INFANT TRACHEOSTOMY: A 10-YEAR EXPERIENCE IN A TERTIARY CENTRE

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ABSTRACT

We aim to report our experience of infant tracheostomies in a period of 10 years and discuss the indications, complications, outcome, and follow-up. This case series will contribute to the data of shifting trends in paediatric tracheostomy indications and outcomes. This study aims to review the indications, complications, and outcomes for paediatric tracheostomy at Hospital USM. A retrospective evaluation of the last ten years of experience at Hospital USM for all infants under the age of one who undergoes tracheostomy from January 2011 to January 2021 was undertaken. During the research period, twelve tracheostomies were performed. Complete data were available for all patients. There were 8 (67%) males and 4 (33%) females. The patient’s age at the time of tracheostomy ranged from one day to nine months, with the mean age of tracheostomy insertion being 95 days. The most frequent indication was prolonged ventilation (50%), followed by upper airway obstruction caused by a craniofacial anomaly (33%), subglottic stenosis (8%), and laryngomalacia (8%). Sixteen per cent of patients were successfully decannulated. In newborns, tracheostomy is a life-saving procedure with high morbidity and mortality. The role of tracheostomy in airway management has evolved, both in terms of indication and outcome. This series complemented the current trends in indications of infant tracheostomy.

Keywords: Infant; Tracheostomy; Complications; Outcome; Decannulation
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Introduction

Tracheostomy is a life-saving surgical procedure with high morbidity and mortality, especially in children [1]. Infants and younger children with tracheostomy have higher complication rates than adults. It also presents a challenge for parents and clinicians regarding tracheostomy care and a long follow-up period. Historically, life-threatening diseases like diphtheria were the primary reason for paediatric tracheostomy before the vaccination era [2]. Indication for tracheostomy nowadays has shifted towards prolonged ventilation and upper airway obstruction from congenital (craniofacial defect) or acquired conditions such as subglottic stenosis [3].

Methods

All tracheostomies performed in Hospital USM were reviewed retrospectively from January 2011 to January 2021. Hospital USM is one of the two tertiary referral centres in Kelantan, Malaysia, referred for paediatric airway cases. Inpatient case records were reviewed for the following characteristics: infant age, demographics, indications, co-morbidities, duration of hospitalisation, decannulation, and complications. All tracheostomies were performed by Otorhinolaryngology (ORL) registrars or surgeons. The technique is a tracheostomy with a horizontal
skin incision. When the trachea is visible, a vertical incision is made and two stay sutures are inserted on each side of the incision. The procedure was performed either electively under general anaesthesia or as an emergency under local anaesthesia.

**Results**

Twelve infant tracheostomies were performed during the 10 years, from January 2011 to January 2021. Complete records were available for all patients consisting of 8 males and 4 females with a ratio of 2:1. The patient's age at the time of tracheostomy ranged from one day to nine months, with the average age of tracheostomy insertion being 95 days. Six infants (50%) were younger than 1-month old, and another 6 infants (50%) were between 2-month and 9-month old. The mean weight at the time of tracheostomy was 2.5 kg (0.93–3.40 kg).

Nine patients (75%) were intubated before the tracheostomy insertion, 3 patients (25%) were not intubated before tracheostomy insertion. Ten (83%) patients had their procedure performed as an elective case, 2 (17%) had their tracheostomy performed as an emergency.

Table 1 summarises the indications for tracheostomy. Prolonged ventilation (50%) was the most prevalent, followed by upper airway obstruction caused by a craniofacial anomaly (33%), subglottic stenosis (8%), and laryngomalacia (8%).

Complications of infant tracheostomy are shown in Table 1. The most common complication was stomal granulation tissue requiring removal under general anaesthesia in 2 out of 3 infants. One infant had a life-threatening event requiring cardiopulmonary resuscitation following tracheostomy tube dislodgment. Late complications such as tracheocutaneous fistula occurred in one infant that required closure after decannulation. In addition, tube blockage developed in one patient. In other words, half of the patients had complications but were treatable.

The mean length of hospitalisation for tracheostomy surgery was 134 days (2–389 days). Only two (16%) patients were successfully decannulated of their tracheostomy tubes. Six patients still require tracheostomy owing to a craniofacial defect and subsequent neurological sequelae. A total of 4 (33%) patients have died. The cause of death of these patients was because of disease progression or complications and not related to tracheostomy.

