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Case report

Vagal reflex stimulation complicating retrieval of an unusual foreign body from the laryngotracheal lumen: Case report



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Abstract Foreign body impaction in the aero digestive tract is a life-threatening emergency, particularly in the paediatric age group. Removal under general anaesthesia poses both surgical and anaesthetic challenges and this may rarely result in mortality. We report a case of a 4 year old boy with an unusual foreign body (FB) impacted in the laryngotracheal causing difficult intubation and precluding tracheostomy with attendant vasovagal reflex stimulation and cardiac arrest. Clinical presentation and radiological evaluation of the patient were highlighted with a review of pertinent literature. We conclude that dis-impacting a foreign body in the trachea could potentiate bradycardia and cardiac arrest; co-existing hypercarbia and/or sepsis increase the risk and worsen the prognosis.

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1. Introduction

Foreign body aspiration is a common cause of accidental death in the paediatric age group worldwide; the under-five age group are the most at risk [1,2]. It often presents as an emergency, necessitating prompt surgical intervention. However, in most cases the event leading to aspiration or ingestion of FB by the child is not witnessed by adult [2,3]. Hence,

diagnosis is delayed with higher risk of complications and fatality. In the united state, foreign body in the aero digestive tract is the sixth most common cause of accidental death; accounting for 500–3000 paediatric mortality per year [4]. Majority of such death occur before getting to the hospital due to poor awareness among caregivers and delayed diagnosis [1,2]. Retrieval under general anaesthesia could also be fraught with surgical or anaesthetic complications with resultant morbidity and mortality.

2. Case report

A previously well four-year-old boy was referred from a rural health centre in the North-Central Nigeria; 432 km away from

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the tertiary health service in the city of Ilorin. He presented with eleven day history of accidental aspiration of a FB. He was said to have been playing alone under a tree in the farm when he suddenly developed respiratory distress. He later developed associated restlessness, pain distress with low cry, inability to sleep, and difficulty in breathing and swallowing. No associated cough, chest pain, haemoptysis or haematemesis, and no cyanosis were found. There was no event of FB ingestion witnessed by any member of the family until radiological investigation revealed a radiopaque object in the airway (Figs. 1 and 2). Patient was subsequently transferred to our tertiary referral unit for further management as no attempt at removal could be made at the rural health centre and several other peripheral hospital attended (over eleven days) due to lack of necessary equipment and specialist manpower.

At presentation at our emergency unit (eleven days later), child was found to be acutely ill looking, in severe respiratory distress with stridorous breathing; he appeared extremely weak and dehydrated. He was mildly pale, anicteric and a cyanosed. Pulse rate was 125 bpm, respiratory rate was 34 cpm, Blood pressure was 90/60 mmHg and arterial oxygen saturation (SpO₂) was 90%. There was demonstrable tenderness on the anterior neck region but no swelling. Auscultation of the chest revealed a reduced air entry with bronchial breath sounds.

Further review of the X-ray soft tissue neck revealed a radio opaque shadow of a bent nail lying obliquely across the sub-glottic region and the upper tracheal rings; the sharp end of the nail lies at the level of the 2nd cervical vertebral and the head at the level of the 6th cervical vertebral. There was no significant widening of the prevertebral shadow. Patient was consequently prepared for emergency direct laryngoscopy and foreign body removal.

Intubation was practically impossible as the foreign body blocked the laryngotracheal lumen. Although anaesthesia via tracheostomy tube had been planned in anticipation of difficult intubation, this was not possible because the tracheostomy tube could not be inserted into the tracheal lumen as the incision line fell directly on the foreign body (nail), which was wedged and impacted within the tracheal lumen. The FB was visible through the anterior tracheal incision and a slight retraction of the incision edges allowed insinuation of a forceps to grasp the nail. However, further attempt at dis-impacting the nail and delivering it out through the tracheal incision provoked bradycardia from vasovagal reflex leading to



Figure 1 X-ray soft tissue neck, lateral view; showing a bent nail impacted in the laryngotracheal.



Figure 2 X-ray soft tissue neck, antero-posterior view; showing a bent nail impacted in the trachea.

intraoperative cardiac arrest. The patient was resuscitated with return of spontaneous cardiac activity within four minutes of the arrest. Ventilation was continued through a face mask while a size 8 naso-gastric tube was adapted in place of a tracheostomy tube. The naso-gastric tube was threaded into the tracheal lumen through the tracheal incision negotiating the narrow spaces beside the impacted foreign body. The tube was then connected to the anaesthesia machine via an Ayre's T-piece breathing circuit using an empty 5 ml syringe with the plunger removed and the flange cutoff as an adaptor (Fig. 3). This enabled us to provide sufficient intermittent positive pressure ventilation to maintain SpO₂ above 96%. With the patient paralysed at an adequate depth of anaesthesia, direct laryngoscopy was performed. The impacted, rusted bent-nail was then gently dis-impacted and removed using a grasping forceps. However, the patient had a repeat cardiac arrest before the end of the procedure necessitating another episode of cardiopulmonary resuscitation. There was return of spontaneous cardiac activity but the patient did not regain consciousness and spontaneous ventilation did not resume despite reversal of neuromuscular blockade. The patient was transferred to the ICU where mechanical ventilation was commenced. However, there was another cardiac arrest within four hours of ICU admission from which the patient could not be resuscitated and was subsequently certified dead. While oxygenation was relatively maintained, hypercarbia could not be ruled out as a contributing factor to repeated intra-operative cardiac arrests, as carbon dioxide monitoring was not done because it was not available at our centre at that time.

