BASIC OF MECHANICAL VENTILATOR

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TARGET OF VENTILATION

Generation of flow and volume to provide adequate alveolar ventilation with the minimal work of breathing (WOB)

To move Gas (O2 & Air) into and out of the lungs to maintain proper levels of O2 and CO2 in blood

"POWER" REQUIRED FOR VENTILATION

- Provided contraction of the respiratory muscles
- The phrenic nerve regulates the timing and intensity of this power

VENTILATION VERSUS RESPIRATION

VENTILATION

Gas Exchange between

Patient Environment --------- Alveoli

RESPIRATION

External Respiration: Gas Exchange between Alveoli & Arteries Bed Arounded Alveolies

Internal Respiration : Gas Exchange between Capillaries and Cells

GOAL OF MECHANICAL VENTILATION

For patients who are unable level of adequate Gas Exchange functionally and carbon dioxide elimination

Ventilators

VENTILATOR

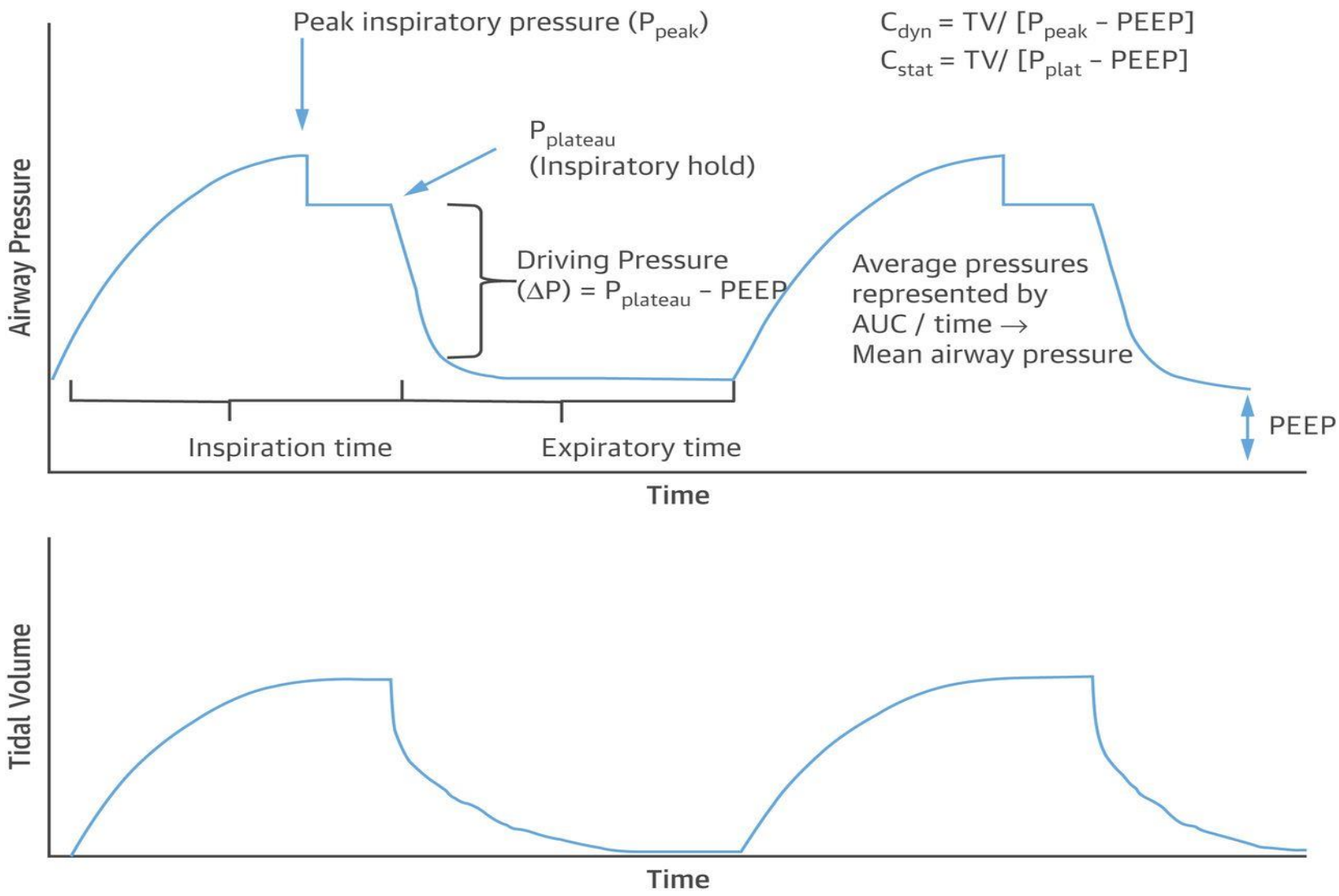
Indication	Example
Acute respiratory Failure	ARDS (P/F Ratio < 200)
Severe hypoxemia / Apnea	Pao2< 40 mmHg, Sao2< 70 % , PF Ratio (Pao2/ Fio2 in Severe ALI < 100)
Respiratory Pump Failure Hypercapnic respiratory failure	Flail chest and impending ventilator Failure , Muscle Fatigue in MG and GB
Decrease level of consciousness	GCS < 8 , CO2 narcosis
Cardiac failure	Cardiogenic shock

