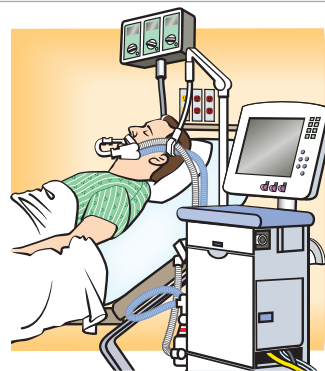


Mechanical Ventilation

Mechanical ventilation is a life support treatment. A mechanical ventilator is a machine that helps people breathe when they are not able to breathe enough on their own. The mechanical ventilator is also called a **ventilator**, respirator, or breathing machine. Most patients who need support from a ventilator because of a severe illness are cared for in a hospital's intensive care unit (ICU). People who need a ventilator for a longer time may be in a regular unit of a hospital, a rehabilitation facility, or cared for at home.



Why are ventilators used?

- To get oxygen into the lungs and body
- To help the body get rid of carbon dioxide through the lungs
- To ease the work of breathing—Some people can breathe on their own, but it is very hard. They feel short of breath and uncomfortable.
- 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.

How does a ventilator work?

The ventilator is connected to the person through a tube (*endotracheal or ET tube*) that is placed into the mouth or nose and down into the windpipe. When the health care provider places the ET tube into the person's windpipe, it is called an intubation. Some people go through surgery to have a hole place in their neck and a tube (tracheostomy or "*trach*" tube) is connected through that hole. The trach tube is able to stay in as long as needed. At times a person can talk with a trach tube in place by using a special adapter called a *speaking valve*. (For more information on having a tracheostomy see ATS patient information series at www.thoracic.org/patients).

The ventilator blows gas (air plus oxygen as needed) into a person's lungs. It can help a person by doing all of the breathing or just assisting the person's breathing. The ventilator can deliver higher levels of oxygen than delivered by a mask or other devices. The ventilator can also provide what is called positive end expiratory pressure (PEEP). This helps to hold the lungs open so that the air sacs do not collapse. The tube in the windpipe also makes it easier to remove mucus if someone has a weak cough.

How are patients on ventilators monitored?

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 also has risks. It also 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 you may need to be on a ventilator depends on many factors. These can include your overall strength, how well your lungs were before going on the ventilator, and how many other organs are affected (like your brain, heart and kidneys). Some people never improve enough to be taken off the ventilator completely or at all.

How does a patient feel while on a ventilator?

The ventilator itself does not cause pain. Some people don't like the feeling of having the tube in their mouth or nose. They cannot talk because the tube passes between the vocal cords into the windpipe. They also cannot eat by mouth when this tube is in place. A person may feel uncomfortable as air is pushed into their 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 a person to breathe with the ventilator. These agents are typically used when a person has 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**—The ET or trach tube allows germs (bacteria) to get into the lungs more easily. This can cause an infection like pneumonia. Pneumonia can be a serious problem and may mean a person has to stay on the machine longer. Pneumonia can often be treated with antibiotics. Also see ATS Fact Sheet on Pneumonia at www.thoracic.org/patients.
- **Collapsed lung (pneumothorax)**—Sometimes, a part of the lung that is weak can become too full of air and start to leak. The leak lets air get into the space between the lung and the chest wall. Air in this space takes up room so the lung starts to collapse. If this air leak happens, the air needs to be removed from this space. A different kind of tube (*chest tube*) can be placed into the chest between the ribs to drain out the extra air. The tube allows the lung to re-expand and seal the leak. The chest tube usually has to stay in for some time to make sure the leak has stopped. Rarely, a sudden collapse of the lung can cause death.
- **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 an agent 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 condition 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 continued ventilator support with you, if you are able. Often the healthcare team will have these discussions with your family, as you may be unable to participate due to the severe nature of your illness. 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. That is because the ventilator cannot fix their underlying condition.

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 health care 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/#/>).

Source: Manthous, C., Tobin, MJ. A Primer on Critical Care for Patients and Their Families. 1st issued in 2001; 2017-2018 Update to be posted on www.thoracic.org/patients

Authors: Martin Tobin, MD; Constantine Manthous.

Reviewers: Marianna Sockrider MD, DrPH
Hrishikesh S Kulkarni, MD, Ann C Long, MD MS

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 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

This information is a public service of the American Thoracic Society. The content is for educational purposes only. It should not be used as a substitute for the medical advice of one’s healthcare provider.

