



Upper Airway Obstruction among the Paediatric Population in the University of Port Harcourt Teaching Hospital: The Place of Tracheostomy in the Management

M. U. Ibekwe^{1*} and Paul Ni²

¹Department of Ear Nose and Throat Surgery, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria.

²Department of Paediatrics, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria.

Authors' contributions

This work was carried out in collaboration between both authors. Author MUI designed the study, performed the statistical analysis, literature search, wrote the protocol and wrote the first draft of the manuscript. Author PN managed the analyses of the study. Both authors read and approved the final manuscript.

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ABSTRACT

Background: The paediatric age group has very peculiar anatomic and physiologic airways therefore, obstruction which commonly occurs in this population, can pose serious challenges in this age group.

Aim: To study the pattern and aetiology of acute upper airway obstruction in the paediatric age group in University of Port Harcourt teaching hospital and to determine the place of tracheostomy in the management.

Patients and Methods: It is a descriptive hospital based study of all paediatric patients; aged 0-15 years with upper airway obstruction that presented to the ear, nose and throat department and the children emergency ward of university of Port Harcourt teaching hospital within the period of

*Corresponding author: Email: ibekwe_uju@yahoo.com;

January 2014 to December 2019. Data on demographics, clinical presentations, causes and management were obtained using a Proforma. The diagnosis of upper airway obstruction is made in a child with any degree of respiratory difficulty with or without associated stridor or stertor arising from lesions above the thoracic inlet. Children with respiratory difficulty other than that from an upper airway obstruction were excluded from the study.

Data obtained were analyzed with the IBM statistical package for social sciences SPSS version 20. Results were presented in simple descriptive forms with tables.

Results: One hundred and sixty paediatric patients with upper airway obstruction with age ranging from 0-15 years were studied. The prevalence of upper airway obstruction was 1.87%. There were more males than females; male to female ratio was 1.2:1. Age group 4-7 years were the most affected, 43.75%. Foreign body aspiration was the commonest cause. Majority of the patients had tracheostomy done, 48.75%. Mortality was n=1(0.625%).

Conclusion: Upper airway obstruction among the paediatric age group is still common with foreign body aspiration as a very important cause in our setting. The very young are the most affected and tracheostomy appears to still be the main option of securing airway in these cases in our environment.

Keywords: Upper airway obstruction; paediatric; tracheostomy; foreign body.

1. INTRODUCTION

Upper airway obstruction is defined as blockage of any portion of the airway above the thoracic inlet [1]. It is a common and serious problem in children who often will present with acute respiratory distress associated with stridor, apnoea or even pulmonary oedema [1]. In these children, stridor, restlessness, cyanosis, confusion, suprasternal retractions, intercostal and subcostal recessions, change in voice are common clinical signs seen [2].

It often presents as acute but can become chronic and insidious in which case it will now be seen as repeated chest infections with obstructive sleep apnoea. This may eventually lead to poor growth in the child and chronic respiratory failure among other things [3]. It is known that the peculiar anatomy and physiology of the paediatric airway tend to make them susceptible to this obstruction [3]. The characteristic finding in upper airway obstruction is stridor which may be inspiratory, expiratory or biphasic. Stridor results from the turbulence of airflow as a result of narrowing from collapse of the airways due to the intraluminal pressure becoming negative at inspiration [3]. It is important to note the type or phase of stridor since this can help in delineating the location of the obstruction. Inspiratory obstruction signifies a lesion in the extra thoracic region while expiratory means an intra thoracic lesion and lesions fixed or at the glottis gives a biphasic stridor [4].

In majority of the cases, the main requirement is a careful evaluation of the degree of obstruction

since they often are such that may require emergency measures and may not leave room for prior investigations or precise diagnosis hence securing and maintaining an airway is often of utmost importance [3]. A correct diagnosis can often be made from the history and physical examination, importantly, the child's clinical appearance is the most reliable indicator of the severity of the obstruction, and measurable signs are of less value [5]. The key signs in determining the cause and site of obstruction in these children are; the onset, presence of fever, character of stridor, retractions and the voice [1]. This is because the clinical presentation of these children is dependent on the degree and location of the obstruction [6].

