Pulmonary Graphics

Flow sensor- Hot Wire anemometer

- Use a hot wire placed within the sensor with airflow changing the temperature of the wire which influences the electric current through the wire.

- This change in current is sensed by microcontroller and it is proportional to the flow in the tube, thereby allowing microcontroller to estimate the flow in tube.

- They are less prone to gas humidity and water rain out.

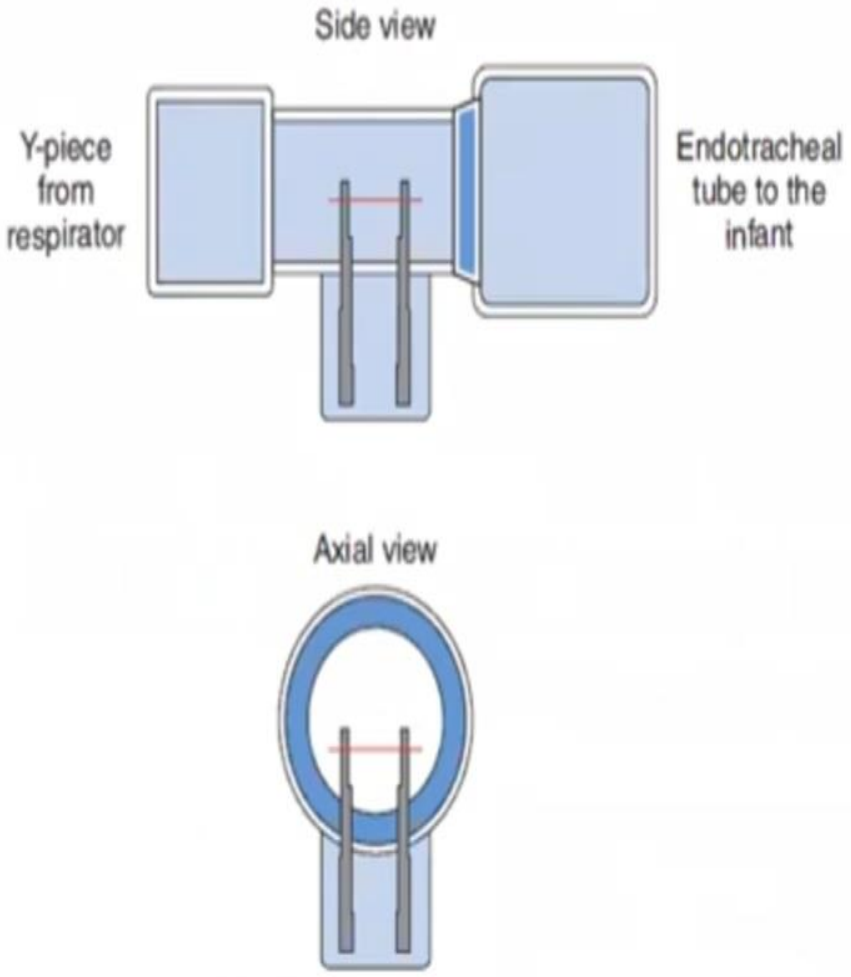


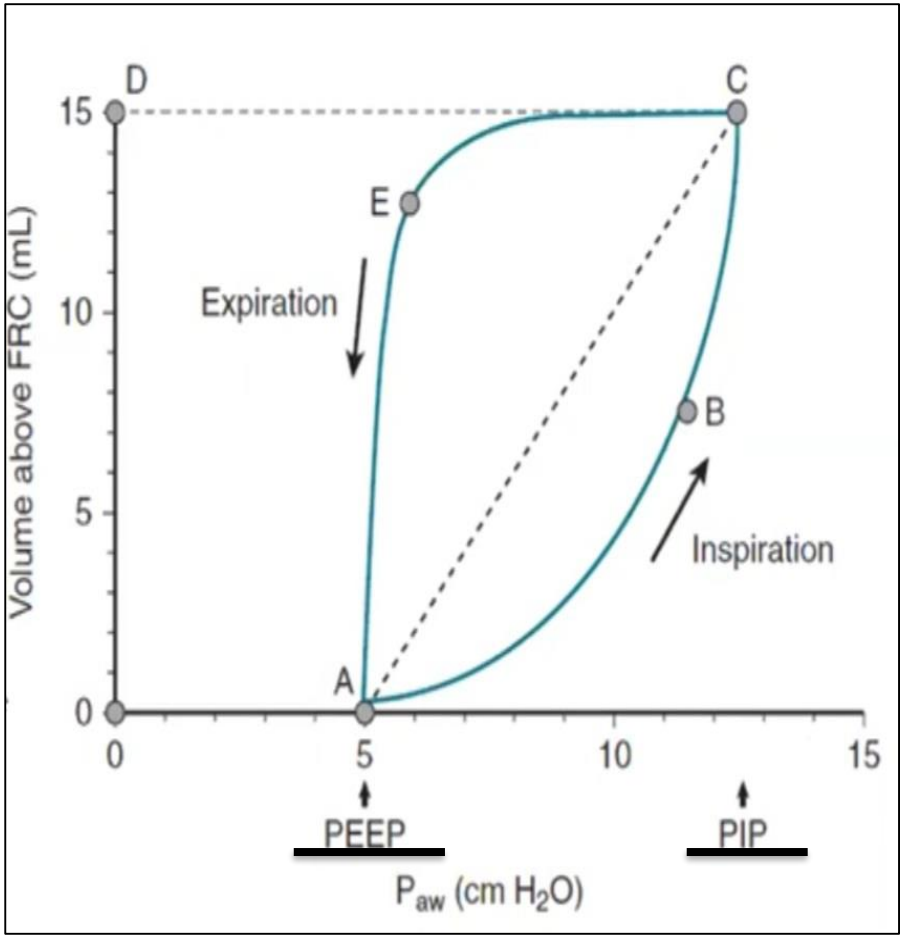
Fig. 12.2 Hot-wire anemometer.

Loops

Loops- Parameters are presented relative to each other on x axis and Y axis on a breath to breath basis.

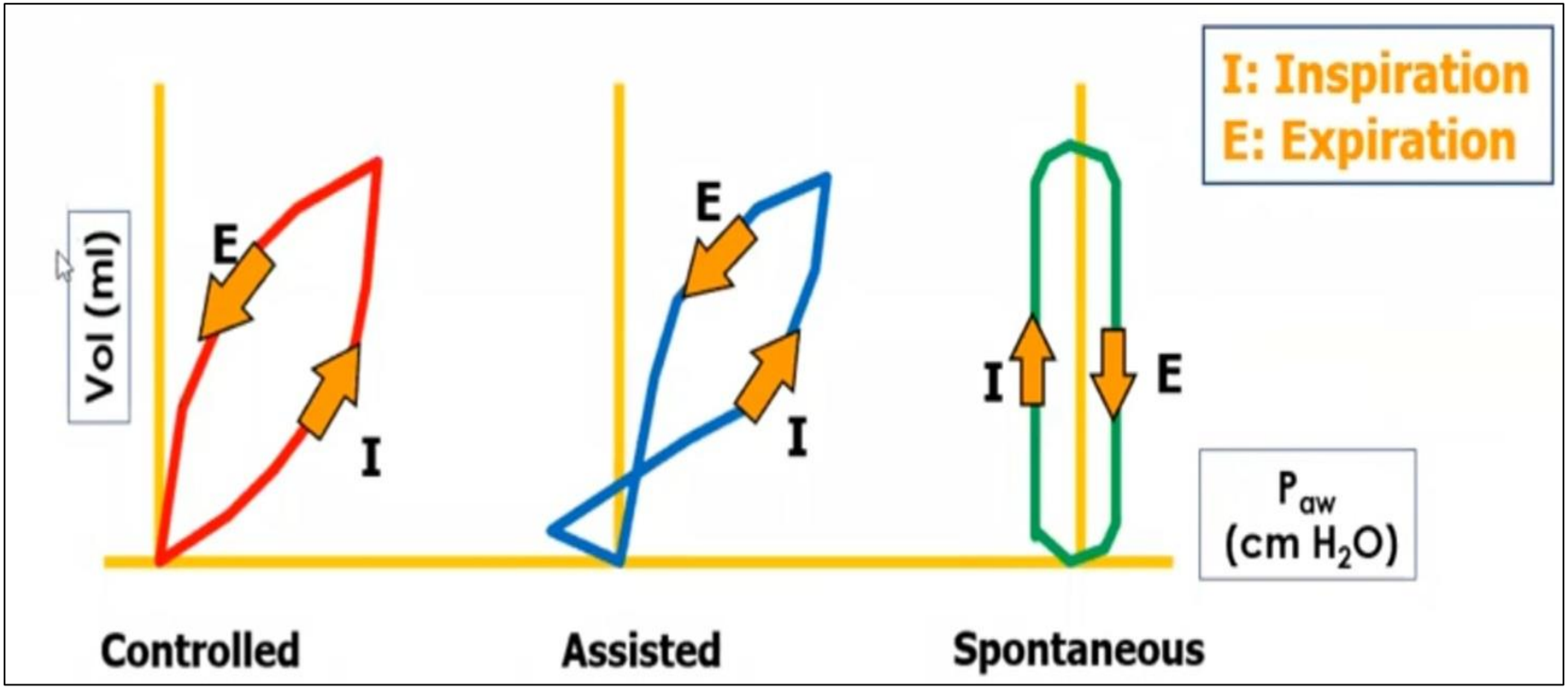
- Pressure- Volume loop
- Flow – Volume loop

Pressure-Volume Loop

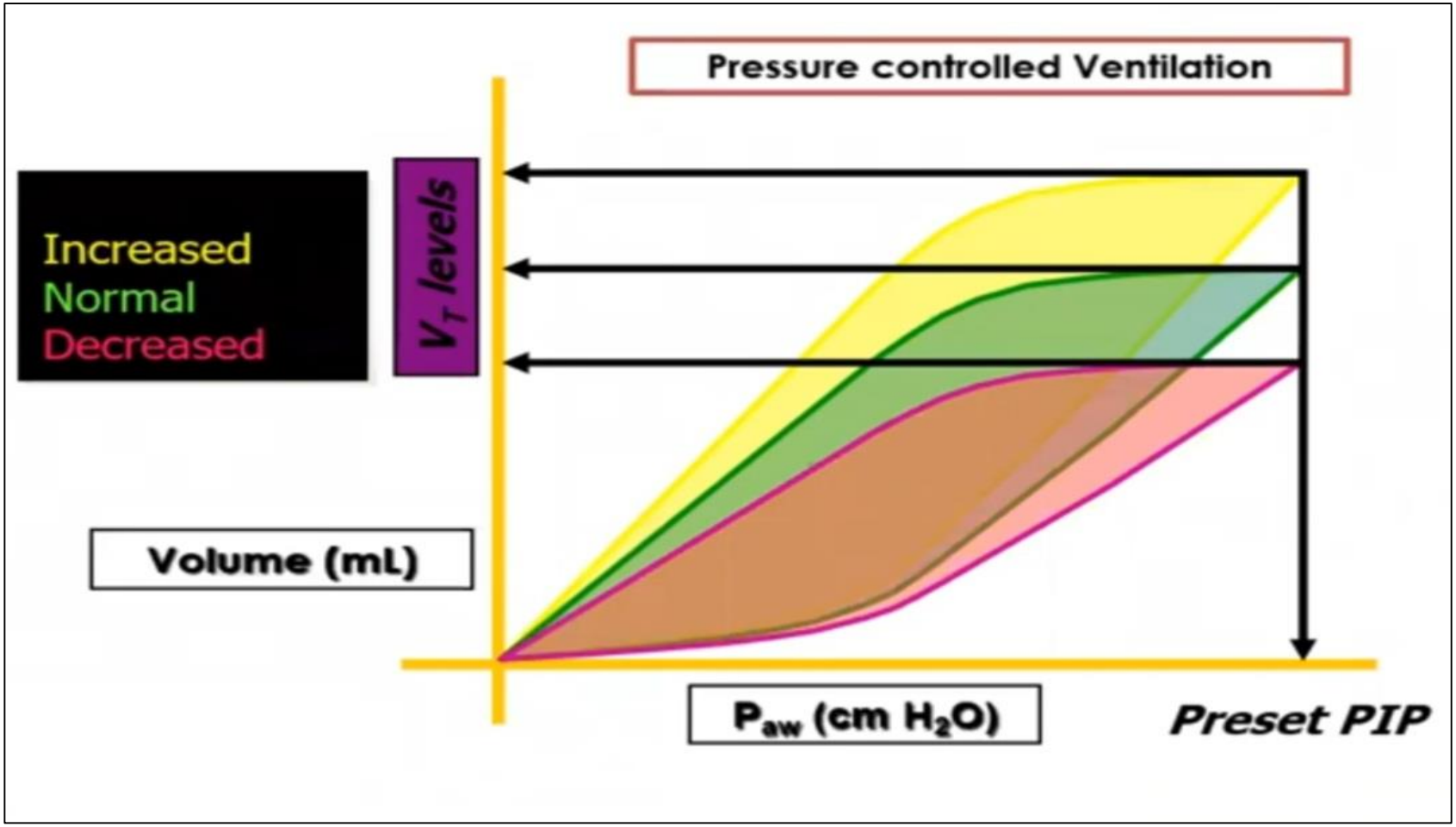


- Inflation starts at PEEP (A) and ends at PIP(C)
- Expiration starts at (C) with rapid drop in pressure to PEEP level(E) and ends at (A)
- Slope AC represents respiratory compliance

