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Ventilator Weaning and Tracheostomy Decannulation in Children: More Than One Way

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Tracheostomy was first described more than 2000 years ago, but was performed infrequently for centuries.¹ In children, its application became acceptable during the diphtheria and poliomyelitis epidemics of the early 20th century.² Tracheostomy was later routinely used to relieve upper airway obstruction (e.g., epiglottitis), provide chronic mechanical ventilation, facilitate mucus clearance, and stabilize the airway prior to reconstructive surgery for major craniofacial abnormalities.^{2–4} In more recent years, improved survival rates in preterm infants with severe bronchopulmonary dysplasia, children with congenital malformations, and critically-ill children have broadened the indications for tracheostomy.^{5,6} Removal of a tracheostomy may be indicated once the underlying condition has resolved.^{7,8} However, determining readiness for tracheostomy decannulation is challenging in the pediatric population. In addition to resolution of the initial indication, factors supporting clinical readiness include the health of the patient, stability of underlying medical comorbidities, and the child's functional status. Premature removal of a tracheostomy tube can result in poor growth, more frequent illnesses, hospitalizations and possibly death.⁹ On the other hand, failure to remove a tracheostomy when indicated can result in speech delay, increased infection risk, increased costs for care, limitation of participation in school, and sudden death due to mucous plugging.^{10,11} American Thoracic Society and American Academy of Otolaryngology Head and Neck Surgery guidelines^{12,13} recommend endoscopic evaluation of airway anatomy prior to decannulation to confirm adequate airway patency at all levels and to exclude or treat peristomal complications such as granulation tissue. Although various protocols have been reported, there is no standardized approach to weaning chronic mechanical ventilation or decannulation in children.^{7,8,14–19}

In this issue of the *Pediatric Pulmonology*, Cristea et al.²⁰, Henningfeld et al.²¹, and Liptzin et al.²² describe the experiences of three institutions with respect to weaning mechanical ventilation and tracheostomy decannulation.

Cristea et al. describes 201 decannulation attempts performed on 189 patients (sixteen patients had multiple attempts).²⁰ 167 (79.5%) decannulation attempts were successful. Of those successfully decannulated, four (2.4%) were recannulated within six months. After endoscopic evaluation of the airway, this institution's decannulation protocol recommends

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for all patients to be evaluated via polysomnogram (PSG) in the sleep laboratory with the stoma decannulated and covered by an occlusive dressing.

Henningfeld et al. performed a retrospective chart review of 46 children who were once ventilator-dependent, but have since underwent successful decannulation.²¹ All patients underwent both bronchoscopy and at least one PSG before decannulation was attempted. Interestingly, 30 of these children (65%) required some form of airway surgery (most commonly adenotonsillectomy, granuloma removal, and laryngotracheal reconstruction). The authors conclude that liberation from chronic mechanical ventilation is a complex multi-step process that can be done safely once a child's respiratory condition has improved.

Finally, Liptzin et al. performed a retrospective review of 21 attempts to wean nocturnal ventilation and 21 decannulation attempts.²² Many of these were in the same children. The authors describe a safe and effective approach to weaning chronic ventilation and decannulation without the use of PSG. This approach may be preferred when timely PSG is not readily available.

Regardless of the setting, the three groups agreed that close monitoring is necessary to determine readiness for weaning nocturnal ventilation and tracheostomy decannulation. Importantly, evaluation of the airway by either flexible or fiberoptic bronchoscopy was recommended in all cases.

Determining the safety of weaning ventilation and tracheostomy decannulation in children is implicitly difficult and carries an element of risk. The applicability of decannulation protocols across all medical centers may be limited. While sleep centers with pediatric expertise may be utilized successfully, they are not available at all medical centers in the United States. Prolonged wait times (between referral and when a PSG is performed), long distances to travel to the sleep center, and the timeliness of the PSG interpretation may stand as barriers to weaning and decannulation even at large tertiary care centers.²³ Long waiting times to obtain a PSG would significantly lengthen weaning times for children receiving care at institutions where a pediatric sleep center is not available. In some settings, weaning ventilation may even occur at home as long as an awake and alert fully-trained caregiver is monitoring the child.

In conclusion, there are no universally agreed-upon protocols for liberating children from chronic mechanical ventilation and tracheostomy decannulation. These three descriptive studies highlight the importance of and need for multicenter, prospective studies to evaluate safe weaning from chronic mechanical ventilation and tracheostomy decannulation.

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