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ORIGINAL ARTICLE

Open-Tracheostomy: Audit at King George Medical University, India

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ABSTRACT

Objective: Audit of open tracheostomies in terms of their indications and outcomes.

Methodology: 500 open tracheostomies were studied for indications of tracheostomy, patient's age, gender, diagnosis, referring facility and complications as mentioned in the archival register along with reasons for deferral of the procedure.

Results: A predominance of males and elective tracheostomy was seen. The most common indication for emergency tracheostomy in adults was laryngeal malignancy, followed trauma while in paediatric population, the various infectious conditions. Cerebrovascular cases were the most common ones referred from medicine ward/ ICU for elective tracheostomy. The short-term complications were haemorrhage, subcutaneous emphysema and difficult insertion/ false placement, while reasons for deferral were deranged coagulation profile, negative patient-consent and low platelet count.

Discussion: The acute complications were comparatively much less than reported in the literature. Even in the absence of data on long-term mortality we certainly anticipate a much lesser mortality. The hemorrhage in this series was possibly due to a restless patient under local anaesthesia often laid on an unstable platform (ward bed) and without diathermy. In addition, injury to thyroid isthmus with thyroid hook can cause abrasion and open tracheostomy is better to access the 'injured' tissue. Insufficient intraoperative haemostasis is likely to result in significant postoperative bleeding. Intraoperative mortality related to tracheostomy remains low (0.4%) possibly related to cardiopulmonary arrest.

Conclusion: Open mid tracheostomy under local anaesthesia conducted primarily by residents gives comparable results and should be adapted in a low-resource centre with a huge patient load.

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Tracheostomy is the most common surgery carried out worldwide to create an alternative airway and involves creating a stoma in the anterior wall of trachea. This may be undertaken for relieving airway obstruction or providing mechanical ventilation or even for reducing risk of aspiration in unprotected airway along with assistance in the pulmonary toilet. The surgical techniques vary from classical (open) to mini and percutaneous tracheostomy. The open technique seems most cost-effective for a low-resource centre catering for a high patient load. Further, tracheostomy can be classified as high/ mid/ low, depending upon the site, or elective/ emergency, depending upon the situation. Traditionally, the complications can be immediate or delayed, but the usual acute ones include haemorrhage, infection, subcutaneous emphysema, tube misplacement, hypoxia or rarely cardiac arrest.

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As a policy almost all the tracheostomies performed at our tertiary care centre are undertaken by our otolaryngology team, comprising of senior residents and as needed be supervised by the attending surgeon. This paper aims to present a complete audit of tracheostomies conducted across the entire hospital.

METHODOLOGY

The archival data of 500 tracheostomies in 2022 from the department of otorhinolaryngology, King George Medical University Lucknow was analysed in this retrospective observational study. No patient-identifiable data was included. Since this audit involves primarily analysis of numbers from the archival register, no informed consent from patient or ethical approval for this analysis was taken. Revision cases as well as those patients who had undergone tracheostomy in other hospitals were excluded from the study. The indications of tracheostomy, patient's age, gender, diagnosis, referring facility and complications if any as mentioned in the archival register were retrieved for analysis. Reasons for deferral of the procedure were also noted. All the tracheostomies were undertaken after obtaining written informed consent from relative/ guardian.

The classical surgical procedure carried out in all the cases needs mention. The technique of tracheostomy we patronize at our centre is the classical open mid-tracheostomy. A 2–3 cm vertical skin incision is given one finger breadth below the cricoid ring and the soft tissue is dissected along the midline (avascular plane). The subcutaneous tissue and strap muscles are dissected off the midline till the pre-tracheal fascia. The thyroid isthmus as encountered is gently retracted superiorly with the help of a thyroid hook and pre-tracheal fascia is incised vertically. It is important to dissect this fascia off the tracheal cartilaginous framework before making an entry into the trachea. It is further important to identify the trachea by demonstrating the extruding air bubbles when suctioned with a needle on water-filled syringe. For a temporary tracheostomy, the inter-cartilaginous membrane is 'stabbed' to enter in the tracheal lumen. The opening is further dilated with artery forceps and then tracheostomy tube is introduced. Alternatively, for a permanent tracheostomy, the central part of the cartilaginous ring is excised and a comparatively larger stoma is created to introduce the tube. Following the tube insertion haemostasis is achieved by circumferential packing with ribbon gauze.

Table 1: Age distribution

Age (y)	N	Percentage (%)
1–10	59	11.8
11–20	49	9.8
21–30	83	16.6
31–40	67	13.4
41–50	71	14.2
51–60	63	12.6
>60	108	21.6
Total	**500**	**100.0**

OBSERVATIONS

Of 500 cases, males (N=346, 69%) outnumbered females, while age of presentation is as depicted in table 1. Amongst 500 patients, 157 (31%) emergency and 343 (68%) elective tracheostomies were undertaken. Following presentation/ referral, the waiting period before emergency tracheostomy varied from 5 min to few hours.