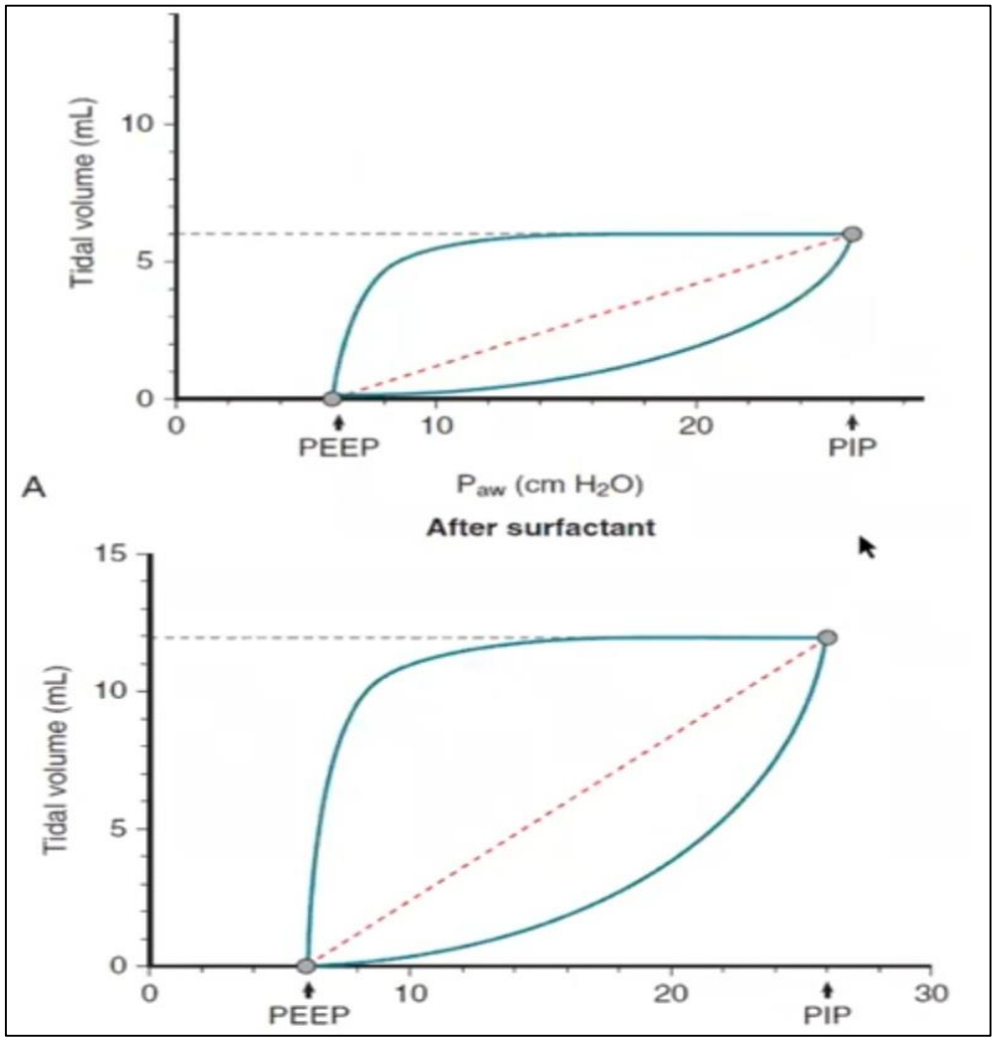
Types of Breath



Compliance

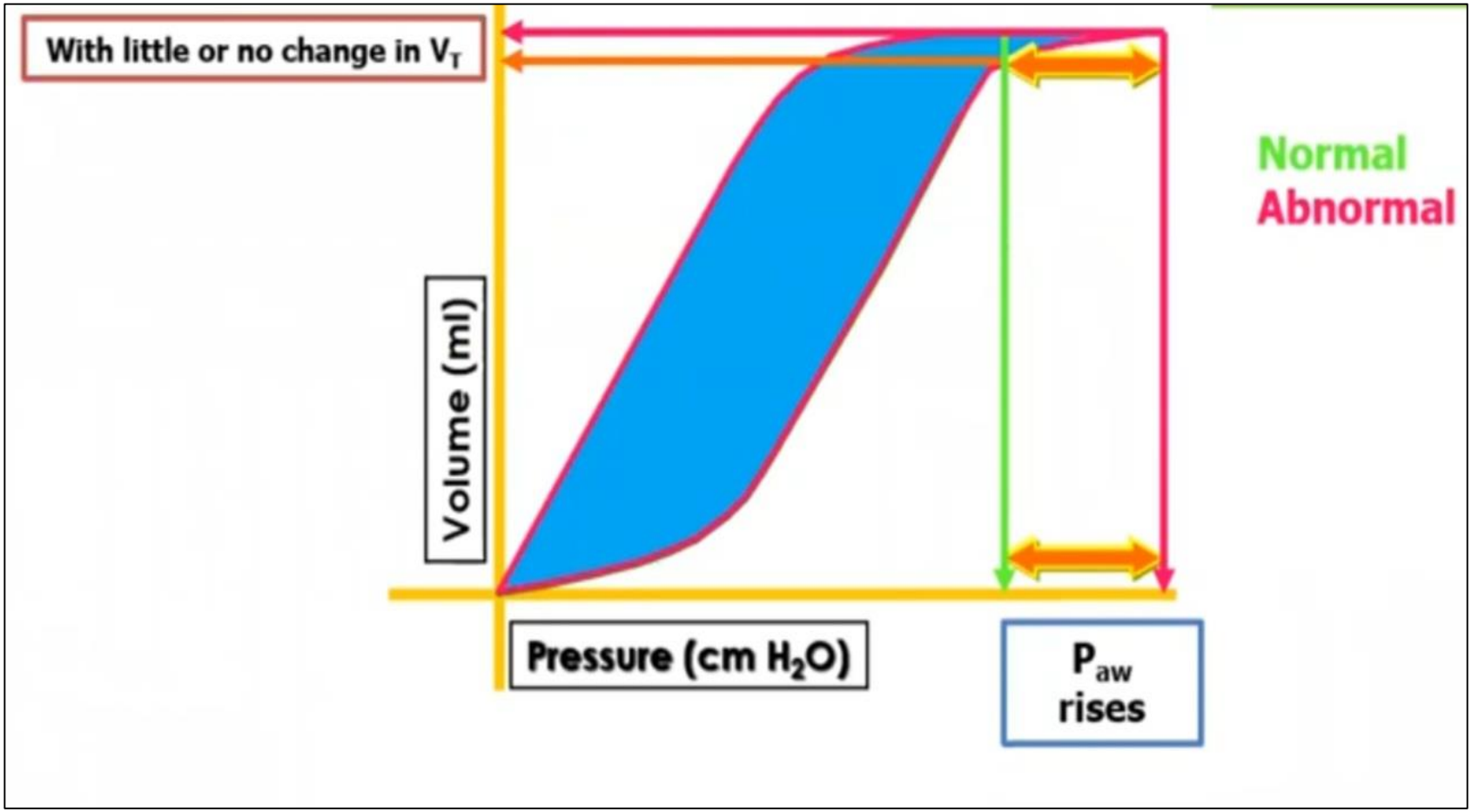

Pressure controlled Ventilation
Increased
Normal
Decreased
V_T levels
Volume (mL)
P_{aw} (cm H_2O)
Preset PIP

Compliance



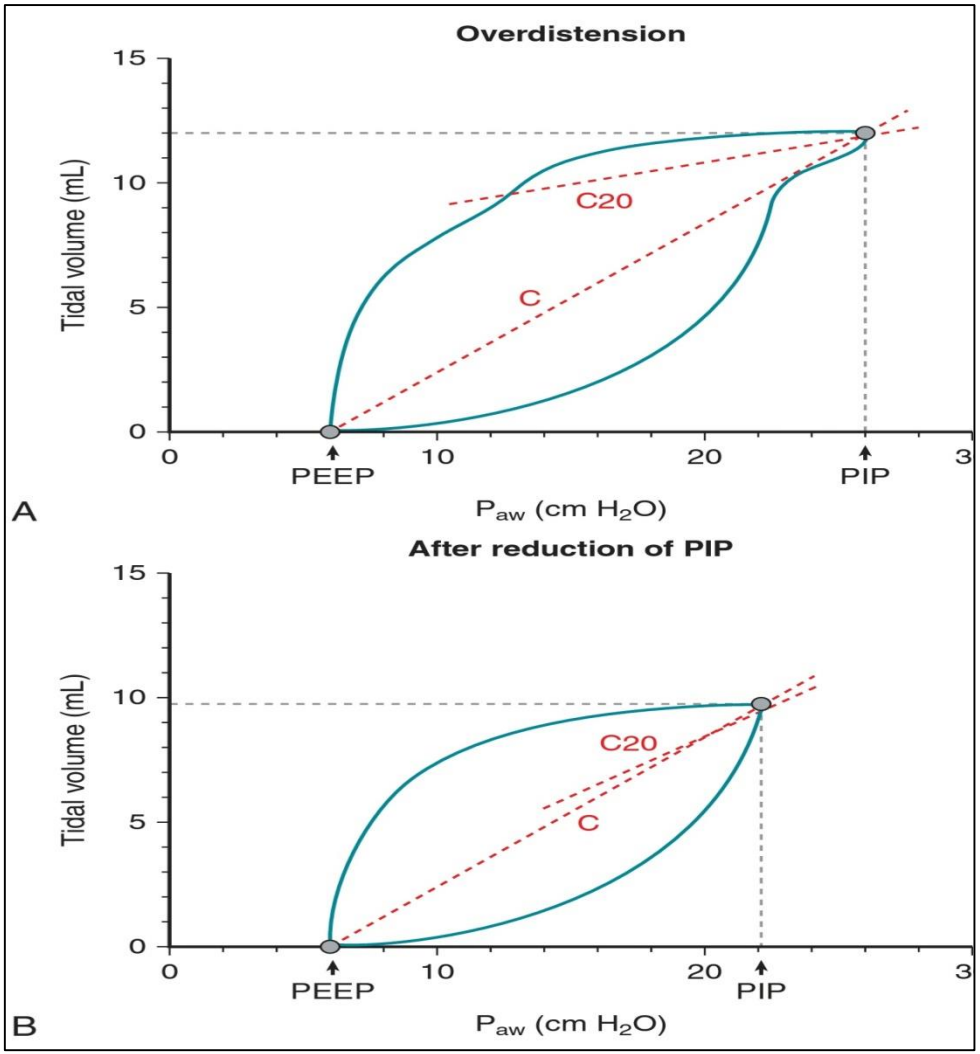
- P-V loop with RDS
- Pre and post surfactant
- Tidal volume delivery doubled
- Complaince improved post SRT

Overdistention



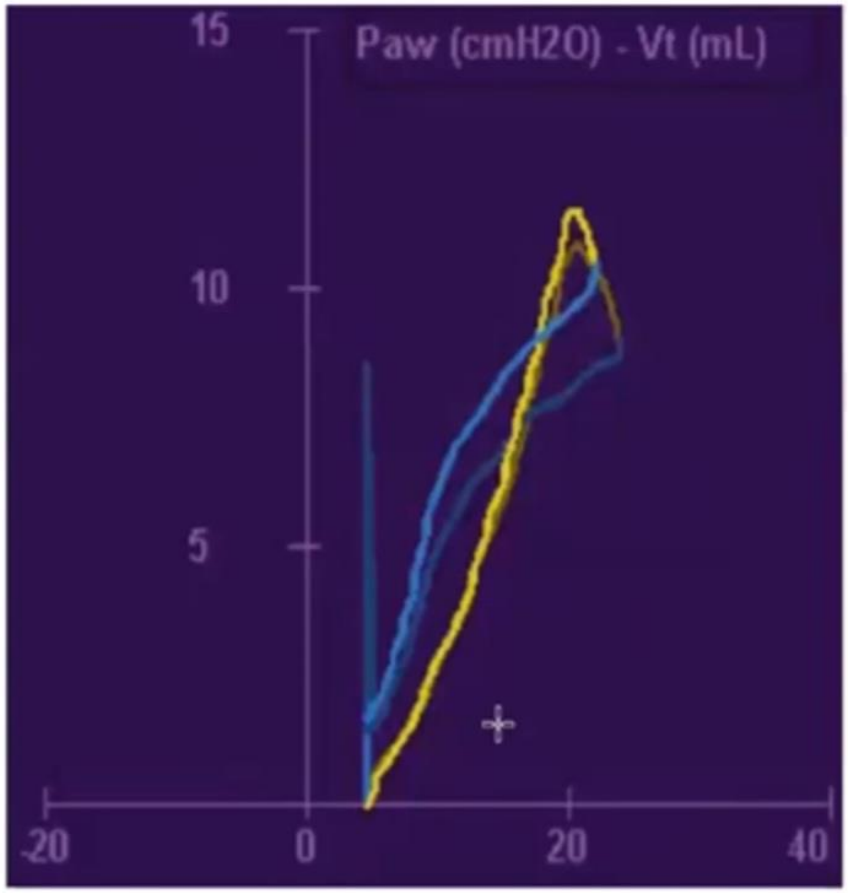
Beaking of PV loop- s/o overdistention

Compliance Ratio C20/C



- Numerical representation of overdistention
- Compares last 20% of compliance to total complaince
- Normal is ≥ 1
- <0.8 -significant overdistention

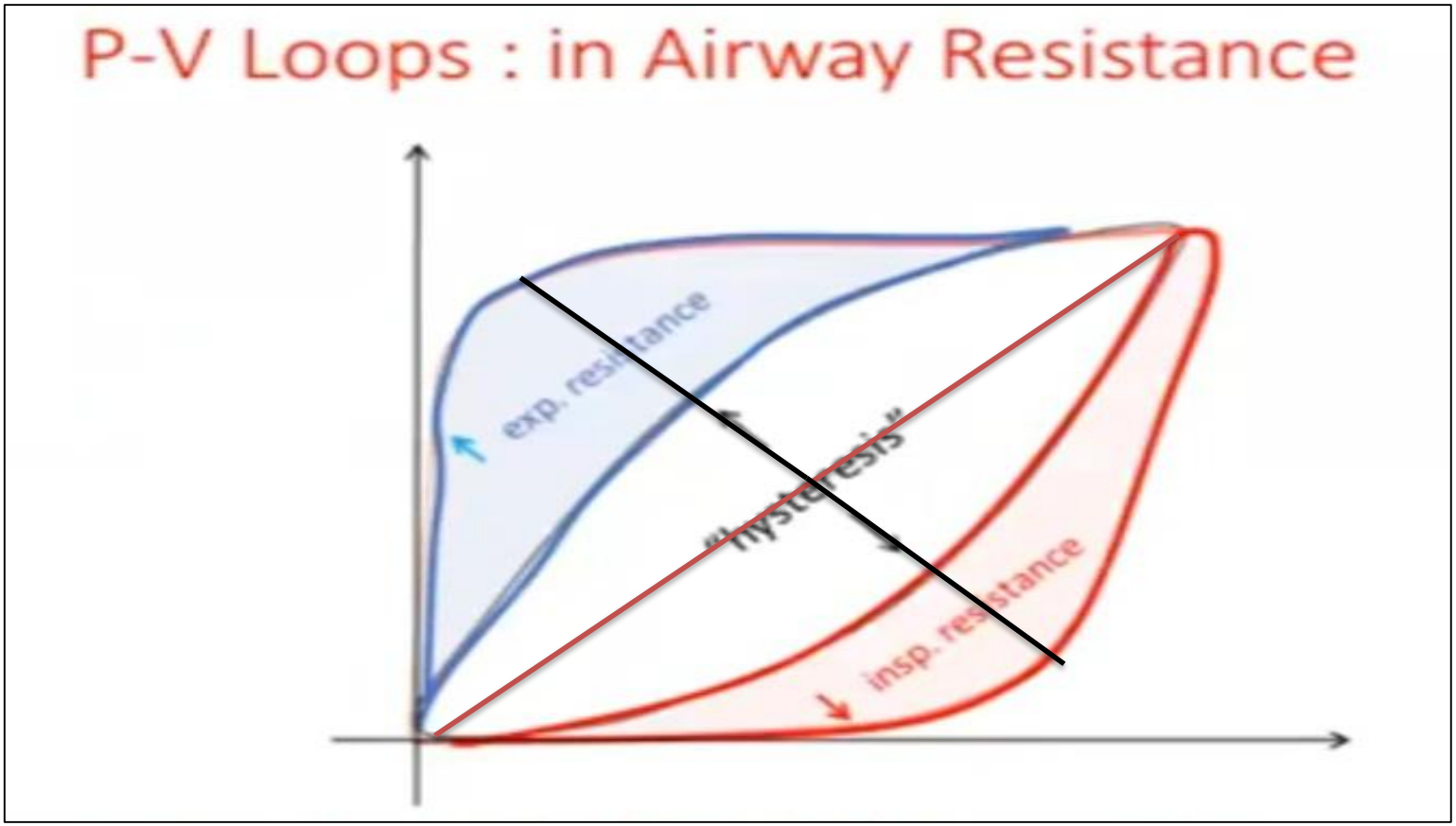
Air Hunger/Flow Starvation



- **Figure of 8-** Reversal of inflation and deflation limb at the top of the loop.

