ABSTRACT

Purpose: Despite advances in anesthetic techniques, health resource environment still face challenges in achieving safe anesthesia due to limited facilities and skilled personnel. This study highlights the value of open tracheostomy in oral/maxillofacial surgery in a health resource-limited setting.

Materials and Methods: Maxillofacial surgery patients who had a tracheostomy in a regional University Teaching Hospital between February 1999 and August 2017 were retrospectively studied. Details sourced included age, sex, surgical condition, indication for tracheostomy and complications. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 16 (SPSS Inc., Chicago, IL, USA). Findings from descriptive statistics were represented in the form of tables and charts.

Results: A total of 51 patients had an open tracheostomy and this consisted of 28 (54.9%) males and 23 (45.1%) females. The main anesthetic indication was preoperative difficult airway assessment, and there was more elective (n=45; 88.2%) than emergency tracheostomies. Orofacial tumors (n=30; 58.9%) were the major conditions managed. More patients with mallampati class IV (n=18; 69.2%) had tracheostomy. About 98.0% (n=50) of the patients had a temporary tracheostomy and the main complications noted were mortality, surgical emphysema and hemorrhage.

Conclusion: In resource limited environments, the maxillofacial surgical team frequently has little facility to work with and often face challenging cases. Although these patients can be safely anaesthetized using less invasive methods in health resource-rich settings, tracheostomy offers surgeons in our environment an opportunity to improve the quality of life of these patients who otherwise cannot be safely anaesthetized due to limited facilities or skilled manpower.

Keywords: Tracheostomy, Maxillofacial, Tumor, Health resources,
emergent, urgent or elective procedure although elective tracheostomy is less frequently performed in developed societies due to advancement in anesthetic technique [6]. Tracheostomy may also be performed using percutaneous or open surgical technique. The percutaneous technique which may be ultrasound or endoscopically assisted is said to be faster, safer, and a less invasive method of placing tracheostomy tubes in ventilated patients [7]. The advantages of tracheostomy include decrease in ventilatory dead space and airway resistance, greater ease of suctioning, increased patient mobility, reduction in orolabial and laryngeal trauma, provision of overall patient comfort, reduction in requirement for sedation, increased ability for the patient to communicate, and variable capacity for oral intake of nutrition and medication [8]. This retrospective study highlights our experience with and the value of open tracheostomy in oral/maxillofacial surgery in a regional university teaching hospital.

MATERIALS AND METHODS
Oral and Maxillofacial Surgical patients, who had tracheostomy done for treatment of their surgical conditions at a regional university teaching hospital between February 1999 and August 2017, were retrospectively studied. Information was sourced from patient case notes and operating theatre records. Patients whose case notes could not be traced were excluded. Details sourced included age, sex, surgical condition, indication for tracheostomy, type of tracheostomy, Mallampati classification, and complications. Data retrieved was analyzed using Statistical Package for Social Sciences (SPSS) version 16 (SPSS Inc., Chicago, IL, USA). Findings from descriptive statistics were represented in the form of tables and charts.

1 Surgical procedure
Open Tracheostomies were performed under local anesthesia plus conscious sedation or under general anesthesia (without an endotracheal tube in situ). With the patient in a supine position and the neck in an extended position (following placement of sandbag behind the upper shoulder in most cases), a transverse incision measuring about 4cm long is made two finger breadths above the suprasternal notch. The incision extends from skin to the subcutaneous layer, and then sharp dissection is made through the platysma in the midline along the long axis of the neck until the strap muscles of the anterior neck are encountered. Once the strap muscles are encountered, they are parted from the midline laterally, and blunt dissection continued in the midline of the trachea with control of hemostasis where necessary. Regular palpation is made over the underlying structures to ensure that dissection is over the trachea. In most cases, we did not encounter the isthmus of the thyroid. Once the trachea has been reached, confirmation is made by palpating the structure (the trachea is composed of tracheal rings and thus not a smooth structure), color assessment and by air aspiration using a hypodermic syringe. Following confirmation and with anesthetist informed, the trachea is incised between the 2-4 tracheal rings and the tracheostomy tube (or improvised endotracheal tube) placed. We use the U-shaped or transverse tracheal incisions in our centre.

RESULTS
1. Sex and Age distribution
A total of 51 patients had open surgical tracheostomy within the years reviewed, and this consisted of 28 (54.9%) males and 23 (45.1%) females, giving a male to female ratio of 1.2:1. The age of patients ranged from 2 to 60 years with a mean of 24.3 ± 14.0 years, and 34 (66.7%) of these cases were adult while the remaining 17 (33.3%) were pediatric cases. The 20-29 year age group (Fig. 1) accounted for the highest number of patients (n=17; 33.3%) followed by the 10-19 year age group (n=13; 25.5%).