Acute upper airway obstruction can be caused by foreign body aspiration, viral or bacterial infections, anaphylaxis, burns, trauma and tumors. Obstruction could initially be stable and partial but can rapidly get worse and develop into a life threatening emergency in these children [3]. Even though acute infectious causes such as viral croup are commonly implicated in upper airway obstruction [1], it is known that one third of children with upper airway obstruction can be from foreign body lodged in their airway [7]. The incidence of foreign body aspiration is known to be higher in children age less than 4 years [8].

In children, upper airway obstruction often occurs as a medical emergency which requires immediate evaluation and institution of effective therapy at the same time so that adequate ventilation and oxygenation can be maintained which in addition, will prevent complications and

fatality [3]. The first step in the management of the paediatric airway problems is to understand the difference between adult airway and that of the infant. In children, a small reduction in the caliber of their small airways can bring about dangerous obstruction to airflow as described by Poiseuille's law; resistance to flow is inversely proportional to the radius of the lumen to the fourth power therefore, allowing for small amounts of inflammation to cause significant obstruction [3]. First line of management therefore is to assess the severity of the obstruction, then resuscitative therapy. This would include oxygen and emergency airway, then treatments directed at the specific underlying cause. In order to arrive at specific diagnosis and effect treatment, once these patients are stabilized investigations such as plain radiographs of the chest, soft tissue of the neck, post nasal space including computerized tomograms could be done in some cases.

Emergency airway provision could include endotracheal intubation, cricothyroidotomy, percutaneous tracheostomy and tracheostomy. Tracheostomy while still a standard surgical procedure in the management of the airway, the improvement in endotracheal intubation and the introduction of percutaneous tracheostomy may have affected the decision and performance of this procedure [9,10,11]. There has been a change in the recent times, in the indications for tracheostomy [9,11]. There is a change in trend from previous infectious and inflammatory indications to more of trauma and prolonged intubation probable due to a more proficient use of antibiotics and improvement in available medical technology and care [9,10,11]. In our environment, tracheostomy in the management of upper airway obstruction still has high prevalence [12,13]. It still occupies an important position in the cadre of emergency airway management especially in the paediatric age group where the slightest assault on the airway could lead to a complete obstruction and delay in relief, to sudden cardiac arrests. It is known that conditions resulting in severe upper airway obstruction are the commonest causes of cardiac arrest in this age group [3]. This work is to study upper airway obstruction; pattern, causes and prevalence among the paediatric age group and the determine the place of tracheostomy in their management in university of Port Harcourt teaching hospital.

2. METHODS

It is a descriptive hospital based study of all paediatric patients; aged 0-15 years with upper airway obstruction that presented to the ear, nose and throat department and the children emergency ward of university of Port Harcourt teaching hospital within the period of January 2014 to December 2019. Data on demographics, clinical presentations, causes and management were obtained using a Proforma. The diagnosis of upper airway obstruction is made in a child with any degree of respiratory difficulty with or without associated stridor or stertor arising from lesions above the thoracic inlet. Children with respiratory difficulty other than that from an upper airway obstruction were excluded from the study. Informed consent were obtained from parents/guardians and ethical clearance sought and obtained from the hospital ethical committee.

Data obtained were analyzed with the IBM statistical package for social sciences SPSS version 20. Results were presented in simple descriptive forms with tables.

3. RESULTS

Total number of patients with upper airway obstruction within the period under study was 280 out of which 160 were children hence the study population comprised of these 160 paediatric patients. Therefore the prevalence of upper airway obstruction in the paediatric age group among those with upper airway obstruction is 57.14%. However the prevalence among all the 8560 patients seen within the study period was 1.87%. There were 87 males and 73 females with a male to female ratio of 1.2:1. The age group 4-7 is the highest affected comprising n=70, 43.75% of the population studied. This is closely followed by age 8-11 with 28.12% (Table 1).