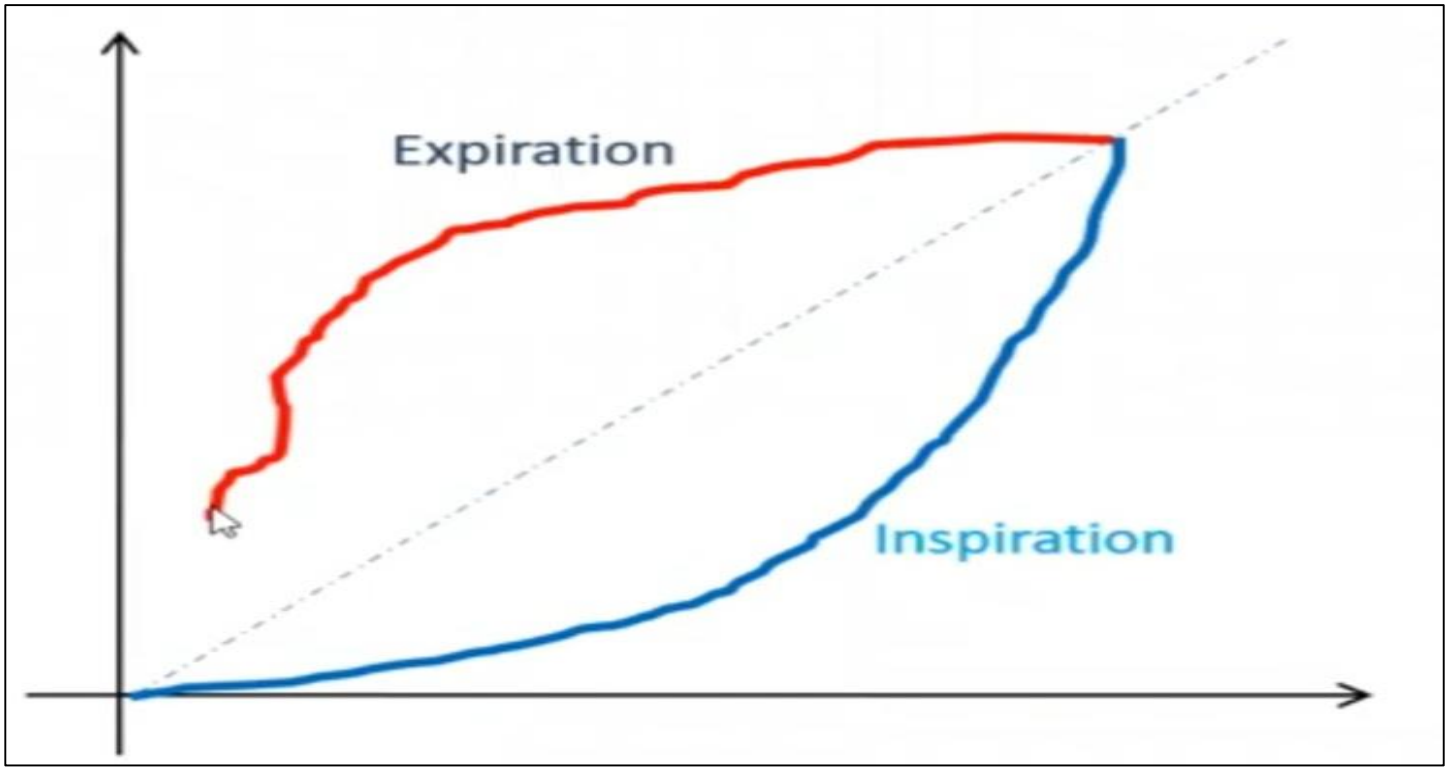
- Intervention- Provide additional flow or volume.

Airway resistance



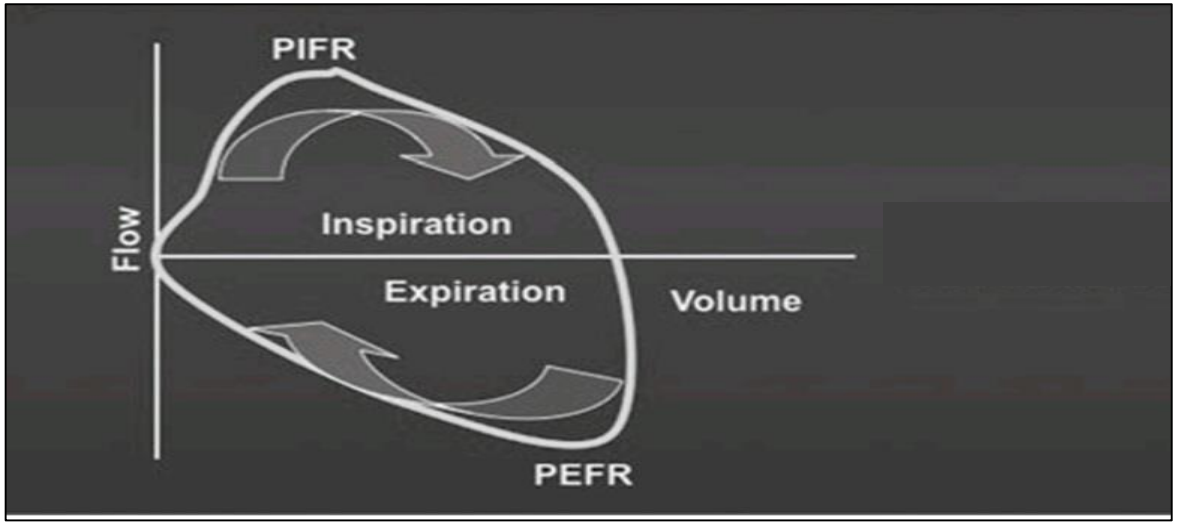
As resistance increases, loop will become wider

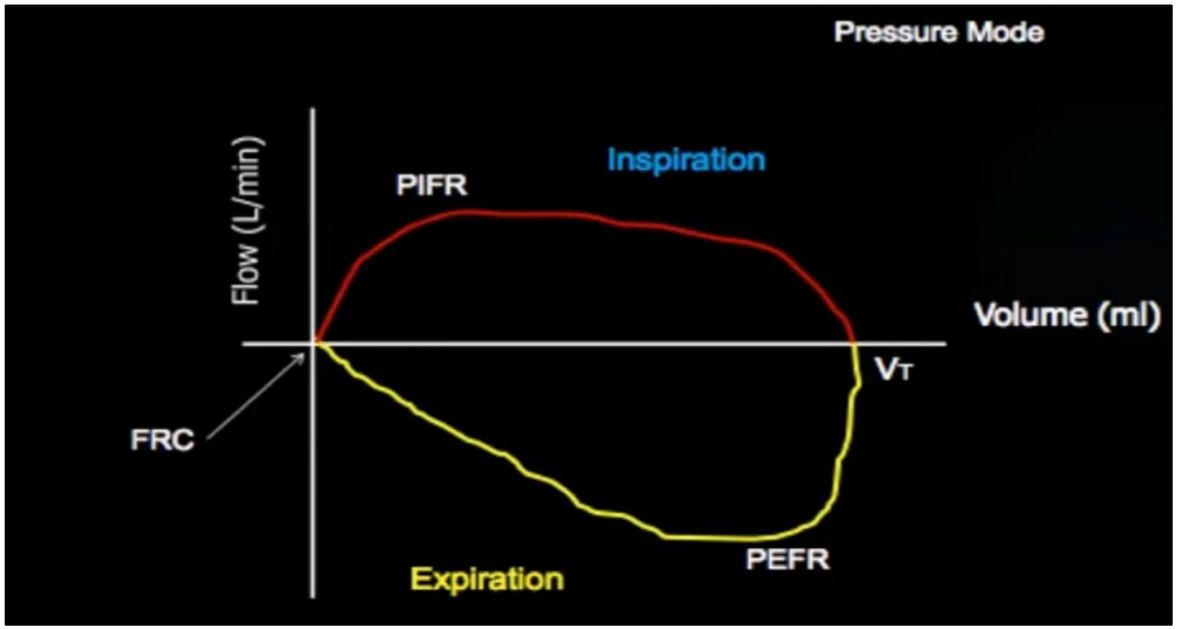
Air Leak



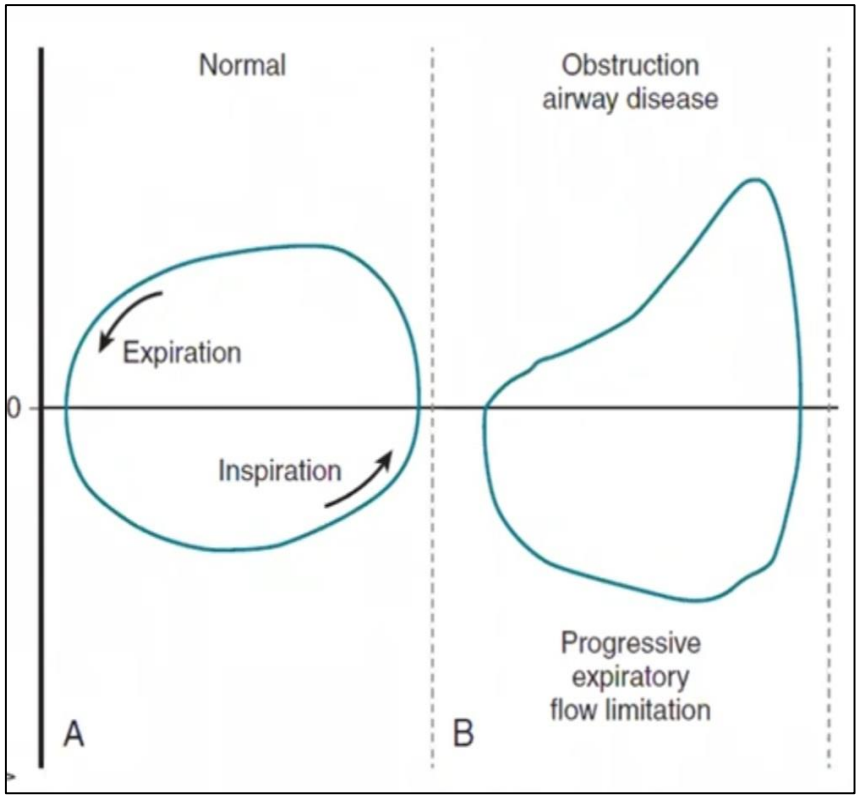
The expiratory portion of loop does not return to baseline