**Discussion**

An infant is described as any child from birth to the age of one year old. Tracheostomy in this age group was historically related to infection of the upper airway. Many series have reported the shifting indications for paediatric tracheostomy from upper airway infections to acquired and congenital causes [4, 5]. None of the infants in this series had a tracheostomy due to an upper airway infection. This shift is due to widespread vaccination and advancement in neonatal intensive care and ventilation devices that improve survival rates. The timing of tracheostomies also varies from day 1 of life to 280 days old. Early tracheostomy was performed mainly due to congenital upper airway obstruction within the first few days of life. Meanwhile, acquired and chronic causes are the primary indications of tracheostomy in infants beyond the age of one month. This is attributed to a higher survival rate of preterm infants and those with primary chronic illness who require prolonged ventilation.

The most frequent indication in our study was prolonged ventilation followed by upper airway obstruction caused by a craniofacial abnormality. This result is consistent with other studies [5, 6]. Male was prevalent in our series which is comparable to findings by Alladi et al. [1]. It could be explained by the higher susceptibility of males to congenital abnormalities and acquired airway lesions [7]. The number of cases in our study had a ratio of 1.2 cases per year for infant tracheostomies, which is almost similar to that reported by Alladi et al. of 14 patients over a 13-year duration [1].

Children's morbidity and mortality rates from tracheostomy are two to three times greater than adults [1]. Death from tracheostomy is rare (approximately 2-3%) and is mainly due to unintentional decannulation and tube occlusion [8, 9]. However, severe co-morbidity resulted in a higher mortality rate of 33 per cent in those with disabling and chronic diseases, as shown in this series. The underlying condition is primarily the cause of mortality.
Table 1. Tracheostomy age, indications, complications, outcome, and cause of death

<table>
<thead>
<tr>
<th>Case No</th>
<th>Age during tracheostomy (days)</th>
<th>Indications</th>
<th>Complications</th>
<th>Outcome</th>
<th>Cause of death</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Upper airway obstruction due to craniofacial abnormality</td>
<td>Tracheocutaneous fistula – closure after decannulation</td>
<td>Decannulated after 2 months</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Lethal congenital anomaly at day 2 of life</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Frequent tube dislodgement</td>
<td>On tracheostomy</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Tube blockage</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>Laryngomalacia and right vocal cord immobility</td>
<td>Suprastomal granulation tissue</td>
<td>Decannulated after 7 months</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>Prolonged ventilation and failed extubation</td>
<td>-</td>
<td>-</td>
<td>ARDS with septicaemic shock with underlying chronic lung disease</td>
</tr>
<tr>
<td>7</td>
<td>88</td>
<td>Hypertrophic cardiomyopathy with underlying mitochondrial myopathy</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>91</td>
<td>Subglottic stenosis</td>
<td>Peristomal granulation tissue and tube dislodgement</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>171</td>
<td>Prolonged ventilation with underlying Pelizaeus-Merzbacher disease</td>
<td>On tracheostomy</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>187</td>
<td>Prolonged ventilation with underlying SMA</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>278</td>
<td>Prolonged ventilation with severe traumatic brain injury</td>
<td>Peristomal granulation tissue</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>280</td>
<td>Prolonged ventilation</td>
<td>-</td>
<td>-</td>
<td>Respiratory failure due to severe tracheomalacia and chronic lung disease</td>
</tr>
</tbody>
</table>

*ARDS- Acute Respiratory Distress Syndrome, SMA- Spinal Muscular Atrophy*
Complications can be classified as early or late-onset. Complications that develop before the initial tube change are referred to as early complications [10]. Acute complications are reported at a rate ranging from 5% to 49% [8, 9, 10]. The most frequent complications are bleeding followed by emphysema, pneumothorax, pneumomediastinum, accidental decannulation, tube dislodgement, tracheal tear, and tracheoesophageal fistula. Meanwhile, chronic complications such as granulation tissue, infection, tracheal stenosis, tracheomalacia, and tracheocutaneous fistula have been reported by various authors, with rates ranging from 24% to 100% [8, 9, 10]. The complications that arose in our case series were minor and not life-threatening. It is worth noting that half of our patients were without complications. We believe the low morbidity is attributed to the surgery being performed in a controlled setting in an operation theatre by an experienced otolaryngologist. Comprehensive tracheostomy care training for health care providers and parents before discharge also contributed to lower morbidity.

Decannulation was successful in only 16% of our patients, which is lower than the 34-35% described by Carr et al. and Ozmen et al. [8, 11]. However, these numbers suggest that decannulation is impossible in most infants due to the severity of their primary disorder.

**Conclusion**

Tracheostomy in an infant is a challenging task that can cause serious complications. Our findings noted that most complications are manageable and rarely directly cause tracheostomy-related death. The indications for infant tracheostomy have changed over the last decade due to improved survival in infants with birth defects and congenital anomalies. Multidisciplinary team collaboration and parents' participation will significantly improve the outcome of an infant with a tracheostomy.

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**References**