2. Diagnosis, Indication and Type of tracheostomy
Of the 51 tracheotomised patients reviewed, oral/maxillofacial surgeons performed 49 tracheostomies while the remaining 2 procedures were performed by ENT surgeons. The most frequent surgical condition requiring tracheostomy was orofacial tumor (n=30; 58.9%) followed by temporomandibular joint (TMJ) ankylosis (n=19; 37.3%) (Fig. 2). There were more elective (n=45; 88.2%) than emergency (n=6; 11.8%) tracheostomies. The only indication for elective tracheostomy was preoperative difficult airway assessment, while the indications for emergency tracheostomies were airway compromise following failed endotracheal intubation (n=1; 2.0%), accidental endotracheal tube extubation intraperatvely (n=2; 3.9%), immediate postoperative airway complications (n=1; 2.0%), and airway obstruction (n=2; 3.9%) following cervicofacial cellulitis and nasopharyngeal carcinoma respectively.
Presenting surgical conditions in patients tracheotomised.

There were 50 temporary tracheostomies and 1 permanent tracheostomy. The duration of tracheostomy tube retention prior to decannulation was documented in 12 patients and ranged from intraoperative to 7 days postoperative period (Table 1). The duration of hospital stay as documented in 14 of the patients ranged from 10-54 days with a mean of 25.8 ± 12.8. Complications noted in patients studied included surgical emphysema of the neck and upper anterior chest wall (n=2), hemorrhage from the trachea stoma (n=1) and mortality in 5 patients (1 elective and 4 emergent cases).

Table 1. Tracheostomy tube cannulation time

<table>
<thead>
<tr>
<th>Cannulation Time</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraoperatively</td>
<td>3</td>
<td>23.1</td>
</tr>
<tr>
<td>2 days Postop</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>4 days Postop</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>5 days Postop</td>
<td>2</td>
<td>15.4</td>
</tr>
<tr>
<td>6 days Postop</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>7 days Postop</td>
<td>4</td>
<td>30.8</td>
</tr>
<tr>
<td>Permanent</td>
<td>1</td>
<td>7.7</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100.0</td>
</tr>
</tbody>
</table>

DISCUSSION

Tracheostomy is one of the oldest surgical procedures performed by different surgical specialties and involves placement of an artificial airway in the subglottic region temporarily or permanently to allow for efficient airway management. In this retrospective analysis, there were slightly more males than females who underwent tracheostomy. This finding is similar to previous studies [9-11]. The sex distribution of patients undergoing tracheostomy appears to be determined by the surgical or medical indication. For example, conditions such as trauma and head/neck tumors are more common in males. Similarly, a high female to male ratio was reported in a study where hair dye poisoning accounted for 50% of cases seen and with females constituting about 92.5% of the patients [12]. The religious and cultural practices of the study population also influence the sex distribution [13].

Most of the patients in this study were adults with the 20-29yr age group accounting for the highest number of cases, similar to a previous study [11]. However, other studies recorded a higher incidence of tracheostomy in the 0-9yr age group [13, 14]. Orofacial tumors were the main surgical condition requiring tracheostomy, and this finding is similar to previous studies [9, 10, 15]. Orofacial tumors may grow to huge sizes leading to inadequate visualization of the airway for safe endotracheal intubation. This is especially true in resource-limited environments where as a result of poverty, cultural and religious beliefs patient often present late (Fig. 4). In some cases of huge and highly hemorrhagic orofacial tumors, endotracheal intubation may be possible but at the risk of provoking se-
vere bleeding. Therefore, tracheostomy may be a safer option, especially where adequate and proper anesthetic facilities are lacking. Prophylactic tracheostomy may be required in some cases of orofacial tumor surgery such as tongue resection and reconstruction due to the risk of obstructive postoperative edema. This will allow for adequate and uneventful postoperative recovery especially where leaving conventional endotracheal tube may not be ideal.

Fig. 4. Delayed presentation of the orofacial tumor.