3. Discussion

Our patient belongs to under-five age group, which is known for high risk of foreign body in the Ear, Nose and throat region because of their curiosity and habitual exploration of body orifices with objects. Although commonly aspirated objects are coins, fish bone, toy parts, pins and needles [2,5], our patient aspirated an unusually bent rusted 6-inches nail which size and shape one would ordinarily consider impossible for a 4 year old infant to swallow or aspirate. Cobanoglu et al. demonstrated that any object held with the lips could be propelled into the airway by coughing, taking a deep breath, laughing or speaking [6].



Figure 3 Ayre's T-piece with syringe adaptor.

There was no report of choking or any important historical clue that could have led to early diagnosis of FB ingestion or aspiration by this patient. Louie et al. observed that up to 40% of cases of foreign body ingestion or aspiration in infants and toddlers are not witnessed by parent or any adult [3].

Presentation at a specialist care was on the 11th day after the aspiration. This may be explained partly by the general late hospital presentation habit of rural people in Nigeria; as traditional healers and religion houses are usually the first point of call. Poverty and poor access to specialist healthcare are other identified factors responsible for this attitude. More so, Otolaryngology manpower is scarce in Nigeria and full otolaryngological service is available only in a few of the existing public hospitals in the country. This patient had to travel a long distance to get to the specialist ENT care. Besides, he was operated on a bill deferment protocol, as parents could not afford cost of treatment. Recent report on National Health Insurance Scheme (NHIS) in Nigeria showed that only 4 million out of the 160 million Nigerian population have been enrolled and 75% of those omitted belong to the informal sector and rural areas including the remote village where this patient resides [7].

FB aspirated by the patient was a rusted nail picked from the soil (Fig. 4). Hence, infection from tetanus or other organisms were other likely risks patient was exposed to in addition to dehydration, electrolyte derangement occasioned by the prolonged anorexia and pain. It is therefore not surprising that patient had features of infection at presentation. This perhaps also contributed to the fatal outcome of the illness.

Reflex bradycardia and cardiac arrest may be the result of a vagal reflex, which can occur during a variety of surgical procedures [8]. Vagus nerve has a parasympathetic inhibitory action on the contraction and excitability of the heart. Hence, overstimulation of the vagus nerve could lead to intense inhibition and cessation of cardiac activity [8,9]. The index case developed cardiac arrest as a result of a vagal reflex stimulation that was potentiated by removal of an impacted, rusted-nail in the trachea during general anaesthesia. Although, the patient was initially resuscitated with return of spontaneous cardiac activity, repeated arrests could not be prevented. While oxygenation was relatively maintained, hypercarbia could not



Figure 4 A rusted bent concrete nail retrieved from patient's trachea.

be ruled out as a contributing factor to repeated intraoperative cardiac arrests, as carbon dioxide monitoring was not done because it was not available at our centre at that time.

In a forensic study of the mechanism of unexpected death in infants and young children, Rogers [10] identified airway obstruction and vagal stimulation as the two main common-pathways to fatal asphyxia and apnoea/arrhythmias respectively in the mechanism of sudden death resulting from impacted FB in the oesophagus, larynx, trachea or bronchia tree [11]. The FB in our case was big enough to cause a near-total obstruction of the laryngotracheal airway. Patient had stridorous breathing, even though there was no cyanosis at presentation. The bent shape and the oblique lie of the FB in the laryngo-trachea lumen constituted a sustained stretch on the wall thus predisposing to reflex vagal stimulation.

Presence of the rusted nail in the tracheal lumen for eleven days is a high risk of ferrous oxide aspiration with attendant toxicity. Such a noxious fluid in contact with the chemosensitive laryngotracheal mucosa surface could have also precipitated in vagal reflex stimulation [11]. Previous studies have reported lethal effect of heavy metal poisoning and severe organ damage in human and other mammals occurring within hours of aspiration or inhalation of metallic objects or nanoparticles [11–13].

Patient disease condition was the most significant cause of cardiac arrest and death during anaesthesia and postanaesthesia care while, emergency surgery and general anaesthesia were identified major risk factors [9]. Similarly, Rouillon et al. reported fatal outcome in 13 out of 28 paediatric cases of FB inhalation requiring treatment in Intensive Care Units. Penetration syndrome was the identified cause of asphyxia, cardio-respiratory arrest and finally death, regardless of the initial treatment [14]. Cause of death in our patient therefore, may be vasovagal reflex precipitated by multiple risk factors.

Rigid endoscopic procedure under general anaesthesia remains the ideal method of removing FB from the airway, and the choice between spontaneous or controlled breathing and the type of drug used is still the subject of debate [15]. Furthermore, induction and maintenance of anaesthesia during endoscopic procedures are commonly performed by intravenous or volatile drugs associated with topical airway lidocaine under spontaneous breathing [16]. Topical airway lidocaine spray of the laryngotracheal lumen before endoscopy was not a routine practice in our centre before this experience.

4. Conclusion

Retrieval of an impacted laryngo-trachea FB under general anaesthesia could rarely be complicated by vasovagal reflex stimulation leading to cardiac arrest and subsequent mortality. Delayed presentation, sepsis and hypercarbia constitute added risk factors. And intraluminal lignocaine spray prior to disimpacting any FB in the laryngo-trachea lumen could be of value in minimizing the risk of overstimulating vasovagal reflex and the resultant cardiac arrest.

While creation awareness on prevention of FB aspiration by all age groups remains the best approach, high index of suspicion, early diagnosis and prompt surgical intervention are critical factors to good treatment outcome.

Conflict of interest

None declared.

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