

# Philosophy of Mechanical Ventilation

*The art of medicine consists of amusing the patient while Nature takes its course.*

—Voltaire

Mechanical ventilation is a wonderful tool. The birth of modern-day critical care occurred in Copenhagen in 1952, when Bjorn Ibsen realized that positive pressure ventilation could save lives during a polio epidemic when the iron lungs (a negative pressure ventilator) were failing. The most common reason for admission to a medical intensive care unit is the need for mechanical ventilatory support. The combination of endotracheal intubation and positive pressure ventilation has likely saved hundreds of thousands, if not millions, of lives.

Likewise, artificial ventilation has prolonged the lives of thousands of people afflicted with spinal cord injuries and devastating neuromuscular diseases. Ventilators attached to wheelchairs permit patients with these conditions to engage in life, to pursue their interests, and to generally live lives that would not have been possible a half-century ago. Truly, this invention has had a positive effect on many, many people.

As is the case with any technology, however, there is the potential for misuse. It is essential that anyone working in an intensive care unit remember the Third Commandment—that the ventilator is a means of support, and not a cure for any condition. In other words, it is folly to believe that the application of mechanical ventilation can reverse chronic lung disease, malignancy, congestive heart failure, or any of the myriad diseases and injuries that result in respiratory failure. The ventilator exists to maintain the respiratory and metabolic functions of the lungs until the patient recovers from his or her illness. It cannot make the patient better by itself. This is actually a point lost on many physicians, who believe that small tweaks and adjustments to the ventilator will accelerate the patient's recovery from acute respiratory failure.

If it is important for physicians to understand the natural history and

trajectory of a patient's disease, it is equally important that the physician present this information to the patient and his family in concise, understandable, and even blunt terms. A life spent connected to a ventilator may be acceptable to a patient with amyotrophic lateralizing sclerosis, who may require mechanical ventilation but can otherwise speak, interact, and engage in what he considers an acceptable quality of life. It is a different matter entirely for a patient suffering from a massive intracerebral hemorrhage who is comatose, and is expected to remain comatose for, if not the rest of his life, a great deal of it. While the patient or his family may consider this to be a worthwhile existence, it behooves the physician to inform them of the stark realities of preserved life on a ventilator (including the medical, social, and financial ramifications) before they pursue this treatment option.

So, what is a dedicated, caring physician, nurse, or respiratory therapist to do? Unsubstantiated optimism can be harmful, but so can overly pessimistic nihilism. Most patients with respiratory failure who recover from the inciting illness or injury will recover; true ventilator dependence, meaning a need for mechanical ventilation more than a year afterward, is rare. Here's what we can do:

1. Protect the lung from iatrogenic injury. Use an evidence- and physiology-based approach to ventilator settings.
2. Promptly and aggressively treat the inciting illness or injury.
3. No disease is effectively treated with starvation. Proper nutritional support is very important.
4. People aren't meant to lie in bed all day. Unless the patient is comatose, in shock, or has profound respiratory failure, it's time to start getting him out of bed and into a chair. Walking, even. I'll add that this, of course, requires a strong dose of common sense. Mobilizing a patient with an open sternum might not be a good idea. But it's surprising how many patients lie flat on their backs for their entire ICU stay. Not healthy.
5. When the patient seems to be recovering, start assessing his readiness for extubation every day.
6. Be patient. It might take longer than you think.
7. Once it's evident that the patient will require prolonged mechanical ventilation, get on with the tracheostomy. There's no need to wait an

arbitrary number of days.

8. Pay attention to the little things like DVT prophylaxis, skin care, and preventing delirium.
9. Be patient. And....
10. Remember that your patient is a fellow human being with wants, needs, cares, and concerns that may be strikingly similar to your own. He deserves to be spoken to, even if he can't speak back. He deserves respect, even though he may not be able to return that respect. He deserves the basics of human kindness and touch. Remember that he has placed his life in your hands. *Your job is not an easy one, and not one that most people can do.* The recognition that you have positively affected the life of another person in a way that few can is the greatest reward of this great profession.

# Chapter 1

## Initial Settings

*\*Note on measurements—unless otherwise specified, all airway pressures are measured in cm H<sub>2</sub>O. Gas pressures (PaO<sub>2</sub>, PaCO<sub>2</sub>) are measures in mm Hg. All tidal volumes are expressed as mL/kg of predicted body weight (PBW).*

### **Modes of Ventilation**

There are several different modes of ventilation, and each ventilator manufacturer has its own (usually trademarked) name for them (PRVC, VC+, CMV with Autoflow, ASV, PAV, Volume Support, and the list goes on and on). This can be intimidating at first—who's to know what to pick? Fortunately, like medications, all of these have a generic name as well. That's all you really need to know, because all of the modes on the different ventilators available for sale will be essentially the same (just with a different trade name).

Each mode of ventilation has its strengths and weaknesses. No mode is perfect, and no mode is useless. It's best to pick the mode that best suits the patient's needs at the time. Each of these modes is discussed in more detail in the following chapters, but here's a brief overview.

### ***Assist-Control Ventilation***

Assist-Control Ventilation is the mode of choice in most circumstances. It allows the ventilator to essentially take over the work of breathing and is preferred when a patient has acute cardiac or respiratory failure. It provides full respiratory support. If the patient wants to breathe over the set rate, he can; when he triggers the ventilator, he gets the full breath with minimal effort.