

WEANING

Weaning is the process of gradual discontinuation of mechanical ventilation.

Strictly speaking, it refers to a process of slow decrease in level of support from the ventilator and gradual increase of proportion of spontaneous ventilation by patient.

1) Does this patient need weaning?

Patients with normal conscious state, respiratory mechanics and stable haemodynamics do not need weaning.

Patients with chronic pulmonary disease with recent deterioration of respiratory mechanics or underlying neuromuscular problems may benefit from weaning.

2) Is the patient ready for weaning?

- Precipitating factors for respiratory failure are under control
- Sedation is not required
- Normal conscious state
- Adequate cough and gag reflexes
- Stable haemodynamics requiring minimal or no vasopressor or inotropes

3) Parameters used to predict weaning success:

- $\text{PaO}_2 \geq 60$ mmHg (8 kPa) with FiO_2 of ≤ 0.35
- Alveolar-arterial PO_2 gradient < 350 mmHg
- $\text{PaO}_2/\text{FiO}_2 > 200$
- Vital capacity > 15 ml per kg body weight
- Maximum inspiratory pressure < -30 mmHg
- Minute ventilation < 10 L per min
- Maximum voluntary ventilation > 2 x resting minute ventilation
- Airway occlusion pressure ($\text{P}_{0.1}$) < 6 cm water
- Rapid shallow breathing index (ratio of respiratory frequency to tidal volume) < 100 breaths per minute per litre

4) Methods of weaning

- Spontaneous breathing via T-piece
- Pressure support
- CPAP trial
- SIMV (Synchronized intermittent mandatory ventilation)
- Noninvasive positive pressure ventilation

So far there is no consensus of the optimal way of weaning. There are studies supporting the use of T-piece, pressure support and noninvasive positive pressure ventilation to expedite weaning.

5) Clinical features suggesting increased work of breathing during weaning trial:

- Nasal flaring
- Use of accessory muscle
- Recession of suprasternal and intercostal spaces
- Paradoxical movement of rib cage and abdomen
- Diaphoresis
- Tachypnoea (RR > 35/min)
- Tachycardia (HR > 140/min, or increased by > 20%)
- ↑ blood pressure
- Desaturation (SpO₂ < 90%)

6) Factors contributing to difficulty in weaning

- Patient anxiety
- Over sedation or withdrawal
- Hypothyroidism
- Neuropathy – eg critical illness polyneuropathy
- Myopathy
- Neuromuscular junction problems
- Electrolyte disturbances
- Malnutrition
- Unresolved sepsis
- Shock
- Muscle fatigue
- Bronchospasm
- Obesity
- Abdominal distension with diaphragmatic splinting
- Pleural effusion
- Pulmonary oedema
- Pneumonia
- Atelectasis

References:

- 1) Manthous CA et al. Liberation from mechanical ventilation: a decade of progress
Chest, Sep 1998; 114: 886 - 901.
- 2) MacIntyre, NR, Cook, DJ, Ely, EW, et al Evidence-based guidelines for weaning and discontinuing ventilatory support. *Chest* 2001;120,375S-395S