

Paediatric Tracheostomy

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Abstract:

Objective: To evaluate the indications of paediatric tracheostomy and associated morbidity within our patient population over the last one and a half years.

Methods: We conducted a retrospective study of patients below 12 years of age, undergoing tracheostomy at our tertiary ENT Hospital from April 2016 to December 2017. Patient age, sex, emergency or elective tracheostomy, indications, complications and decannulation were assessed.

Results: 27 paediatric patients who underwent tracheostomy were investigated. 17 were males, and 10 were females. The most common indication for tracheostomy was Laryngeal diphtheria, followed by recurrent respiratory papillomatosis. 5 cases were successfully decannulated.

Keywords: Paediatric tracheostomy, laryngeal diphtheria, decannulation.

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I. Introduction

Tracheostomy is the surgical procedure by which a cannula is introduced into the trachea in order to establish direct communication with the external environment. When performed on children, it is associated with greater morbidity and mortality than when performed on adults¹⁻³. The small diameter of the infant larynx and trachea means that any minor changes due to mucosal edema can quickly lead to severe and sometimes even life threatening narrowing of the airway. The infant larynx is hidden by hyoid bone, since it occupies a higher position in the neck than in adults. The thyroid cartilage has a broad leading edge. Cricoid cartilage is often prominent, palpation to establish the level of the airway can sometimes be difficult. These anatomical characteristics that differ from those in adults make management more problematic.

The purpose of this study was to present our clinical experience with the indications, morbidity, decannulation, and other factors involved in tracheostomy in children and discuss this experience in the light of the relevant literature.

II. History

Asclepiades is credited with carrying out the first tracheostomy in Rome in the second century BC⁴. Antyllus defined the tracheostomy technique once again in the second century AD, emphasizing that the trachea should be opened at the third or fourth rings. Nevertheless, it was only during the 16th century that the Italian physician Antonio M. Brasovola described successfully performing a tracheostomy on a patient with an abscess of the trachea⁴. In 1766, Caron described a tracheostomy on a 7-year old child carried out to remove a foreign body. This is considered to be the first successful tracheostomy performed on a child in the paediatric age group⁵. Other successful reports were given by Andree in 1782 and Chevalier in 1814⁴.

In 1833, Trosseau reported having saved 50 children with diphtheria by carrying out tracheostomies⁵. This was the first report in history that also described techniques for postoperative care⁵. As a result of this satisfactory use of tracheostomy in children with diphtheria, surgical management of airway problems increased in popularity, even in the knowledge that the mortality associated with the procedure remained high. In 1921, Jackson demonstrated a reduction in mortality when tracheostomies were carried out correctly, especially so where there was also appropriate postoperative care⁶. The next impetus to increased use of the procedure came when Galloway reported using tracheostomy with patients with poliomyelitis⁷.

III. Material And Methods

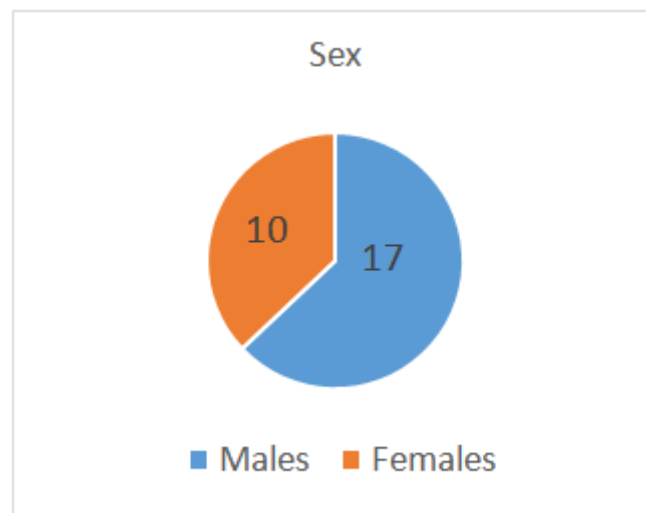
All tracheostomies were carried out by ENT Surgeons mostly under general anesthesia. The patient was placed in a shoulder roll to expose the laryngeal and tracheal cartilages. Standard tracheostomy performed at our institution consists of a vertical skin incision, followed by a vertical incision in lower layers to protect the large vessels of the thyroid plexus and thyroid gland. Following exposure of the trachea, the surgical technique performed then differs between adults and children. Tracheostomy in children involves a vertical incision only, with no removal of any tracheal cartilage. Then the tracheostomy tube is inserted. Post operative care frequently involves endotracheal aspiration, and daily examination to prevent occlusion due to clot, debris, or thick mucus.

