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MANAGEMENT OF TRACHEO-BRONCHIAL FOREIGN BODIES IN CHILDREN

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ABSTRACT

Objectives: To review alternative surgical and anaesthetic options in the management of foreign bodies lodged in the tracheobronchial tree in children aged below 10 years.

Design: A five year retrospective secondary data analysis.

Setting: Three hospitals based in Eldoret Municipality, Kenya.

Main outcome measures: Outcome variables included morbidity and mortality.

Results: Of the thirty two children studied, 74.1% had bronchoscopy and 25.9% thoracotomy. The overall mortality rate was 3.3%.

Conclusion: Foreign bodies in the tracheo-bronchial tree are a major cause of morbidity and mortality in children aged below 10 years. In settings where appropriate equipment is inadequate, timely thoracotomy may be life saving.

INTRODUCTION

Foreign body aspiration occurs frequently in children who usually present with a history of cough, wheezing and fever. Though in most cases there is a definite history of aspiration, it must be considered in patients with chest infection even without a positive history. To avoid complications, it is important that this condition is treated as early as possible even when it is not life threatening(1).

General anaesthesia for thoracic diagnostic and therapeutic procedures can be very challenging because not only does the airway have to be shared with the surgeon but often with the instruments being used. In cases of thoracotomy the challenges become even greater due to the fact that the very organ of gas exchange is the target of surgery. In both situations a compromise must be reached so that surgery is undertaken while ensuring adequate oxygenation.

MATERIALS AND METHODS

An analysis of medical records of all children under 10 years of age treated for tracheo-bronchial foreign body aspiration at the Moi Teaching and Referral Hospital, Uasin Gishu Memorial Hospital and Eldoret Hospital between June 1992 - June 1997 was done. Tracheo-bronchial foreign body was defined as any solid object aspirated below the level of the vocal cords. Children with aspiration of regurgitated gastric contents were excluded from this study. Thirty two such children met this criterion. Age, sex, clinical symptoms, investigations, type of surgery done, anaesthesia given, nature of aspirated foreign body and site of its lodgement were analysed.

All patients were premedicated with 0.02mg kg⁻¹ of atropine sulphate intramuscularly. An induction dose of 0.5mg kg⁻¹ of either midazolam or diazepam was given

intravenously depending on availability(2). The patient was then allowed to breathe a MAC EL₅₀ (1.3%) concentration of halothane vapourized in a nitrous oxide/oxygen mixture with an inspired oxygen fraction of 0.4(3). MAC EL₅₀(1.3%) is the minimum alveolar concentration needed by 50% of the population to permit laryngoscopy, easy visualization of the glottis, relaxation of the vocal cords, absence of extremity movement and absence of bucking after tracheal intubation. Using an aerosol spray of 4% lignocaine with a long dispenser, the oropharynx was first sprayed and then the progressive instillation of the drug on valleculae, the epiplottis and the adducted vocal cords. Suxamethonium chloride 1mg kg⁻¹ IV was then given and the patient artificially ventilated when apnoea was established.

A rigid bronchoscope was introduced when the correct size was available. Intermittent positive pressure ventilation was instituted through an appropriately sized cuffed endotracheal tube made to fit the bronchoscope viewing port when (peripheral arterial haemoglobin oxygen saturation) dropped to less than 85%. The anaesthetic gas mixtures were delivered by the Ohmeda Excell 210E anaesthesia system or similar equipment. During the procedure SpO₂, non-invasive blood pressure and heart rate were continuously measured.

In cases where the foreign body could not be removed through bronchoscopy, the patient was intubated with a cuffed endotracheal tube with 0.08mg kg⁻¹ of pancuronium bromide intravenously providing the neuromuscular blockade, and with the patient in a left or right lateral position, thoracotomy was carried out.

RESULTS

Thirty two children with foreign bodies in the tracheo-bronchial tree were evaluated. Diagnosis was based mainly on history and physical findings. Most of the patients had chest signs. Less than half of the patients had been taken chest X-rays but the foreign body did not show at all, except in one case in which

the foreign body was radio-opaque. No laboratory investigations were done before surgery since all of these were treated as emergencies.

Most of the patients were under two years of age and ranged between six months and eight years. They had inadvertently inhaled either leguminous seed or maize grain. Other objects were also encountered in this study.

Table 1

Distribution by age

Age Group (Yrs)	No.	(%)
0 - <2	21	67.70
2 - <4	6	19.40
4 - <6	2	6.45
6 - <8	2	6.45
8 - <10	1	0
Total	32	100

Table 2

Types of foreign bodies aspired

Type	No.	%
Beans, Nuts, Maize and other seeds	28	87.1
Plastic	2	6.5
Piece of cypress leaf	1	3.2
Nail (metal)	1	3.2
Total	32	100

They presented on admission in very poor condition (American Society of Anaesthesiologists (ASA) class 3-5) with varying degrees of haemoglobin oxygen desaturations. There were eighteen males (56.1%) and fourteen females (43.9%) in the study. The treatment options employed were bronchoscopy in twenty three cases (74.2%), bronchoscopy and thoracotomy two cases (6.4%) and thoracotomy alone in seven cases (19.4%).

The site where the foreign bodies lodged in the bronchi was also documented. The majority of the foreign bodies lodged in the right bronchus, which were seventeen (53.12%), left bronchus had eight (25%) and the tracheal seven (21.88%). This shows that the majority of the foreign bodies lodged in the right bronchus more than in the left bronchus in the ratio of 2.125:1.

