Non-Invasive Ventilation:  
When a Trach Isn’t the Best Choice  
by Susan Agrawal

Over the past five years, the use of non-invasive ventilation has exploded in the pediatric world. It is used in hospitals for acutely ill children as an alternative to intubation, and is also used in home care by children to help meet their ventilation needs. While once restricted only to children with sleep apnea, non-invasive ventilation is now considered appropriate for many different conditions, ranging from neuromuscular weakness to congenital central hypoventilation syndrome and a wide variety of pulmonary conditions.

Non-invasive ventilation includes any form of pressure, volume, or other ventilatory support, including CPAP, BiPAP, and VPAP, as well as the use of negative pressure ventilation and complex forms of ventilation given by mask.

Making the Choice

Not long ago, any child who needed ongoing ventilatory support required a tracheostomy and ventilator. While ventilation by tracheostomy is still the best choice for children requiring full-time ventilation, non-invasive ventilation has become a potential alternative for some children.

Good candidates for non-invasive ventilation include children with the following characteristics:

- Nose, mouth, and upper airway are intact and free of defects that would interfere with ventilation by mask
- Ventilation is less than 24 hours per day, intermittent, or short-term
- Child has a mild to moderate need for ventilatory support
- Child has a low risk for aspiration
- Child is able and willing to keep a mask on the face

A trial of non-invasive ventilation can be attempted for children who meet the above criteria in order to prevent the need for tracheostomy surgery.

While a tracheostomy is necessary for many children, in certain cases it may be contraindicated or undesirable. For example, children receiving palliative care may choose not to receive a tracheostomy as part of a comprehensive care plan. Other
children with immune deficiencies, bleeding disorders, or extreme medical fragility may also be poor candidates for tracheostomy due to an inability to tolerate the surgical procedure or the potential infections associated with tracheostomy. Some children may want to avoid tracheostomy due to fears that they may lose the ability to speak, cosmetic reasons, sensory issues, or lifestyle choices.

Pros and Cons of Non-Invasive Ventilation

There are many pros of non-invasive ventilation, including avoiding tracheostomy surgery, lower risk of infection, complete preservation of the ability to talk, lesser need for maintenance procedures such as trach changes and suctioning, and the ability to completely remove the device at times when it is not needed.

There are, however, many cons to non-invasive ventilation. The most significant problem that children may encounter is that non-invasive ventilation is not sufficient to meet their ventilatory needs. Children requiring high settings, who need 24-hour ventilation, who have a lot of secretions, or who aspirate may be unable to use non-invasive ventilation satisfactorily. Individuals who require daytime ventilation—even for just part of the day—may find wearing a mask at all times uncomfortable and embarrassing, especially since masks may limit speaking and eating.

Another common problem is skin breakdown resulting from the pressure of the mask. While this can be minimized by providing time off the mask, ensuring a correct mask fit, and using Mepilex and other dressings to prevent skin breakdown, it remains a difficult issue for many children. Other potential problems include gastric distension from swallowing air, aspiration, dry mouth, increase in secretions, and increased ear and sinus problems.

Non-invasive ventilation is difficult to tolerate for some children, particularly toddlers and preschoolers, as well as children with sensory issues. These children may have difficulties complying with their treatment protocol, and may be unable to use non-invasive ventilation. Some children may refuse to wear the mask or may pull it off during sleep, either intentionally or unintentionally. Other children may find the sensation of the device uncomfortable or intolerable. These children may do better with tracheostomy, or possibly high-flow oxygen if available.

Interfaces

One of the most important aspects of non-invasive ventilation is finding an appropriate mask. Unfortunately, children are somewhat limited by a small number of choices, especially for infants and very small children. Things are beginning to improve, and there are now multiple masks designed just for kids, and older kids may use adult petite or small versions. Hopefully even more styles of masks will be available soon.
There are many different types of masks, but they fall into four basic categories: masks that cover the nose and mouth, masks that only cover the nose, nasal pillows that fit into the nose, and masks that cover the entire face/head.

Because of the risk of vomiting and aspiration, masks that cover the nose and mouth and masks that cover the entire face are not recommended for young children and children with disabilities. A child may vomit into the mask and then inhale the vomit. These types of masks can be used at home if a child is continuously monitored by a nurse or parent, under limited circumstances. For example, my daughter uses one only when she has a bad cold and cannot inhale through her nose. She must have a nurse present at all times when she uses this mask.

There are currently several nasal masks developed specifically for children that work well for daily and long term usage. These include the ResMed Mirage Kidsta (for children seven and older), the ResMed Mirage Micro (for children seven and older), the ResMed Pixi (for children two and older), SleepNet MiniMe (for children two and older), Respironics Small Child Profile Lite (for small children), Respironics Profile Lite Youth (for elementary school-age children), and Respironics Small Child Contour (for small children). In addition, Cooper Surgical makes an infant nasal CPAP cannula that is used in NICUs. Hamilton Medical also makes a complete Arabella Infant CPAP system, though this is typically only available in a NICU environment.

There are no nasal pillows, full-face masks, or total-face masks designed specifically for children, though the small FitLife total-face mask fits most children when used with small headgear. Older children may be able to use small adult or petite versions of other masks, but often the headgear, pillows, or mask is too large.

Devices

While standard CPAP or BiPAP devices may be sufficient for some children, other children may need a device with more sophisticated settings, including tidal volume control or a mandatory or back-up rate. More sophisticated types of ventilation can be provided by a select number of advanced BiPAP devices, including Respironics’ BiPAP S/T, Respironics’ AVAPS, ResMed’s VPAP and ResMed’s Stellar.

Children who need ventilatory support during the day typically use standard ventilators. Most BiPAP machines do not have batteries and are not easy to use on-the-go. In addition, children may require more complicated settings than can be provided with a BiPAP machine, or may need a device with alarms to alert caregivers of problems.

Virtually all standard ventilators can be used non-invasively. Some have special modes, settings, and equipment for non-invasive use, while others use standard vent modes and settings. Commonly used ventilators that work well non-invasively include the LTV series (CareFusion/Viasys), Trilogy (Philips Respironics), and various Puritan Bennett models, including the 540 and Achieva (Covidien). Other ventilators may also work well
for some children. The Trilogy in particular is a good choice for non-invasive ventilation because it is especially designed to counteract the leaks that typically occur with non-invasive ventilation.

**Trial It**

Unfortunately, your ability to trial non-invasive ventilation and your child’s success with it may ultimately depend on your health care facility. While some facilities have many children on non-invasive ventilation, including children with complicated ventilatory needs, others have not embraced non-invasive ventilation to the same degree.

For many children, a trial of non-invasive ventilation is worth a try. While it is not perfect, especially since there are so few pediatric interfaces available, non-invasive ventilation can work well for some children.