The main anesthetic indication for tracheostomy in this study was preoperative difficult airway assessment. Difficult airway remains a challenge in patients with massive orofacial tumors or limited mouth opening from TMJ ankylosis (both of which accounted for a high proportion of the patients studied). In anticipated difficult airway, both non invasive and invasive options for safe anesthesia exist. Non invasive options available for the management of a difficult airway as outlined in the updated report by the American Society of Anesthesiologists task force on management of the difficult airway include awake intubation, video-assisted laryngoscopy, intubating stylets or tube-changers, supraglottic airway anesthesia (SGA) for ventilation (e.g., laryngeal mask airway, laryngeal tube), SGA for intubation (e.g., intubating laryngeal mask airway), rigid laryngoscopic blades of varying design and size, fiberoptic-guided intubation, and lighted stylets or light wands [1]. Invasive techniques available for management of a difficult airway include cricothyroidotomy, retrograde intubation using a guide wire, and tracheostomy [16]. Each of these options has its advantages and disadvantages. Facemask techniques enable the delivery of both oxygen and anesthetic gases/vapors to the patient and are widely used for both induction and maintenance of general anesthesia. However, prolonged positive pressure ventilation with facemask may lead to gastric insufflations. Similarly, it is associated with difficult ventilation in certain patients such as an obese and edentulous patient, and the airway remains unprotected from tracheal aspiration which is undesirable in most oral and maxillofacial surgical procedures. Blind nasal intubation has the advantage of achieving rapid intubation whilst avoiding the pressor response of rigid instrumentation which is observed with direct laryngoscopy. Also, the risk of trauma to teeth which may occur with direct laryngoscopy is eliminated [17]. In addition, it does not require the availability of special or high tech devices, nor is it affected by the presence of blood or secretions [18, 19]. However, it requires skill for success, it is associated with risk of trauma to operator’s finger from patient teeth in blind oral intubation, and it is contraindicated in patients with conditions such as base of skull fracture, bleeding disorders, nasal polyps, nasal stenosis, severe laryngeal trauma, and in the presence of foreign body in the upper airway to avoid further downward displacement [20]. In-direct laryngoscopy provides a non-line-of-sight view of the glottis aperture and involves the use of an optical stylet, rigid laryngoscopes and flexible laryngoscopes (which may be video or non-video laryngoscopes). Advantages include faster intubation time, elimination of the need for a line-of-sight view of the glottis aperture, require the use of less force in comparison to direct laryngoscopy and thus reduces trauma to dentition and soft tissues, produces less cervical movement and have a faster learning curve [21, 22]. Cricothyroidotomy and tracheostomy are the two acceptable emergency surgical airways in the ‘cannot intubate, cannot ventilate’ scenario outlined in the American Society of Anesthesiologists difficult airway algorithm. Cricothyroidotomy (which may be a cannula or surgical cricothyroidotomy) is less invasive when the cannula technique is used, instrumentation needed is easily available, and both inspiration and expiration are possible through the endotracheal tube with surgical cricothyroidotomy. Suctioning, sealing of the airway by the cuff to prevent aspiration, and adequate ventilation/carbon dioxide removal is not feasible with cannula cricothyroidotomy. Despite the stated advantages of cricothyroidotomy such as ease of learning, the absence of intervening tissues in the path of dissection and its safety, most emergency airway establishment is still

Fig. 5. Improvised tracheostomy tube using the conventional endotracheal tube.
achieved using tracheostomy. Cricothyroidotomy for long-term access is safe in only a highly selected population of patients, and absolute contraindications should be observed [23, 24].

All the patients reviewed in this study had an open tracheostomy, and this was performed mainly in the operating theatre with only a single case of tracheostomy performed on the dental chair. One of the predictors of a difficult airway is the Mallampati score although its predictive value when used alone is low. In this retrospective analysis, patients with Mallampati class IV accounted for the highest number of cases requiring a tracheostomy. Previous studies did not indicate the mallampati score or other scoring systems.

More elective than emergency tracheostomies were recorded in this study and this is in agreement with previous studies [15, 25]. However, other studies reported a higher incidence of emergency tracheostomies [6, 11]. The major indication for tracheostomy and the referral pattern appear to influence the type of tracheostomy performed. In our study, the main indication was anticipated preoperative difficult airway whereas it was airway obstruction in studies that reported a higher incidence of emergency tracheostomies. Furthermore, in contrast to a previous report [15], the maxillofacial surgery department in our center performs tracheostomy primarily on its patients undergoing surgery and not on patients being treated by other departments. The latter cases are handled by the otorhinolaryngology department, and this may have contributed to the lower rate of emergency tracheostomies recorded. However, emergency tracheostomy was indicated in six of the cases as a result of “can’t intubate, can’t ventilate” situation with increasing hypoxaemia. In two of these cases, emergency tracheostomy was done following accidental extubation (of the previously placed tube using fibreoptic laryngoscopy) during surgery. Attempt at reintubation using fibreoptic laryngoscope was not successful. This highlights the need for maxillofacial and other surgeons involved in head and neck surgery to be proficient in this surgical procedure and be ever ready during surgery to perform one if the need arises. Presently, proficiency in tracheostomy by surgical residents is a departmental priority in our center, and surgical residents performed 45.1% of tracheostomies reviewed in this study. Tracheostomy has been found to be a safe and simple technique for surgical residents especially if correct anatomic markers are used, and important structures are recognized and handled appropriately [10].

