Original Article

Tracheostomy: A hospital based descriptive study

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Abstract **Background:** Tracheostomy is one of the most frequently performed surgeries in the emergency department, Intensive care units and at bedside in the present scenario. This prospective study comprises of hundred cases of varying age groups with different indications for the procedure. The aim of our study is to outline the frequent indications, to analyse various complications and to evaluate the outcomes of tracheostomy in our setting in our Institution. Data obtained from the tracheostomised patients during $1^{1/2}$ year period were collected and analysed. Despite the fact that tracheostomy is a common life saving procedure in the care of critically ill patients, there is paucity of information in our local setting regarding the subject and hence the need for the study. **Materials and Methods:** In this prospective study 100 patients who underwent tracheostomy due to various indications were studied from February 2014 to July 2015 at Academy of medical sciences, Pariyaram, Kannur, Kerala, India. **Results:** There were 77 male patients and 23 female patients in our study with a male: female ratio of 3.3: 1.The most common indication for tracheostomy was upper airway obstruction secondary to neoplastic causes (32%), followed by upper airway obstruction due to traumatic causes in 24%. Post tracheostomy complication rate was 34%. Complication rate was significantly higher in emergency tracheostomy than in elective procedure. Mortality rate was 13%. The mortality was due to their underlying illnesses, none had tracheostomy related mortality. **Conclusion:** Tracheostomy still remains a life saving procedure in the surgical management of airway if performed timely despite its few complications. Most of tracheostomy related complications can be avoided by meticulous attention to the details of the technique and postoperative tracheostomy care by skilled and trained staff.
Key Words: Tracheostomy, Airway obstruction.

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INTRODUCTION

Tracheostomy is one of the earliest surgical procedures performed dating back to 3600BC[11]. It still remains a time tested life saving procedure even though there are different other techniques available to address airway obstruction. The history of tracheostomy has evolved from period of legend from 2000BC to AD 1546 into period of rationalization from 1965 to present during which the relative merits of intubation and tracheostomy are debated. Attitudes toward tracheostomy began to change in the mid nineteenth century, when surgeons became more confident in the procedure with better knowledge of anatomy. Moderrn approaches to open tracheostomy still draw on classic description of Chevalier Jackson who also established protocols for care of these patients[1]. Although initially thought as hazardous it is now considered as a safe and simple procedure with wide range of usefulness. Tracheotomy is the creation of an opening in the anterior tracheal wall. Tracheostomy, on the other hand, is the formalization of a permanent stoma by suturing the edges of the trachea to the skin[17]. Over the years, these terms have come to be used synonymously. Whereas open tracheotomy is typically performed in the operating suite, in select patients the procedure can be performed at bedside in the ICU[17].The indications of tracheostomy have changed and expanded during the twentieth century. The advances in critical care in the last half of the twentieth century have made prolonged mechanical ventilation the leading indication for tracheotomy in the current era[17].Almost two thirds of tracheostomies are performed on intubated patients in the intensive care units and tracheotomy is currently one of the most commonly performed operations in the critically ill patient[17]. Although a seemingly routine procedure,

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tracheotomy is not without risk. Mortality rate from procedure- related complications is approximately 0.6%. Complication rates were higher in patients with upper airway infections, obesity, paralysis, and congestive heart failure[17]. Otolaryngologists are continuously developing and refining the surgical techniques of tracheostomy so that there is significant reduction in the number of complications and deaths due to tracheostomy. The use of multidisciplinary teams and protocols for tracheostomy care can decrease morbidity, result in earlier decannulation, and generally improve the quality of life of tracheostomy patients[17]. Aim of our study is to present an analysis of various indications, techniques, management and complications encountered in tracheostomized patients in our Institution.

MATERIALS AND METHODS

The study was carried out in Department of ENT, Academy of Medical Sciences Pariyaram, Kerala, India.

Study Population

100 consecutive cases of tracheostomy were included in the study during the period of 18 months from February 2014 to July 2015. These cases were consecutive, unselected, comprising of varying age groups who underwent elective as well as emergency tracheostomy due to various indications. Cases referred for tracheostomy to our department from Neurosurgery, Emergency Medicine, Maxillofacial surgery and various ICUs were included in the study. Ethical committee approval to conduct the study was obtained prior to commencing the study.

Study Design

Hospital based descriptive study.

Inclusion Criteria

All patients who underwent tracheostomy during the study period, willing to be included in the study.

Exclusion Criteria

Patients not willing for the study and not available for follow up.

