International Journal of Otorhinolaryngology and Head and Neck Surgery
Munjal M et al. Int J Otorhinolaryngol Head Neck Surg. 2025 Aug;11(4):483-486
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937
DOI: https://dx.doi.org/10.18203/issn.2454-5929.ijohns20252268

Review Article

Tracheotomy decannulation in the pediatric age group: an enigma

Manish Munjal[1], Shubham Munjal[1]*, Vineeta Arora[2], Swati Chauhan[1], Garima Bansal[1], Lovleen Sandhu[1], Karambir Gill[3], Sidharth Bhargava[3], Shruti Kakkar[3], Jatinder Goraya[3], Kamal Arora[3], Fatehvir Singh Nain[1], Ayush Ahuja[1]

[1]Department of Ear, Nose, Throat-Head and Neck Surgery, Dayanand Medical College, Ludhiana, Punjab, India
[2]Guru Teg Bahadur Hospital, Ludhiana, Punjab, India
[3]Department of Paediatrics, Dayanand Medical College, Ludhiana, Punjab, India

Received: 01 March 2025
Revised: 07 July 2025
Accepted: 09 July 2025

***Correspondence:**
Dr. Shubham Munjal,
E-mail: manishmunjaldr@yahoo.com

ABSTRACT

Asclepiades was the pioneer of a successful pediatric tracheostomy which is the commonest surgery undertaken in the critically-ill child for prolonged airway, ventilatory support and bronchial toilet. Newborn/neonatal intensive care units globally consider tracheostomy as a priority in their protocols, in the pediatric individual who have a high probability of retaining the endotracheal tube for a long period. The removal of the tracheostomy tube is called decannulation. Reinsertion of the tracheostomy tube within 48-96 hours is labelled failed decannulation. Sensorium, ability to cough, laryngo-tracheal secretions, and blood gas levels are crucial parameters prior to decannulation. Granulomas in the supra-glottic and subglottic region lead to stenosis which is one of the common reasons for an unsuccessful outcome. Mortality is usually secondary to the underlying ailment and, not the tracheotomy itself.

Keywords: Tracheostomy, Pediatric, Decannulation, Subglottic stenosis, Stoma

INTRODUCTION

Cervical airway obstruction and a shorter access to bronchial toilet necessitate opening the trachea in the neck and to keep it patent, make it communicate with the external environment, through a opening in the skin called a 'stoma'. The former procedure being captioned a "tracheotomy" while the latter a "tracheostomy."

The tracheo-cutaneous fistula facilitates a quick insertion of an inert tube which retains the lumen of the fistula. Surgical intervention namely tracheostomy is discussed historically in the scriptures of two Greek physicians, Galen who credited Asclepiades as being the father of this surgical intervention; and Aretaeus both scholars of the 2nd century.[1,2]

NICU's (Newborn/neonatal intensive care units) all over the world have incorporated tracheostomy as a priority issue in their protocols, in the pediatric populace where there is a high probability of retaining the endotracheal tube for a long period. The tracheostomy facilitates mechanical alveolar ventilation and bronchial cleaning.[3]

REVIEW OF LITERATURE

The tracheostomy aptly captioned "an artificial cervical airway stands for gaining surgical access to the trachea in the anterior triangle of the neck and fabrication of a stoma in the skin that leads into the trache". Earliest illustrations and details of the procedure date to 100 B. C. by Asclepiades who was the pioneer of a successful pediatric tracheostomy and documented it in the early 17th century.[1,2] Tracheostomy is the commonest surgery

undertaken on the critically-ill for prolonged airway and ventilatory support.[3]

These set of individuals compared to the adults need specialized care during the intervention and in the post operative phase to reduce the morbidity and mortality of the procedure.[3,4]

Inability to expectorate the trachea-bronchial secretions, obstructive upper airway pathologies, impaired neurological status and assisted prolonged ventilation are the common conditions that require a tracheostomy in the pediatric age group.[5]

When the individual achieves the ability to easily breathe and protect the airway normally, the tracheostomy tube can be removed. This process is called decannulation.

