

Understanding the Basic Ventilator Modes to Create A Baseline for Further Improved and Advanced Ventilator Techniques

Vaibhav Mishra *

Abstract

This article is about basic ventilator mode, this article aims to know the basic settings of the ventilator and the values which can be modified in ventilators like tidal volume, positive end- expiratory pressure, respiratory rate, and F_{iO_2} . This research methodology is based on making the narrow and big theoretical topic into a compact and informative way. The article will teach you the main 3 basic ventilator modes and when to use them and which settings can be modified.

Keywords: Ventilator Modes, Baseline for Further Improved, Advanced Ventilator Techniques

Volume control

Volume control is a mode of ventilation where you are controlling the actual volume of air that is delivered to the patient. The volume can be controlled by the rate of breathing, which is either controlled by a mechanical ventilator or manually by a healthcare provider [1]. The rate of breathing is often expressed as the frequency, which is the number of breaths per minute, or the tidal volume, which is the amount of air delivered with each breath.

Pressure control

In pressure-controlled ventilation, the ventilator delivers a set amount of pressure to the patient, regardless of the volume of air delivered. To maintain that set pressure, the ventilator delivers a proportional amount of air, which is determined by the patient's respiratory system function. This is commonly used in patients who have lung pathologies like acute respiratory distress syndrome or pulmonary edema.

Bachelors in Cardiac Perfusion,
Sumandeep Vidyapeeth, Vadodara,
Gujarat, India

*Corresponding Author: Vaibhav
Mishra, Bachelors in Cardiac
Perfusion, Sumandeep Vidyapeeth,
Vadodara, Gujarat, India.

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Monitoring of patients

Before starting the actual ventilation process, we need to ensure that the patient is well monitored. This includes monitoring of the patient's blood pressure, heart rate, respiratory rate, and the presence of some alarms like the high or low oxygen saturation. Some ventilators will also allow you to monitor the tidal volume, positive end-expiratory pressure, and respiratory rate. These are helpful to make sure that the patient is receiving the correct amount of ventilation.

Management of volume control

Volume control ensures that the patient is receiving the set amount of volume each minute. To understand the management of volume we need to understand some parameters.

Tidal volume (Vt)

Volume of air set to be delivered per minute.

Frequency/Respiratory rate (F/RR)

Number of breaths per minute.

O₂ concentration (Fio₂)

The concentration of air to be delivered, always too said in fraction for eg. Fio₂ to be delivered is 60% then it is said to be 0.6.

Peep

Positive end-expiratory pressure is the constant pressure applied through the expiration.

Pressure support

Extra pressure of air help to support breath.

Ventilation modes

This is the basic mode of ventilation that is selected during the initiation of mechanical ventilation [2]. This is based on the patient's condition and physiological parameters like respiratory rate, respiratory rate, blood gas status, and the presence of some alarms.

Assisted ventilation

In this mode, an operator can manually control the rate of ventilation and the level of positive pressure. This is useful when a patient is not able to control their own breathing rate, but can still receive positive pressure ventilation.

Automatic ventilation

In this mode, the ventilator operates at a set rate and pressure, regardless of the patient's condition. This is useful when a patient is extremely ill, is not able to control their own breathing rate, and/or has a high level of positive pressure in their lungs. The apnea mode is a special mode that is used when a patient is in a comatose state. In this mode, the machine keeps delivering positive pressure to the patient's lungs, which keeps the airways open and prevents them from collapsing. This mode is used in patients who are in a very critical condition and have to be on a ventilator.

Some basic ventilator modes

Assist control

Assist control is the setting of a ventilator in which we can assist the spontaneous breathing of the patient.

The parameters which can be controlled are,

SET: Vt, F, Fio₂, peep

In this mode, we can deliver the required tidal volume for eg, 500ml with the patient own breathing, keep in mind this mode is only to support the patient's own breathing in critical conditions.

Side effect

This can lead to excessive ventilation.

Synchronized intermittent ventilatory support (SIMV)

In this ventilator mode the parameter which can be set are:

Set: Vt, F, Fio₂, peep, Pressure setting

This setting will determine automatically how much O₂ should be delivered upon the patient own breathing rate, for eg. If Vt is set at 500ml and the patient can get 200ml on their own then this mode will synchronize with the patient and will deliver 300ml.

Pressure support

References

1. Chatburn RL. Classification of ventilator modes: update and proposal for implementation. *Respir Care*. 2007;52(3):301-23. PubMed | CrossRef
2. Yuan Lei. Mechanical Ventilation Modes. Oxford Medicine Online. 2017.

Pressure support is the mode to take a trial before weaning of patient from ventilator.

The parameters which can be set through this mode are:

Set: Fio₂, peep, PS

In this mode, the tidal volume is not set because we have to just give the pressure support to the patient and not the volume support and is most of the time used as a trial before extubation.

Conclusion

This article discussed the basic ventilator modes of ventilation. It also described the types of volume and pressure control modes and provided an overview of monitoring for a patient on a ventilator. As an Emergency Medicine physician or medical and paramedic, understanding the basic ventilator modes will help you establish a baseline for further improved and advanced ventilator techniques.