METHODS

Consent for the study was obtained from each patient prior to the procedure. Data regarding indications for tracheostomy including symptoms of patients presenting with airway obstruction were collected. Detailed history including sociodemographic variables and ENT examination findings were recorded in a pretested structured questionnaire. All patients who underwent elective tracheostomy underwent a routine blood and urine examination and bleeding time as well as clotting time preoperatively. Selected patients also underwent a preoperative X -ray Soft tissue neck – lateral view, Chest X ray PA view and CT scan of Neck and thorax. Standard open surgical technique was adopted for all patients with either a vertical or horizontal incision depending upon the nature of the procedure. Tracheostomies were performed both emergency and electively under general as well as local anaesthesia. The procedure was carried out in the regular operation theatre under GA or at bed side under LA in critically ill patients. All the procedures were carried out by the duty ENT surgeon and junior residents (under supervision) with all aseptic precautions in a well equipped operating room with a good suction and electrocautery. For elective procedure horizontal incision and for emergency procedure vertical incision were adopted. A mid tracheostomy was performed in most of the cases the stoma being made in between third and fourth tracheal rings. We used Standard Portex cuffed tracheostomy tube with inner tube (size 8.0 and 8.5 for males and 7.5 for females) as well as Jackson's metallic tracheostomy tube sizes 36, 34 and 32. The complications encountered per operatively were recorded in the operation notes. All patients were given intensive care during the first 48 hours postoperatively with strict attention paid for frequent suctioning of the tube, oxygen saturation monitoring and periodic deflation of cuff. A chest X ray was taken for all patients postoperatively. Complications like haemorrhage, surgical emphysema and tube displacement/ blockage etc were carefully monitored and managed on an emergency basis. Complications encountered during the first 24 hours were categorised as immediate (within 24 hours), intermediate (after 24 hours up to fourth week) and later on as late (after fourth week to 6months). The data was carefully noted down in the proforma during the follow up of each patient. Decannulation was carried out based on the aetiology and depending upon when the patient starts maintaining satisfactory airway. Tracheostomy was corked and patient observed prior to strapping. Strapping of tracheostomy was done with air tight dressing. After decannulation patient was observed for 24 hours and was sent home. Air tight dressing was given and the wound was left to heal by secondary intension. The attendant of the patient was advised to bring the patient immediately in case patient develops any respiratory distress. After decannulation, first follow up was done after two weeks followed by at 4 weeks and then once monthly depending upon condition of the patient.

The data collected was subjected to statistical analysis. A descriptive and inferential analysis was done.

RESULTS AND OBSERVATIONS

In our study we analysed 100 patients who underwent tracheostomy during 18 month period from February 2014 to July 2015.The study was carried out in Academy of Medical Sciences, Pariyaram, Kannur, Kerala. Demographic profile: Among the 100 patients, there were

77 males and 23 females and the male to female ratio was 3.3: 1 (Figure: 2). The predominant age group was 61-70 years (Figure: 1).The youngest patient was 8 years old and the oldest was 87 years old (Table: 1). In our study, emegency tracheostomy was done for 52 patients (52%) whereas the remaining 48 cases (48%) underwent elective tracheostomy (Figure:3). Elective group included patients who required prolonged mechanical ventilation (cerebrovascular accidents, organophosphorous poisoning and other neurological conditions). Emergency group included patients presented with acute upper airway obstruction (malignancies of larynx, hypopharynx, thyroid, neck space infections and severe neck injuries). Vast majority of cases in our study underwent tracheostmy under local anaesthesia 58 (58 %), the remaining 42 (42%) underwent tracheostomy under general anaesthesia (Figure: 4). Tracheostomies done under local anaesthesia were also carried out preferably in the operation theatre where good suction facility was available. In 8 critically ill patiens (8%) bedside tracheostomy was carried out due to the problems anticipated while shifting. We used vertical incision in 62 cases (62%) where as in 38cases (38%) horizontal incision was used. In emergency tracheostomy vertical incision was adopted in majority (Figure: 5). The most common indication for tracheostomy in our study was upper airway obstruction 65 cases (65%). They were mainly due to head and neck malignancies 32(49.2%), 24 cases (36.9%) due to traumatic causes and 9 cases (13.8%) due to infections (Figure: 6). 21% of cases underwent tracheostomy for prolonged mechanical ventilation and for tracheobronchial toileting. Majority of these patients were critically ill patients admitted in ICU due to various conditions like cerebrovascular accidents, hypoxic ischemic encephalitis, congestive cardiac failure and organophosphorous poisoning. In patients who had tracheostomy secondary to prolonged ventilation, the duration of intubation before tracheostomy was performed ranged from 5 to 26 days with the median duration of 12 days. 32 % of our patients had malignancies in the head and neck region. They were predominantly laryngeal malignancies 22 (68.7%) followed by hypopharyngeal tumours 5 (15.6%), oral cavity and oropharyngeal malignancies 4 (12.5%) and malignant thyroid tumour 1 (3.1%). Most of the patients who underwent tracheostomy secondary to malignancy presented with airway obstruction. These patients had a variety of presentations ; majority presenting with stridor due to large obstructive primary lesions, post irradiation oedema, trismus, recurrent tumours after chemoradiation and severe oropharyngeal bleeding due to vascular erosion by the tumour. 1 case of postcricoid malignancy and 1 case of thyroid carcinoma presented with bilateral abductor palsy (Table: 2). In our study head and neck malignancies were more commonly seen in males 27 (84.4 %) than in females 5 (15.6%). The male to female ratio was 5.4: 1. Among the 5 female patients 3 (60%) had hypopharyngeal malignancy. Of the remaining two patients 1 (20%) had malignancy of oral cavity and the other one (20%) had malignancy of thyroid. Among 9 cases (13.8%) of infections, we encountered 3 cases each of acute epiglottitis and tetanus (33.3%), 2 cases of parapharyngeal abscess (22.2%) and 1 case of Ludwig's angina (11.1%) (Figure: 9). In the present study the most common traumatic indication for tracheostomy was severe head and neck injuries following road traffic accidents. In these patients with blunt injury neck and maxillofacial injuries emergency tracheostomy was done (Figure: 8). Percentage distribution of indications of tracheostomy due to infectious causes are shown in Figure: 9.