Indications of emergency surgery

The most common indication for emergency tracheostomy in adults was laryngeal malignancy, followed by head and neck trauma (road traffic accidents, firearm injuries of maxillofacial region, sports injury, bomb blast injuries, mechanical injuries of neck and burn injuries) with difficult intubation, while in paediatric population, the more common indication for tracheostomy was infectious conditions like diphtheria, tetanus, Gullian Bare syndrome. The etiological factors are listed in table 2. Among traumatic indications road traffic accidents were commonest followed by burn injuries. A single case of toxic epidermal necrolysis encountered in the current series presented with severe mucositis of oral cavity and upper airway (as documented on direct laryngoscopy) severely compromising the airway and hence necessitating emergency tracheostomy.

Indications of elective surgery

The elective tracheostomy was undertaken for many medical indications as referred by different other specialities. The various referral indications

Table 2: Indications of emergency tracheostomy			
Etiology	**N**	**% in 500**	**% in 157**
Laryngeal malignancy	60	12	38.2
Road traffic accidents	32	6.4	20.38
Infective conditions	21	4.2	13.38
Burn injuries	18	3.6	11.46
Mechanical injuries	10	2	6.37
Mass oral cavity/ oropharynx	9	1.8	5.73
Bilateral abductor paralysis	3	0.6	1.91
Subglottic stenosis	2	0.4	1.27
Thyroid malignancy	1	0.2	0.64
Toxic epidermal necrolysis	1	0.2	0.64
Total	**157**	**-**	**-**

Table 3: Referral indications for elective tracheostomy			
Aetiology	**N**	**% in 500**	**% in 343**
Cerebrovascular cases (ICU)	108	31.49	21.6
Respiratory conditions	79	23.03	15.8
Postoperative cases	34	9.91	6.8
Burn injuries	33	9.62	6.6
Gastrointestinal cases	21	6.12	4.2
Postpartum conditions	13	3.79	2.6
Renal conditions (ICU)	12	3.50	2.4
cervical injuries	11	3.21	2.2
Cardiovascular cases (ICU)	9	2.62	1.8
Tetanus	9	2.62	1.8
Poisoning cases (ICU)	8	2.33	1.6
Haematological (ICU)	3	0.87	0.6
Rhabdomyolysis with MODS (ICU)	1	0.29	0.2
Diphtheria	1	0.29	0.2
Myasthenia gravis	1	0.29	0.2
Total	**343**		

Table 4: Referral departments for tracheostomy		
Department	**N**	**% in 500**
Internal Medicine ICU	167	33.4
ENT emergency	76	15.2
Other Surgical wards	54	10.8
Critical care	47	9.4
Pediatrics	45	9
Internal Medicine ward	39	7.8
Plastic surgery (Burn ICU)	38	7.6
Respiratory medicine	25	5
Radiotherapy	5	1
Neurology	4	0.8
Total	500	100

are depicted in table 3, while various referring specialities are depicted in table 4. Cerebrovascular cases were the most common ones referred from medicine ward/ ICU for elective tracheostomy. Table 4 also depicts the various ICUs across the hospital requiring a ‘tracheostomy support’.

Type of surgeon

The emergency tracheostomies were predominantly performed by senior residents assisted by other residents in training. The elective surgery was however supervised by the attending although performed primarily by the senior resident. The first- and second-year residents are routinely not authorised to assist this procedure but if needed the senior resident may take assistance on his responsibility.

Place of surgery

All the emergency surgeries are performed under local anaesthesia preferably in minor-OR setup of the department. None was undertaken under general anaesthesia in major-OR. However, the elective tracheostomy was usually done under local anaesthesia either bedside in ICU/ ward or in the respective OR during the initial intraoperative phase (difficult intubation).

Complications

Majority revealed an uneventful postoperative phase except for prolonged cannulation in some. The long-term complications were not registered in this study as the compliance of patients is poor in this part of the world. However, the most common short-term complication was haemorrhage (N= 47, 9.4%) followed by subcutaneous emphysema (N= 14, 2.8%), difficult insertion (N= 13, 2.6%), false placement (N= 8, 1.6%), hypoxia/ apnoea (N= 4, 0.8%), and death in a single case (0.2%).

Deferral of surgery

The commonest reason for deferral of elective tracheostomy was documented as a deranged coagulation profile (N= 47, 9.4%) followed by negative consent (N= 42, 8.4%) and low platelet count (N=12, 2.4%).

