SELF-ASSESSMENT - MODULE 3-1: Mechanics of Ventilation
COMPLIANCE AND RESISTANCE

SOLVE THE FOLLOWING PROBLEMS

1. V_t - 800 ml
Peak Pressure (PIP) - 40 cm H_2O
Static Pressure (Plateau Pressure) - 20 cm H_2O
PEEP +5 cm H_2O
Flowrate (") - 60 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.8\,L}{40 - 5} = \frac{0.8\,L}{35} = 0.023\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.8\,L}{20 - 5} = \frac{0.8\,L}{15} = 0.053\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{40 - 20}{60} \times 60 = \frac{20}{60} \times 60 = 20.0\,cm\,H_2O/L/sec$

2. V_t = 500 ml
Peak Pressure (PIP) - 32 cm H_2O
Static Pressure (Plateau Pressure) - 25 cm H_2O
PEEP +7 cm H_2O
Flowrate (") - 70 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.5\,L}{32 - 7} = \frac{0.5\,L}{25} = 0.020\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.5\,L}{25 - 7} = \frac{0.5\,L}{18} = 0.028\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{32 - 25}{70} \times 60 = \frac{7}{70} \times 60 = 6.0\,cm\,H_2O/L/sec$

3. V_t - 650 ml
Peak Pressure (PIP) - 60 cm H_2O
Static Pressure (Plateau Pressure) - 42 cm H_2O
Flowrate (") - 80 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.65\,L}{60 - 0} = \frac{0.65\,L}{60} = 0.011\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.65\,L}{42 - 0} = \frac{0.65\,L}{42} = 0.015\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{60 - 42}{80} \times 60 = \frac{18}{80} \times 60 = 13.5\,cm\,H_2O/L/sec$

4. V_t - 700 ml
Peak Pressure (PIP) - 45 cm H_2O
Static Pressure (Plateau Pressure) - 32 cm H_2O
PEEP +10 cm H_2O
Flowrate (") - 45 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.70\,L}{45 - 10} = \frac{0.70\,L}{35} = 0.020\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.7\,L}{32 - 10} = \frac{0.7\,L}{22} = 0.032\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{45 - 32}{45} \times 60 = \frac{13}{45} \times 60 = 17.3\,cm\,H_2O/L/sec$

5. V_t - 850 ml
Peak Pressure (PIP) - 35 cm H_2O
Static Pressure (Plateau Pressure) - 20 cm H_2O
Flowrate (") - 50 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.85\,L}{35 - 0} = \frac{0.85\,L}{35} = 0.024\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.85\,L}{20 - 0} = \frac{0.85\,L}{20} = 0.043\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{35 - 20}{50} \times 60 = \frac{15}{50} \times 60 = 18.0\,cm\,H_2O/L/sec$

6. V_t - 675 ml
Peak Pressure 20 cm H_2O
Static Pressure 10 cm H_2O
Flowrate (") - 55 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.675\,L}{20 - 0} = \frac{0.675\,L}{20} = 0.034\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.675\,L}{10 - 0} = \frac{0.675\,L}{10} = 0.068\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{20 - 10}{55} \times 60 = \frac{10}{55} \times 60 = 10.9\,cm\,H_2O/L/sec$

7. V_t - 900 ml
Peak Pressure (PIP) - 60 cm H_2O
Static Pressure - 40 cm H_2O
PEEP +15 cm H_2O
Flowrate (") - 75 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.9\,L}{60 - 15} = \frac{0.9\,L}{45} = 0.02\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.9\,L}{40 - 15} = \frac{0.9\,L}{25} = 0.036\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{60 - 40}{75} \times 60 = \frac{20}{75} \times 60 = 16.0\,cm\,H_2O/L/sec$

8. V_t – 1,000 ml
Peak Pressure (PIP) - 65 cm H_2O
Static Pressure - 50 cm H_2O
PEEP +5 cm H_2O
Flowrate (") - 60 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{1.0\,L}{65 - 5} = \frac{1.0\,L}{60} = 0.017\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{1.0\,L}{50 - 5} = \frac{1.0\,L}{45} = 0.022\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{65 - 50}{60} \times 60 = \frac{15}{60} \times 60 = 15.0\,cm\,H_2O/L/sec$

9. V_t – 450 ml
Peak Pressure (PIP) - 35 cm H_2O
Static Pressure - 20 cm H_2O
PEEP +5 cm H_2O
Flowrate (") - 80 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.45\,L}{35 - 5} = \frac{0.45\,L}{30} = 0.015\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.45\,L}{20 - 5} = \frac{0.45\,L}{15} = 0.03\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{35 - 20}{80} \times 60 = \frac{15}{80} \times 60 = 11.3\,cm\,H_2O/L/sec$

10. V_t – 900 ml
Peak Pressure (PIP) - 40 cm H_2O
Static Pressure - 12 cm H_2O
PEEP +7 cm H_2O
Flowrate (") - 40 L/min

A. Dynamic Compliance $C_{DYN} = \frac{V_t}{P_{Pk} - PEEP} = \frac{0.9\,L}{40 - 7} = \frac{0.9\,L}{33} = 0.027\,L/cm\,H_2O$

B. Static Compliance $C_{STAT} = \frac{V_t}{P_{Pl} - PEEP} = \frac{0.9\,L}{12 - 7} = \frac{0.9\,L}{5} = 0.18\,L/cm\,H_2O$

C. Airway Resistance $R_{AW} = \frac{P_{Pk} - P_{Pl}}{\dot{V}} \times 60 = \frac{40 - 12}{40} \times 60 = \frac{28}{40} \times 60 = 42.0\,cm\,H_2O/L/sec$