COMPLICATIONS OF TRACHEOSTOMY

In our study, out of 100 patients, 34 patients (34 %) were noted to have complications. Of these 25 patients were in the emergency group whereas 9 patients were in the elective group (Table: 3). 1 patient had cardiopulmonary arrest intraoperatively but could be successfully revived. The early complications (i.e. within first 24 hours after tracheostomy) were mainly bleeding, apnoea and 2 cases with significant surgical emphysema. Minor subcutaneous emphysema was present in 30 patients which subsided without any intervention within 1-2 days and hence it was not considered as a complication (Figure: 12). As intermediate complications (i.e. after 24 hours to the first 4 weeks) we encountered aspiration pneumonia, tube block, bleeding and accidental decannulation (Figure: 13). In the late postoperative period (i.e beyond four weeks up to 6 months) we observed stomal infections, suprastomal granulations, 4 persistent tracheocutaneous fistula, 1 case each of tracheoesophageal fistula and hypertrophied scar (Figure: 14). Posttracheostomy complications were significantly higher in emergency tracheostomy than in elective group.

OUTCOME OF TRACHEOSTOMY

Tracheostomy decannulation was successfully performed in 77 (77%) patients and these patients were discharged home. In the remaining 23 patients, 13 patients (13%) died during the study period due to worsening of their underlying systemic conditions. Rest of the 10 patients had difficulty in decannulation and were followed up.

Table 1: Percentage distribution of sample according to age

Age Distribution	Number of patients	Percentage
0-10	1	1%
11-20	2	2%
21-30	3	3%
31-40	8	8%
41-50	16	16%
51-60	27	27%
61-70	32	32%
71-80	7	7%
81-90	4	4%
Grand total	**100**	**100%**

Table 2: Percentage Distribution of Sample according to Indications of tracheostomy

INDICATION	DIAGNOSIS	NUMBER OF CASES	PERCENTAGE
Upper airway obstruction		65	65
	Traumatic	24	36.9
	Severe head and neck injuries	14	58.3
	Maxillofacial injuries	9	37.5
	Foreign body aspiration	1	4.2
	Neoplastic-Malignancy	32	49.2
	Supraglottic	13	40.6
	Glottic	9	28.1
	Oral cavity	1	3.1
	Oropharynx	3	9.4
	Pyriform fossa	3	9.4
	postcricoid	2	6.3
	Thyroid	1	3.1
	Infections	9	13.8
	Ac Epiglottitis	3	33.3
	Ludwig's angina	1	11.1
	Parapharyngeal abscess	2	22.2
	Tetanus	3	33.3
Mechanical ventilation/ Tracheobronchial toileting		21	21
	Prolonged ventilation	21	100
Adjunct to head and neck surgeries		8	8
	Anticipated difficult intubation	8	100
Others		6	6
	Burns	1	16.7
	Failed intubation	2	33.3
	Post intubation tracheal stenosis	2	33.3
	Guillian Barre Syndrome	1	16.7

Table 3: Percentage distribution of Complications of Tracheostomy

Period	Type of complications	No of Cases	percentage
Intraoperative	Cardiopulmonary arrest	1	2.9%
Early	Bleeding	3	8.8%
	Apnoea	1	2.9%
	Subcutaneous emphysema	2	5.8%
Intermediate	Tube block	3	8.8%
	Accidental decannulation	2	5.8%
	Aspiration pneumonia	3	8.8%
Late	Bleeding	2	5.8%
	Suprastomal granulation	3	8.8%
	Stomal infection	10	29.4%
	Tracheoesophageal fistula	1	2.9%
	Persistent tracheocutaneous fistula	2	5.8%
	Hypertrophic scar	1	2.9%

