

Tracheostomy: Experience at Tertiary Hospital

Reshma P. Chavan¹ · Shivraj M. Ingole² · Balaji Mane¹ · Tushar M. Kalekar³ · Santosh N. Birajdar¹

Received: 12 November 2017 / Accepted: 28 May 2018 / Published online: 3 June 2018
© Association of Otolaryngologists of India 2018

Abstract An attempt was made to find indications of tracheostomy procedure and its complications in the modern era of medicine with refined surgical techniques at a tertiary hospital. A retrospective study of 240 patients, who had undergone tracheostomy, was done during the period from January 2013 to April 2017 at Govt. Medical College Hospital. Various details of all participants such as age and sex of patients, detailed history of the current disease, and detailed information about tracheostomy and complications were recorded. In the present study, the most common indication for tracheostomy was prolonged ventilation due to Organophosphorus poisoning and Snake bite. The complication rate for tracheostomy procedure was 11.5%. The most common complication was tubal occlusion (7.5%) followed by Granulations around stoma (2.5%), Tracheal stenosis (1.25%), tracheoesophageal fistula (0.4%). No death was occurred during the tracheostomy procedure. The morbidity and mortality due to tracheostomy are reduced definitely. Tracheostomy Complications can be prevented by refined surgical techniques, use of high volume low pressure cuffed tracheostomy tubes and attentive post-operative nursing care. Yet complications of tracheomalacia and tracheal stenosis call for further improvement.

Keywords Tracheostomy · Tracheal stenosis · Complications · Organophosphorus poisoning

Introduction

Tracheostomy is one of the most commonly performed surgeries in emergencies, in intensive care unit (ICU) set-up and bedside in the wards. Mini-tracheostomy with use of guide wire does not become so popular. Over a period, the modifications in the techniques of tracheostomy such as horizontal incision on the skin, cartilage window on the trachea, cutting of one or two rings of the trachea, either high or low tracheostomy, etc. were made. The aim of these modifications was to preserve most of the tracheal rings and to minimize complications of tracheostomy. These modifications in techniques of open tracheostomy are well accepted. Few complications such as haemorrhage, displacement of the tube, blockage of the tube, surgical emphysema, pneumothorax, granulation formation, and tracheal stenosis are still occurring. Cuffed tracheostomy tubes used for mechanically assisted ventilation are the culprits for granuloma formation and tracheal stenosis. Tracheal stenosis usually occurs at the site of introduction of tracheostomy tube into the trachea, site of tracheostomy cuff or at the tip of the tracheostomy tube. Tracheostomy tubes with cuffs should be of high volume and low pressure with thin walls. Cuff pressure must not exceed that of the capillaries and cuff should be deflated periodically. Prolonged tracheostomies and endotracheal intubation are other contributory factors for granuloma formation [1]. According to Heffner JE, late complications of tracheostomy were present in 65% patients [2]. The present study aimed to study indications of tracheostomy

✉ Reshma P. Chavan
entproblem@gmail.com

¹ Department of ENT, Dr. VMGMC, Solapur, Maharashtra, India

² Department of Radiology, GGMC and Sir J.J group of Hospitals, Mumbai, India

³ Department of Radiology, D.Y. Patil Medical College, Pune, India

procedure. The other aim was to study complications of tracheostomy procedure and its management.

Materials and Methods

This is a retrospective study of 240 tracheotomized patients carried out from January 2013 to April 2017, at Shri Chhatrapati Shivaji Maharaj Sarvopchar Rugnalaya and Dr V. M. Government Medical College, Solapur, Maharashtra. The study was approved by the Institutional Ethical Committee.

Patients included in this study were from of E.N.T Ward, Surgery Ward, Medicine Ward, Paediatric Ward, Operation Theatre, Pediatric ICU, Medical ICU, Trauma ICU and Casualty. The age range varied between 1.6 and 85 years. The inclusion criteria are patients who had tracheostomy procedure on the emergency basis where intubation is difficult or not possible, patients who undergo elective tracheostomy where stridor is anticipated and tracheostomy was done in intubated patients. All patients with tracheostomy are included in the present study. Detail history of patients such as Age, Sex, and occupation, economic status of the patient address and Symptoms of the patients were noted. Detail history of present illness was taken. Routine investigations were done in elective tracheostomies.