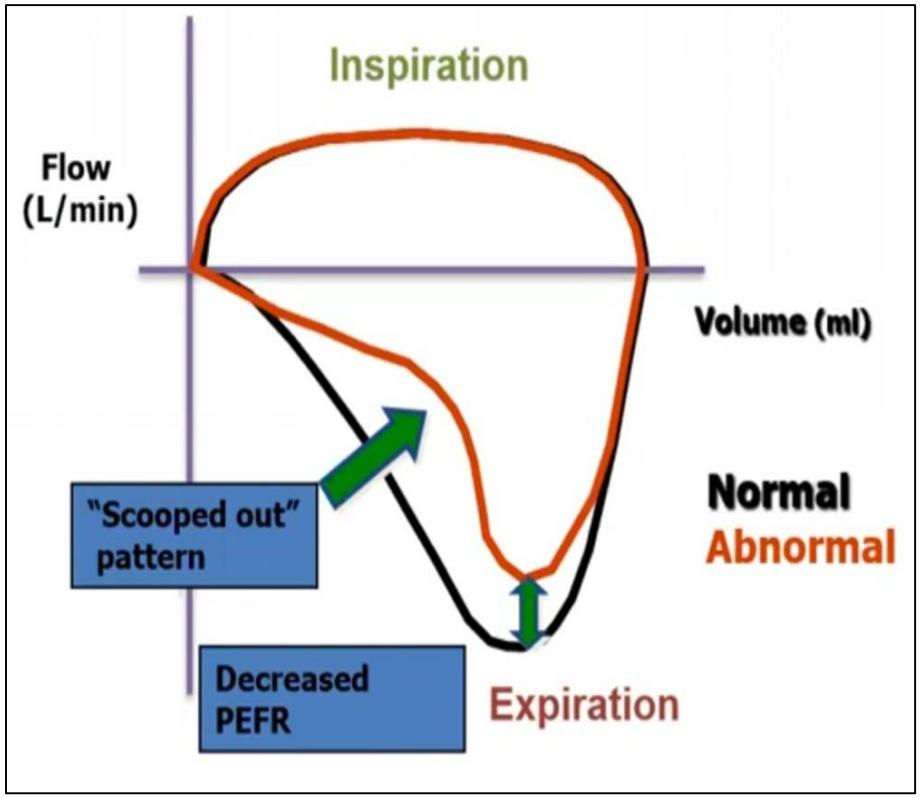
Flow Volume Loop





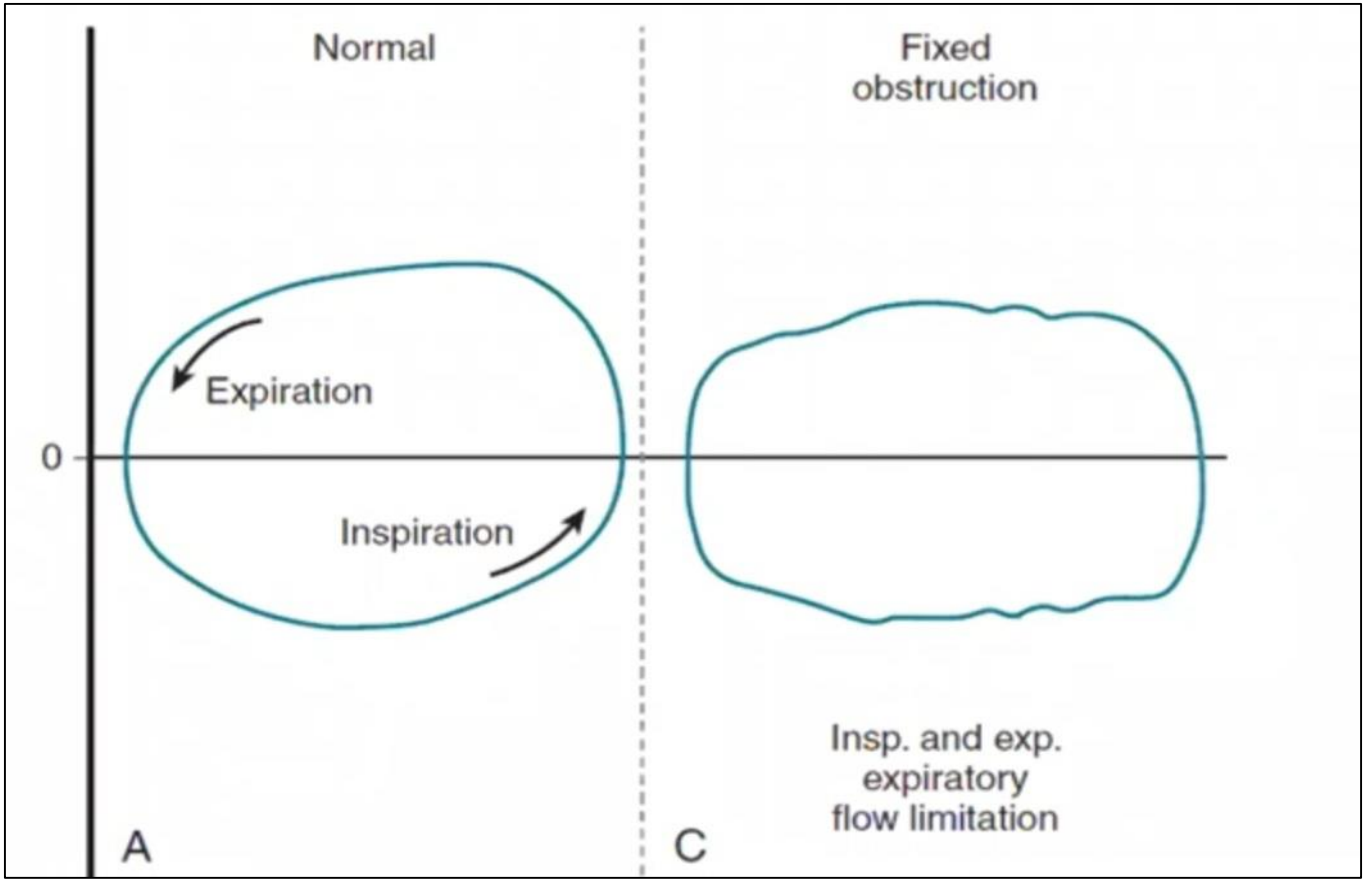
Flow Limitation





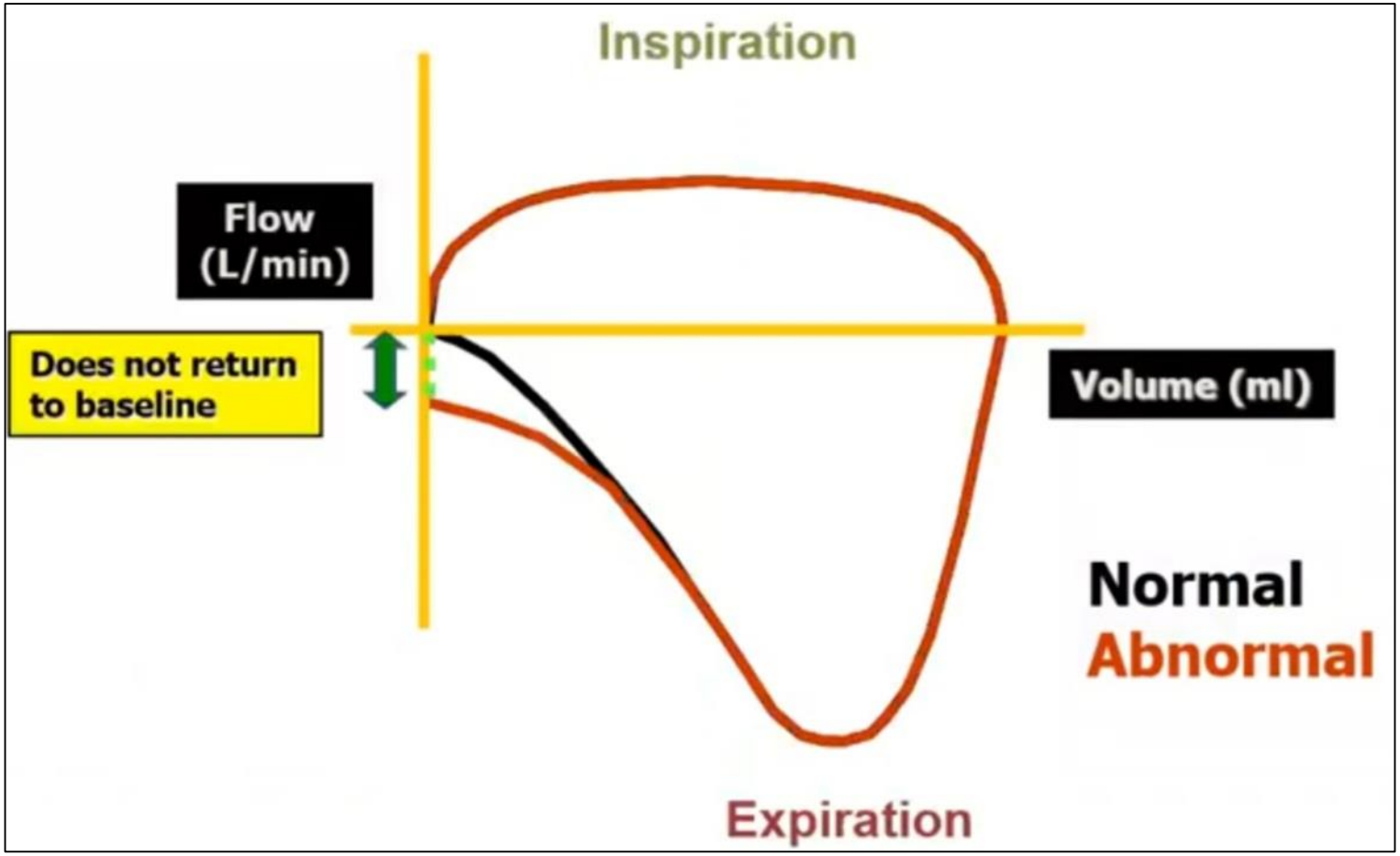
Expiratory flow limitation- In BPD

Flow limitation

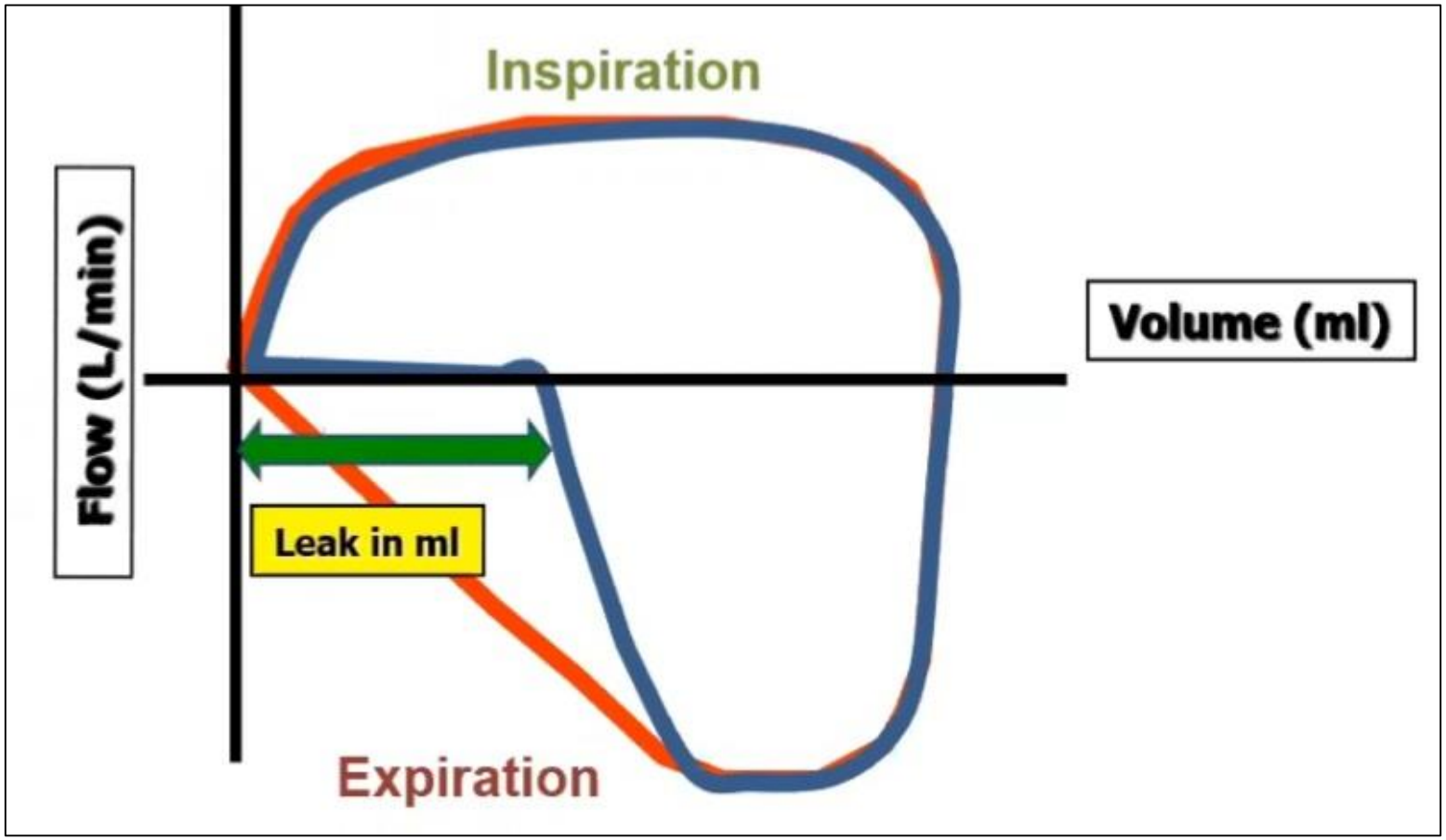


Extrathoracic airway obstruction with insp and exp flow limitation. Eg- Subglottic stenosis

