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Editorial

Chronic ventilator dependence in infants

The first reference to positive pressure ventilation and tracheostomies was published by Andreas Vesalius in 1543. An excerpt from his treatise on anatomy entitled *De Humani Corporis Fabrica* states, “But that life may be restored to the animal, an opening must be attempted in the trunk of the trachea, into which a tube of reed or cane should be put; you will then blow into this, so that the lung may rise again and take air” [1]. Over the next several centuries, experiments were being performed to better understand the relationship between the lungs and circulation, but it wasn't until the late 19th century where the prototype for the first negative pressure ventilator was built. This became the basis of the widely used iron lung that was developed in Boston by Drinker and Shaw in 1929 and used to treat patients during the polio epidemic. There were many disadvantages of the iron lung. It was large and bulky which limited portability and access to the patient. During this time, Bjorn Ibsen, an anesthesiologist from Boston, recommended tracheostomy and positive pressure ventilation via “hand bagging” as there were no positive pressure ventilators available at the time. By the end of the epidemic, approximately 1,500 students provided manual ventilation for a total of 165,000 hours [2]. To better care for those requiring chronic mechanical ventilation, the establishment of intensive care units were created. The discrepancy between the increasing number of pediatric patients requiring long-term ventilation and the number of available pediatric ICU beds prompted the need for families to manage these patients at home.

Since it's advent in 1977, the LP3 portable volume ventilator made home use of positive pressure devices a possibility. For the pediatric patient, home mechanical ventilation reduces hospital costs, improves quality of life, enhances development, and reduces exposure to infectious diseases [3,4]. The benefits of home care are obvious, but the decision to shift care from a PICU to a home setting can be a complicated one. The technology dependent child belongs to a heterogeneous group of patients whose underlying pathology can be attributed to neuromuscular disease, severe prematurity resulting in bronchopulmonary dysplasia (BPD), or defective respiratory drives. Despite these variations in etiology, the majority have similar medical and social needs that need to be considered in order to successfully and safely provide care for these patients at home. In 2016, The Pediatric Assembly of the American Thoracic Society (ATS) developed evidence-based clinical practice guidelines for management of children requiring invasive mechanical ventilation at home. These guidelines established recommendations addressing coordination of care, readiness for home care, training of caregivers, and necessary equipment [5].

In this issue of *Seminars of Fetal & Neonatal Medicine*, we review best practices for mechanical ventilation of infants with tracheostomy-dependent chronic respiratory failure. Dr. Zhang et al., describe differences in ventilation strategies between neonatal respiratory distress syndrome and established chronic lung disease. Dr. Bhombal explains the complex cardiopulmonary interactions in mechanically ventilated infants. Dr. Flannagan's and Dr. Healy's article covers indications and timing for both tracheostomy placement and decannulation. Drs. Fierro and Panitch discuss the process of transitioning from hospital ventilators to portable home ventilators. Dr. Benscoter and colleagues review steps necessary to prepare families to care for their mechanically ventilated infants in the home. Following successful transition to home, Chou and Webster highlight advances in telemedicine for technology-dependent children. Finally, Drs. Koltsida and Konstantinopoulou provide an update on long-term outcomes in children requiring long-term mechanical ventilation for chronic lung disease. Taken together, these articles provide a thorough summary of the technological progress in the care of infants with chronic respiratory failure from neonatal intensive care unit to the home care setting.

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