

# Study of indications and complications of tracheostomy in pediatric age group

Rakesh Sheth<sup>1</sup>, Chintu Chaudhari<sup>2</sup>, Virag Damaniya<sup>1</sup>, Bhavesh Goyani<sup>3</sup>, RG Aiyer<sup>4</sup>

<sup>1</sup>Department of ENT, GMERS Medical College, Valsad, Gujarat, India.

<sup>2</sup>Department of Pediatrics, GMERS Medical College, Valsad, Gujarat, India.

<sup>3</sup>Department of Radiology, GMERS Medical College, Valsad, Gujarat, India.

<sup>4</sup>Department of ENT, Government Medical College, Baroda, Gujarat, India.

Correspondence to: Rakesh Sheth, E-mail: rockki1234@gmail.com

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## Abstract

**Background:** Tracheostomy is a lifesaving procedure in infants and children. However, it increases the morbidity and mortality rates in pediatric population twice than those of adults.

**Objective:** To unveil some newer and least studied facts in areas such as indication of pediatric tracheostomy, appropriate time to perform it, and complications arising during and after the procedure and their modes of managements.

**Materials and Methods:** This prospective study was carried out for over two-and-a-half year period. A total of 45 patients were enrolled from various departments such as otorhinolaryngology, surgery, and pediatrics. Various details of all participants such as demographic data, detailed history of current disease, and detailed information about tracheostomy and complications were recorded.

**Result:** The most common age group was younger than 2 years (33%), followed by 2–4 years (16%) and 4–6 years (16%). Obstruction was the most common indication in our study (88%), followed by lifesaving procedure (7%), posthead injury (3%), and congenital anomaly (2%). Of the 45 participants, 47% showed tetanus and 38% diphtheria. Tetanus was more common in boys (15 of 24), while diphtheria was more common in girls (11 of 21). Frequency of complications was very high (80%) among all tracheostomy patients, with the highest in immediate postoperative period (52.72%).

**Conclusion:** We conclude from the study that the anatomy of pediatric trachea is different from that of adult trachea. The higher incidence of tracheostomy in pediatric patients probably relates to a higher incidence of infection and vulnerability of pediatric trachea to edema and inflammation. Maximum number of tracheostomies is performed owing to upper respiratory infections such as tetanus and diphtheria.

**KEY WORDS:** Pediatric tracheostomy, indications, complications

## Introduction

Tracheostomy is a lifesaving procedure in infants and children. It is well established that the morbidity and mortality rates of tracheostomy in the pediatric population are twice

than those of adults.<sup>[1]</sup> Whereas, formerly, the operation was done largely for management of epiglottitis and laryngotracheobronchitis, today, the prime indication is subglottic stenosis in infants consequent upon intubations for respiratory distress syndrome and prematurity in developed countries. However, still in some tertiary setup, upper airway infections form one of the mainstay indications. A reduction in the incidence of infections, notably hepatitis B, and in epiglottitis that cause airway obstruction in children and an improved management of airway pathology by anesthetist and pediatricians have brought about a change in the indications for tracheostomy.<sup>[2]</sup> But, current trend widely accepts that premature babies may be safely intubated for several weeks under strict monitoring, and tracheostomy should be reserved for older children after

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2 or 3 weeks of endotracheal intubation. So, endotracheal intubation rather than tracheostomy is the accepted mode of management for acute obstructing airway infections in children. As consequences of relative rarity of the procedure, the medical literature relating to pediatric tracheostomy, the significant randomized-controlled trial, and ample number of publications are still not easily available. However, using changing trend for management of pediatric airway problem into the prime consideration, this study may unveil some newer and least studied facts.

So, the objective of this study was to study various indications and appropriate time of performing tracheostomy in pediatric age group. Moreover, the other objectives were to study the complications of pediatric tracheostomy and measures to avoid them and to evaluate the efficacy of various modes of management of complications of pediatric tracheostomy.

### Materials and Methods

It was a prospective study with a duration of two-and-a-half years. The study was carried out at Otorhinolaryngology Department of SSG Hospital and Government Medical College, Gujarat, India, from May 2007 to December 2009. Permission of Institutional Ethics Committee was taken before enrolment of the participants.