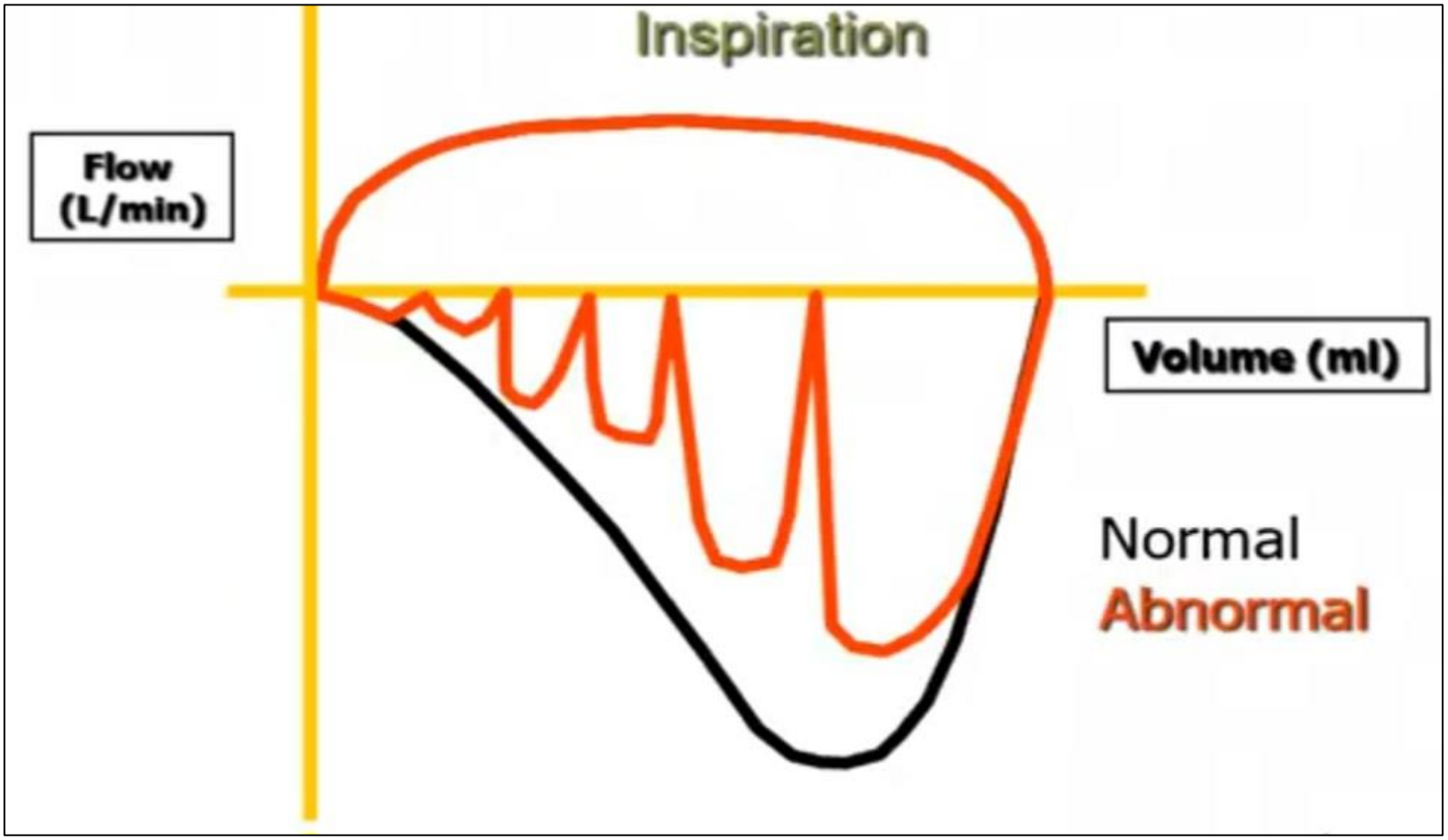
Air Trapping



Air Leak



Airway Secretions

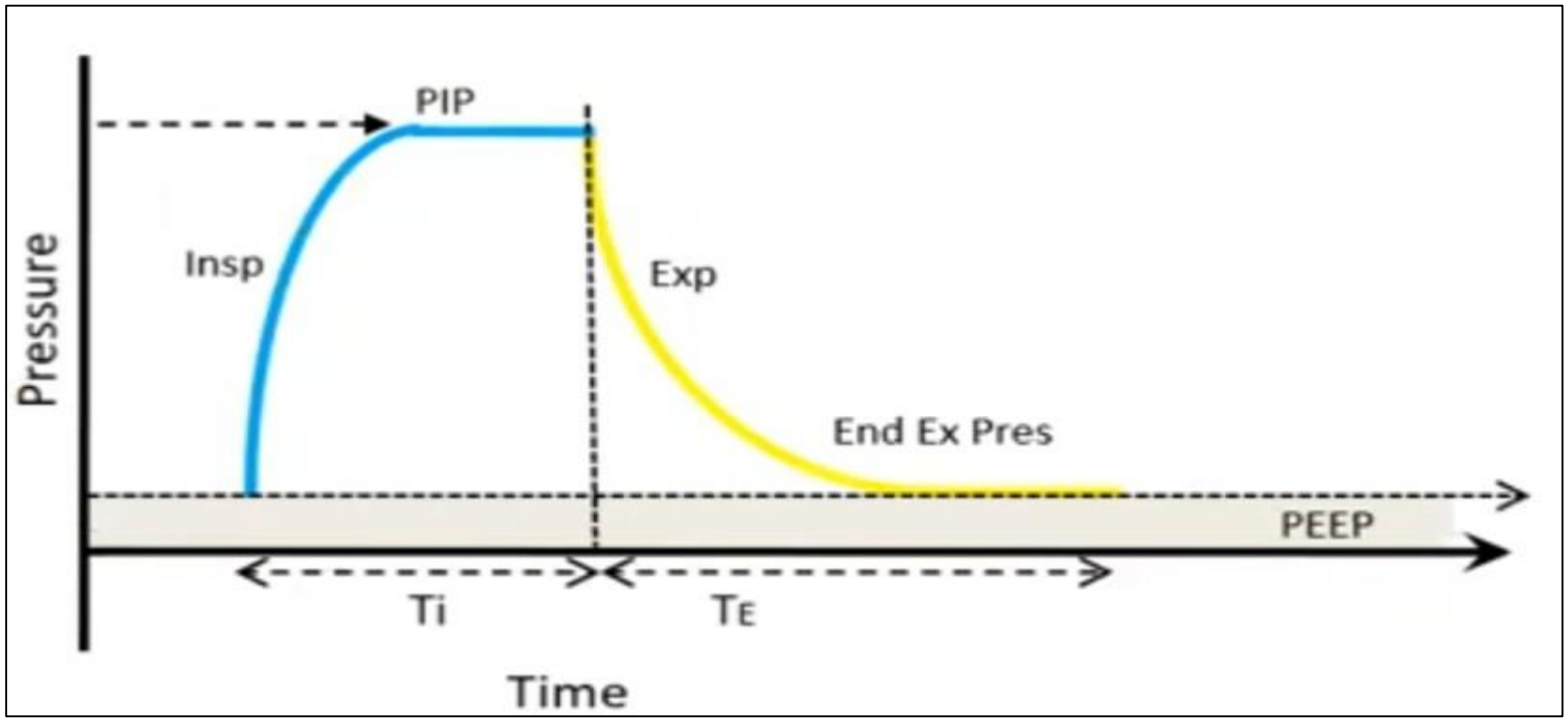


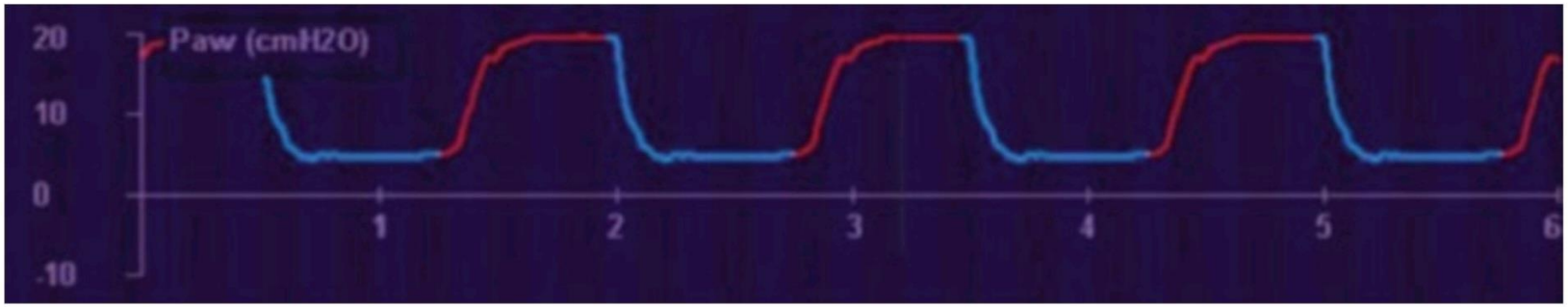
Scalars

Scalars- Inter-relationship between respiratory parameters (Y axis) and time (X axis) on breath to breath basis.

- Pressure vs Time
- Flow vs Time
- Volume vs Time

Pressure scalar- Pressure control mode





MAP-

To increase MAP
1. Increase flow
2. Increase peak pressure
3. Lengthen inspiratory time
4. Increase PEEP
5. Increase rate

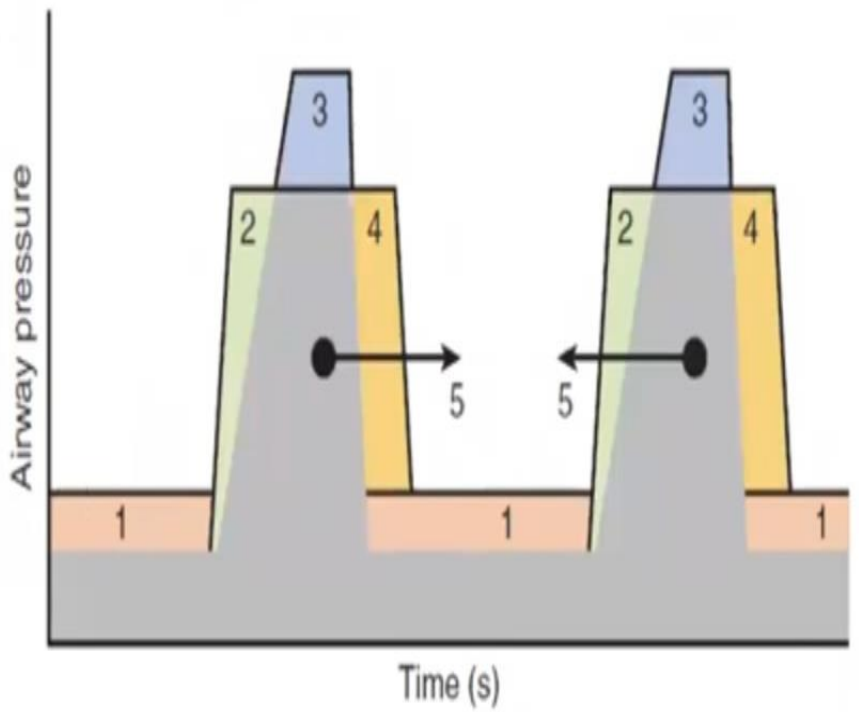
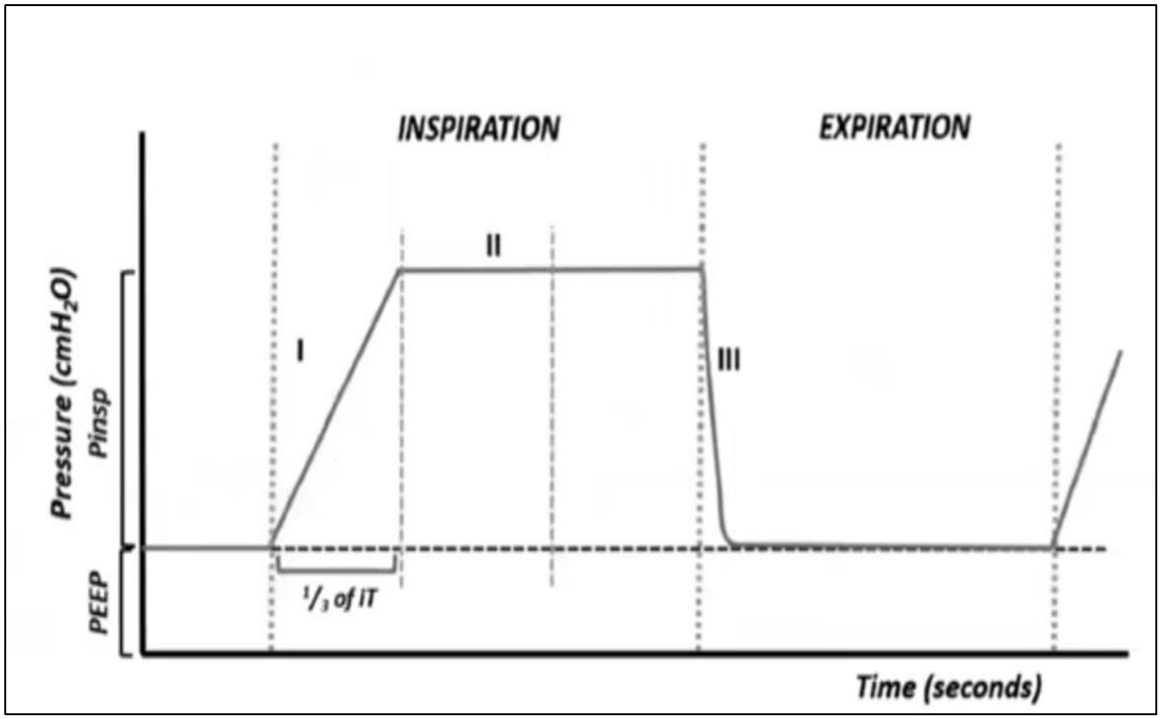


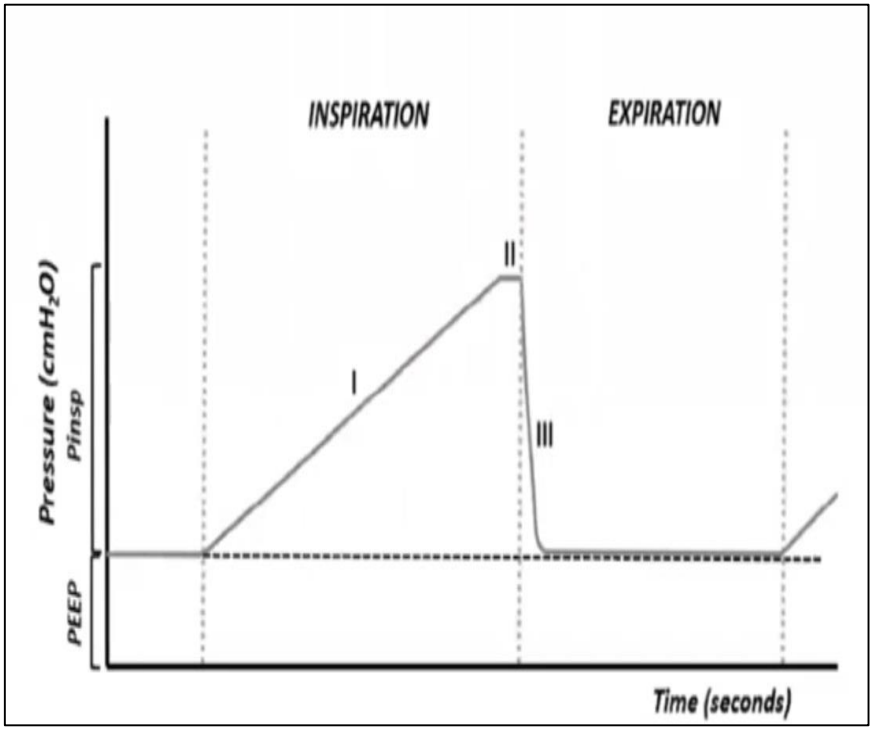
Fig. 12.6 Five options to increase mean airway pressure. Increase in positive end expiratory pressure (1), steeper slope (2), increased peak inflation pressure (3), longer inspiratory time (4), higher rate (5).

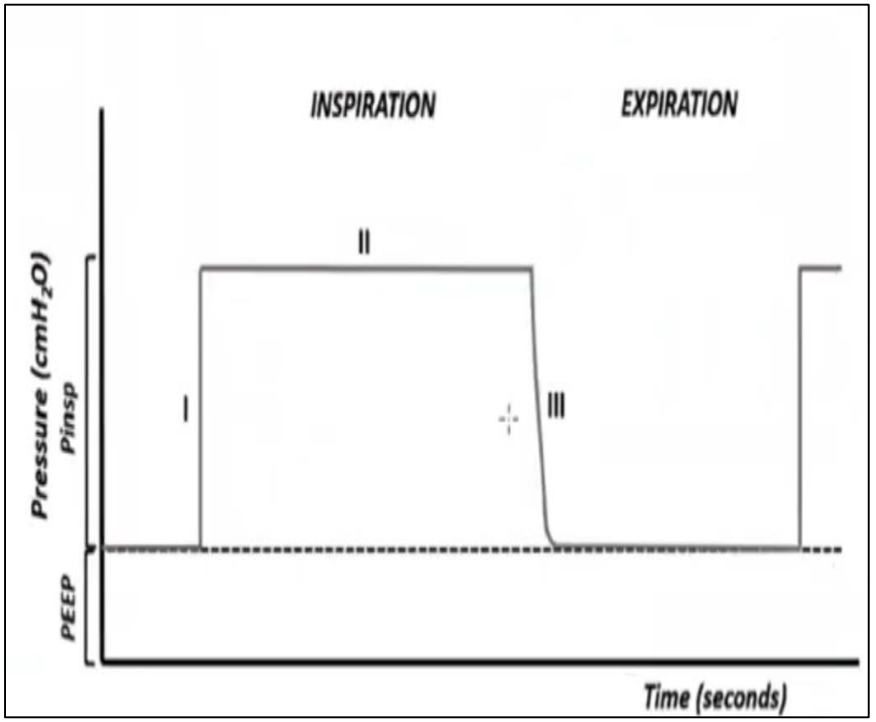
Flow Adequacy-



- Flow is adequate when desired pressure is reached at the end of the first one third of the inspiration.
- Slope should last 1/3rd of the inspiratory time.