After the underlying cause was treated, Direct Laryngoscopic Examination under General anaesthesia was performed to plan for decannulation. First, the tube was downsized and the patient observed for any signs of respiratory distress for 24 hours. Next the tube was blocked at night, and the patient was observed if he could tolerate well till morning. Then the tube was blocked, and patient observed for 48 hours. If he could tolerate well, then decannulation was done and the stoma closed with Dynaplast.

IV. Results

Age: The least age was 8 months and highest was 12 years.

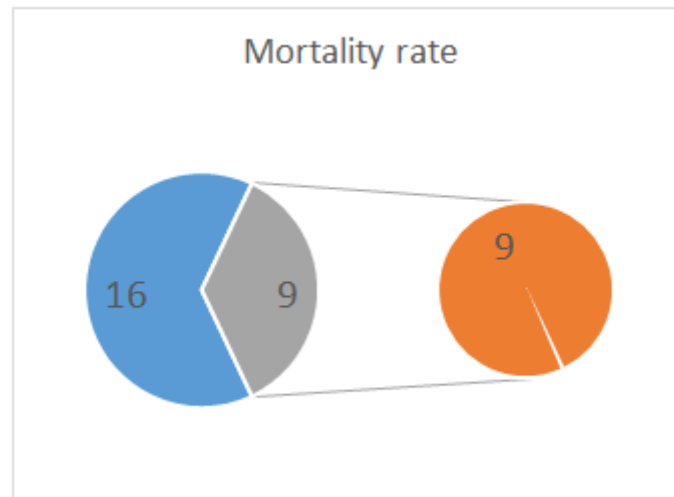
Gender: Out of the 27 paediatric patients who were investigated, 17 were males, and 10 were females.



Indication: The indications for tracheostomy in our study were Diphtheria (12 cases), Respiratory papillomatosis (3 cases), Prolonged intubation SGS (2), B/L Abductor palsy (2), AV Malformation of Tongue (1), Rhabdomyosarcoma of Nasopharynx (2), Plexiform Neurofibromatosis of Larynx (1), Glottic web (2), Hemangioma left cheek (1), Tracheal cyst (1). The most common indication for tracheostomy was Laryngeal diphtheria, followed by recurrent respiratory papillomatosis.

S.No	Indication	No (%)
1.	Diphtheria	12 (44.4%)
2.	Respiratory papillomatosis	03(11.1%)
3.	Prolonged intubation SGS	02(7.4%)
4.	BL Abductor palsy	02(7.4%)
5.	AV Malformation of Tongue	01(3.7%)
6.	Rhabdomyosarcoma of Nasopharynx	02(7.4%)
7.	Plexiform Neurofibromatosis of Larynx	01(3.7%)
8.	Glottic web	02(7.4%)
9.	Hemangioma left cheek	01(3.7%)
10.	Tracheal cyst	01(3.7%)

Mortality: Out of the 27 patients, 16 patients remained alive at the end of the study. Laryngeal diphtheria was the cause of death in our patients. There was no death due to tracheostomy.



Decannulation: 5 cases were successfully decannulated.

V. Discussion

Although paediatric tracheostomy is seldom performed nowadays, it remains necessary for the management of a few “technology-dependent” children, enabling them to be discharged from the ICU⁸⁻¹¹. The best data regarding its true incidence stem from a study by LEWIS et al.¹², which analysed the data from 2,521 US hospitals and estimated the rate to be 6.6 children per 100,000 child-years during 1997. Although originally this technique was developed as an emergency procedure to solve difficult acute situations, in many settings, it has now become a programmed decision, part of a multidisciplinary approach in complex patients with chronic disorders. CORBETT et al.¹³ found that just 6% were performed for emergency airway management in a series of 122 children between 1987 and 2003. 72% of our cases were emergency tracheostomies, while 33% were elective tracheostomies.