Table 1. Age distribution of patients with obstruction

Age group(years)	Frequency	Percentage %
0-3	30	18.75
4-7	70	43.75
8-11	45	28.12
12-15	15	9.37
Total	160	100

Table 2. Causes of upper airway obstruction

Causes	Frequency	Percentage %
Foreign body aspiration(into the larynx)	80	50.0
Foreign body ingestion(cricopharyngeal region)	5	3.13
Neoplasia		
- Oropharyngeal mass	-2}	4
- Cervical mass	-2}	2.50
Retropharyngeal abscess	6	3.75
Trauma to the neck	2	1.25
Obstructive adenotonsillar hypertrophy	50	31.25
Acute exudative tonsillitis	4	2.50
Croup	3	1.87
Laryngomalacia	5	3.12
Envenomation with laryngospasm	1	0.62
Total	160	100

Table 3. Management options

Treatment	Frequency	Percentage %
Intubation and ventilation	3	1.87
Tracheostomy	78	48.75
Laryngoscopy & foreign body removal	80	50.0
Oesophagoscopy & foreign body removal	5	3.12
Abscess drainage	6	3.75
Tumor excision	4	2.50
Medical therapy	25	15.62
Adenotonsillectomy	35	21.87
Surgical repair of neck trauma	1	0.62

**Multiple treatment options apply
Mortality n=1, 0.625%*

The commonest condition associated with upper airway obstruction from this study is foreign body aspiration seen in 50.0% of the patients followed by obstructive hypertrophy of the tonsils and adenoids in 31.25%. Infective causes were seen in 4.38% with croup and acute exudative tonsillitis while inflammatory process was in 3.75% as retropharyngeal abscess (Table 2).

Majority of the patients had laryngoscopy done for foreign body removal; 50.0% while 48.75% also had tracheostomy while conservative medical therapy was done in 15.62%. Adenotonsillectomy was carried out in 21.87% of the cases. In some of the cases, the treatment options overlap some had more than one modality of treatment. One child out of the three with croup was intubated and ventilated, was moved to the intensive care unit but later died. It represents the only mortality in this study (Table 3).

4. DISCUSSION

The study involved 160 patients out of a total number of 8560 patients seen within the study

period giving a prevalence of 1.87%. In an earlier similar study in 2001, Chan et al found a prevalence of 3.3% [14]. This difference may stem from patient selection because they studied mainly patients requiring intensive care. There was a male preponderance which is similar to the finding by Ogunleye et al. in an earlier study in Ibadan [15]. The general explanation being that the male child is more adventurous and robust therefore more likely to be affected by the common things causing the obstruction such as foreign body inhalation. The age group 4-7 years were the age most affected with 43.75% while some researchers found age 0-5 years more affected [16,12]. It is of note that majority of the patients in the present study belong to the age 0-7 years, 62.50%.

The commonest cause of obstruction of the paediatric airway seen in this study was foreign body aspiration. Foreign body in the larynx accounted for 50.0% of all the obstructions, therefore it is the commonest cause similar to the finding of Eziyi et al. [10] While Adoga et al and Oguleye et al found respiratory papilloma as the commonest cause in an earlier study, [11,15]

some other studies had viral croup as the commonest cause [3,17]. In the paediatric age group, viral croup is well documented as a very common cause of upper airway obstruction. In the united states of America the incidence was given as 60 per 1,000 children between ages 1-2 years [18]. This was before the introduction of vaccination against *Haemophilus influenzae* and *Corynebacterium diphtheria* [19]. Infective causes in the present study accounted for only 8.13% of the upper airway obstruction in these children. In contrast, Amusa et al. in an earlier study, had 29.5% which was very high [9] while Eziyi et al. in a study 7 years later, had a lower prevalence of 1.9% [10].

It was also found that some of the children with ingested foreign body that lodged at the upper oesophagus, especially at the cricopharyngeal region presented with upper airway obstruction. This is likely due to the anatomic peculiarity of the paediatric airway and the oesophagus such that at this region, the foreign body can mechanically narrow the airway even though it is not inside the airway hence causing respiratory obstruction. Obstructive hypertrophy of the adenoids and tonsils was also found to be a significant cause of obstruction in the present study which was not commonly found in other studies. These were treated with surgery (Adenotonsillectomy) mainly. There was an interesting case of envenomation in a child that had insect bite that resulted in laryngospasm as part of the anaphylactic reaction and was one of the patients treated with intubation and ventilation as well as corticosteroids.

