATIVE)**
   C. List a clinical situation that may cause this type of V/Q ratio. **HYPOTENSION**

5. Given an alveolar ventilation of 2 L/min and a cardiac output of 0 L/min, calculate the V/Q ratio. ∞

6.
   A. List a clinical condition that may cause this type of V/Q ratio. **Pulmonary Embolus**
   B. Is this a high, low or normal ratio? **HIGH**
   C. What type of V/Q ratio is this? **TRUE DEADSPACE**

7. Given an alveolar ventilation of 10 L/min and a cardiac output of 5 L/min, calculate the V/Q ratio. **2**
   A. Is this a high, low or normal ratio? **HIGH**
   B. What type of V/Q ratio is this? **RELATIVE DEADSPACE**

8. Given a Vd/Vt ratio of 50% and a tidal volume of 400 mL, calculate:

A. Physiologic Deadspace: **0.5 x 400 = 200 mL**

B. Alveolar Ventilation: **400 – 200 = 200 mL**

9. Given a Vd/Vt ratio of 70% and a tidal volume of 600 mL, calculate:

   A. Physiologic Deadspace: **0.7 x 600 = 420 mL**

   B. Alveolar Ventilation: **600 – 420 = 180 mL**

10. Given the following information ($PaCO_2$ of 50 mmHg, P_ECO_2 of 34 mmHg and Tidal Volume of 600 mL), calculate:

    A. Vd/Vt ratio $\frac{V_d}{V_t} = \frac{PaCO_2 - PECO_2}{PaCO_2} = \frac{50 - 34}{50} = .32$

    B. Physiologic Deadspace **.32 x 600 = 192 mL**

    C. Alveolar Ventilation **600 – 192 = 408 mL**

11. Given an alveolar ventilation of 0 L/min and a cardiac output (Qt) of 5 L/min, calculate the V/Q ratio. **0**

    A. What type of V/Q ratio is this? **TRUE SHUNT**

    B. List three clinical conditions which could cause this type of V/Q ratio
       I. **Atelectasis**
       II. **Pneumonia**
       III. **ARDS**

    C. How would you treat this type of V/Q ratio? **Alveolar recruitment**

12. Given an alveolar ventilation of 2 L/min and a cardiac output of 6 L/min, calculate the V/Q ratio. **0.33**

    A. What type of V/Q ratio is this? **Shunt (relative)**

    B. Give a clinical situation that may cause this type of V/Q imbalance **Pulmonary secretions**

    C. How would you treat this type of V/Q imbalance? **Maintain patent airway**

13. You calculate a patient's shunt to be 30%.

    A. What does this mean to you? **Elevated**

    B. What is the normal shunt? **2 to 5%**

14. Given an alveolar ventilation of 5 L/min and a cardiac output of 10 L/min, calculate the V/Q ratio. **0.5**
    A. What type of V/Q ratio is this? **Relative Shunt**

B. What type of clinical situation would cause this type of V/Q imbalance? **Sepsis (Increased cardiac output)**

15. Given an alveolar ventilation of 0 L/min and a cardiac output of 0 L/min, what is the V/Q ratio? **0**

    A. What effect does this type of V/Q ratio have on a patient? **Death**

    B. Name clinical conditions that may cause this type of V/Q imbalance. **Significant unilateral disease with contralateral pulmonary embolus**