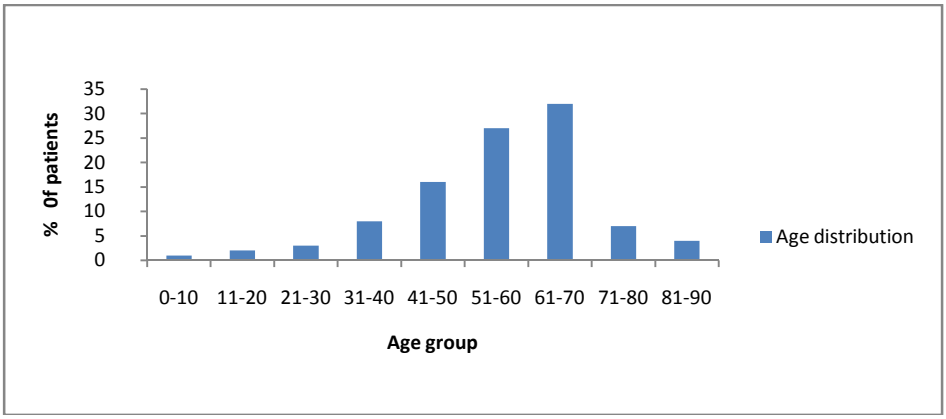


Figure 1: Distribution of sample according to age

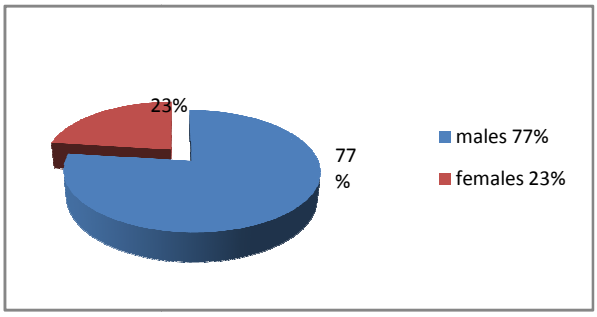
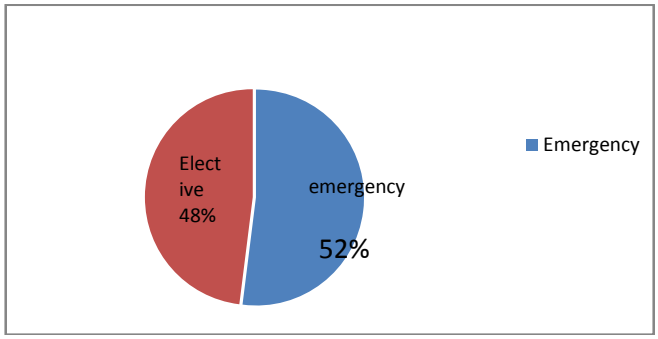


Figure 2: Sex distribution of the sample



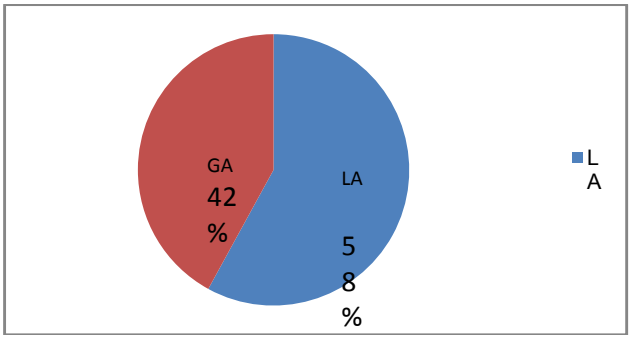


Figure 3: Percentage distribution of sample according to type of tracheostomy

Figure 4: Percentage distribution of sample according to type of Anaesthesia used