Concerning the age at which the tracheostomy was performed, the study with the most patients published so far¹² indicates two peaks: <1 yr (32%) and 15–18 yrs (10.3%), the latter mainly resulting from cranioencephalic trauma. Others have reported figures for children <1 yr of age of between 50% and 66%¹³⁻¹⁵. The mean age for tracheostomy in most series ranges from 3.2 to 7.8 months^{13,14,16,17}, or around 3 yrs of age^{18,19}. In our study, the least age was 8 months and highest was 12 years. 7% of patients in our study were <1 yr of age. As in our series, most studies have found a slightly higher frequency in males (60–63.8%)^{12,16,20}, though not all (48%)¹⁷.

Between 1968 and 2005 numerous institutions across the world reported changing indications for tracheostomy, from prolonged intubation to upper airway obstruction²¹⁻²⁴. In the 1970s, tracheostomy was commonly performed for acute upper airway involvement due to infectious diseases. Of interest among the indications was that conditions associated with the classical pathogens, such as *C.diphtheriae* or epiglottitis due to *H.influenzae*, have disappeared from the statistics over the last 10 yrs. Wide use of antibiotics and improvements in intubation and *Haemophilus influenzae* type B vaccine in the treatment of acute epiglottitis or diphtheria have resulted in a major decrease in the indications of tracheostomy for acute infectious diseases²⁵. In contrast to this, our study suggests a trend toward more tracheostomies being performed for laryngeal diphtheria (44%). This might be attributed to our centre being the referral centre for Sir Ronald Ross Institute of communicable diseases. The next common indication was recurrent respiratory papillomatosis (11%). Though prolonged intubation was the common indication in other studies, in our study it accounted to only 7%.

Carron et al.¹⁸ reported overall mortality of 19%, with a 3.6% tracheostomy related death rate. In other studies, mortality due to the main underlying disease varied from 6.9–39.2%^{13,14,15,16,18}. The mortality rate in our study was 33.3%, most common cause being laryngeal diphtheria.

Communication via speech is lost, and can be compensated for in older children using signs or with writing for children who have already learnt to read and write. A speaking valve can be used with children if the tracheostomy cannula does not exceed two thirds of the tracheal diameter, if clinical status is stable, secretions are not too thick and they have a certain ability to vocalize with occlusion of the tube.

Removal of a paediatric tracheostomy is a difficult procedure and should only be attempted after the primary disease that indicated the procedure has been resolved. The attempt at decannulation should be preceded by fibrobronchoscopy in order to rule out obstructive diseases (laryngeal or subglottic stenosis, granulomas, tracheal collapse above the tracheostomy, and others) which prevent the cannula from being removed. If present, obstructions should be dealt with, before removing the tracheostomy cannula. After the

cannula is removed, the child must remain in hospital under observation for a minimum of 24 hours. Comparison of our 18.55 % of patients who achieved decannulation with other series, which report decannulation figures of 29– 52.7%^{13,16-19}, gives a notably lower percentage. Possible reasons for this include the shorter period of our study, the high percentage of patients with severe laryngeal diphtheria.

VI. Conclusion

From our experience, we conclude that paediatric tracheostomies vary in terms of indication, morbidity and decannulation. Tracheostomy in males was more common than females. The most common indication for tracheostomy was Laryngeal diphtheria, followed by recurrent respiratory papillomatosis. The most common cause for mortality was Laryngeal diphtheria. Therefore, measures should be taken for the prevention and proper treatment of Diphtheria. Paediatric patients may also require a prolonged follow-up.

References:

