RESPIRATORS/VENTILATORS

Oral Positive Pressure

Augusta Alba

All forms of airway ventilators are positive pressure ventilators or pressure ventilators. We consider the mouth one of the best forms of using a positive pressure simply because you can use glossopharyngeal breathing concomitantly with mouth positive pressure breathing. The airway breathing can give you a tidal volume as large as the volume you can receive in a body ventilator; iron lung, and poncho. No other body ventilator; and that includes the Pneumobelt, the chest respirator; and the rocking bed, can give you the same large amount of volume. The older the ventilator-dependent individual becomes, the more he requires a ventilator that can give him a larger volume.

Basically mouthpieces of many shapes and forms can be used. The one that is most convenient both for sitting and lying down has some degree of angulation. For years at Goldwater, and now throughout the country we have been using a Bennett Lipseal with a straight mouthpiece, either with a simple plastic strap with a hook that attaches behind your mastoid or canvas straps above and below the ears with Velcro closure. This allows you to use the mouth positive pressure when you are lying down and when you fall asleep. It is a conditioned reflex.

Acute toxic metabolic states can occur with certain disease conditions, or infections can be contracted in which you have a decreased state of consciousness. In these circumstances you should be tracheostomized, at least temporarily, if not permanently. One young man went through a period of renal failure and needed to be tracheostomized because he was in a state of delirium. Now, months later, he has peritoneal dialysis on a regular basis and has decided to take his tracheostomy tube out. He's back to frog breathing, although he no longer can do it for prolonged periods of time.

About 12 years ago we did a study at Goldwater that showed there are people who cannot breathe longer than 5 minutes at a time with frog breathing. This occurs in intrinsic lung disease and possibly in severe kyphoscoliosis or in repeated bouts of pneumonia or other complications. If you don't have normal lungs, no matter how hard you try, it may not be possible because your blood oxygen level drops too rapidly for you to use this as your only method of breathing. When the saturation drops to 85%, you will want to use some form of breathing other than frog breathing by itself.

If an individual has repeated difficulties in handling secretions, we may recommend tracheostomy. Sometimes an individual doesn't have caretakers available to perform the postural drainage and chest physical therapy needed. If there have been recurrent bouts of atelectasis or of acute pneumonia with a prolonged period of incubation and secretions that will be present for several weeks, we may decide to tracheostomize. Aspiration also occurs when you may change from mouth positive pressure to tracheostomy positive pressure.

Dr. Adolph Rataka is working on a form-fitting mask, which he hopes to develop commercially. He is also working on a form-fitting mouthpiece.

Nasal CPAP (positive pressure ventilation) has now been given successfully with a nasal mask, instead of mouth positive pressure ventilation, not only during the day but possibly in

your sleep. Just as you learn to close your softpalate when you are breathing through your mouth, you can learn to close your mouth when you are breathing through your nose with positive pressure in sleep. occasionally there is a problem with loosening of the lower incisors from the use of the mouth positive pressure mouthpiece. This may require extraction and the fitting of a permanent partial plate.

Plastic Wrap

Ernest W. Johnson

The types of polio that are going to require ventilation we used to divide into abortive, nonparalytic, and paralytic. Abortive meant only the gastrointestinal phase of the disease was present. it never entered the central nervous system. Most of us had this type of polio, with no residual effects. The non-paralytic type does not involve functional weakness. If the disease invades the central nervous system, technically it is paralytic, even if there is no functional weakness. If more sophisticated tests were used, we could perhaps see some weakness. The paralytic variety is further divided into bulbar and spinal types. Bulbar polio has to do with muscles of the pharynx. It is often mistakenly thought that people on ventilators have bulbar polio, but they do not. They have high spinal polio. Spinal polio is divided into the high spinal type, in which ventilators are almost always necessary, and the low spinal type which involved the lower extremities.

The breathing muscle, the diaphragm, is responsible for about 55% of our vital capacity. If we lose control over the diaphragm, as in the high spinal type of polio, we might need ventilation during the acute phase, however, if we have control over our intercostal muscles, our chest muscles, and what we call your accessory neck muscles, we can still probably breathe alter the acute phase is over, because we still have 40% ventilation.

How do we breathe? Basically we develop a negative pressure within the lungs so that the atmospheric pressure will force air into the lung. If the atmospheric pressure is 760 mm Hg or cmH20, and we lower our diaphragm and raise our ribs so that The space in our chest lowers the pressure about 3 or 4 cm, air comes in. That is the principle of the plastic wrap ventilator or the iron lung. It deals with the ambient pressure, the pressure around the body. This pressure is reduced by either putting the person in an iron lung or putting the person in this plastic wrap.