Surgical Technique

The patient is positioned on his back with a pillow under shoulders to allow extension of the head. Local/General anaesthesia was given. Local anaesthetic solution (Lignocaine and adrenalin) was infiltrated in Jackson's triangle. A vertical or horizontal skin incision was taken. In elective cases, a transverse incision in skin crease for better cosmetic results was taken. The skin incision is deepened. Strap muscles are retracted laterally exposing the pre-tracheal fascia. Confining dissection to midline, throughout the dissection, the position of the trachea is ascertained by palpation. Thyroid isthmus above the 3rd tracheal ring is retracted upwards.

The trachea is identified. Few drops of 4% xylocaine injected into the lumen of the trachea to minimize the spasmodic coughing. A transverse slit is made between the second and third ring of the trachea which is followed by the hiss of air.

In paediatric patients, small vertical slit incision was taken on the anterior tracheal wall. The tracheal opening is dilated with a tracheal dilator. The tracheostomy tube of appropriate size was inserted. Suctioning had done after tracheostomy because of increase in tracheobronchial

secretions secondary to tracheal irritation. A tape was attached to tracheostomy tube and tied around the neck with the head flexed.

To avoid the risk of subcutaneous emphysema and subsequent pneumomediastinum, the skin is not closed. Place a sponge soaked with iodine or petrolatum gauze between the skin and the flange for 24 h to deflect infection and anxiety about minor oozing of the skin edge. Humidification at the site of tracheostomy was achieved with the application of wet gauge piece on a tracheostomy tube. Periodic instillation of a mucolytic agent was done for thinning of tracheal secretions and to avoid the formation of mucous plugs or crusts.

Results

During the period from January 2013 to April 2017, total 240 patients had the tracheostomy in our hospital. 30 tracheostomies were performed in children and 210 in adults which accounted for 12.5 and 87.5% respectively (Table 1). 134 male patients (56%) and 106 female patients had tracheostomy during the period (Table 2). Out of 240 cases, 11 tracheostomies were done to relieve airway obstruction. 229 tracheostomies were done in which patient was on prolonged ventilator support (Table 3). Diphtheria was the most common obstructive indication for tracheostomy and Organophosphorus poisoning was the most common non-obstructive indication for tracheostomy (Table 4). In pediatric tracheostomies, Diphtheria was the most common indication for tracheostomy and in adult tracheostomies, Organophosphorus poisoning was the most common indication for tracheostomy followed by snake bite.

Out of 240 tracheostomies performed, 11 cases (4.5%) were performed on the emergency basis and 229 cases (95.5%) were performed electively (Fig. 1). Out of 240 cases, 238 tracheostomies (99%) were performed under local anaesthesia and two cases (1%) were performed under general anaesthesia (Fig. 2).

In present study complication rate for tracheostomy procedure was 11.5%. Out of 240 cases, 18 cases (7.5%) developed early complications and 10 cases developed late (4%) complications. Tube occlusion was the most common complication of tracheostomy seen in 7.5% patients followed by granulation tissue around stoma which was seen in 2.5% patients. Tracheal stenosis was seen in three patients (1.25%) and the tracheoesophageal fistula was seen in one patient (0.4%) (Table 5). No mortality was seen during the tracheostomy procedure. Out of 240 cases, eight patients were died and rest 232 patients were discharged. Deaths occurred as result of cardiac arrest (two

Table 1 Age distribution of patients with tracheostomy

Age	No. of cases	Percentage
Children	30	12.5
Adult	210	87.5
Total	240	100

Table 2 Sex distribution of patients with tracheostomy

Sex	No. of cases	Percentage
Males	134	56
Females	106	44
Total	240	100

Table 3 Indications of tracheostomy

Indication	No. of cases	Percentage
Obstructive	11	4.5
Non obstructive	229	95.5
Total	240	100

patients), myocarditis (four patients) and respiratory failure (two patients) (Table 6).