POSITIVE-PRESSURE BREATHS VARIABLES

(1) the trigger variable (what initiates the breath)

(2) the limit variable (the algorithm that over positive pressure delivery)

(3) the cycle variable (what terminates the inspiratory phase)


Peak inspiratory pressure (P_{peak})
C_{dyn} = TV/ [P_{peak} – PEEP]
C_{stat} = TV/ [P_{plat} – PEEP]
$P_{plateau}$
(Inspiratory hold)
Driving Pressure
(ΔP) = $P_{plateau}$ – PEEP
Average pressures
represented by
AUC / time →
Mean airway pressure
Airway Pressure
Inspiration time
Expiratory time
PEEP
Time
Tidal Volume
Time

set on the ventilator

3 main physiologic variables of the breathing pattern

THREE MAIN PHYSIOLOGIC VARIABLES OF THE BREATHING PATTERN

(1) the ventilatory drive (when inspiration begins = timing

(2) the ventilatory requirements (how much flow and volume are necessary to satisfy the metabolic demands)

(3) the duration and ratio of inspiratory time to total breath cycle duration

BASIC MODES

- Volume Mode
- Pressure Mode

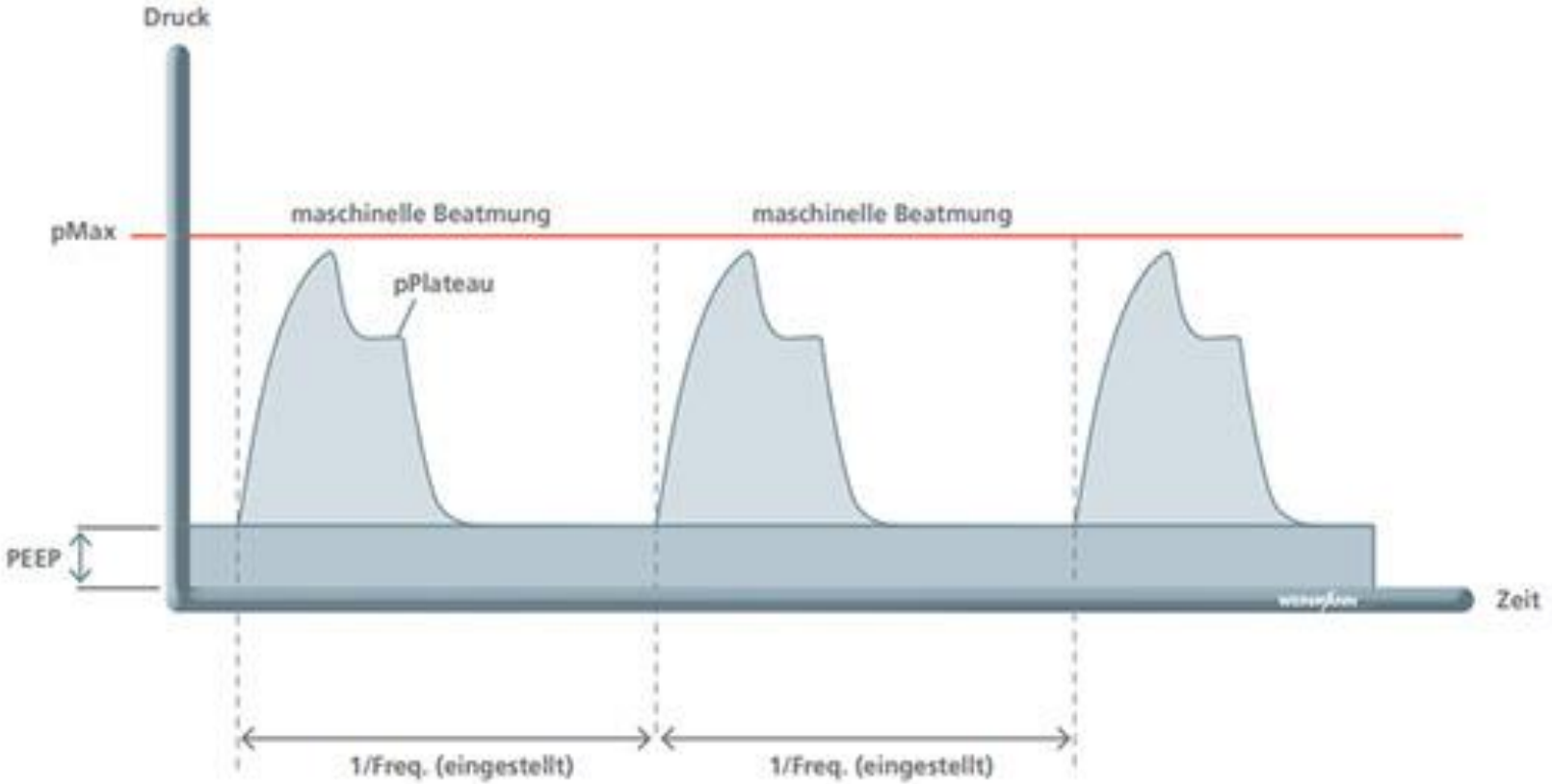
VOLUME MODE

- Tidal volume = 6- 10 ml/kg
- Setting Rate = 12- 20/min
- PEEP
- PSV (Pressure support)
- FiO2 start with high level then titrate down (safety limit = 0.40 or O2= 40%)
- I/E Ratio
- Trigger (Flow/ Pressure)