The phonation and deglutition function as well as cervical cosmesis is regained. Moreover, the confidence of the person comes back and this improves the quality of one's life.[5]

Global literature on pediatric tracheostomy and its late sequel favorable or otherwise is trivial. Though a consensus of success achieved in full removal of the tracheostomy tube is between 35% to 75%.[6-13]

Differences in the individuals and protocols adopted at different health care facilities affect the analyses and interpretations of the parameters of decannulation in children who have been tracheostomised.[11]

DISCUSSION

Decannulation necessitates a pre procedure evaluation of the upper and lower airways least one may have a successful outcome rather than it being an embarrassing situation. All likely causes of failure and their remedial measures are meticulously chalked out.

Noninvasive investigations like radiography neck and chest are the perquisites. Neck radiography includes the lateral and antero-posterior views to determine the status of the anterior-posterior and the right-left lateral walls of the trachea, respectively. The luminal status is evaluated as well.

Radiography chest guides regarding the ventilation situation or otherwise of the lungs and thereby the expiratory-inspiratory efforts of the intercostal muscles.

Laryngoscopic evaluation, rigid Mackintosh/Miller or the flexible fibroptic laryngo-tracheo-bronchoscopy is vital to asses' glottic status, cord mobility, granulomas, and rare fistulous communications. Duration of tracheostomy, and its indications significantly affect the decision for decannulation.

The individual's neurological status and ability to cough out secretions and thus protect one's airway is vital before considering decannulation. The size and type of the endotracheal and the tracheostomy tubes (red rubber/ silicone etc.), tracheal cultures, prolonged antibiotic usage, and duration of ventilation are issues of concern

Satyawati et al analysis did not find any role of these factors in making a decision to decannulate.[14] While on the contrary some studies suggest an association between these factors and subglottic narrowing affecting the outcome of decannulation.

Tracheostomy decannulation in subjects where Ambu bag ventilation, mouthpiece or post endotracheal intubated is not possible, fall in the "difficult decannulation 'high risk group who are prone to risk of loss of the only airway, access in emergent situations.

No clear definition has been given to this malady of "decannulation failure."[15]

De Trey et al, 119 retrospective pediatric tracheostomy analysis concluded that airway obstruction was the primary indication for tracheotomy (70%) followed by prolonged mechanical ventilation (30%). Their study spanned over a period of 30 years.[11] Tracheostomy mortality was documented in a single subject, and 23% (25) with serious complications. Though 60% could be decannulated successfully. There was a tracheostomy related death in one patient.[11]

Carron documented 3.2±0.6 years as the mean age of tracheotomy. They suggested six indications for the intervention, namely, neurological impairment (27%), prolonged intubation (26%), upper airway obstruction (19%), craniofacial abnormalities (13%), paralysis of vocal fold (7%), and trauma (7%).[12] The 41%, could be successfully decannulated. The duration period to decannulation was less in the craniofacial vis a vis the neurological impairment and prolonged intubation groups. Serious complications, tracheotomy-related death and overall mortality rates were 44%, 3.6%, and 19%, respectively.

Leung et al retrospective analysis concluded that the" diagnosis and indication for tracheostomy "could predict the duration of cannulation.[16] They noticed that tracheostomy for tracheobronchial toilet requires shorter duration of cannulation wrt intervention in neurological and traumatic indications.

Simma et al 10 years 108 subject study recorded that in their series pediatric tracheostomy was undertaken in subglottic stenosis (31.4%), bilateral vocal cord paralysis (22.2%), and congenital airway malformations (22.2%) and in acquired tumors (11.1%). Decannulation success was in 85 out of 108 patients (78.7%) and median period of tracheostomy was of 486 days (8 days and 6.6 years).[17]

The Satyawati et al study had prolonged mechanical ventilation and pulmonary toileting as common indications for pediatric tracheostomy i.e. 89.56% followed by acute airway obstruction 7.46% and a airway narrowing 2.98%. Decannulation success was seen in 91.04% This was contrary to other worldwide studies.[11,12,17] The mean age at tracheostomy in their series was 4.88±3.70 years higher than that reported by Carron et al.[12]

