



Liberation off the ventilator

Intubation (inserting a breathing tube into the mouth to the trachea) and the initiation of mechanical ventilation is a major event in any patient's life as it is ultimately related to life or death situation. Once intubation is ensued and the patient connected to a mechanical ventilator is stabilized, clinicians start thinking of when and how can they liberate or extubate the patient (remove the breathing tube).

The sooner is the better because mechanical ventilator is a device to sustain lives but not to cure disease and can pose harm.

The liberation process is a three-step process. Starting with *readiness* to wean (is the patient improving and ready? followed by *weaning* (the process of reducing the ventilator support and transitioning to patient resuming spontaneous breathing) and finally *extubation*.

To measure the readiness of extubation, clinicians go through weaning process which is called spontaneous breathing trial (SBT). The patient has to meet some criteria to initiate the SBT:

- Hemodynamically stable; for example, heart rate less than 120 per minute, systolic blood pressure is 90-180mmHg
- Stable cardiovascular status
- No significant use of vasopressors (medications to support the heart and blood pressure)
- Absence of excessive trachea-bronchial secretion
- Presence of adequate cough and gag reflexes
- The cause of the respiratory failure such as pneumonia, heart failure has improved
- Light or no sedation to have spontaneous breathing (patients can initiate their own breathing)
- Low support from the ventilator; for example, low oxygen and pressure

Today there are guidelines and protocols that are usually implemented to facilitate and shorten the weaning process.

When clinicians proceed with the SBT, there are several ways and modes to perform it.

Pressure Support Ventilator mode (PSV)

A spontaneous breathing mode where the patient has more autonomy of his breathing with minimum support from the ventilator to evaluate if patients can tolerate the setting.

Intermittent Mandatory Ventilation

A combination of machine breaths and spontaneous breath with gradual reduction of the machine breaths till transitioning to all spontaneous patients' breaths.

Continuous positive airway pressure mode (CPAP)

Another spontaneous mode like pressure support with only low pressure to avoid collapsing airway

Automated Ventilator modes

Those are smart automated modes that self-adjusts to help facilitate the process, they adjust the support depending on how much patients can breathe on their own, for example Adaptive Supportive Ventilator (ASV) mode, SmartCare, Proportional Assist Ventilation.

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It is old style but still is useful. Basically, a patient is disconnected from a ventilator and only oxygen is given. There is no support from the ventilator.

Monitoring patients during SBT

While proceeding with the SBT, a clinician keeps a close eye on the patient. Clinicians look at the hemodynamic status such as heart rate and blood pressure as well as respiratory status such as oxygen saturation (oxygen level in the blood), tidal volume (volume for each breath), respiratory rate, work of breathing, mentation or signs of fatigue to see if the patient is tolerating the SBT or not.

If a patient is stable and tolerating the SBT, and can protect his/her airways, the clinicians decide to extubate. If a patient is not stable, they are placed back on original full support mode, evaluate the reason of the failure, and try again later.

The vast majority of patients are extubated quickly after one trial, however some might require multiple trials or prolonged ventilation till they are off the ventilator.

After extubation

After extubation, clinicians still keep a close eye on the patient to make sure if he/she does not have signs of respiratory distress.

Unfortunately, for many reasons about 10-15% of patients fail the extubation and require to be re-intubated and back on the ventilator. In some cases, clinicians connect noninvasive ventilator (using facial mask instead of inserting breathing tube) to a patient directly right after extubation to avoid such failure.