Flow- High/Low

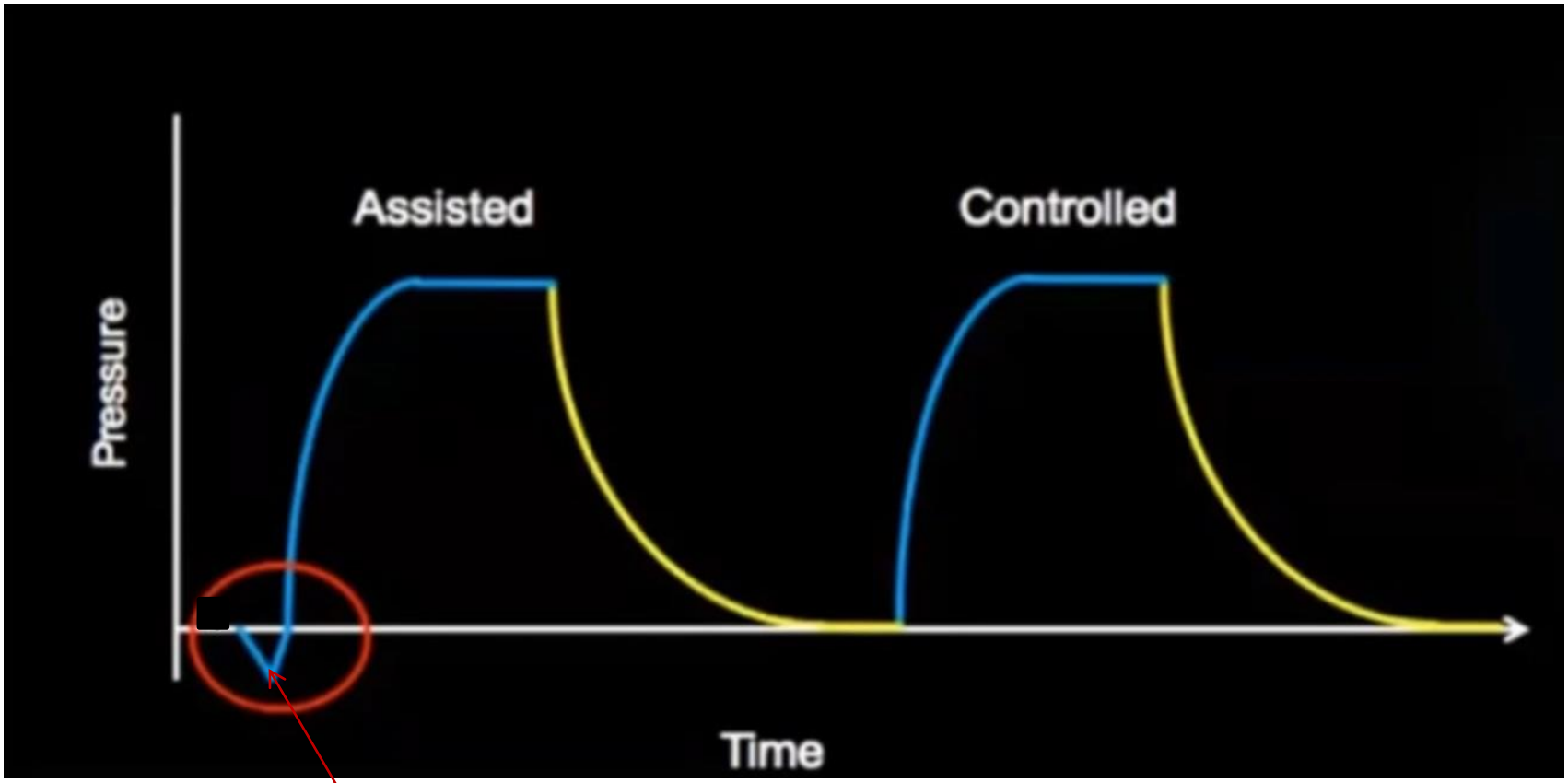




- Flow too low.
- Phase I is prolonged, not allowing adequate air delivery

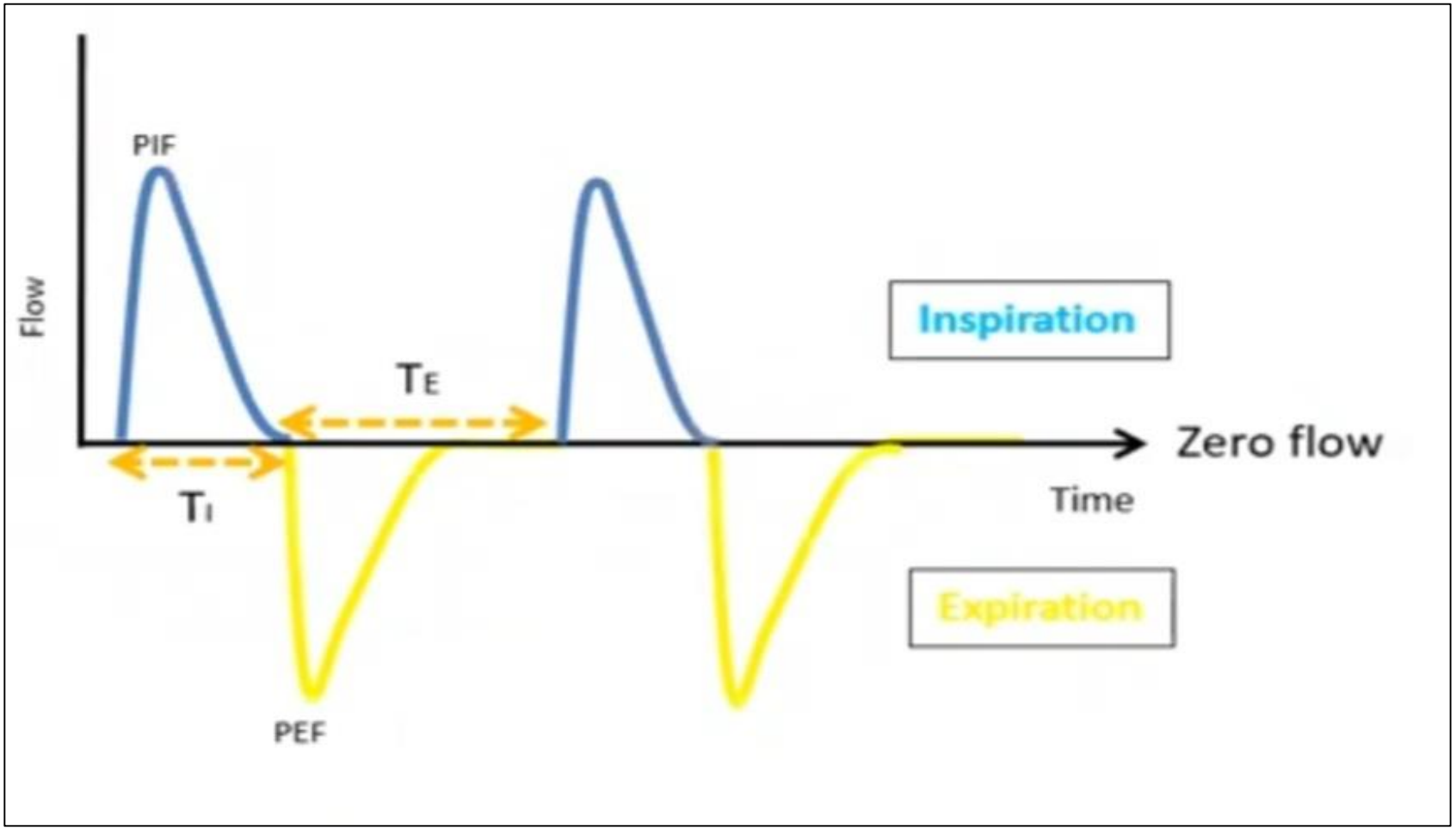
- Flow too high
- At starting itself max pressure is reached.