During the two-and-a-half years of duration, a total of 45 cases of pediatric tracheostomy could be enrolled from various departments such as otorhinolaryngology, surgery, and pediatrics. For that, permission from the various departments and superintendent was taken beforehand. Details of all the patients were recorded in the case record form. The case record form was divided into four parts. The first part consisted of demographic data of the patients. The second part recorded history of present illness, which contains chief complaints, origin, progress and duration of the diseases, and birth and immunization history. The third part comprised examination of the patients, specifically otorhinolaryngology examination. The fourth part contained details about tracheostomy such as cause, level of tracheostomy, problems faced, postoperative complications and their managements, total duration of procedure, date of decannulation, if death occurred, then cause of death, and duration of survival time and voice recovery time.

### Result

All patients who underwent tracheostomy aged younger than 12 years in various departments such as otorhinolaryngology, surgery, and pediatrics of Government Medical College, Baroda, Gujarat, India, were counseled for enrolment in the study. Of the total 58 patients, legal guardians of 45 pediatric patients gave the consent to participate in the study.

In this study, the most common age group for tracheostomy found was 0–2 years of age [i.e., 15 (33%)], followed by 2–4 years and 4–6 years, which revealed a same frequency of 7 (16%) each. Of the 45 patients, 24 (54%) were boys and 21 (46%) girls.

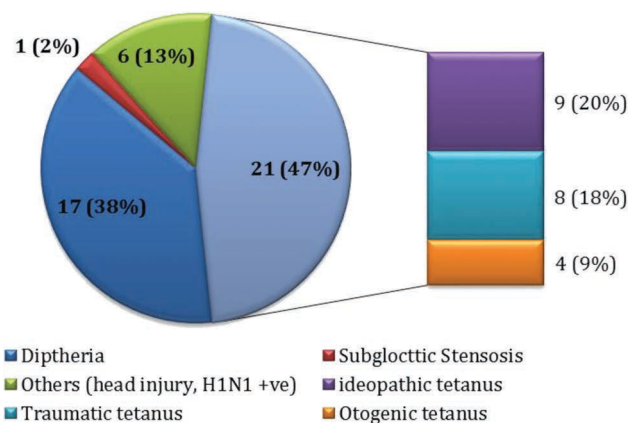


Figure 1: Distribution of patients as per the causative factors for tracheostomy.

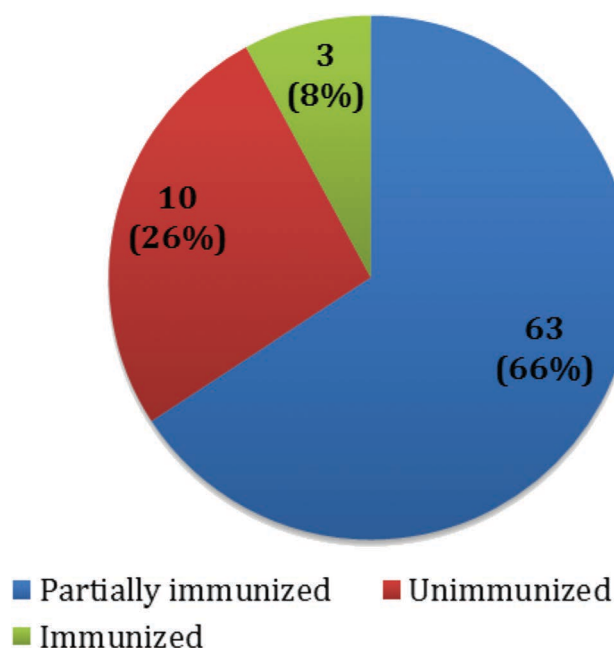


Figure 2: Immunization status of paediatric patients with tracheostomy who had vaccine-preventable diseases.

