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Original Article

Audit of Open Pediatric Tracheostomies at the University College Hospital, Ibadan

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Abstract

Background: Tracheostomy is the creation of a communication between the trachea and the overlying skin, maintained by a tube. This is done either by an open or percutaneous technique. Anatomical and physiological variation of the paediatric trachea and adjoining structures necessitates finite skills and consistent competence in performing pediatric tracheostomies, lack of which may cause higher mortality and morbidity outcome in tracheostomies in the pediatric age group. **Objectives:** There are inadequate local data on the outcomes of pediatric tracheostomies; therefore, we conducted a local audit of pediatric tracheostomy to describe our experience. **Methods:** A retrospective study of pediatric patients who had tracheostomies from June 2011 to December 2017 was done. **Results:** Thirty-four patients were identified, all of whom had an open tracheostomy. The age range was 3 weeks to 16 years; M: F ratio was 2.4:1. Indications for surgery were obstructive (88.2%) and prolonged-assisted intubation (11.8%). Recurrent respiratory papillomatosis, retropharyngeal abscess, and foreign-body aspiration were the main obstructive causes. Three patients (8.8%) had repeat procedures, and these patients were initially discharged on tracheostomy tube and instructions were given for home care. **Conclusion:** Despite the evolving local challenges peculiar to clinical practice in developing countries, the outcome of pediatric tracheostomy in our hospital is good.

Keywords: Audit, pediatric, tracheostomy

Introduction

Tracheostomy is the creation of an iatrogenic communication between the trachea and the overlying skin, and subsequent maintenance of the stoma with a tube. The procedure may be done either by open or percutaneous technique. Tracheostomy in the pediatric age group is usually life-saving but requires finite skills and consistent competence. Pediatric tracheostomy is quite unique compared to the adult procedures owing to the anatomical and physiological variation of the trachea and adjoining structures between the children and adults. Moreover, children have delicate and pliable airway. In addition, the perioperative management of pediatric tracheostomy requires special care and skill;[1] especially since the tracheostomy procedure in the pediatric age group have higher mortality and morbidity outcome compared with the adult population.[2]

There are varying indications for pediatric tracheostomy worldwide. Hadfield highlighted prolonged ventilation due to neuromuscular or respiratory problems as the most common indication in a 9-year retrospective study of 362 cases.[3] Others indications were subglottic and tracheal stenosis, respiratory papillomatosis, caustic ingestion, and craniofacial syndromes.[3] Another study on open-bedside tracheostomy in the intensive care unit (ICU) revealed that indications were mostly laryngotracheal anomalies such as laryngeal web, subglottic stenosis, subglottic hemangioma laryngomalacia, and vocal cord paralysis (unilateral or bilateral). Others were bronchopulmonary dysplasia, Arnold Chiari syndrome, Down syndrome and craniofacial anomalies such as Robin sequence, Treacher Collins syndrome, Möbius syndrome, and Goldenhar syndrome.[4] Data from Northern Nigeria identified upper airway obstruction as the leading indication for pediatric tracheostomy.[5]

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There is a paucity of literature on the local challenges and outcomes of pediatric tracheostomy in Nigeria; there is also a lack of formal management guidelines or standard operating procedures in the management of pediatric tracheostomies in many local institutions in the country. Therefore, we decided to audit our experience to elicit common challenges, compare with data from other centers and enable a template for respective solutions and quality control.

Methods

A retrospective study was conducted from June 2011 to December 2017. Data on demography, type of tracheostomy, preoperative evaluation, consent, surgeon's cadre, route of anaesthesia, technique, outcome, and complications were extracted from the case folders of the patients managed by the ENT department alone or with other teams. There are two types of tracheostomy: open and percutaneous. The facility for the latter is not available in our centre; thus, limiting this audit only to open type of tracheostomy. Analysis of data done was with the descriptive statistics. The institutional management protocol for pediatric tracheostomy in our center includes a clinical evaluation with or without a lateral view of X-ray of the soft tissue of the neck and chest X-ray for the diagnosis. Emergency cases are often done under local anesthesia, with oxygenation via facemask, in the theater using an appropriate tracheostomy tube. Inpatient tube care and decannulation follow standard practice. Caregivers of patients who are clinically stable patients but yet to be decannulated are educated on home care; the patient is only discharged after the caregiver has satisfactorily demonstrated tracheostomy tube care.