Assisted vs Controlled



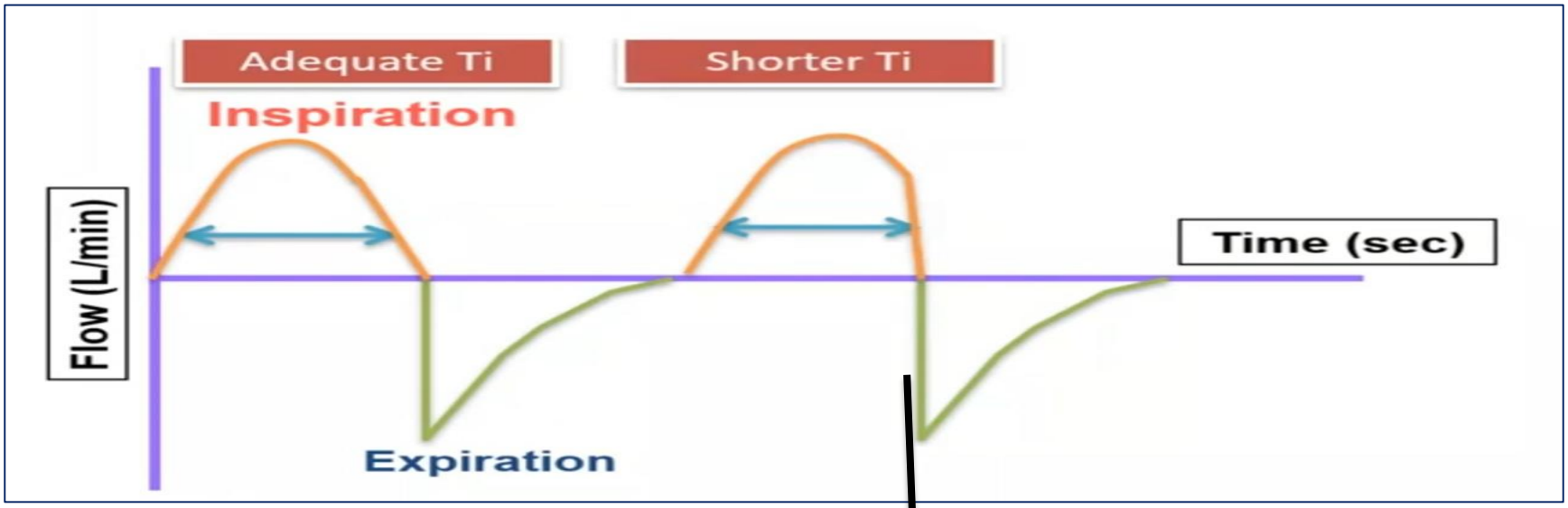
Negative deflection - trigger from baby

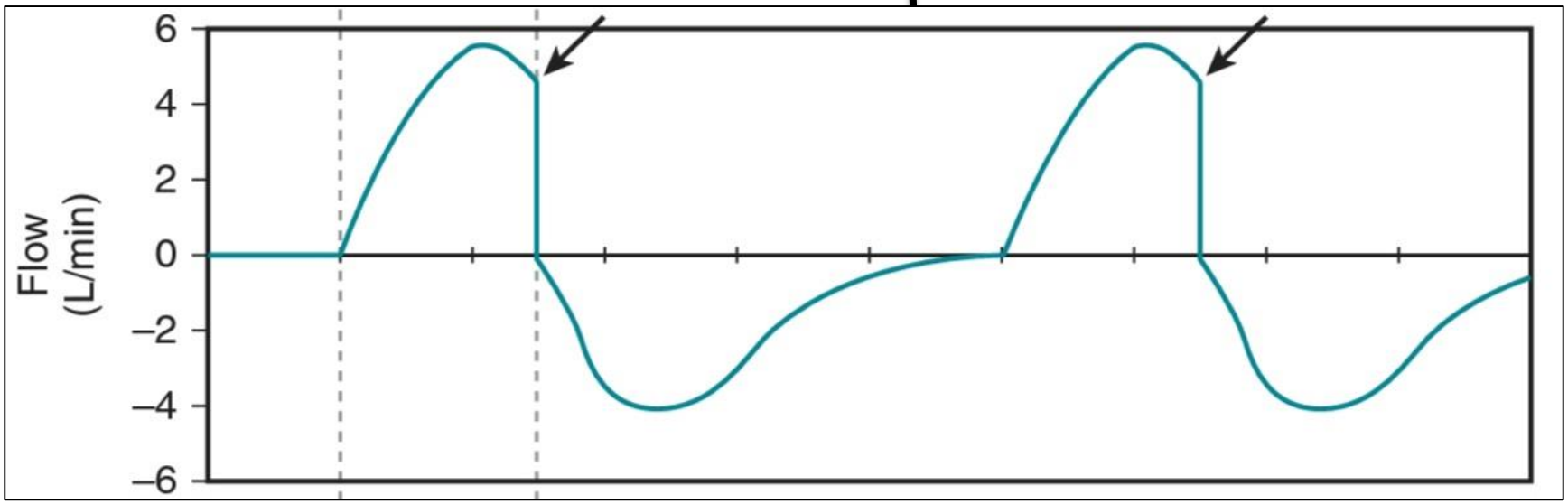
Flow Scalar



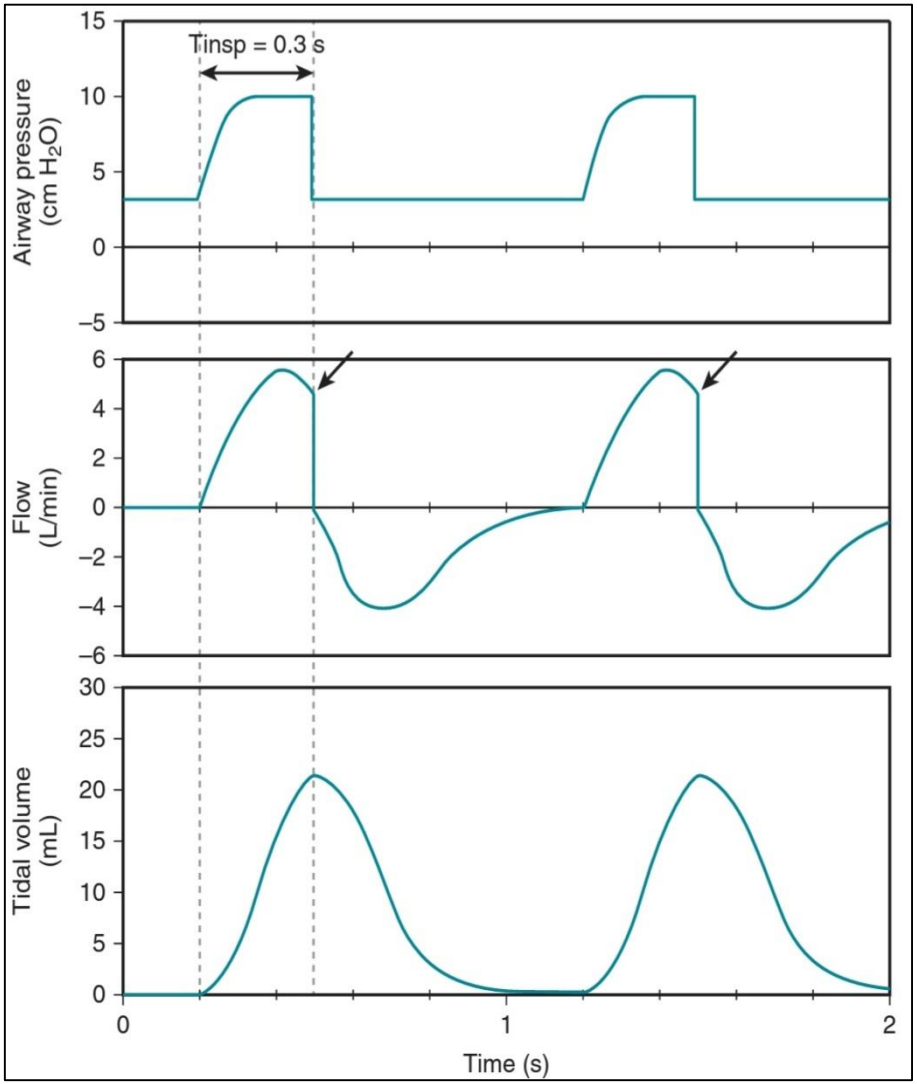
Excessive Ti

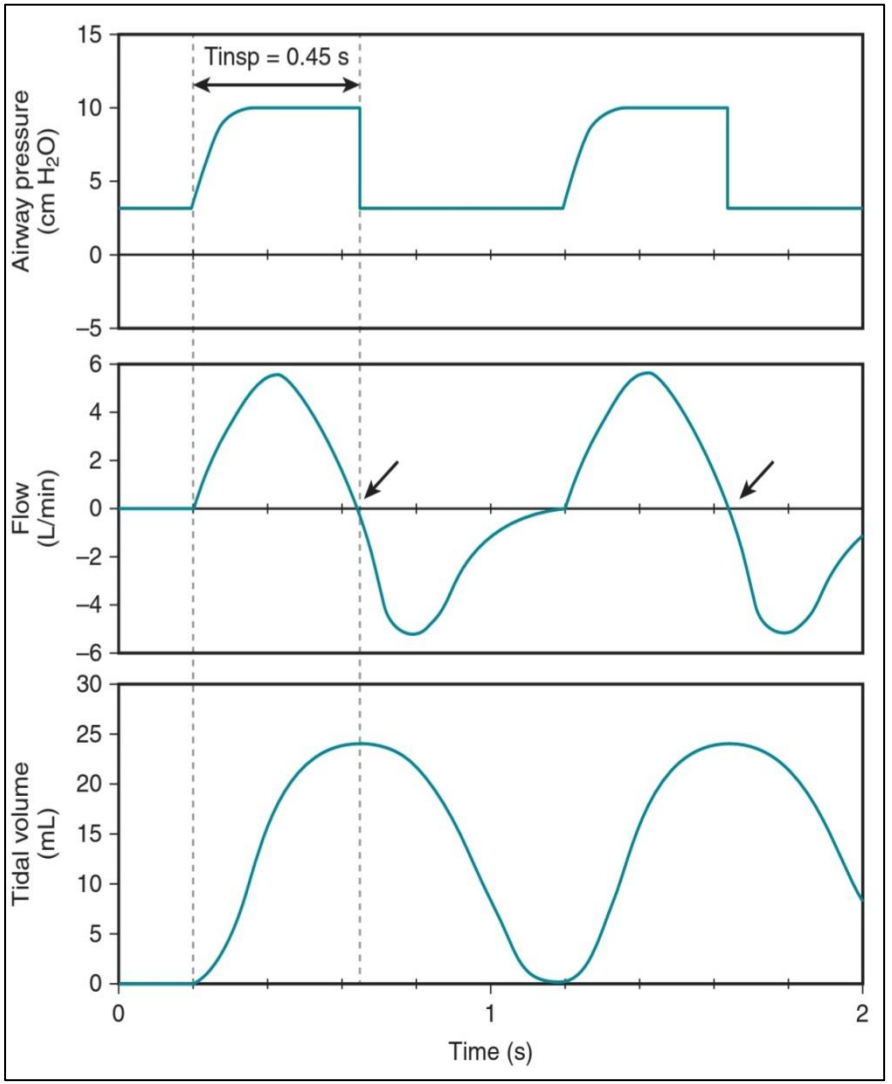
Inadequate Ti



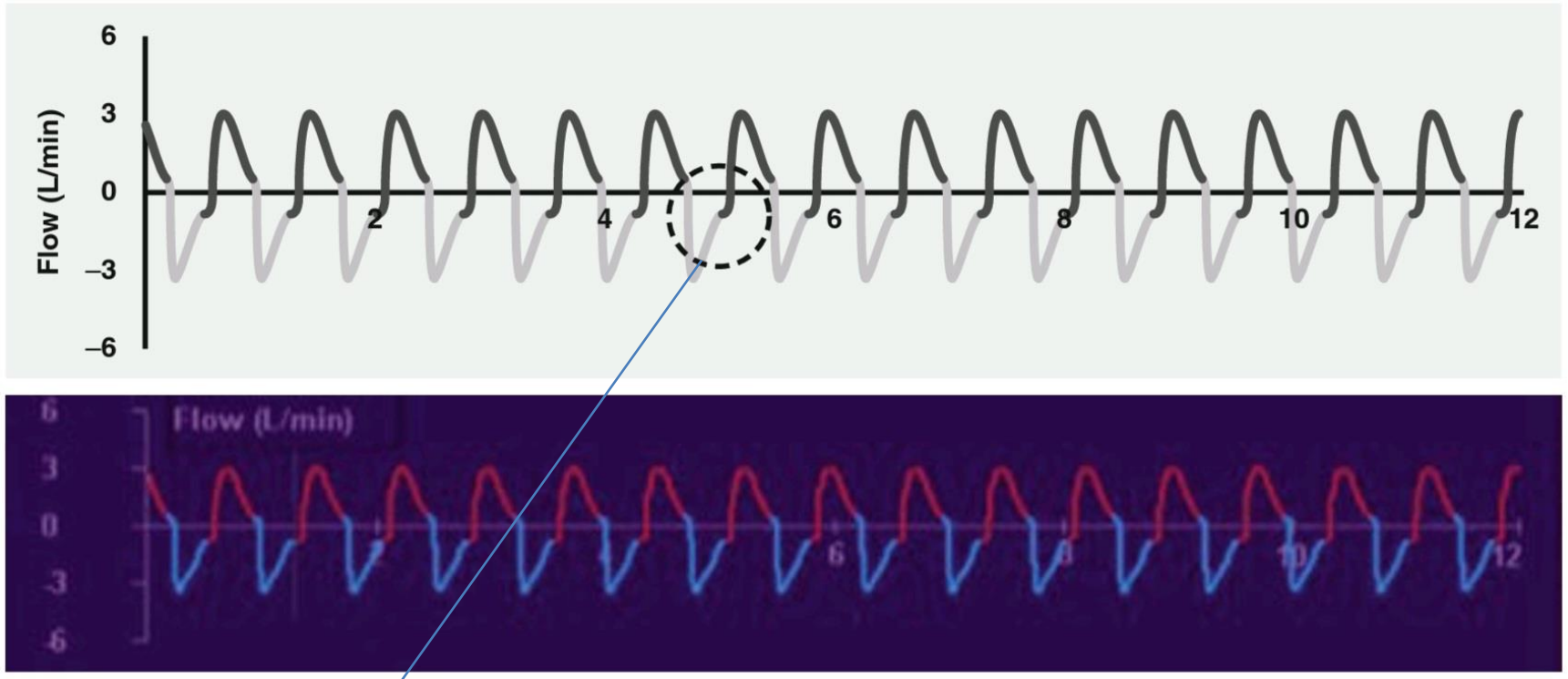


Effect of Ti on Tidal volume





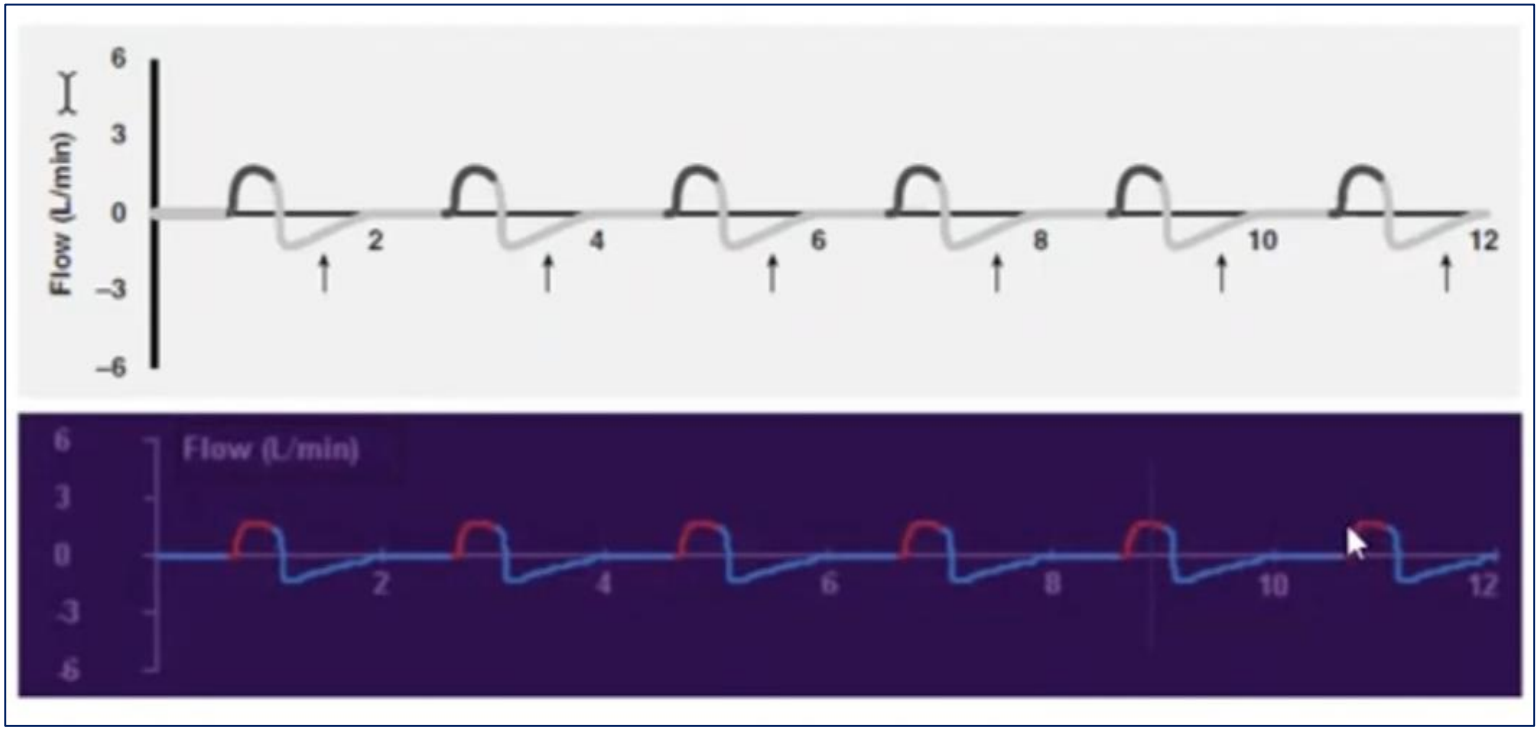
Air trapping/Auto PEEP



Expiratory flow fails to reach baseline before next breath is initiated

Intervention-Decrease rate / shorten I time

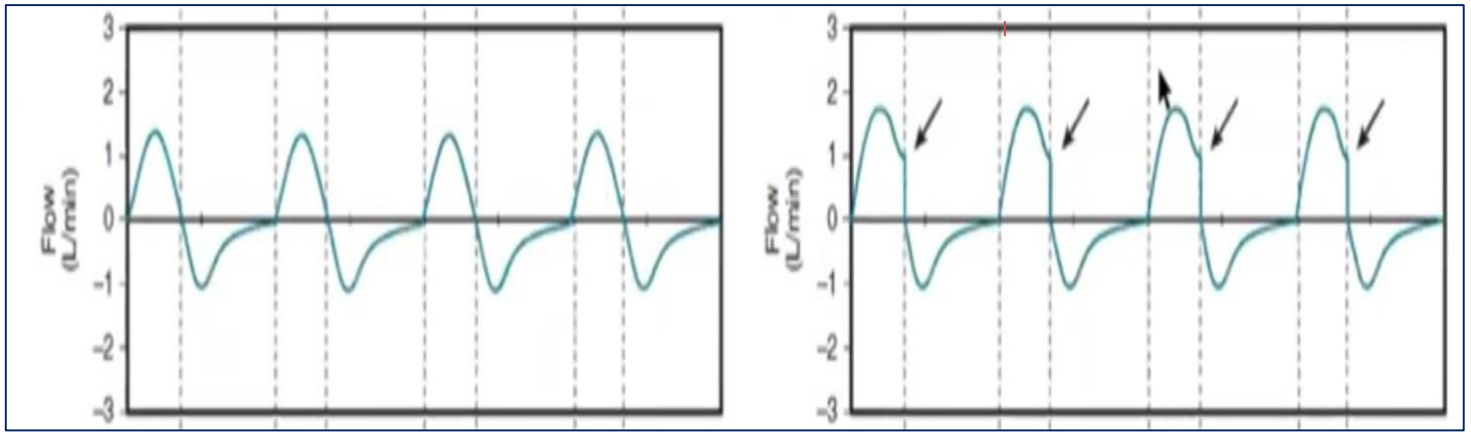
Increased Expiratory resistance



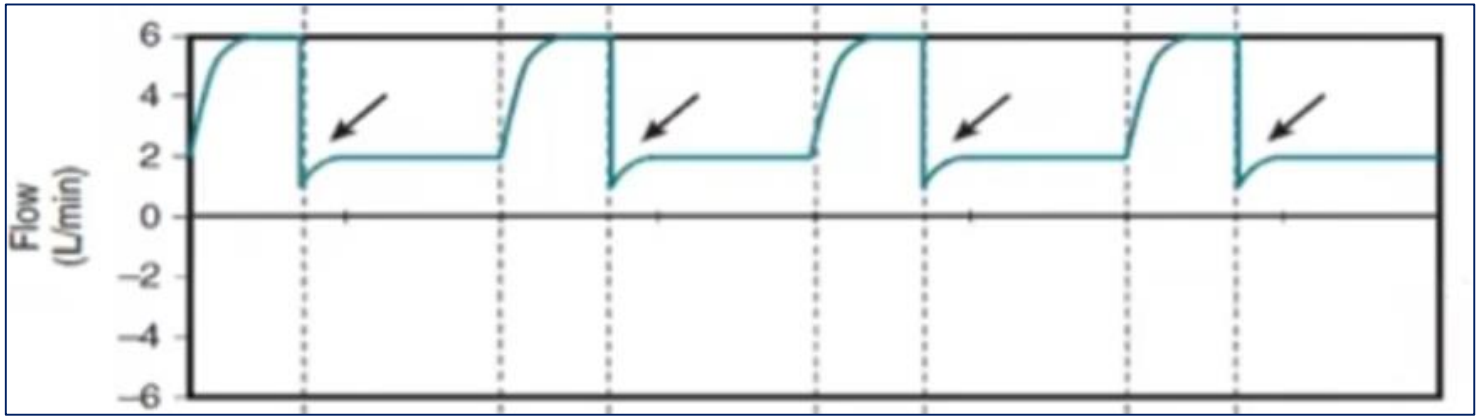
Shallow exp flow with decrease PEF & prolonged time to return to baseline during decelerating exp flow. Eg- BPD/bronchospasm