As seen in Figure 1, the most common causative factor for tracheostomy was tetanus with a frequency of 21 (47%), followed by diphtheria [17 (38%)] [Table 1]. In tetanus, idiopathic cases were nine, traumatic eight, and otogenic four. There were also cases of subglottic stenosis, head injury, and others. On analysis, it was found that, of the 24 male patients who underwent tracheostomy, 15 showed tetanus, and of the 21 female patients, 11 showed diphtheria. The most common indication for tracheostomy was obstruction (88%), followed by lifesaving procedure (7%), posthead injury (3%), and congenital anomaly (2%).

Immunization status of patients who had undergone tracheostomy and who showed vaccine-preventable diseases is

**Table 1:** Distribution of cases

Causative factor	No. of cases	Percentage
Tetanus	21	47
Diphtheria	17	38
Subglottic stenosis	1	2
Others	6	13

**Table 2:** Type and frequency of complications

Complications	Frequencies
Intraoperative complications	
Hemorrhage	2
Tracheostomy tube problem (false passage)	2
Anatomical damage	0
Sudden apnea	5
Total	9
Immediate postoperative complications	
Accidental decannulation	0
Infection (tracheitis/stomal infection)	3
Subcutaneous emphysema	6
Pneumonia (patchy consolidation)	11
Pneumothorax	2
Obstructed tube (retained secretions)	7
Total	29
Late complications	
Tracheocutaneous fistula	0
Tracheoarterial fistula	0
Tracheal granuloma	1
Stomal granulations	2
Subglottic stenosis	2
Difficult decannulations	4
Accidental decannulation	0
Scarring	8
Total	17

given in Figure 2. Of the total 48 cases, 38 cases presented vaccine-preventable diseases such as tetanus and diphtheria. Among them, 25 (63%) patients were partially immunized, 10 (29%) were unimmunized, and only 3 (8%) were totally immunized up to date.

Of the 45 patients, 36 (80%) developed complications. The complications were classified according to time of development such as intraoperative, immediate postoperative, or late postoperative. Frequency and type of complications are given in Table 2. A total of 36 patients developed 55 different complications. Some of them developed more than one type of complication. As seen in the table, the most common type of complications were of the immediate postoperative type (29), followed by late postoperative (17) and intraoperative (9). The most common intraoperative complication was sudden apnea (5), followed by tracheostomy (2) and hemorrhage (2). The most common immediate postoperative complication was pneumonia (11), while others were obstructed tube (7),

**Table 3:** Type of management done for complications developed in tracheostomy patients

Complications	Management	
	Spontaneous recovery	Medical/surgical
Hemorrhage	–	Medical
Tube problems	–	Reexploration of neck
Sudden apnea	Spontaneous recovery	–
Infections	–	Higher antibiotics
Emphysema	Spontaneous recovery	–
Pneumonia	–	Higher antibiotics
Pneumothorax	–	Higher antibiotics
Obstructed tube	–	Tube change
Subglottic stenosis	–	IV Dexamethasone
Scarring	Spontaneous recovery	–

subcutaneous emphysema (6), locan infection (3), and pneumothorax (2). In late complication, the most common was scarring (8), followed by difficult decannulations (4), stomal granulations (2), and subglottic stenosis (2). The most common age group with complication was younger than 2 years. Although many patients presented with different complications owing to tracheostomy, only few needed special attentions. The management done for the complicated patients is described in Table 3.

Mortality was very much high in the study population. Of the 45 participants, 32 (73%) died and 13 (27%) survived after 1 month of tracheostomy. It was found that the cause of death was primary disease condition and not owing to complication of tracheostomy.

## Discussion

Over the years, tracheostomy has come to be recognized as a simple, speedy, and efficient lifesaving procedure. Tracheostomy in pediatric patients differs considerably from that in adults. Greater care and skill are required for the pediatric patients. Even then, morbidity and mortality associated with pediatric tracheostomies are relatively higher.