- [1]. Gilmore BB Jr, Mickelson AS. Pediatric tracheotomy: controversies in management. *Otolaryngol Clin North Am*. 1986; 19:141-51.
- [2]. Pereira KD, MacGregor AR, Mitchell RB. Complications of neonatal tracheostomy: a 5-year review. *Otolaryngol Head Neck Surg*. 2004; 131:810-3.
- [3]. Ruggiero FP, Carr MM. Infant tracheotomy: results of a survey regarding technique. *Arch Otolaryngol Head Neck Surg*. 2008; 134:263-7.
- [4]. Wetmore RF. Tracheotomy. In: Bluestone CD, Stool SE, Alpes CM, Arjmand EM, Casselbrant ML, Dohar JE, et al., editors. *Pediatric otolaryngology*. 4th ed. Philadelphia: Saunders; 2003. p. 1583-98.
- [5]. Goodall EW. The story of tracheotomy. *Br J Child Dis*. 1934; 31: 167-76.
- [6]. Jackson C. High tracheotomy and other errors: the chief causes of chronic laryngeal stenosis. *Surg Gynecol Obstet*. 1921; 32: 392-8.
- [7]. Galloway TC. Tracheotomy in bulbar poliomyelitis. *JAMA*. 1943; 123:1096-7.
- [8]. Fields AI. Pediatric tracheostomy: the great liberator or the last battlefield. *Pediatr Crit Care Med* 2008; 9: 126–127.
- [9]. Graft JM, Montagnino BA, Huekel R, et al. Children with new tracheostomies: planning for family education and common impediments to discharge. *Pediatr Pulmonol* 2008; 43: 788–794.
- [10]. Cohen E, Kuo DZ, Agrawal R, et al. Children with medical complexity: an emerging population for clinical and research initiatives. *Pediatrics* 2011; 127: 529–538.
- [11]. Principi T, Morrison GC, Matsui DM, et al. Elective tracheostomy in mechanically ventilated children in Canada. *Intensive Care Med* 2008; 34: 1498–1502.
- [12]. Lewis CW, Carron JD, Perkins JA, et al. Tracheotomy in pediatric patients. A national perspective. *Arch Otolaryngol Head Neck Surg* 2003; 129: 523–529.
- [13]. Corbett HJ, Mann KS, Mitrab I, et al. Tracheostomy – a 10-year experience from a UK pediatric surgical center. *J Pediatr Surg* 2007; 42: 1251–1254.
- [14]. Mahadevan M, Barber C, Salked L, et al. Pediatric tracheotomy: 17 year review. *Int J Pediatr Otorhinolaryngol* 2007; 71: 1829–1833.
- [15]. Parrilla C, Scarano E, Guidi ML, et al. Current trends in paediatric tracheostomies. *Int J Pediatr Otorhinolaryngol* 2007; 71: 1563–1567.
- [16]. Al-Samri M, Mitchell I, Drumond DS, et al. Tracheostomy in children: a population-based experience over 17 years. *Pediatr Pulmonol* 2010; 45: 487–493.
- [17]. Vanker A, Kling S, Booyens JR, et al. Tracheostomy home care: in a resource-limited setting. *Arch Dis Child* 2012; 97: 121–123.
- [18]. Carron JD, Derkay CS, Strobe GL, et al. Pediatric tracheostomies: changing indications and outcomes. *Laryngoscope* 2000; 110: 1099–1104, 2000.
- [19]. Butnaru CS, Colreavy MP, Ayari S, et al. Tracheotomy in children: evolution in indications. *Int J Pediatr Otorhinolaryngol* 2005; 70: 115–119.
- [20]. Alladi A, Rao S, Das K, et al. Pediatric tracheostomy: a 13-year experience. *Pediatr Surg Int* 2004; 20: 695–698.
- [21]. A. Lawrason and K. Kavanagh, "Pediatric tracheotomy: are the indications changing?" *International Journal of Pediatric Otorhinolaryngology*, vol. 77, no. 6, pp. 922–925, 2013.
- [22]. S. Ozmen, O. A. Ozmen, and O. F. Unal, "Pediatric tracheotomies: a 37-year experience in 282 children," *International Journal of Pediatric Otorhinolaryngology*, vol. 73, no. 7, pp. 959–961, 2009.
- [23]. C.S. Butnaru, M.P. Colreavy, S. Ayari, and P. Froehlich, "Tracheotomy in children: evolution in indications," *International Journal of Pediatric Otorhinolaryngology*, vol. 70, no. 1, pp. 115–119, 2006.
- [24]. A. H. C. Ang, D. Y. K. Chua, K. P. Pang, and H. K. K. Tan, "Pediatric tracheotomies in an Asian population: the Singapore experience," *Otolaryngology—Head and Neck Surgery*, vol. 133, no. 2, pp. 246–250, 2005.
- [25]. O. Rajesh and R. Meher, "Historical review of tracheostomy," *The Internet Journal of Otorhinolaryngology*, vol. 4, no. 2, 2005.