Results

A total number of 34 pediatric tracheostomies were recorded during the study period. All the patients had open tracheostomies (100%). The age range was 3 weeks to 16 years. The predominant age groups in our study were 0–1 and 7–10 years, respectively [Table 1], male-to-female ratio was 2.4:1. Indications for surgery were mainly obstructed airway, 30 cases (88%) while prolonged assisted intubation accounted for four cases (12%) [Figure 1]. Three patients (8.8%) had the same procedure done twice – one patient had a similar indication for the repeat procedures. Two patients were initially discharged on a tracheostomy tube, and instructions were given for home care before they were subsequently successfully decannulated. The average blood loss was 10 ml. General anesthesia was administered in all cases done in the operating room (OR), whereas local anesthesia was used for two of the cases in the ICU.

Table 1: Age distribution of patients

Age range (years)	*n* (%)
0-1	11 (32.35)
2-6	7 (20.59)
7-10	11 (32.35)
11-16	5 (14.71)

Senior registrars led most of the surgeries, (64.7%), whereas the consultant surgeons led the remainder (35.3%). Four procedures (11.76%) were performed in the ICU, whereas 30 cases (88.24%) were performed in the OR. All patients with obstructive indication had surgeries in the operating theater. Recurrent respiratory papillomatosis, retropharyngeal abscess, and foreign-body aspiration [Figure 2] were the leading obstructive causes (n = 7 [23.3%], n = 6 [20%] and n = 6 [20%], respectively). Twelve patients (35.29%) had Shirley tubes compared with 11 patients (32.35%) who had Portex tracheostomy tubes. In 10 cases (29.41%), the types of tubes were not stated. An endotracheal tube was improvised for a single case all through (2.94%).

Two patients had preoperative cardiopulmonary arrests (CPA) but were fully resuscitated and discharged home after decannulation. There were only 2 cases (5.9%) of tracheostomy dependence and 1 case (2.94%) of subglottic stenosis both resulting in difficult decannulation.

There were two cases of dislodgment of tracheostomy tubes while on admission. Seven patients (20.6%) died while on admission, but the deaths were not tracheostomy-related (Diphtheria-2, sepsis with necrotizing enterocolitis, rhabdomyosarcoma, foreign-body in the bronchus, and advanced Hodgkin's Lymphoma). No incidence of tracheostomy-related death was noted.

Discussion

The pediatric age group constitutes the larger percentage of the general population of patients who had tracheostomies for different indications, in South-western, North-eastern, and North-western Nigeria.[5-8] This differs from the predominant 3rd to 5th decade reported in a 10-year study in the North-central region. The most common indication for pediatric tracheostomy in our audit was upper airway obstruction. This is comparable to other local studies in both open pediatric and adult tracheostomies.[5,7,8] However, it is contrary to findings in the Western literature: prolonged intubation has been an increasing need for tracheostomy, owing to the advent of enhanced fiber-optic intubation techniques, thus edging out tracheostomy as the first-line option of securing the airway in upper airway obstruction.[3,5]

The age range in this study is wider than previous studies in the country.[5,6] Perhaps, the reason might be due to the strength of an internationally recognized neonatal facility in our centre, which serves as a referral center for many states in South-west Nigeria.[9] The male sex is more preponderant in our audit, mirroring reports from other studies.[1,2,6,10] Adoga and Ma'an stated that higher susceptibility of males to congenital and acquired disorders might generally account for the male gender predominance in cases of pediatric tracheostomies,[5]