The factors that effects decannulation in subjects with head trauma were analyzed by Perin et al. In this group of individuals, a successful outcome i.e. decannulation was observed in those who had spontaneous cough compared to those with anoxic brain damage and profuse secretions. A valid and unprovoked cough was a vital parameter for decannulation success. Vis a vis in the neurologically traumatized the evaluation of cough, mobility of the vocal cords and capability to protect airway are decisive in decannulating from tracheostomy.[18]

Takahashi et al 42 pediatric tracheostomised subject study assessed the successful outcome of decannulation in existence or otherwise of underlying diseases, indications for tracheostomy, degree of motor development i.e. ability to walk without assistance, and being able to ingest food by mouth. Merely 11 children went home minus the tracheostomy tube.[19]

Singh et al advocated a protocol of “graded downsizing” and “blocking” the tracheostomy tube in individuals on “chronic or long duration” mechanical ventilator support and on the other hand directly “corked “in those on short duration ventilation. They evaluated the correlation of decannulation with swallowing and coughing. They included patients 18 yrs and above.[20]

The invasive procedure of flexible fibroptic laryngo-tracheo-bronchoscopy was utilized in the pediatric age group prior to initiating tracheostomy decannulation by Sachdeva et al. The likely reasons for failure of decannulation and to intervene or not could be determined. In these 49 subject studies mean duration of tracheostomy was 8 months and in 51% i.e. 36 children, exuberant granulation tissue was observed. In 46.9%, i.e. 23 children, the tracheostomy tube could be successfully removed without any surgical intervention. The 30.6% i. e. in 15 airway obstruction had to be managed surgically before decannulation.[21]

The retrospective 188 study of Maslan et al, exhibited that in hospital decannulated subjects the unsuccessful outcome was less, i.e. was hardly 2.2%, one patient in 46. The profuse secretions choked the lower airway necessitating tracheal reinsertion. Uncapped sleep study, direct visualisation laryngoscopy, rigid laryngo-tracheo-bronchoscopy, and sleep endoscopy, if need be to plan removal of tracheostomy tube. The patient’s age ranged from neonate to eighteen years.[22]

Airway obstruction, congenital or acquired with subglottic stenosis as the commonest etiology was observed in the Chen et al 46 subject neonate analysis.[23] There was no difference between pre-mature and full term infants wrt indications or outcome of decannulation. 104.5 days was the median age of the newborns in the study.

The findings of the Gray et al and Ceriana et al studies showed acquired airway obstruction as the most common cause of failure of decannulation in two patients with congenital and acquired (post intubation) subglottic stenosis and one case with supra-glottic stenosis (following the ingestion of corrosive) and malacia. However, the most common cause in these studies was prolonged mechanical ventilation. Here, gradual decannulation was practiced in all pediatric patients which is an agreed technique by other researchers.[24,25]

CONCLUSION

Decannulation failure is the requirement to reinsert an artificial tracheal airway within 48 to 96 hours of planned tracheostomy removal. The sensorium, consciousness, cough effort, tracheal secretions, and oxygenation levels are critical indicators of concern prior to tracheostomy decannulation. Supra and subglottic stenosis usually secondary to exuberant granuloma have been seen as the predominant reasons for decannulation failure. Mortality is usually related to the underlying disease, not the tracheotomy itself.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Goodall EW. The story of tracheostomy. Br J Child Dis. 1934;31(167):1934.
2. Patel A. Management of the Acutely Compromised Airway. Laryngeal and Tracheobronchial Stenosis. 2015: 121.
3. Crysdale WS, Feldman RI, Naito K. Tracheotomies: a 10-year experience in 319 children. Ann Otol Rhinol Laryngol. 1988;97(5):439-43.
4. Ang AH, Chua DY, Pang KP, Tan HK. Pediatric tracheotomies in an Asian population: the Singapore experience. Otolaryngol Head Neck Surg. 2005;133(2):246-50.
5. O’Connor HH, White AC. Tracheostomy decannulation. Respirat Care. 2010;55(8):1076-81.
6. Tantinikorn W, Alper CM, Bluestone CD, Casselbrant ML. Outcome in pediatric tracheotomy. Am J Otolaryngol. 2003;24(3):131-7.
7. Özmen S, Özmen ÖA, Ünal ÖF. Pediatric tracheotomies: a 37-year experience in 282 children. Int J Pediatr Otorhinolaryngol. 2009;73(7):959-61.
8. French LC, Wootten CT, Thomas RG, Neblett III WW, Werkhaven JA, et al. Tracheotomy in the