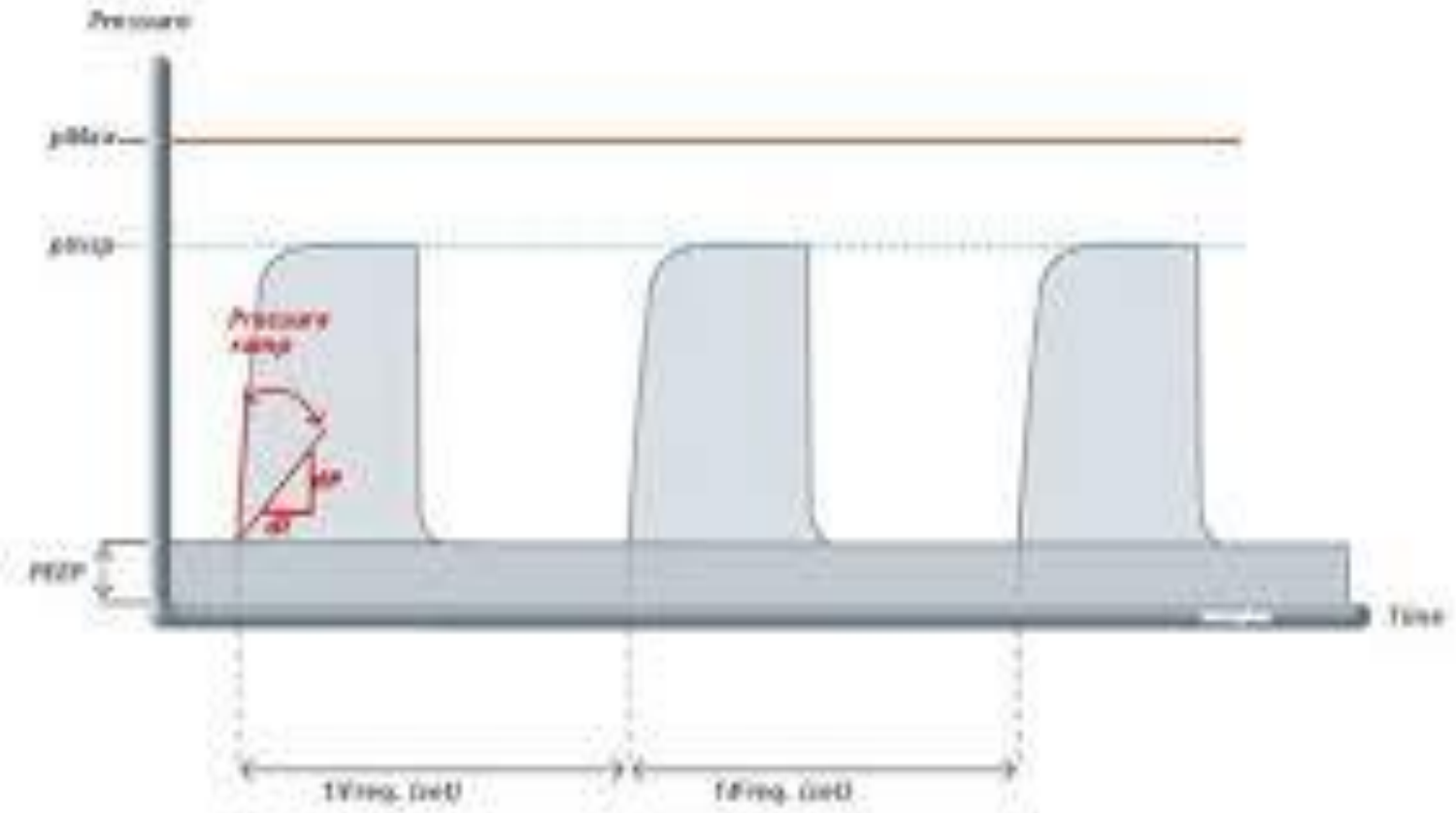
PRESSURE MODE

- P Max or PIP (Peak Inspiratory Pressure)
- Setting Rate
- PEEP
- PSV (Pressure support)
- FiO2 (safety limit = 0.40 or O2= 40%)
- I/E Ratio
- Trigger (Flow/ Pressure)

VOLUME CONTROL MODE (CMV)



PRESSURE CONTROL MODE (PCV)



TYPES OF BASIC MODES

* Volume mode

1- CMV (controlled mechanical ventilation)

2- A/CMV (Assisted CMV)

3- SIMV (synchronized intermittent mechanical ventilation)

* Pressure Mode

1- PCV (pressure control ventilation)

2- A/ PCV (Assisted PCV)

3- PSIMV (Pressure SIMV)

NONINVASIVE VENTILATION

- Avoiding endotracheal intubation or tracheostomy tube
- Less patient discomfort
- Reduced need for sedation
- Less frequent incidence of ventilator-associated pneumonia and sepsis
- Significant improvement in outcome variables.

ESTABLISHED INDICATIONS FOR NONINVASIVE VENTILATION

- Acute COPD exacerbation
- Acute cardiogenic pulmonary edema
- Postoperative mild respiratory failure
- Mild Respiratory failure in immunocompromised patients

PREDICTORS OF SUCCESS FOR NONINVASIVE VENTILATION

- Younger age
- Lower acuity of illness
- Ability of the patient to cooperate
- Intact dentition
- Technical ability to minimize air leaks
- moderate hypercapnia (i.e., between 45 and 90 mm Hg)
- Moderate (i.e., instead of severe) acidosis (i.e., PH = 7.10- 7.35)

SUCCESSFUL TRIAL OF NONINVASIVE VENTILATION

- Reduction in respiratory rate
- Decrease in Paco2 within 30 to 60 minutes