The wrap (Dr. Alba calls it a poncho) is hooked up to a pump so that the pressure around the body will be considerably less. If it is at 20 cm H20 negative pressure around the body the pressure in the air passages would be -3 or -4, so air would come in the mouth. The so-called negative pressure ventilators, like the plastic wrap, are no different from positive pressure by mouth as Dr. Alba was describing. Pressure higher than atmospheric can be applied at the mouth to force air in, or pressure can be withdrawn from around the body so that atmospheric pressure is then positive. The physiological effects are the same.

With respect to the efficiency of the various ventilators, this has been well documented over the years. The iron lung or the tank respirator is considered 100% efficient. The next most efficient is probably the plastic wrap, which is close to 100% and is for people who are using positive pressure during the day I don't think there is any reason for using an iron lung any more, except if you don't have the Thompson AC-driven pump. The advantage to the plastic wrap, of course, is that it doesn't have anything in contact with the skin. It would be nice to use in spinal cord injury, and we do use it because people with spinal cord injury don't have surface sensation.

Next is a chest abdomen cuirass. It is about 60% as efficient as the iron lung, if it is fitted properly. At about 50% efficiency is the Pneumobelt. The unfortunate aspect of the Pneumobelt is that you have to be almost sitting at about 45 degrees for it to work because it works by pushing the diaphragm up and then using active expiration and passive inspiration. It is a different principle, but it works very nicely sitting in a chair

Finally, the least efficient are the rocking bed and the chest respirator. The chest shell just covers the chest, and we rarely use them any more. Most of the cuirass types are chest-abdomen respirators, that is they cover the abdomen too. We nave the Monaghan and the turtle types.

The plastic wrap respirator has the advantage of not causing any irritation around the skin. The new plastic wrap has a zipper so it is convenient and easy to put on. This type is very close to natural breathing.

I would recommend the use of positive pressure by mouth during the day and the plastic wrap at night.

I feel there has been a general reluctance to indict the tracheostomy by our group, but I will indict it because I think it's very often an unnecessary operation. It is often done because the person arrives at the emergency room and no one knows what to do. I think our technology today is such that we ought not to have so many tracheotomies. If you have one, I think you can practice closing it with the Plum button. Fred Plum was one of the original respiratory center directors, a neurologist, and became interested in this. He devised this button so that you could close off a tracheostomy without compromising the lumen of the trachea.

Respiratory Equipment

Eric Killam

Thompson Respiration Products and J. H. Emerson & Co., the manufacturers of the original iron lung, are manufacturing wraps in two different styles: the poncho wrap, which is a half wrap, and a full body wrap. LIFECARE is also manufacturing a full body wrap.

The wraps now are gaining wide respectability across the country There has recently been a lot of publicity about the effectiveness of wraps and a lot of different application sensors. I think this shows a trend toward the rehabilitative issue of independent living. I think this is a very positive issue.

Chest shells are still being manufactured by two or three companies. LIFECARE is manufacturing chest shells and cuirasses. Thompson is manufacturing chest shells and there are also independent companies around the United States who are doing custom shell work, using body casts that are made in the home or in orthopedic-type jobs.

The negative pressure ventilators that are used to power wraps and shells can be obtained from Emerson and the chest respirator from Thompson. The Thompson negative pressure ventilator offers both negative and positive pressures. There are various alarms for patient safety and also proximal airway sensing potential. Both of the negative pressure ventilators just mentioned are very reliable pieces of equipment, and they have both been designed for home application.

Iron lungs and rocking beds are still being manufactured by Emerson. They manufacture these

on a limited supply and through order only.

Many of you have seen Sunny Weingarten's quarter lung. This is a recent development and is a very positive step as far as portable iron lung equipment.

Positive volume ventilators are being manufactured by numerous companies. Life Products is manufacturing the LP3 and LP4, which are both portable and very reliable units. Thompson produces the M25 and the M3000 XA. Both of these units offer variable I:E ratios and assist capabilities. The M3000 XA also features a sigh mode. LIFE-CARE currently manufactures the PVV and will soon be releasing a PLV-100. The PLV-100 is designed for home use, as is the PVV and will feature IMV capabilities, variable I:E ratios, and proximal airway pressure sensing and assist.

All of the equipment I have mentioned is good, up-to-date equipment. Many patients who are using ventilators at home are doing just fine on equipment manufactured during the polio era, but manufacturers feel pressure to develop equipment to suit the needs of various types of individuals. Cost and effectiveness are important considerations. Emerson is located in Boston, Massachusetts. Sunny Weingarten, Life Products, Thompson, and LIFECARE are all in the Denver area. Sunny has a data sheet on his Porta Lung, Thompson has data sheets on their equipment, and LIFECARE would be glad to send data sheets on all of our equipment.

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