

Mechanical Ventilation

Mechanical ventilation is a form of life support. A mechanical ventilator is a machine that takes over the work of breathing when a person is not able to breathe enough on their own. The mechanical ventilator is also called a **ventilator**, respirator, or breathing machine. There are many reasons why a patient may need a ventilator, but low oxygen levels or severe shortness of breath from an infection such as pneumonia are the most common reasons.



Why are ventilators used?

- To deliver high concentrations of oxygen into the lungs.
- To help get rid of carbon dioxide.
- To decrease the amount of energy a patient uses on breathing so their body can concentrate on fighting infection or recovering.
- To breathe for a person who is not breathing because of injury to the nervous system, like the brain or spinal cord, or who has very weak muscles.
- To breathe for a patient who is unconscious because of a severe infection, build up of toxins, or drug overdose.

How does a ventilator work?

When a person needs to be on a ventilator, a healthcare provider will insert an endotracheal tube (ET tube) through the patient's nose or mouth and into their windpipe (trachea). This tube is then connected to the ventilator. The endotracheal tube and ventilator do a variety of jobs. The ventilator pushes a mixture of air and oxygen into the patient's lungs to get oxygen into the body. The ventilator can also hold a constant amount of low pressure, called positive end-expiratory pressure (PEEP), in order to keep the air sacs in the lung from collapsing. The endotracheal tube allows doctors and nurses to remove mucous from the windpipe by suction.

If a person has a blockage in the trachea, such as from a tumor, or needs the ventilator for a long period of time, then they may need a tracheostomy procedure. During a tracheostomy, a surgeon makes a hole in the patient's neck and trachea, then inserts a breathing tube called a tracheostomy tube into the hole. The tracheostomy tube is then connected to the ventilator. A tracheostomy tube can stay in as long as needed, but does not have to be permanent and can be removed if a patient no longer needs it. It is possible for a person to talk and eat with a tracheostomy tube. For more information about having a tracheostomy tube, see ATS Patient Information Series fact sheet at www.thoracic.org/patients.

How are patients on ventilators monitored?

Most patients on a ventilator are monitored in an ICU. Anyone on a ventilator in an ICU setting will be hooked up to a monitor that measures heart rate, respiratory rate, blood pressure, and oxygen saturation ("O₂ sats"). Other tests that may be done include chest-x-rays and blood drawn to measure oxygen and carbon dioxide ("blood gases"). Members of the health care team (including doctors, nurses, respiratory therapists) will use this information to assess the patient's status and make adjustments to the ventilator if necessary.

How long is a ventilator used?

A ventilator can be life saving, but its use has risks. It doesn't fix the problem that led to the person needing the ventilator in the first place; it just helps support a person until other treatments become effective, or the person gets better on their own. The health care team always tries to help a person get off the ventilator at the earliest possible time. "Weaning" refers to the process of getting the patient off the ventilator. Some patients may be on a ventilator for only a few hours or days, while others may require the ventilator for longer. How long a patient needs to be on a ventilator depends on many factors. These can include overall strength, how well their lungs were before going on the ventilator, and how many other organs are affected (like the brain, heart and kidneys). Some people never improve enough to be taken off the ventilator.

How does a patient feel while on a ventilator?

The ventilator itself does not cause pain, but the tube may cause discomfort because it can cause coughing or gagging. A person cannot talk when an ET tube passes between the vocal cords into the windpipe. He or she also cannot eat by mouth when this tube is in place. A person may feel uncomfortable as air is pushed into the lungs. Sometimes a person will try to breathe out when the ventilator is trying to push air in. This is working (or fighting) against the ventilator and makes it harder for the ventilator to help.

People on ventilators may be given medicines (*sedatives* or pain controllers) to make them feel more comfortable. These medicines may also make them sleepy. Sometimes, medications that temporarily prevent muscle movement (neuromuscular blocking agents) are used to allow the ventilator to do all the work for the patient. These medications are typically used when a person has a very severe lung injury; they are stopped as soon as possible and always before ventilator support is removed.