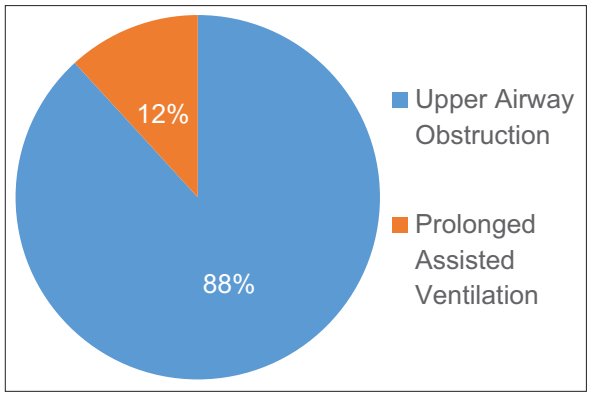

Figure 1: Indication for tracheostomy

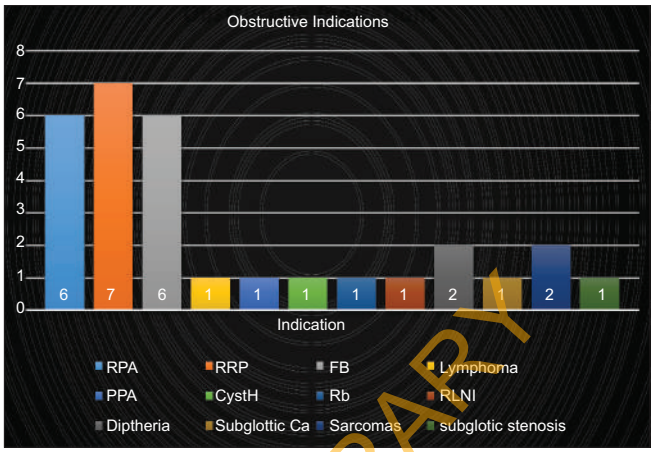

Figure 2: Causes of Upper Airway Obstruction

even though our audit had no cases of congenital anomalies. Moreover, it is believed that males are more adventurous, thus, predisposing them to aspiration of foreign bodies and subsequently a tracheostomy to secure the airway.[11,12] In a study by Shinkwin and Gibbin, 70% of the patients were <1 year of age, and 50% of the patients were younger than 3 months.[1] This preponderance for younger ages at the surgery in developed countries may be multifactorial, and this may include an earlier presentation to hospital and societal safety net such as health insurance.

The preponderance of upper airway obstruction as an indication for pediatric tracheostomy in Ibadan was similar to the studies from the two other geographical zones of Nigeria, i.e. the North-Central and South-South zones in 2010 and 2013, respectively, but markedly different from reports from developed countries such as the UK which reported prolonged ventilation as the most common surgical indication.[5,6] The most common cause of pediatric upper airway obstruction is recurrent respiratory papillomatosis; this is similar to other publications from south-western Nigeria.[5,13] This emphasizes that infectious disease still poses a significant burden of mortality and morbidity in the pediatric age group.

Our review established the safety of open tracheostomy in pediatric age group by various cadres of surgeons. The rank of surgeons performing pediatric tracheostomy did not correlate with the occurrence of complications. The senior ENT surgical trainees were apparently comfortable in performing this procedure; more than half of the procedures were done by trainees. Comparison with output from other institutions is difficult because other similar audits did not clearly identify the cadres of the surgeons who performed the procedures.[5,6,14] The inclusion of surgical cadres in audits would provide more objective leverage for comparing morbidity and mortality rates in similar studies; moreover, it may provide a yardstick for assessing the training of surgical residents. The surgical discipline in this audit was limited to ENT trainees and specialists. However, a study within the NHS, in the UK showed that apart from ENT surgeons, cardiothoracic surgeons performed 8% of the 102 open tracheostomy cases in the review.[15] In another audit, ENT surgeons with pediatric otolaryngology fellowship performed the procedures;[4] however, none of the surgeons in this audit were exclusively trained as pediatric otolaryngology fellows – and there was no apparent negative impact on the morbidity or mortality outcomes.

There were two instances of preoperative CPA: the first patient had earlier been reviewed and scheduled for emergency tracheostomy at the children emergency room but had a delay in transfer to the OR. The patient had a CPA in the OR, probably due to the delay. The second patient was a case of para-pharyngeal abscess planned for drainage but had failed intubation twice and subsequently had a CPA secondary to laryngospasm necessitating an emergency tracheostomy. Resuscitation was successful in both cases without any documented sequela.

