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# Effect of tracheostomy timing in premature infants

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ABSTRACT

*Objective:* To examine if timing of tracheostomy placement in premature infants affects the rates of decannulation and length of time required for mechanical ventilatory support.
*Materials and methods:* Consecutive case series with chart review of premature patients born at a gestational age of 36 weeks or less at a tertiary-care, academic children's hospital who underwent tracheostomy placement between July 1, 2007 and December 31, 2010 for failure to extubate and chronic lung disease of prematurity. Last follow-up data reviewed was January 1, 2013.
*Results:* 43 patients were identified. 32 patients (74.4%) were able to be weaned from mechanical ventilation by the end of follow-up period, and the average time that elapsed between tracheostomy placement and weaning from mechanical ventilator support was 17.9 months. 19 patients (44.2%) were able to be decannulated, and of those patients, the amount of time between tracheostomy placement and decannulation was 27.9 months. No statistical significance was found in the relationship between tracheostomy timing placement and ability to wean from mechanical ventilator support or decannulate. For those patients able to wean from mechanical ventilator support and get decannulated, no difference in the amount of time and tracheostomy timing was found. Earlier premature patients tended to undergo tracheostomy later in life.
*Conclusions:* Decisions regarding tracheostomy placement should be individualized. We were unable to detect a relationship between tracheostomy timing and the ability or duration for premature infants with chronic lung disease of prematurity to wean from mechanical ventilator support or successfully decannulate.



## 1. Introduction

Premature neonates with lung disease of prematurity who require prolonged intubation and mechanical ventilation may be recommended to undergo tracheostomy placement. The timing of which can be variable, based on individual cases and patient concerns. However, premature patients often will undergo a much more prolonged period of intubation and later placement of a tracheostomy compared to adults. The timing of tracheostomy placement among different ago cohorts is very different, and generally, when an adult is identified to potentially require prolonged mechanical ventilation, tracheostomy placement may be recommended earlier on during the hospital course. Tong et al. examined a cohort of critically ill adults who required prolonged mechanical ventilatory support and underwent tracheostomy. The authors reported that early tracheostomy placement, performed before day 7 of mechanical ventilation, was associated with earlier intensive care unit (ICU) discharge, shorter duration of mechanical ventilation, and decreased length of overall hospital stay without affecting mortality rates [1].

Unfortunately, the outcomes and results for adults cannot be correlated to children, as their underlying respiratory failure pathology is much different. Our objective was to investigate if the timing of tracheostomy placement in premature infants affected rates of decannulation and/or length of time required for mechanical ventilatory support.

## 2. Methods

After institutional review board (IRB) approval was obtained, a billing code search was performed for current procedural terminology (CPT) codes: 31600 and 31601, tracheotomy, planned,

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**Table 1**
Demographic patient information.

| | Number of patients (%) | Age or amount of time [range] |
|---|---|---|
| Males | 24 (55.8) | |
| Females | 19 (44.2) | |
| Patients weaned from mechanical ventilator support | 32 (74.4) | |
| Patients decannulated | 19 (44.2) | |
| Patients who underwent airway reconstruction | 15 (34.9) | |
| Patients with syndromes or comorbidities not related to prematurity | 13 (30.2) | |
| Decannulated patients who underwent tracheocutaneous fistula closure | 10 (52.6) | |
| Mean gestational age at birth (weeks) | | 27.9 [23–36] |
| Mean age at tracheostomy placement (weeks) | | 21.4 [1.4–40.2] |
| Patients weaned from mechanical ventilator support, average amount of time (months) | | 17.8 [4–39] |
| Patients decannulated, average amount of time (months) | | 27.9 [14–42] |

and tracheotomy, planned – under 2 years, respectively, in patients 12 months of age and younger between June 1, 2007 and December 31, 2010. The subjects' charts were reviewed for follow-up until January 1, 2013.

Inclusion criteria included those patients who were born at a gestational age $\leq$ 36 weeks and had an indication for tracheostomy placement related to chronic lung disease of prematurity. Patients without sufficient medical records for review, absence of a diagnosis for chronic lung disease of prematurity, presence of obstructive, external airway obstructive lesion, such as a vascular anomaly, teratoma, or congenital high airway obstruction syndrome (CHAOS) were excluded.