The results show that the mortality in this series was only one case (3.3%). This probably could have been higher had thoracotomy not been employed in cases where bronchoscopy had failed. The most common foreign bodies retrieved from the tracheo-bronchial tree

were mainly leguminous seeds or maize seeds, which were twenty-eight (87.1%), plastic pieces two (6.5%), one piece of cypress leaf (3.2%) and one two inch metallic nail (3.2%), (Table 2). The high incidence of leguminous seeds is because most of these seeds are very common in the households in the area of the study.

DISCUSSION

Aspiration of foreign bodies in the tracheo-bronchial tree is life threatening and may lead to severe lung damage if not promptly attended to(4-6). This is a common condition in children between 1-3 years(7) and is usually followed by bronchial obstruction in children less than five years old(8) as is true in this study (Table 1). The male:female ration was 1:1 though in some series males are more affected than the females(9).

Children with a history of foreign body aspirations may present with acute symptoms of cough, choking and occasionally cyanosis. These symptoms have a high sensitivity but a low specificity as they may also occur in respiratory tract infections. The most important factor in diagnosis is a high index of suspicion in children with acute or recurrent pulmonary symptoms. Even then diagnosis can easily be missed altogether(10). In many cases in this study, these children presented late because the referring hospitals/health centres usually treated these cases as respiratory tract infections and were only referred when the symptoms persisted or worsened.

There is no conclusive agreement concerning which bronchus commonly lodges the foreign body. Many studies indicate that most foreign bodies lodge in the right bronchus because anatomically, it is wider, shorter and more vertical. Due to its width and vertical angulation, most foreign bodies entering the right bronchus lodge in the middle and lower lobes(11). However, other factors such as the body posture of the child at the time of aspiration may determine the side of foreign body lodgement. In this study most of the foreign bodies lodged in the right bronchus.

Early complications of foreign bodies in the lower respiratory tract may include acute dyspnoea, asphyxia, cardiac arrest, laryngeal oedema and pneumothorax while late complications include bronchiectasis, haemoptysis and bronchial stricture(12). In chronic cases of foreign body aspiration, inflammatory polyps or granulation tissue may obscure it. Subcutaneous emphysema as a clinical feature of foreign body aspiration with little or no concomitant features above is rare but has been documented(13). In this study the common complication seen was dyspnoea in the acute phase. Late complications, which could occur even after removal of a foreign body particularly in cases where treatment was delayed, were probably missed because the follow up was poor. The poor follow up in many cases was because patients failed to come back for review after discharge.

The definitive treatment of foreign bodies in the tracheo-bronchial tree is removal as soon as possible. Although the rigid bronchoscope is the instrument of choice, fiberoptic bronchoscope is now widely used. There are advantages and disadvantages of both procedures but rigid bronchoscopy is superior in removing foreign bodies in children(13). Surgical challenges can occur when faced with foreign body in the airway in the face of inadequate or no facilities for removal. Unavailability of bronchoscopes and forceps or appropriate size and attendant anaesthetic risks worsen the dilemma. This explains why a number of patients had thoracotomy to remove the foreign bodies in this study.

Normally, thoracotomy is indicated only in situations where one fails to remove the foreign body on bronchoscopy. However, in our situation, seven patients had thoracotomy without bronchoscopy because of lack of appropriate bronchoscopes and forceps. When the exact position of the foreign body was not known a right thoracotomy was preferred because in this way, it is possible to get into both bronchi. When the foreign body was in the left bronchus the azygos vein was divided and incision made just above the carina through which access into the left bronchus was possible.

A number of techniques have been described for maintaining ventilation and oxygenation during rigid bronchoscopy. The technique employed in this series gave satisfactory operating conditions as would be obtainable when using the Sander's injector without the problems associated with the use of the latter(14). The apnoeic oxygenation technique was not used due to its limitation of the duration of safe apnoeic time of only 5 minutes(15). Although the higher MAC EL50 and MAC BAR50 (is the age adjusted dose of anaesthesia that blocks the adrenergic response in 50% of individuals to skin incision) levels of halothane were considered unsafe for these patients who were very ill at the time of the bronchoscopy, the MAC EL50 concentration employed had to be supplemented with intermittent thopentone and suxamethonium when the need arose especially after 30 minutes of surgery. This is attributed to the possible wearing off of the lignocaine block of the internal branch of the superior laryngeal nerve. There were no difficulties associated with the optical distortion due to the changes in the refractive index of the gas mixture that would be expected with the presence of nitrous oxide(16).

The role of one lung anaesthesia in thoracotomy is well known. In this study, certain circumstances militated against its use. First, some of the foreign bodies (22.7%) were actually lodged in the trachea. Secondly, by not using this technique, we retained the ability to reverse the troublesome haemoglobin oxygen desaturations that occurred in some patients as a result of lung retraction that essentially created an obligatory

transpulmonary shunt through the depended lung that improved very quickly when we allowed the lung to expand. Otherwise, one lung anaesthesia is an invaluable technique in cases of removal of foreign bodies from the bronchus.

The problem of managing foreign bodies in the tracheo-bronchial tree in children would be much easier if bronchoscopic equipment were provided to all hospitals with requisite manpower. It would also help if awareness of causes and dangers of foreign body in the tracheo-bronchial tree were increased in the community and among the primary health workers. In addition to this, the shared airway with its attendant problems calls for close co-operation between the surgeon and the anaesthetist. This essence enhances the team spirit that is necessary in such life saving situations.

In conclusion foreign bodies lodged in the tracheo-bronchial tree in children offer real surgical and anaesthetic dilemmas. As such, management options of surgery and anaesthesia have to be employed in order to manage this life threatening condition. These options become more applicable in the hospitals that have inadequate facilities. Thoracotomy and appropriate anaesthetic manoeuvres, therefore, can be life saving in such rural set ups.

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