The major oral/maxillofacial surgical procedure performed on tracheotomised patients in this study was mandibular osteotomy, and this was commonly for TMJ ankylosis. The range of surgical procedures performed would not have been possible without tracheostomy due to our health resource-limited setting, and patient’s quality of life would have been low, or their surgical condition may have resulted in further morbidity or mortality. A number of oral and maxillofacial surgical patients who can be safely intubated using other methods other than tracheostomy in health resource-rich environments may end up being tracheotomised in health resource-limited environments. Even where facilities such as fibreoptic laryngoscope exist, the lack of skilled manpower still results in the use of tracheostomy electively.

Although standard tracheostomy tubes are available in our environment, in cases of emergency tracheostomy, these tubes may not be handy to use. The surgeon, therefore, must learn to improvise in securing a safe route for adequate ventilation. In this study, the conventional endotracheal tube was used temporarily in two of the cases and subsequently replaced with conventional tracheostomy tube later (Fig.5).

The duration of tracheostomy tube cannulation is variable and depends on objective quantitative and semi-quantitative factors such as tolerance to tube capping, cough effectiveness, age, ability to swallow, airway patency and the initial indication [26]. Tracheostomy cannulation time was poorly documented in this study (11 cases) and ranged from immediate postoperative period to 7 days postoperative period, similar to a report [9]. However, this is lower than some previous findings [11, 27], and this may be related to the fact that most of the patients in our study were tracheotomised for non-obstructive reasons and thus had no need for prolonged cannulation postoperatively. The benefits of early decannulation include early restoration of respiratory physiology, restoration of speech and swallowing and reduction in the risk of complications such as supraglottic stenosis and tracheomalacia [28]. It has been established [29] that the use of multidisciplinary tracheostomy teams involving speech pathologist, physiotherapist and nursing staff reduces the cannulation time. A multidisciplinary tracheostomy team is currently not available in our center although this is desirable since management of tracheotomised patients during the harramatic season is often challenging due to the production of a thick tenacious mucous from exposure to a dry and dusty northeasterly trade wind.

The length of hospital stay in tracheotomised patients is variable and is dependent on the timing of tracheostomy, primary pathology and availability of multidisciplinary tracheostomy team among other factors [11, 29]. In this study, the mean length of hospital stay in fourteen of the patients was 25.8 days (range = 10 -54 days). However, this length of hospital stay is not directly related to the tracheostomy procedure since the period of cannulation was low. Rather, the mean length of hospital stays observed in this study is related to factors such as delays in surgery following admission (as a result of patient and theatre logistics factors), need to care for the postoperative surgical site, and preparations for the commencement of oncological care in malignant tumor cases. Previous studies documented a mean length of hospital stay ranging from 15.5 to 56 days [11, 14, 30].

An overall complication rate of 15.6% was recorded in this retrospective study and death was the main complication. Mortality was related to severe hypoxia following failed endotracheal intubation (can’t intubate, can’t ventilate situation) and premature decannulation. The
mortality rate recorded (8.9%) is higher than findings from other studies [13, 15]. However, higher mortality rates have also been reported [11,14]. Commonly reported complications directly related to tracheostomy include surgical emphysema, chest infection, stoma infection, and granulation tissue formation [10, 11, 14, 25].

CONCLUSION

In resource-limited environments, the maxillofacial surgical team is frequently given little facility to work with and often face challenging cases. Tracheostomy offers the surgeon an opportunity to improve the quality of life of these patients who otherwise cannot be safely anaesthetized due to limited facilities or skilled manpower. This procedure in maxillofacial surgical patients appears to be directly associated with minor complications and lower cannulation time. It should form part of the surgical armamentarium of all maxillofacial surgeons in this setting.

REFERENCES:

5. Collins SR. Direct and Indirect Laryngoscopy: Equipment and Techniques. Respir Care. 2014 Jun;59(6): 850-64. [PubMed] [CrossRef]


*Please cite this article as:* Agbara R, Fomete B, Athanasius-Chukwudi O, Uchenna-Kevin O, Onyebuchi P, Idowu EA. Open tracheostomy in oral and maxillofacial surgery in a resource limited setting: the hope of whom little is given. *J of IMAB.* 2018 Jul-Sep;24(3):2142-2148. DOI: https://doi.org/10.5272/jimab.2018243.2142

Received: 15/02/2018; Published online: 03/09/2018

**Address for correspondence:**
Dr Rowland Agbara
Department of Dentistry, Faculty of Medical Sciences, University of Jos, Plateau state, Nigeria.
Phone: +2348034627811
E-mail: row_prof@yahoo.com