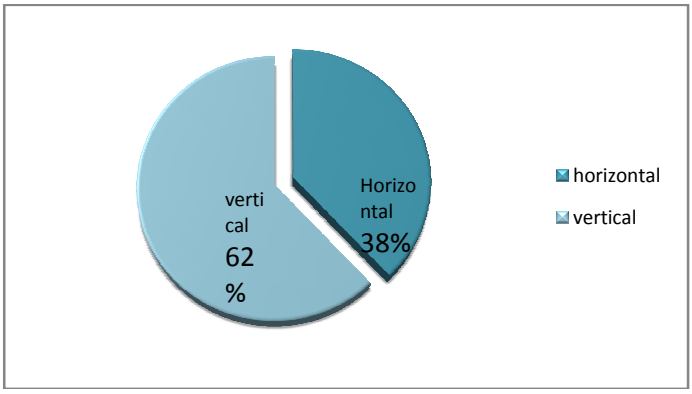


Figure 5: Percentage distribution of sample according to type of Incision used

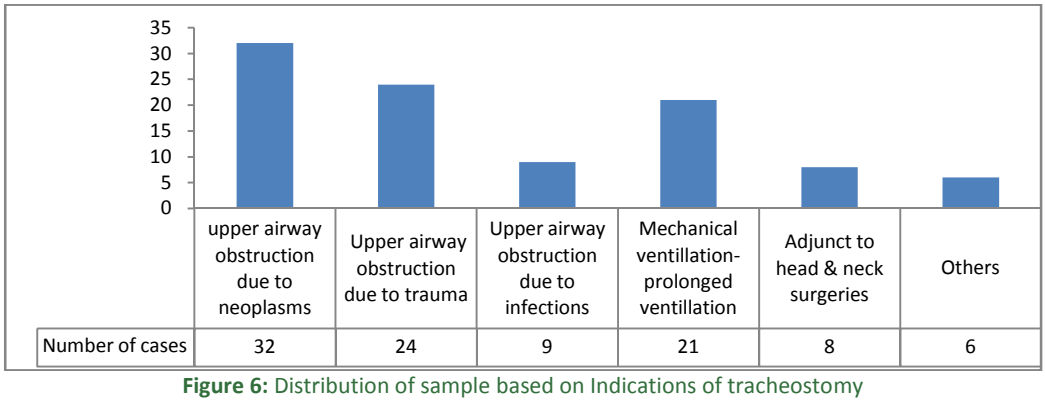


Figure 6: Distribution of sample based on Indications of tracheostomy

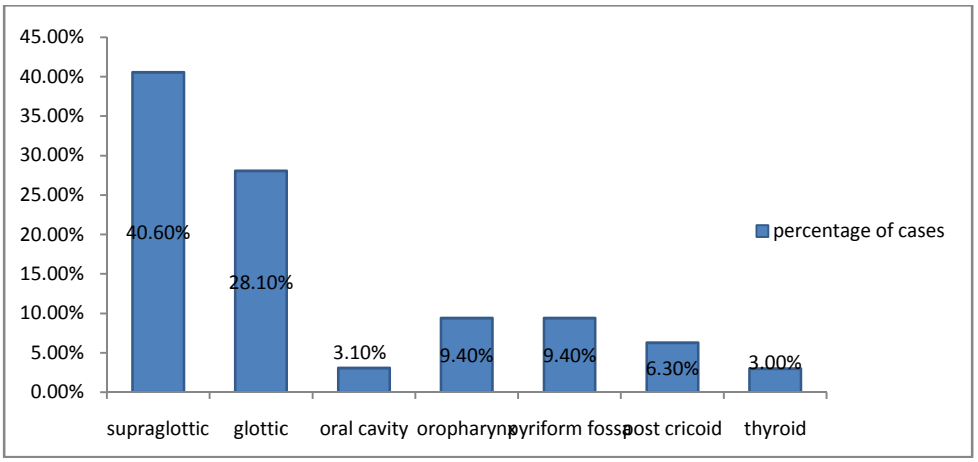
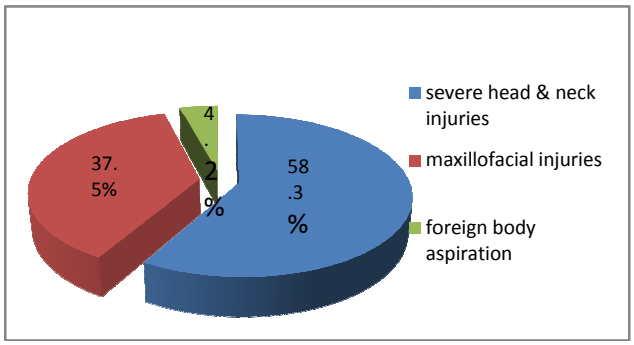


Figure 7: Percentage distribution of sample based on neoplastic indication of tracheostomy (N=32 cases)



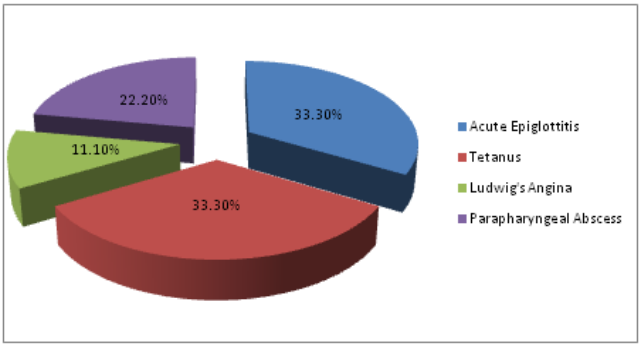
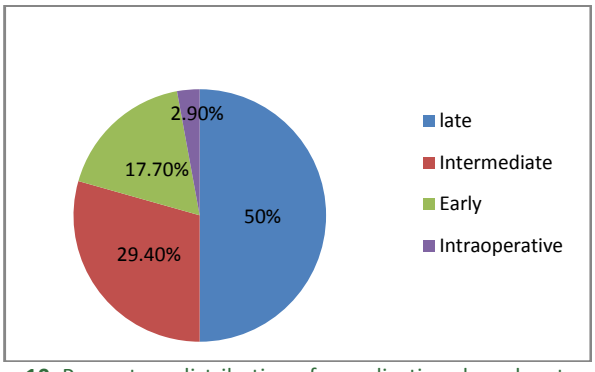


Figure 8: Percentage distribution of sample based on Traumatic indications of tracheostomy (N = 24 cases)
Figure 9: Percentage Distribution of Sample based on Infectious Indications of Tracheostomy (N= 9 Cases)