Air Leak

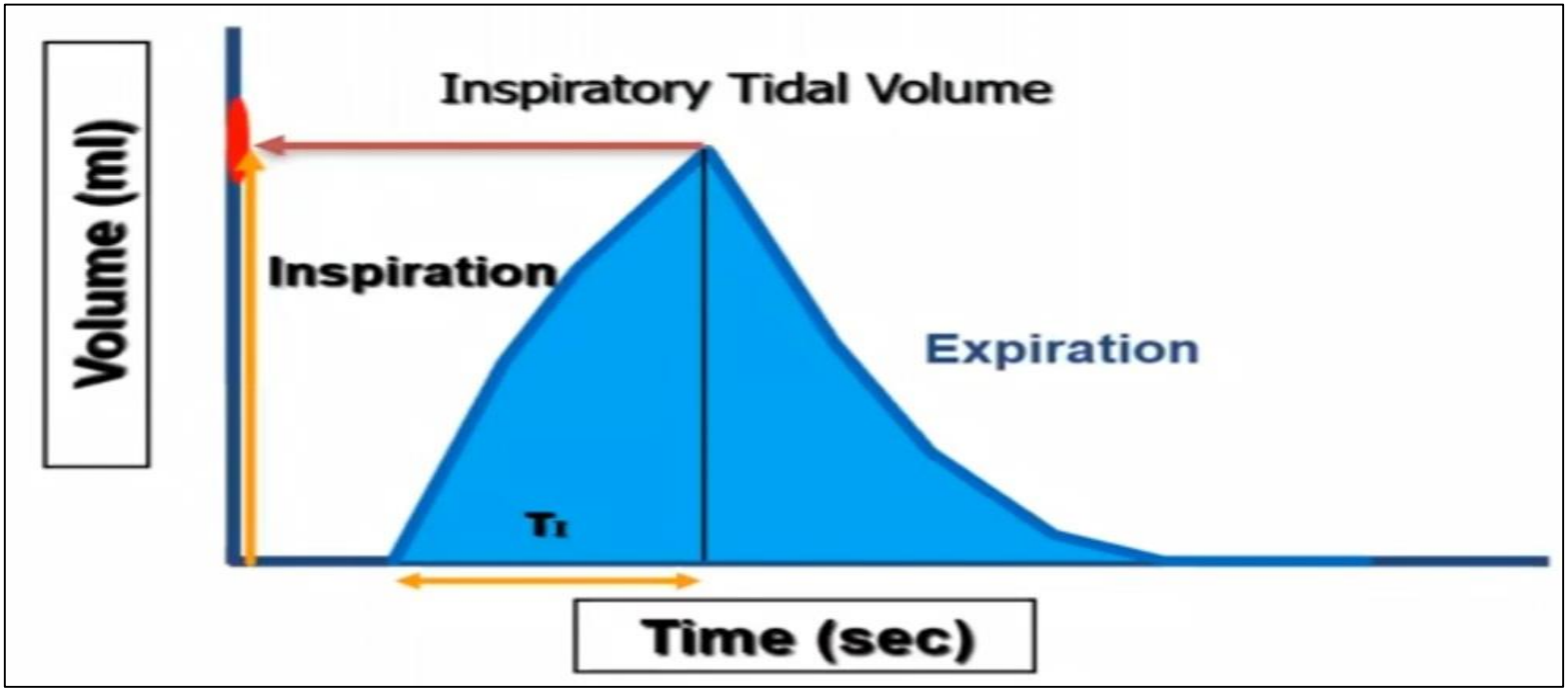
Small leak

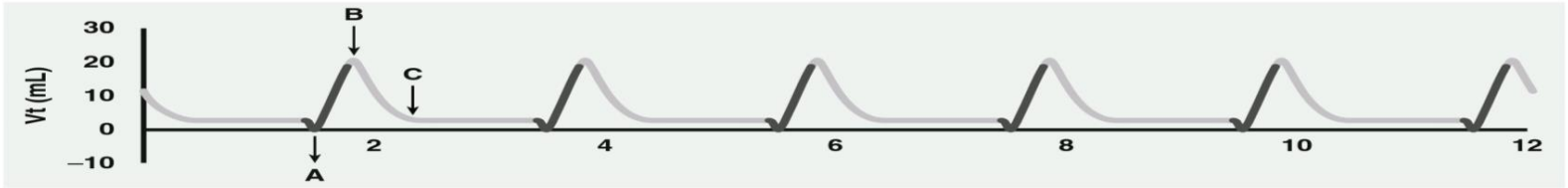


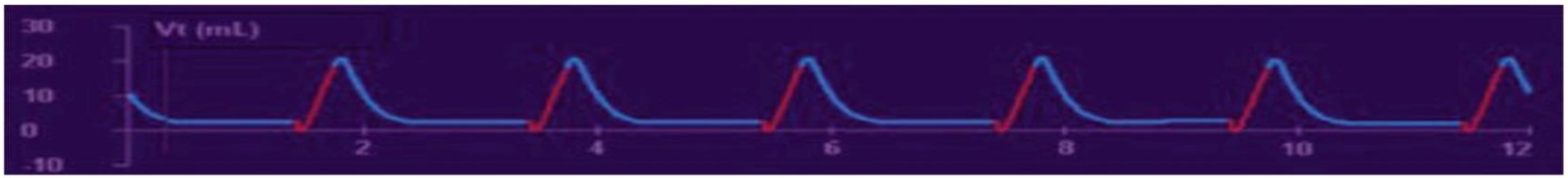
Large leak



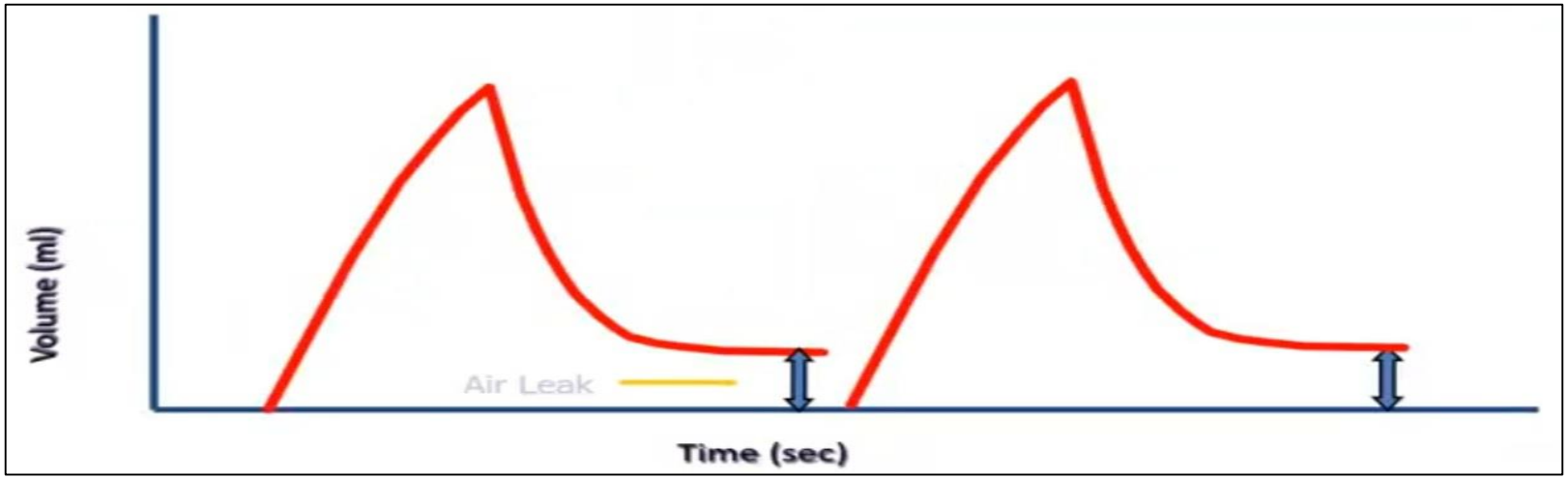
Volume scalar

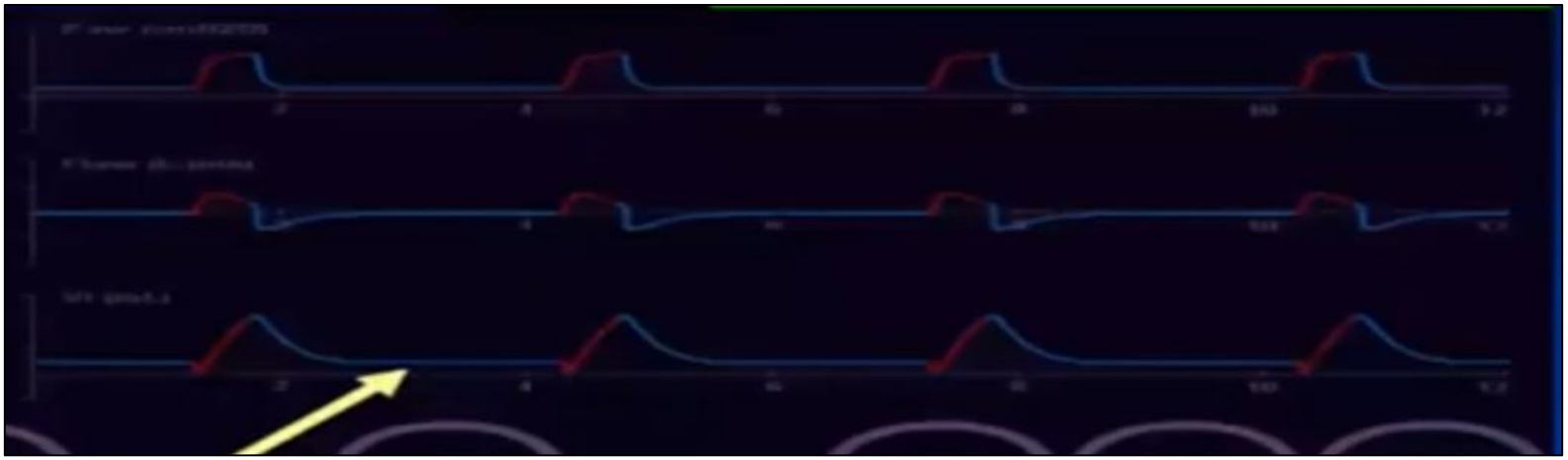






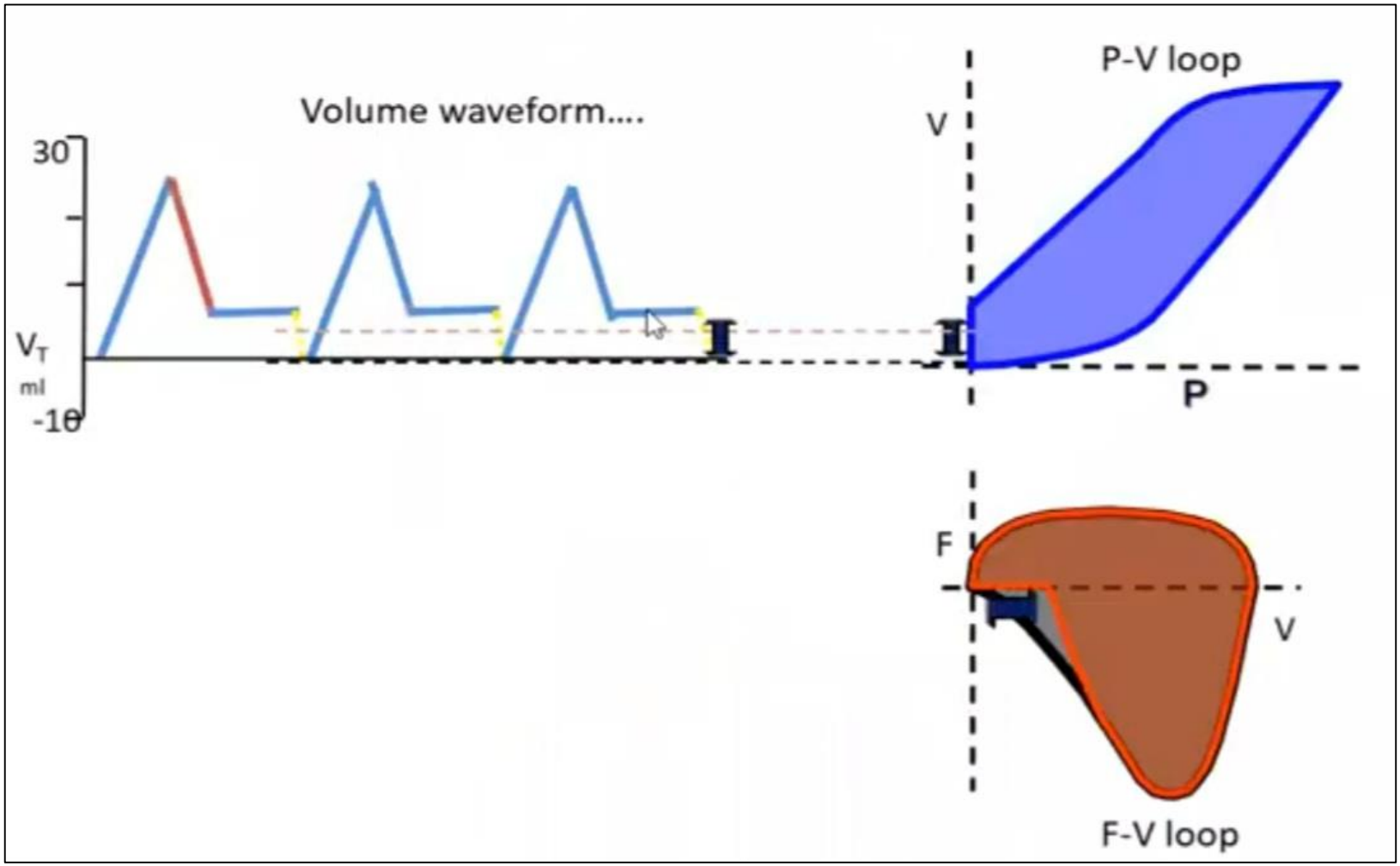
Air Leak





Exhalation does not return to zero

Air Leak



Importance of pulmonary graphics

- Helps to assess a patient's respiratory physiology and pathophysiology of disease.
- Helps to adjust ventilator settings.
- Assess therapeutic response to pharmacological agents.
- Detects tube leakage and secretions.
- Improves quality of care.

THANK YOU