What are risks of mechanical ventilation?

Problems that can develop from using a ventilator include:

- **Infections**—Patients who are on the ventilator are more likely to get pneumonia, which can be a serious problem. A patient may need to remain on the ventilator for longer while the pneumonia is treated with antibiotics.
- **Collapsed lung (pneumothorax)**—Sometimes, a part of the lung can become weak and develop a hole, letting air leak out and causing a collapsed lung. If the lung collapse is severe enough, it can cause death. In order to re-expand the lung, a tube needs to be placed into the chest (chest tube) to drain the air that is leaking out. Once the lung has healed, then the tube can be removed. For additional information on chest tubes, see ATS Patient Information Series fact sheet at www.thoracic.org/patients.
- **Lung damage**—The pressure of putting air into the lungs with a ventilator can damage the lungs. Doctors try to keep this risk at a minimum by using the lowest amount of pressure that is needed. Very high levels of oxygen may be harmful to the lungs as well. Doctors only give as much oxygen as it takes to make sure the body is getting enough to supply vital organs. Sometimes it is hard to reduce this risk when the lungs are damaged. However, this damage may heal if a person is able to recover from the serious illness.
- **Side effects of medications**—Sedatives and pain medications can cause a person to seem confused or delirious, and these side effects may continue to affect a person even after the medications are stopped. The healthcare team tries to adjust the right amount of medication for a person. Different people will react to each medicine differently. If a medication to prevent muscle movement is needed, the muscles may be weak for a period of time after the medication is stopped. This may get better over time. Unfortunately, in some cases, the weakness remains for weeks to months.
- **Inability to discontinue ventilator support**—Sometimes, the illness which led a person to need a ventilator does not improve despite treatment. When this happens, the healthcare team will discuss your treatment preferences regarding continuing support on the ventilator. Often the healthcare team will have these discussions with family members or the patient, if the person is able to participate. In situations where a person is not recovering or is getting worse, a decision may be made to discontinue ventilator support and allow death to occur.

How can I make my wishes about using a ventilator known?

Mechanical ventilation is a “life-sustaining treatment”. It is a treatment that can prolong life. It may be needed for only a short time. However, some people cannot be weaned off

the ventilator and do not want to stay on the machine. Other people who know they have a very severe lung or health problem may not even want to use a ventilator at all because the ventilator cannot fix their underlying disease.

Some people have very specific thoughts about if and when they should be placed on a ventilator. Although the healthcare team helps people and their families make tough decisions about the end of life, it is the person him or herself who has the final say. If a person cannot talk or communicate decisions, the healthcare team will talk with his or her legally authorized representative (usually a parent, wife or husband, adult child, or next of kin).

It is important that you talk with your family members and your healthcare provider about using a ventilator and what you would like to happen in different situations. The more clearly you explain your values and choices to friends, loved ones and the healthcare team, the easier it makes it for them to follow your wishes if and when you are unable to make decisions yourself. Advance directives are ways to also put your wishes in writing to share with others. In the hospital, nurses, doctors and social workers can provide information about an advance directive form. You can also obtain information on advance directives from your primary care provider, state Attorney General’s office, public health department, or organizations such as Aging With Dignity (www.agingwithdignity.org) and PREPARE for Your Care (<https://www.prepareforyourcare.org/#/>).

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Rx What to do...

- ✓ Ask the healthcare team to explain why a ventilator is needed
- ✓ Share any concerns you have about use of the ventilator
- ✓ Work with the healthcare team to help your loved one be as comfortable as possible while on a ventilator.

Healthcare Provider’s Contact Number:

Additional Resources:

American Thoracic Society
www.thoracic.org/patients

National Heart Lung & Blood Institute
<https://www.nhlbi.nih.gov/health/health-topics/topics/vent>

Family Caregiver Alliance National Center on Caregiving
<http://www.caregiver.org>

Aging With Dignity
www.agingwithdignity.org

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