Discussion

Most of the time tracheostomy is a lifesaving procedure. It is used as an alternative to difficult intubation and also used in patients on ventilators for the better tracheobronchial toilet.

In the present study, minimum age of patient undergone tracheostomy was 1.6 years and maximum age of patient undergone tracheostomy was 85 years. Out of 240 cases in our study, 30 (12.5%) tracheostomies were performed in children and 210 (87.5%) in adults. Endotracheal

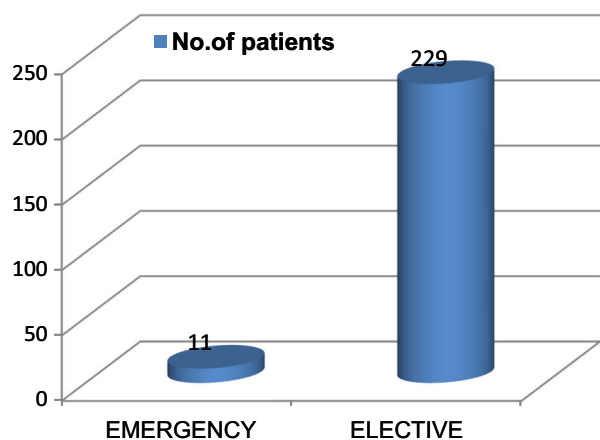
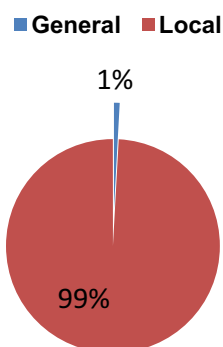
intubation was tried in most patients and patients were shifted to ventilators. As the airway in the pediatric patient is narrow and not able to sustain for longer duration in respiratory diseases so early mortality is seen in pediatric patients. Availability of higher antibiotics, shifting of patients to off ventilation early and increased awareness regarding vaccination are some reasons for fewer pediatric tracheostomies nowadays. The most common indication in pediatric tracheostomies was Diphtheria, which was due to lack of awareness regarding vaccination at state border area. The study done by Crysdale had shown more male patients than female patients who had undergone tracheostomy [3]. In a Crysdale study, 70% tracheostomies indicated for airway obstruction, 20% tracheostomies were done for tracheobronchial toilet and 10% tracheostomies done for continued assisted ventilation [3]. According to the study done by Goldenberg et al. [4] the most common indication for tracheostomy was long-term mechanical ventilation which was seen in 76% tracheostomies. In the study by Zettoni [5], 57% tracheostomies had done for airway obstruction.

In the present study, tracheostomy was performed on emergency grounds in 11 patients (4.5%) and in 229 patients (95.50%) tracheostomy was done electively. Out of 240 cases, 238 tracheostomies (99%) were performed under local anaesthesia. Two tracheostomies (1%) were done under general anaesthesia.

Among 240 cases, 28 cases (11.5%) had early and late complications. Complications of tracheostomies were seen in emergency tracheostomies. Three patients had tubal blockage within the week of tracheostomy procedure. Change of a tube was done. Culture and sensitivity of the tracheal secretion were done, and antibiotics had started according to culture-sensitivity report to avoid excess secretions due to tracheobronchitis. Six patients had granulations around the stoma. When these granulations mature it becomes fibrous bands and causes narrowing of the tracheal lumen. These patients had given intravenous steroids and antibiotics for 10 days. Steroid ointment was applied locally to granulation tissue. The Patients were assessed

Table 4 Obstructive and non obstructive indications of tracheostomy

Obstructive Indications	No. of cases	Non-obstructive indications	No. of cases
Carcinoma larynx	03	Organ phosphorus poisoning	142
Diphtheria	04	Snake bite	51
Hanging	02	Tetanus	01
Subglottic stenosis	01	Respiratory failure	02
Laryngotracheobronchitis	01	Head injury	23
		Septicaemia	03
		Pneumonia	07