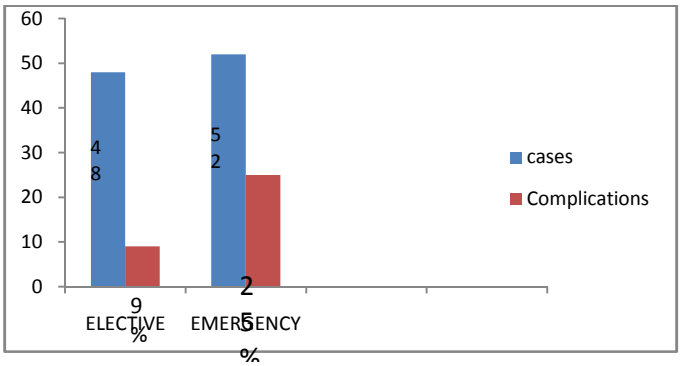


Figure 10: Percentage distribution of complications based on type
Figure 11: Complications observed in emergency Vs elective cases

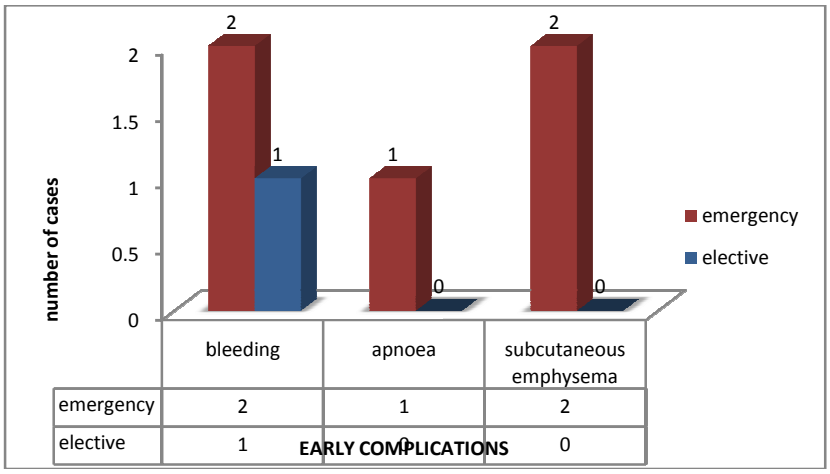


Figure 12: Early Complications

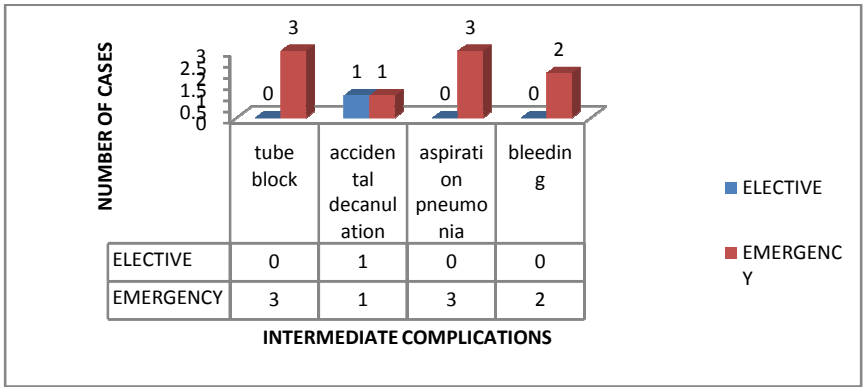


Figure 13: Intermediate Complications

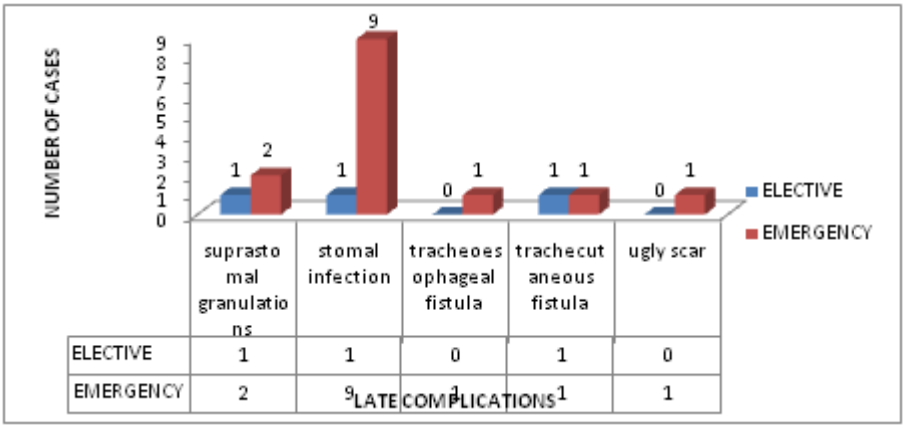


Figure 14: Late complications

DISCUSSION

Since it was originally described in the first century B.C, tracheostomy is currently one of the most commonly performed operations in the critically ill patients[1]. In our study, the highest age incidence of the patients who had tracheostomy was in the sixth decade with a male sex predilection (3.3: 1). 60-70 years was the predominant age group in the study by Chandrika *et al*[4]. The youngest patient in our study was an 8 year old girl who had cervical myelopathy. Male preponderance in this age group may be due to their increased susceptibility to trauma and increased incidence of malignancy in males than females owing to their habits of smoking and alcohol consumption. Similar demographic profile was reported by few other studies.[2,4,5,6,7,10,13.] The most common