preschool population: indications and outcomes. Otolaryngol Head Neck Surg. 2007;137(2):280-3.
9. Mahadevan M, Barber C, Salkeld L, Douglas G, Mills N. Pediatric tracheotomy: 17 year review. Int J Pediatr Otorhinolaryngol. 2007;71(12):1829-35.
10. Funamura JL, Durbin-Johnson B, Tollefson TT, Harrison J, Senders CW. Pediatric tracheotomy: indications and decannulation outcomes. Laryngoscope. 2014;124(8):1952-8.
11. de Trey L, Niedermann E, Ghelfi D, Gerber A, Gysin C. Pediatric tracheotomy: a 30-year experience. J Pediat Surg. 2013;48(7):1470-5.
12. Butnaru CS, Colreavy MP, Ayari S, Froehlich P. Tracheotomy in children: evolution in indications. Int J Pediatr Otorhinolaryngol. 2006;70(1):115-9.
13. Carron JD, Derkay CS, Strope GL, Nosonchuk JE, Darrow DH. Pediatric tracheotomies: changing indications and outcomes. Laryngoscope. 2000;110(7):1099-104.
14. Chauhan N, Mohindra S, Patro SK, Mathew PJ, Mathew J. Investigation of the pediatric tracheostomy decannulation: factors affecting outcome. Iran J Otorhinolaryngol. 2020;32(110):139.
15. Stelfox HT, Crimi C, Berra L, Noto A, Schmidt U, Bigatello LM, et al. Determinants of tracheostomy decannulation: an international survey. Crit Care. 2008;12:1-9.
16. Leung R, Berkowitz RG. Decannulation and outcome following pediatric tracheostomy. Ann Otol Rhinol Laryngol. 2005;114(10):743-8.
17. Simma B, Spehler D, Burger R, Uehlinger J, Ghelfi D, Dangel P, et al. Tracheostomy in children. Eur J Pediatr. 1994;153(4):291-6.
18. Perin C, Meroni R, Rega V, Braghetto G, Cerri CG. Parameters influencing tracheostomy decannulation in patients undergoing rehabilitation after severe acquired brain injury (sABI). Int Arch Otorhinolaryngol. 2017;21(4):382-9.
19. Takahashi N, Takano K, Mitsuzawa H, Kurose M, Himi T. Factors associated with successful decannulation in pediatric tracheostomy patients. Acta Oto-Laryngologica. 2017;137(10):1104.
20. Singh RK, Saran S, Baronia AK. The practice of tracheostomy decannulation-a systematic review. J Intensive Care. 2017;5:38.
21. Sachdev A, Ghimiri A, Gupta N, Gupta D. Pre-decannulation flexible bronchoscopy in tracheostomized children. Pediatr Surg Int. 2017;33(11):1195-200.
22. Maslan JT, Feehs KR, Kirse DJ. Considerations for the successful decannulation of the pediatric patient: a single surgeon's experience. Int J Pediatr Otorhinolaryngol. 2017;98:116-20.
23. Chen CH, Chang JH, Hsu CH, Chiu NC, Peng CC, Jim WT, et al. A 12-year-experience with tracheostomy for neonates and infants in northern Taiwan: Indications, hospital courses, and long-term outcomes. Pediatr Neonatol. 2018;59(2):141-6.
24. Gray RF, Todd NW, Jacobs IN. Tracheostomy decannulation in children: approaches and techniques. Laryngoscope. 1998;108(1):8-12.
25. Ceriana P, Carlucci A, Navalesi P, Rampulla C, Delmastro M, Piaggi G, et al. Weaning from tracheotomy in long-term mechanically ventilated patients: feasibility of a decisional flowchart and clinical outcome. Intensive Care Med. 2003;29(5):845-8.

Cite this article as: Munjal M, Munjal S, Arora V, Chuahan S, Bansal G, Sandhu L, et al. Tracheotomy decannulation in the pediatric age group: an enigma. Int J Otorhinolaryngol Head Neck Surg 2025;11:483-6.