Distribution of cases according to type of Tracheostomy**Fig. 1** Distributions of cases according to type of tracheostomy**Type of Anaesthesia****Fig. 2** Distributions of cases according to type of anaesthesia**Table 5** Complications of tracheostomy

Complications	Cause	No. of cases	Percentage
Early	Tube occlusion	18	7.5
Late	Granulation tissue around stoma	06	4
	Tracheoesophageal fistula	01	
	Tracheal stenosis	03	
Total			100

Table 6 Outcome of tracheostomy

Outcome	No. of cases	Percentage
Survived	232	
Death	08	
Total	240	100

1 month after discharge through bronchoscopy. There was a narrowing of the trachea at the site of tracheostomy which was asymptomatic.

According to the study done by Goldenberg et al. [4] the most common complication of tracheostomy was tracheal stenosis and haemorrhage was the second most common complication of tracheostomy. According to Ting et al. [6] Postoperative bleeding was the most common early complication seen in 2.6% tracheostomies, whereas airway stenosis was the most common late complication seen in 1.7% tracheostomies. Costa et al. [7] had shown tracheostomy complications such as haemorrhage, surgical wound infection, subcutaneous emphysema and no death had occurred during the tracheostomy procedure. According to the study done by Sarper et al. [8] tracheostomy tubes can cause severe stomal stenosis in the trachea or infra-glottic region.

Tracheal stenosis was seen in three patients, in one patient stenosis was at the lower trachea, due to repeated intubation trauma in a patient with organophosphorus poisoning on the ventilator with the history of tracheostomy. Two of them were asymptomatic with routine work, and stenosis was at the tracheostomy site so no intervention was attempted. One patient was presented 15 days after decannulation with respiratory distress. CT scan was showing tracheal stenosis. The Patient had required intervention. The patient was referred to the higher centre where a cardiothoracic surgeon is available and managed by trachea-tracheal anastomosis with excision of stenosis segment. Tracheoesophageal fistula can occur as a result of the prolonged nasogastric tube, the prolonged inflated cuff of a tracheostomy tube, and injury to the posterior tracheal wall during tracheostomy in paediatric patient or injury with the tip of tracheostomy. One paediatric patient had a tracheoesophageal fistula. The tracheoesophageal fistula was managed by a pediatric surgeon with the stent in the trachea and oesophagus.

The incidence of tracheostomy complications had varied in different study series. Goldenberg et al. had seen complications of tracheostomy in 49(4.3%) cases. The most common complication in his study was tracheal stenosis was seen in 21 cases, haemorrhage was seen in nine cases, the tracheo-cutaneous fistula was seen in six cases, infection was seen in five cases, tube obstruction was seen in four cases [4]. In the study done by El Solh [9] had shown tracheostomy complication rate between 14 and 25%. The study was concluded that complication rates in tracheostomy patients were more in obese patients.

According to Ting et al., intraoperative, early (< 1 week), and late complication rates were 1.4, 5.6, and 7.1%, respectively. According to Adoga et al. [10] study, the complication rate of 15.2% was recorded in pediatric tracheostomies.

In a retrospective study of hospital records of 43 tracheotomised patients by Aass AS at Scandinavia (1975) had shown tube occlusion in 2.3% tracheostomies,

dislocated tube in 2.3% tracheostomies, bilateral pneumothorax in 2.3% tracheostomies, fatal innominate arterial haemorrhage in 2.3% tracheostomies as early complications and the late complication seen was tracheal stenosis in 40–60% tracheostomies [11].

A prospective study of the complications of tracheostomy on 21 critically ill adult patients was done by Stauffer TL, Olson DE, and Petty TL in 1981. Problems with tracheostomy had included stomal infection (36%), stromal haemorrhage (36%) and subcutaneous emphysema or pneumomediastinum (13%). Follow up studies revealed a high prevalence of tracheal stenosis in 65% tracheal stenosis [12].