The treatment of these patients is dependent on the cause, site and the degree of the obstruction as well as the mode of presentation of the patient. Often times the management overlaps. The children with infective causes such as croup were managed with nebulized and parenteral corticosteroids, adrenaline as well as humidification, similar to that done in other works [20,21] Croup treatment has so improved that it is managed in the paediatric unit and has reduced referrals to the ear, nose and throat unit [22]. However one of such patients was managed in the intensive care unit (ICU) because the child needed ventilation due to severity of the obstruction though this same patient later died. It is known that severe upper airway obstruction can be a reason for paediatric ICU admission. It accounts for 3.3% of such admissions [14]. Conservative medical therapy which included

antibiotics, corticosteroids, decongestants, vitamins was employed in some of these patients. The commonest surgical management was endoscopy; laryngoscopy and oesophagoscopy with removal of foreign body both from the larynx and oesophagus. This is because the commonest condition was foreign body aspiration. The prevalence of tracheostomy in this study was 48.75%, they were all done as emergency tracheostomy and were temporary, lasting for 8 to 14 days. Most of the patients were decannulated successfully without any sequelae. Majority of the patients with foreign body aspiration had tracheostomy done to secure their airway prior to endoscopic removal. The reasons for this stems from the fact that in our setting the patients often present late after spending time seeking for medical help from the unqualified. Majority has to pay for their hospital management from out of pocket for lack of health insurance. Therefore by the time of presentation, they already may have developed inflammations, infections and laryngeal oedema therefore making attempts at removal of the foreign bodies without first securing an alternative airway very dangerous. In addition, unavailability of required facilities such as ventilators, venture system that would have enhanced use of scopes with oxygen being delivered at the same time and lack of proper paediatric intensive care unit makes tracheostomy the only feasible option in the management of this condition in our setting. Therefore prevalence of 48.75% of tracheostomy in this condition appears high compared to the less than 3% obtainable in other climes [23] however a study in North western Tanzania, had a prevalence of 13.3% done for foreign body aspiration [22]. While in a study by Fasunla et al although it was on laryngeal papillomatosis only, the prevalence of tracheostomy was 90% [24]. In the present study, there was no record of laryngeal papilloma as a cause of airway obstruction. Owing to the changing trend in the management of most causes of upper airway obstruction, tracheostomy indications appear to have changed [25]. While from the present study it occupied an important position in the management of foreign body in the paediatric age, in the finding of some other researchers, it was employed most often in conditions such as prolonged ventilation, trauma and some congenital anomalies [10,11,26]. In the united states of America, more than 4,800 paediatric tracheostomies are performed annually with about 33% of it on infants but mainly due to indications such as respiratory failures and need for prolonged ventilation [27].

Tracheostomy therefore to a large extent still has a place in the management of upper airway obstruction in the paediatric age group in our environment however the trend appear to have changed in the more developed settings. It's incidence in the paediatric population is still high but not for upper airway obstruction but more for improved ventilation especially in neonates and infants [26,27]. The mortality rate experienced in this study was 0.625% which means that there was a good treatment outcome for most of the patients.

Tracheostomy is still a very valuable procedure in the management of paediatric upper airway obstruction. Therefore prompt referral of these patients to centers where immediate access to proper treatment could be instituted is of utmost importance so as to avoid preventable mortality.

5. LIMITATIONS

The sample size studied maybe inadequate to make conclusions that should affect the general population. It was also done from a single center that caters mainly for the urban area therefore may not be a complete picture of the entire region.

6. CONCLUSION

Upper airway obstruction among the paediatric population is still common and the commonest cause in our setting is foreign body aspiration. Tracheostomy remains a relevant mode of treatment of this condition in our environment. There is however need for provision of adequate facilities such as ventilators, good paediatric bronchoscopes etc especially for a more optimal management of these cases.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICAL APPROVAL

Informed consent were obtained from parents/guardians and ethical clearance

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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