DISCUSSION

The literature reveals that tracheostomy is more commonly undertaken as an emergency procedure[1,2] but in our facility elective procedures predominate possibly due to administrative policy. This may also reflect that the predominant indication for tracheostomy is to provide mechanical ventilation/ reducing risk of aspiration/ airway suction rather than an acute airway obstruction. In addition, many specialities at our hospital do not perform this procedure themselves and expect the otolaryngological team to accomplish the task. Also as per our institutional policy the otolaryngology team is deemed responsible for all hospital tracheostomies. We prefer open mid-tracheostomy under local anaesthesia in all cases rather than other techniques such as per-cutaneous dilatational tracheostomy or instituting general anaesthesia. While the latter options increase the expenditure cost and time our current protocol enables us to outperform even in meagre resources/ infrastructure and results, which are in no way inferior to other centres. The actual surgery is performed by the resident trainees along with a senior resident even at times under torchlight and paddle suction during power failures. Almost always during emergency-tracheostomy, there is no availability of diathermy or ways to relax the patient except counselling. The elective-tracheostomies are comparatively more comfortable as they have a 'less turbulent' patient and better suction/ illumination facilities. The overall duration of the procedure at our facility varies from 3 to 10 minutes depending upon the situation and average blood loss is about 10 to 20 mL.

Our complication rate was about 17% while that of open technique as quoted in the literature varies from 8% (N= 102)[3]; 15% (N= 150)[4] to 18.9% (N= 74).[5] A single death as extremely rare outcome has also been reported[5]. In a study[6] of 522 open tracheostomies, haemorrhage was the commonest complication (N= 35) while 3 patients died within 3 days of tube placement. Further, they reported a mortality of 40% within 30 days following tracheostomy. Our acute complications were comparatively much less. Although we do not have a follow-up data to document the long-term mortality, we certainly anticipate much lesser mortality. The hemorrhage (N=47) in our cases was possibly due to restless patients under local anaesthesia often laid on unstable platform (ward bed) and without diathermy. Another theoretical cause of hemorrhage can be an injury to thyroid isthmus with thyroid hook abrading the isthmus during retraction. Fortunately, open tracheostomy can better access the 'injured' isthmus than percutaneous tracheostomy, and facilitate better haemostasis through its cauterization/ ligation or division. Insufficient intraoperative haemostasis may result in significant postoperative bleeding. In another study of open tracheostomy on 552 patients[7] admitted in ICU, significant complications were appreciated in 4.34% (24 cases) with minor and major bleeding in 9 cases each along with subcutaneous emphysema in only 2. The scenario in the current study was however different since tracheostomies were not exclusively carried out in ICU only.

Subcutaneous emphysema can be trivial or rarely life-threatening.[8,9] It may reflect underlying tracheal injury or pneumothorax.[8] Although incidence of subcutaneous emphysema was 14 in current series but none were life threatening. To prevent free air leak into subcutaneous spaces, it is important to completely dissect off pretracheal-fascia from the anterior tracheal wall because dreaded complication may ensue if air dissects through the fascial spaces into mediastinum.[10] Our surgical residents perform bedside tracheostomy under local anaesthesia in often uncooperative patient with a shaking bed-base that possibly predisposes to faulty/ incomplete dissection at times. In addition since extensive subcutaneous emphysema has been attributed to injury of the posterior wall of trachea, the surgeon must carefully incise the anterior wall, taking care not to accidentally cause inadvertent laceration of the posterior wall.

In an interesting case of tracheostomy where a thyroid swelling had displaced the trachea off the midline, the severely atherosclerotic carotid artery presented a cartilaginous-feel. The confirmation test for trachea revealed frank blood instead of air-bubbles. This cautioned us from avoiding that structure, thereby preventing a catastrophic iatrogenic entry into the carotid artery. Hence the importance of confirming the trachea before 'stabbing' cannot be over-emphasized specially since routine tracheostomies are performed by residents/ trainees instead of attending.

The hypoxia can result from tube misplacement as appreciated in 8 of our cases. Often in obese patients with increased distance between skin and

trachea, multiple trials of tube insertion have to be attempted that may prolong periods of desaturation. The enhanced subcutaneous fat in such cases predisposes to serve as a tract for a false passage.[11] Such mishaps are theoretically more common with percutaneous techniques than open ones.[12] Another important aspect to discuss is reversion of hypoxia induced by apnoea. Emergency tracheostomy is expected to be accomplished in less than few minutes and hence needs to be undertaken rapidly. But the surgeon needs to slow down while opening the tracheal lumen. A smaller nick should be made initially that slowly needs to be enlarged in next 8–10 secs for preventing a sudden CO_2-washout. Also an endotracheal tube needs to be kept handy so that if apnoea occurs, it can be immediately inserted and room air through ambu bag (preferably the exhaled air of surgeon) be blown into the patient's lungs. In current series 4 such apnoeic episodes reverted without any squeal.

Intraoperative mortality related with tracheostomy remains low as also reported in a national survey (2012), to the tune of 0.4%. This has been attributed primarily to cardiopulmonary arrest and also in a case, to pre-existing tracheal injury.[13] However in absence of proper monitoring it could not be established if the single cardiac arrest in this current series was related to severe hypoxia.

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