A prospective study of complications of tracheostomy by Imperatore et al. [13] on 140 patients over 2 years had shown haemorrhage, wound infection and tracheal stenosis in 2.14, 2.85 and 0.71% of tracheostomies respectively. In the present study, out of 240 cases, five patients died. However, causes of death in all these cases were not attributed to the procedure of tracheostomy, rather due to the co-morbid condition. Thus, in the present study, tracheostomy accounted for no deaths per se. The study done by Klemm E had shown 0.62% mortality related to tracheostomy. The two most common causes of death were haemorrhage and displaced tube. A technique of tracheostomy would decrease the incidence of mortality in the displaced tube [14]. In the present study, tube occlusion, granulations around tracheostomy site and tracheoesophageal fistula were complications of tracheostomy procedure. Complications were managed with an uneventful recovery of patients. There was no death related to tracheostomy.

Thorough anatomical knowledge of the trachea and adjacent structures, the skill of a surgeon, sterile techniques, use of high volume low pressure cuffed Portex tracheostomy tubes and good bedside tracheostomy care results in minimal intra-operative and immediate post-operative complications. Immediate and late postoperative complications were minimised due to good tracheostomy care, educating the patient and the patient's caretaker about the tracheostomy care.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval Ethical Approval was taken by Institutional Ethical Board as per ICMR guidelines by letter no. Pharma Dept/IEC/Approval letter/68/18.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Klingbeil G (1988) Airway problems in patients with traumatic brain injury. *Arch Phys Med Rehabil* 69:493–495
2. Heffner JE, Miller KS, Sahn SA (1986) Tracheostomy in the intensive care unit Part 2: Complications. *Chest* 90(3):430–436. <https://doi.org/10.1378/chest.90.3.430>
3. Crysdale WS, Fieldman RI, Natio K (1988) Tracheostomies: a 10 year experience in 319 children. *Ann Otol Rhinol Laryngol* 97:439–443
4. Goldenberg D et al (2000) Tracheostomy complications: a retrospective study of 1130 cases. *Otolaryngol Head Neck Surg* 123:495–500
5. ManoukianJ Zeitouni A (1993) Tracheostomy in the first year of life. *J Otolaryngol* 22:431–434
6. Ting JY, Plowman EK, Belafsky PC, Harbarger CF, Postma GN et al (2012) A multi-institutional analysis of tracheotomy complications. *Laryngoscope* 122:38–45
7. Costa L, Matos R, Júlio S, Vales F, Santos M (2016) Urgent tracheostomy: four-year experience in a tertiary hospital. *World J Emerg Med* 7(3):227–230. <https://doi.org/10.5847/wjem.j.1920-8642.2016.03.011>
8. Sarper A, Ayten A, Eser I, Ozbudak O, Demircan A (2005) Tracheal stenosis after tracheostomy or intubation: review with special regard to cause and management. *Texas Heart Inst J* 32(2):154–158
9. El Solh AA, Jaafar W (2007) A comparative study of the complications of surgical tracheostomy in morbidly obese critically ill patients. *Crit Care* 11(1):R3. <https://doi.org/10.1186/cc5147>
10. Adoga AA, Ma'an ND (2010) Indications and outcome of pediatric tracheostomy: results from a Nigerian tertiary hospital. *BMC Surg* 10:2. <https://doi.org/10.1186/1471-2482-10-2>
11. Aass AS (1975) Complications to tracheostomy and long-term intubation: a follow-up study. *Acta Anaesthesiol Scand* 19(2):127–133
12. Stauffer TL, Olson DE, Petty T (1981) Complications and consequences of endotracheal intubation and tracheotomy: a prospective study of 150critically ill patients. *Am J Med* 70(1):65–76
13. Imperatore F, Diurno F, Passannanti T et al (2004) Early and late complications after elective bedside surgical tracheostomy: our experience. *Medscape Gen Med* 6(2):32
14. Klemm E, Nowak AK (2017) Tracheotomy-related deaths. *Dtsch Arztebl Int* 114(16):273–279. <https://doi.org/10.3238/arztebl.2017.0273>