Difficult decannulation could be devastating to parents and caregivers due to the additional financial burden of prolonged hospital admission. There were three cases of difficult de-cannulation, one was discharged home with the tracheostomy tube before he was successfully de-cannulated at a subsequent visit. Another patient had a surgical decannulation in the OR, while the third patient was weaned off by downsizing the tracheostomy tube after spending up to a month on admission (the patients' parents had declined the offer for surgical de-cannulation). Verbal instructions and demonstrations of how to take care of the tracheostomy tube were provided for caregivers before the discharge. Although no complication ensued, this approach cannot be adopted as a standard modus operandi for home care.[16] There has been advocacy for standardized quality control and local guidelines for tracheostomy care which include organized home nursing care.[17]

The two intraoperative complications in our audit were cardiopulmonary arrests which were likely due to delay before the commencement of surgery. However, audits from Jos and Benin did not record similar intraoperative complications.[5,6] Moreover, the most common postoperative complication in our audit was difficult decannulation owing to dependence

and supra-stoma stenosis from granulation tissue, while tube obstruction was the most common in studies by Adoga and Ma'an, Onyeagwara and Emokpaire, and Onotai and Esawo[5,6,18] – comparable to a foreign retrospective study in Canada.[19] Our mortality profile was similar to that of Adoga and Ma'an[5] as no tracheostomy-related death was recorded, whereas, one mortality was reported in Benin.[6] The morbidities seen in this audit included inadvertent injury to the left recurrent laryngeal nerve in a patient with tracheoesophageal fistula repair and subglottic stenosis following a difficult removal of a spherical laryngeal foreign body, whereas other complications reported in similar local studies were emphysema[5,6] and tracheal stenosis.[6] Saadia *et al.,* in an open neonatal tracheostomy study in India, reported peri-stoma necrotizing fasciitis and sepsis and tracheocutaneous fistula.[20] Life-threatening complications are most likely during emergency surgeries for both pediatric and adult procedures compared to elective tracheostomies,[5,6,8,21] for example, the intraoperative complications seen in our audit occurred during an emergency scenario.[6]

Challenges are often rife in health-care delivery in low-resource settings, and these are often based on financial constraints owing to the high rate of poverty. More than half of the emergency pediatric tracheostomies were done with a consideration for deferment of surgical fees though the range of prices of tracheostomy tubes over the 6-year duration is 7.5–21 USD. The cost of the tracheostomy tube may be prohibitive in an environment where the majority of the patients live on <1 USD per day–coupled with the relative scarcity of pediatric size tracheostomy tubes the managing physicians had to be creative multiple times to manage patients. Portex endotracheal tube had been creatively fashioned to serve the purpose of a tracheostomy tube when there was no available appropriate tracheostomy tube size, this creative approach to problem-solving has also been documented in other audits.[20] Delays in offering medical care have also been encountered due to cultural constraints. Surgical consent is often given by the fathers, and there is a customary restraint on the independence of mothers in making a health-related decision. In situations where mothers brought the patient to the hospital, delays are often encountered in waiting for the arrival of the father.

Identifying local predictive risks variables are also essential. Systemic morbidity is a single but most important factor that governs mortality. Beyond relieving airway obstruction, diphtheria toxins, sepsis, and disease progression in cancer cases (rhabdomyosarcoma and lymphoma) led to non-tracheostomy related death inevitably. Neonatal age, cardiac risk factors, and intraventricular hemorrhage were described as independent risks associated with a higher likelihood of major complications as outcomes in a multicenter study in the US.[22] Thus, extending this audit of open pediatric tracheostomy to multiple hospitals in the country would be required to further substantiate our findings.

The total cost of care for each individual would have been an important component of this audit, but there was no documented information on the entire expenses. The expenses include procedure, tracheostomy tube, admission, drugs, and miscellaneous. Similarly, data on the mean operative time could not be ascertained for both the procedure in the OR and ICU. This limitation of retrospective study has been highlighted in similar studies.[15]

Conclusion and Recommendations

In spite of the delicate nature of pediatric tracheostomy management, successful outcomes of the procedure can be easily ensured even in the hands of the experienced trainees. Regular nation-wide audits are required to formulate the safety policies and operational guidelines in handling common and peculiar challenges to health-care practice in Africa.

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Conflicts of interest

There are no conflicts of interest.

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