In this study, 45 patients underwent tracheostomies at SSG Hospital, Baroda, during the period from July 2007 to December 2009. The mean age group in our study was 4.86 years. Whereas in the studies conducted by Carron *et al.*,<sup>[3]</sup> Ang *et al.*,<sup>[4]</sup> and Ozmen *et al.*,<sup>[5]</sup> the mean age was 3.2, 3.24, and 2.25 years, respectively. Thus, the mean age group in our study was comparatively on a higher side. However, maximum number of patients was in 0- to 2-year-age group. This predilection of infants for infections requiring tracheostomy is owing to transition at this age from a shelter environment to

one exposed to various viral and bacterial infections and the gradual enlargement of the larynx to one with a greater safety factor. In this study, male to female ratio was 1.14:1, which is comparable with the study conducted by Carron *et al.*<sup>[3]</sup> in which male to female ratio was 1.2:1. The slight male predominance for tracheostomy might be owing to an increased male susceptibility to both congenital and acquired disorders. In this study, the most common indication for performing tracheostomy was obstruction owing to upper airway infection (86%), the most common being tetanus and diphtheria, which was comparable with the study conducted by Ozmen *et al.*,<sup>[5]</sup> while in the study conducted by Kremer *et al.*,<sup>[6]</sup> congenital anomalies of upper respiratory tract were the most common indications for tracheostomies. However, in this study, only 2% showed congenital anomaly. Absence of this kind of anomaly in our study is owing to difficulty in early recognition of these patients, lack of awareness, and lack of prenatal and perinatal screening. We had only one patient who underwent tracheostomy for coma owing to head injury. Coma following trauma was present in 9% of patients in a study conducted by Ozmen *et al.*<sup>[5]</sup> In this study, mortality was 73%. Thirty-two of 45 patients who were tracheostomized died. The mortality observed was very high when compared with other studies in which mortality was less than 20%. However, all those patients who died were owing to their primary disease condition. The plausible explanation for this higher mortality is that most of the patients presented at an advanced stage of disease owing to ignorance and lack of medical facilities in periphery. Tetanus and diphtheria resulted in the highest number of tracheostomies in this study. Mortality owing to diphtheria was many folds higher than tetanus. About 91% of tracheostomy was performed for vaccine-preventable diseases such as tetanus and diphtheria, and it was observed that mortality owing to these diseases was also high. There were ample reasons<sup>[7-9]</sup> given in pediatric literature for diphtheria being a disease carrying higher mortality: high toxicity of diphtheria toxins, poor socioeconomic status of patients, and poor host response to diphtheria antitoxin are some of them. In this study, 36 of 45 patients developed complications related to tracheostomy (80%). Some patients developed more than one complication at a time. The percentage of complications in our study was very high when compared with the studies by Carron *et al.* (44%) and Ozmen *et al.* (18%). The explanation for this higher complication rate in this study is lack of ideal operating facilities in ICU. The highest complications were seen in 0- to 2-year age group (33.5%). The complications were more prevalent in male patients; however, the mortality observed was higher in female patients. Pertaining to intraoperative complications, sudden apnea was most common. Operative complications are almost as a result of faulty technique. Tracheostomy in pediatric patient requires a sound knowledge of anatomy and more than ordinary

skill. Postoperatively, the most common complications were pneumonia (24%) and obstructed tube (16%), which were comparable with the study conducted by Wetmore *et al.*,<sup>[10]</sup> in which the abovementioned complications were 20% and 10%, respectively. Regarding late complications, scarring was most common (20%). Difficult decannulation was observed in 10% of patients, while in the study by Wetmore *et al.*,<sup>[10]</sup> difficult decannulation was observed in 24% of patients. Difficult decannulation occurred owing to tracheal granuloma, peristomal granulation, and subglottic edema. We used intravenous steroid to treat this, and 80% granulation resolved and laryngeal edema subsided, which was similar to the study conducted by Perkin *et al.*<sup>[11]</sup>

## Conclusion

Anatomy of pediatric trachea is different from adult trachea. The higher incidence of tracheostomy in pediatric patients probably relates to a higher incidence of infection and vulnerability of pediatric trachea to edema and inflammation. The ratio of male to female is nearly constant with a slight preponderance of male patients owing to their increased susceptibility to congenital and acquired diseases. Maximum number of tracheostomies was performed owing to upper respiratory infections such as tetanus and diphtheria. Complications were high but can be managed appropriately. Higher mortality observed was owing to late presentation with advanced disease.

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