The identified patients were then examined using 12, 16, and 20 weeks of life as the cutoff for the early tracheostomy placement groups. We chose these cutoff points to determine if there was an optimal "early" tracheostomy timing period, and started at 12 weeks because historically, that is the time at which tracheostomy is usually recommended for mechanically ventilator dependent infants. We also performed the same analysis comparing the outcomes of the earliest and latest 15 tracheostomy placed patients. A Fisher's exact test was used to examine if there was a significant difference between tracheostomy timing (early or late) and ability to wean from mechanical ventilation, decannulation, and having undergone airway reconstruction. A paired *t*-test was used to compare gestational age, length of time on mechanical ventilator support for those able to be weaned, and length of time until decannulated between the tracheostomy timing groups. Statistical significance was set at a *p*-value of $\leq$0.05, and unless otherwise noted, were two-tailed.

After pooling the results and determining the difference in rates of decannulation between the early and late tracheostomy timing groups, a power analysis was conducted, using a power of 80% to examine if the study contained enough patients to accept the null hypothesis.

## 3. Results

A total of 43 subjects were identified, 24 (55.8%) males and 19 (44.2%) females. The mean gestational age was 27.9 weeks, with the mean age at tracheostomy placement of 21.4 weeks. There were no tracheostomy related mortalities.

Thirty-two patients (74.4%) were able to be weaned from the vent by the end of follow-up period, and the average time that elapsed between tracheostomy placement and weaning from mechanical ventilator support was 17.9 months. Nineteen patients (44.2%) were able to be decannulated by the end of the study, and of those patients, the amount of time between tracheostomy placement and decannulation was 27.9 months. Ten (52.6%) of those patients that were decannulated had a persistent tracheocutaneous fistula, for which they underwent surgical closure.

Thirteen (30.2%) patients had coexistent syndromes or medical comorbidities, not related to or complications of prematurity. Twenty-seven (62.8%) patients had coexistant airway pathology such as subglottic or posterior glottic stenosis, unilateral or bilateral vocal fold immobility, or Pierre-Robin sequence (PRS). Fifteen (34.9%) patients underwent open laryngotracheal reconstruction. A summary and clinical outcomes of the patients can be found in Tables 1 and 2.

The results of our analysis of tracheostomy timing and patient demographics and clinical outcomes are summarized in Table 3. No statistical significance was detected in the relationship between tracheostomy timing placement earlier than 12, 16, and 20 weeks and ability to wean from mechanical ventilator support, to be decannulated, or to have undergone airway reconstruction. In addition, no relationship was found between tracheostomy timing and the amount of time that elapsed for those that were able to be weaned and/or decannulated. Those patients in the late tracheostomy group for each respective cohort were born at a disproportionately earlier gestational age.

## 4. Discussion

There is no current evidence to help guide the timing for tracheostomy placement in premature infants with chronic lung disease of prematurity. The literature seems to be unclear about whether or not there is an advantage for early versus late tracheostomy placement in adults requiring prolonged mechanical ventilation. Patients requiring mechanical ventilatory support with an endotracheal tube often have more challenging sedation and analgesic needs than those who have a tracheostomy. Theoretically, decreased sedation and/or paralytic requirements may allow these critically ill patients may have better clinical outcomes if they can be transitioned earlier to weaning trials and awakened from sedation. Gomes Silva et al. performed a meta-analysis of the currently available studies comparing early and late tracheostomy placement and concluded that there was no strong evidence demonstrating real differences based on the timing of tracheostomy placement [2].

The mechanical ventilatory needs of premature infants can be very challenging to manage, along with the associated requirements for sedation with or without muscle relaxation. With these patients who require prolonged mechanical ventilatory support, it may potentially be advantageous for early tracheostomy placement, as weaning trials or decreased sedation and paralytic requirements may then be initiated.

Anesthetic concerns and other complicating medical factors may preclude tracheostomy placement early on. Tracheostomy placement in this group of patients may have significant morbidity, with potential for mortality with accidental displacement or mucus plugging. Generally, it is acknowledged that tracheostomy placement in younger patients is associated with higher morbidity and mortality. An early case series by Gaudet et al. found an overall complication rate of one-third of pediatric patients who had a tracheostomies [3]. However, later, Zenk et al. reported that