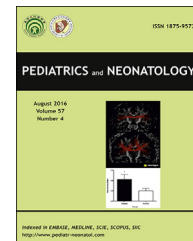


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Original Article

# A 12-year-experience with tracheostomy for neonates and infants in northern Taiwan: Indications, hospital courses, and long-term outcomes

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## Key Words

decannulation;  
indication;  
infant;  
outcome;  
tracheostomy

**Background:** Tracheostomy is a valuable procedure in infants and neonates with chronic respiratory failure or severe airway obstruction. The aim of this study is to identify the indication, hospital course, and long-term outcome in a cohort of infants who required tracheostomy in a neonatal and pediatric tertiary care center in northern Taiwan.

**Methods:** Medical records of infants, who underwent tracheostomy between January 2002 and December 2013, were retrospectively reviewed. Demographics, indication for tracheostomy, hospital course, discharge disposition, further hospitalization and surgery, and long-term outcome data were collected.

**Results:** Fifty-six patients were enrolled. The median gestational age was 38.0 weeks, and median birth weight was 2770 g. The median age at tracheostomy was 104.5 days. The primary indications for tracheostomy were airway obstruction in 35 patients (62.5%), craniofacial anomalies in 7 (12.5%), neuromuscular disorder in 7 (12.5%), cardiopulmonary disorder in 5 (8.9%), and brain injury-related problem in 2 (3.6%). Twenty-two patients (39.3%) were decannulated successfully, and the median time from tracheostomy to decannulation was 2.1 years. Overall mortality rate was 3.6%, but no death was related to tracheostomy. Forty-nine patients

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underwent regular follow-up at our hospital, and 46 patients (93.9%) required further hospitalization, and 30 (61.2%) underwent further surgery related to a respiratory problem or tracheostomy. Ratio of delayed growth at the time of tracheostomy (28.6%) did not have significant difference at 1 year of age (21.4%) and 2 years of age (25.0%).

*Conclusion:* In this study, the most common indication for tracheostomy in neonates and infants was airway obstruction. Excluding patients with neuromuscular diseases, a successful decannulation rate of >50% can be achieved.

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## 1. Introduction

Tracheostomy is a valuable procedure in children with chronic respiratory failure or severe airway obstruction. In the past 50 years, globally, the most common indications for pediatric tracheostomy had changed from acute infection, such as epiglottitis, to airway obstruction or prolonged ventilation.<sup>1–5</sup> The primary diagnoses of children assigned to require tracheostomy depend on the age of the child, and most of them received this procedure during infancy.<sup>2</sup> The survival rates of preterm infants and patients with congenital anomalies have increased in recent years.<sup>6</sup> Some premature infants require a tracheostomy for long-term respiratory support, while others require a tracheostomy due to severe congenital or acquired airway obstruction with minimal ventilator needs.<sup>7</sup>

The decision to perform a tracheostomy remains challenging for most of parents in Taiwan due to the traditional culture and the associated concerns about further care. However, the option of home care allows for more normal social adjustment of the child and family life away from the hospital.<sup>8–10</sup> In this context, tracheostomy may be a safe choice.<sup>10,11</sup> Notably, tracheostomy can lead to late complications, such as suprastomal granulation, accidental decannulation, mucous plugging, and speech delay.<sup>4,12,13</sup> Therefore, adequate home care training of the caregiver is important after tracheostomy, and the decannulation rate is an important issue.

The study reported herein is the first to investigate neonatal and infant tracheostomy patients in Taiwan. The aim of this study was to identify the indication, hospital course, and long-term outcome in a cohort of infants who underwent tracheostomy in a neonatal and pediatric tertiary care center in northern Taiwan over a 12-year period. The information yielded by this study can help clinicians to assess the risks associated with tracheostomy in neonates and infants, and provide relevant information about the procedure and further care to care-givers, thus enabling them to make more informed decisions.

## 2. Methods

The design of this study was a retrospective chart review of infants (0–1 year of age) who underwent tracheostomy at a neonatal and pediatric tertiary care center in northern Taiwan, between January 2002 and December 2013, with chart review through June, 2015.

Patient charts were reviewed individually, and the data collected included gestational age, gender, birth weight, overall mortality, age at admission, age at tracheostomy, length of ventilator use before tracheostomy, length of intubation before tracheostomy, length of hospitalization before tracheostomy, time from tracheostomy to discharge, whether discharge with ventilator, discharge position, indication for tracheostomy, time to decannulation, whether achieving successful decannulation, duration of follow-up length after tracheostomy, and body weight at the time of tracheostomy, and at 1 and 2 years of age. We also reviewed the number of hospitalization and reasons for further surgery.

Successful decannulation was consistently observed in a 48-h capping trial involving decannulation under continuous pulse oximetry monitoring during hospitalization. We distinguished between hospitalization due to unexpected causes, such as airway infection, accidental decannulation, wound infection, wound bleeding, ventilator breakdown, and pneumothorax; and expected causes, such as scheduled decannulation, scheduled bronchoscope examination, and scheduled operation. "Further surgery" was also assigned to 1 of 4 categories for data analysis: (1) surgery for complications related to tracheostomy (e.g. granulation, wound infection), (2) airway reconstruction, including endoscopic intervention or expansion reconstruction, (3) tracheostomy closure, including tracheocutaneous fistula closure, laryngotracheal reconstruction with cartilage graft (LRCG), and (4) procedures performed solely for the purposes of examining the airway.

Descriptive statistics were calculated for categorical variables, including gender, home ventilator use, indications for tracheostomy, successful decannulation, and delayed growth (weight < 3rd percentile) at 1 year and at 2 years of age. Continuous variables, including gestational age, birth weight, age at admission and tracheostomy, time from tracheostomy to discharge, length of hospitalization before tracheostomy, duration of ventilator use before tracheostomy, duration of intubation before tracheostomy, and the number of hospitalization and further surgery were also assessed.

We compared characteristics in term infants and preterm infants by the Mann–Whitney U test in continuous variables and Fisher's exact test or Pearson's chi-square test in categorical variables. We separated the patients into 2 groups according to the success of decannulation, and compared these groups with regard to gestational age, birth weight, and numbers of hospitalization and further

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