indication for tracheostomy in our study was upper airway obstruction secondary to malignancies 32 (49.2%), which is comparable with studies by few other workers[2,4,6,18,]. In our study high incidence of traumatic causes of upper airway obstruction was seen between the third and fourth decades of life while patients of 7th - 8th decades recorded high incidence of laryngeal and other head and neck malignancies. These results are comparable with study by Datta *et al* [8,] Crysalde WS *et al* [6], Goldenberg *et al*[11] and Japhet M *et al* [13]. The indications of tracheostomy are diverse and changing. Tracheostomy, once used almost exclusively to bypass upper airway obstruction is now a very common elective therapeutic procedure used mostly to facilitate prolonged intubation and mechanical ventilation to the critically ill[16]. In this study, all cases with laryngeal and hypopharyngeal malignancies and other neck malignancies presented late in severe respiratory distress and so an emergency tracheostomy was performed under local anaesthesia.58% of our tracheostomies were done under local anaesthesia. This finding is similar to study by Mahadevan M *et al* [15]. Higher incidence of laryngeal carcinoma in our study may also be due to the increase in the incidence of laryngeal cancer in our society due to increased consumption of tobacco and alcohol. This finding is in agreement with studies by various other authors.[3,6,13, 15, 19] In our study female patients who had malignancies were found to have oral cavity, postcricoid and thyroid malignancies. Trauma to the head and neck was the leading indications in the 3rd decade of life in our study and interestingly the majority of these injuries were from road traffic accidents involving motorcycles. This could be due to the increase use of motor cycles by younger generation in this part of country and their noncompliance for using helmets. The surgical technique employed in most of our emergency patients was vertical incision in the operation theatre as vertical incision has the advantage of running in the line of the trachea and it is easy to perform with less bleeding. This is in variance with other authors who reported use of horizontal incision more than vertical.[2,6,7,22.] The presence of postoperative complications has an impact on the final outcome of tracheostomized patients. The incidence of postoperative complication in our study was 34 %. Posttracheostomy complication rates were found to be significantly higher in emergency tracheostomy than in elective one, which is also comparable with other studies.[2,4,5,6,20,21.] High complication rate in patients who had emergency tracheostomy can be explained by the fact that the majority of patients with upper airway obstruction presented late to the Emergency Medicine Department in severe respiratory obstruction and so emergency tracheostomy was always the rule. The general incidence of complications in our study was 34%. Of these 25 patients were in the emergency group whereas 9 patients were in the elective group. These findings were similar to studies by Chandrika *et al*[4] and Hamid AA *et al*[10.]. Out of 34% of complications, 17 (50%) were late complications of which stomal infection and suprastomal granulations were the predominant ones. 10 patients (29.4%) developed intermediate complications like tubal block and aspiration pneumonia. Bleeding in 2 patients, significant subcutaneous emphysema in 2 patients and 1 case of apnoea were the predominant early complication in our study. Similar finding were also reported by other authors [4,5,7,8,10,21]. In our study, bleeding during the first 24 hours was mainly from the wound edges which subsided completely with pressure dressing around the stoma. We had two cases of significant subcutaneous emphysema as early complications. Both cases were emergency tracheostomies where the tracheal opening made was larger than usual and with tight sutures. With the release of sutures and observation the emphysema subsided in 4-5 days time. The most common intermediate complication in the present study was aspiration pneumonia. This finding is at variance with one other study where stomal infection was predominant[4]. The most common late complication in our study was stomal infection which was similar to study by Chandrika *et al*[4]. This was treated by using culture directed antibiotics, regular cleaning and dressing with antibiotic ointments and use of sofratule dressing. Suprastomal granulations were treated by repeated cauterisation with copper sulphate. Tracheostomy decannulation in patients with temporary tracheostomy was successfully carried out in 77% of patients who survived, which is almost similar to the study done by Japhet M *et al*[13] showing 72.4% decannulation accomplished successfully. The overall mortality recorded in our study was 13% and these were from underlying diseases. There was no mortality attributed to tracheostomy or its complications in the present study. Mortality obtained in our study was more compared to studies by Chandrika *et al*[4] and Japhet M Gilyoma [13] in their study. This could be because of the various associated comorbidities in our critically ill patient groups. The potential limitation of this study is that since it was a prospective study of 18 month duration and the follow up period of these patients were relatively short.

CONCLUSION

In our study the predominant age group who underwent tracheostomy was 61-70 years with a male preponderance. The most common indication for tracheostomy was upper airway obstruction due to malignancy, trauma, prolonged ventilation and infections

respectively. In our study emergency tracheostomy was more in number than elective one. Emergency procedure was predominantly done under local anaesthesia using vertical incision. Among complications we observed more of late complications. The most common early complications observed were haemorrhage and subcutaneous emphysema. The most common intermediate complication observed was stomal infection. These were seen predominantly in patients who used metallic tubes than in patients who used Portex tubes. Intermediate complications were significantly less in elective tracheostomy group. 13 patients died during the study period due to the underlying morbid systemic conditions. Tracheostomy remains a quick, safe and simple procedure, when performed by experienced surgeon under controlled circumstances, and should be considered as an option for the care of critically ill. Patient and caregiver education prior to performing elective tracheostomy and during discharge will help to improve patient outcomes and decrease complications related to tracheostomy tube. Complication rates associated with tracheostomy can be prevented by use of non metallic tubes, good surgical technique and meticulous postoperative care.

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REFERENCES

1. Jackson C. Tracheostomy. Laryngoscope 1909; 19: 285-90.
2. Amusa Yb, Akinpelu VO, Fadiora SO, Agbabakwuru EA. Tracheostomy in surgical practice: experience in a Nigerian tertiary hospital. West Afr J Med. 2004 Jan-Mar; 23 (l):32-4.
3. Brian B. Burkey, Steven L. Goudy, Sarah L. Rohde "Airway control and laryngotracheal stenosis " Chapter 78, John.J.Ballenger Otolaryngology Head and Neck Surgery,17th edition, A lea and Febiger Book, 2009 BC Decker Inc pp 905-907.
4. Chandrika A, Somaraj S, Karat A; A descriptive study on complications of tracheostomy. J.Evid. Based Med. Healthc.2016; 3 (99), 5451-5457. DOI: 10.18410/jebmh/2016/1129.
5. Cohen D, Gurvitz Y, Friedman P, Raveh D, Perez R. Self-retaining T-incision for difficult tracheotomy. J Laryngol Otol. 2007 Jul; 121(7):664-7. Epub 2007 Mar 29.
6. Crysalde WS, Fieldman RI, Natio K. Tracheostomies: a 10 year experience in 319 children Ann Otol Rhinol Laryngol 1988: 97: 439-443.
7. Datta R.K, Viswanatha B, Puneet P.J, Merin Bobby Tracheostomy : Our Experience, Research in Otolaryngology 2015, 4 (2): 29-33
8. Fazal-i-Wahid, Hamza A, Khan Q et al An audit of tracheostomy at a tertiary healthcare hospital JPMI 2012; (26) 2: 206-211.
9. Fradis M, Malatskey S, Dor I, Krimerman S, Joachims HZ, Ridder GJ, et al. Early complications or tracheostomy performed in the operating room. J Otolaryngol. 2003; 32 (1): 55-7.
10. Hamid AA, Sattar F, Shahedin et al Complications of tracheostomy, JPMI 2003; 18 (3) 385-390.
11. Goldenberg D, Ari EG, Golz A, Danino J, Netzer A, Joachims HZ, Tracheostomy Complications : a retrospective study of 1130 cases, Otolaryngol Head and Neck Surg 2000; 123 (4) : 495-500.
12. Hackeling T, Triana R, Ma OJ, Shockley W. Emergency care of patients with tracheostomies: a 7-year review. Am J Emerg Med. 1998 Nov; 16(7):681-5.
13. Japhet M Gilyoma, Darius D Balumuka, Phillipo L Chalya ; Ten year experiences with tracheostomy at a University teaching hospital in Northwestern Tanzania : A retrospective review of 214 cases, World Journal of Emergency Surgery, biomedcentral.com/articles/10.1186/1749-7922-6-38.
14. Jos Straetmans, Georg Schlondorff, Gabi Herzhoff, Jochen P. Windfuhr Complications of Midline- Open Tracheostomy in Adults, The Laryngoscope 120: 84-92, 2010.
15. Mahadevan M Barber C, Salkeld L. et al Paediatric Tracheostomy 17 year review. Int J Paediatr Otorhinolaryngol 2007: 71 (12): 1829-1835.
16. Paul Pracy " Tracheostomy", Chapter 175, Scott-Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition, 2008 Edward Arnold (Publishers) Ltd, pp 2292-2302.
17. Shannon M Kraft, Joshua Schindler "Tracheotomy" chapter 7, Cummings Otolaryngology Head and Neck Surgery, 6th edition, 2015 by Saunders, an Imprint of Elsevier Inc pp 95-103.
18. Sigdel B, Acharya A, Ghimire A Tracheostomy in tertiary care health Institution Nepal Health Res Counc 2014 Jan; 12(26): 30-2
19. Stauffer TL, Olson DE, Petty TL "Complications and consequences of endotracheal intubation and tracheotomy. A prospective study of 150 critically ill patients" American journal of med. 1981 jan ; 70(1) : 65-76.
20. Stemmer EA, Oliver C, Carey JP, Connolly JE. Fatal complications of tracheotomy. Am J Surg. 1976 Mar; 131(3):288-90
21. Terra RM, Fernandez A, Bammann RH, Castro AC, Ishy A, Junqueira JJ. Open bedside tracheostomy: routine procedure for patients under prolonged mechanical ventilation. Clinics. 2007 Aug; 62(4):427-32.
22. Waldron J, Padgham ND, Hurley SE. Complications of emergency and elective tracheostomy : a retrospective study of 150 consecutive cases, Ann R Coll Surg Fngl 1990; 72 (4): 218-220.

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