

# Bronchoscopic removal of aspirated foreign bodies: an essential skill for a paediatric surgeon working in the developing world

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## Abstract

**Background:** Foreign body aspiration is a common cause of pulmonary complications and accidental death in children. A high index of suspicion and an early bronchoscopy are essential for the removal of an aspirated foreign body to prevent morbidity and mortality. **Methods:** This is a retrospective audit of the cases of aspirated foreign bodies in children up to 15 years of age managed in our unit over a 16-year period from 1st February 1995 to 31st January 2011. **Results:** There were 37 children with the diagnosis of foreign body aspiration during this period. Twenty-seven of these children resided between 50 and 200 km from our hospital. The age ranged from 14 months to 14 years. Twenty-one of these patients presented with an acute onset of respiratory distress without a history of choking. A radio-opaque foreign body was visible only in 13 children. In 14 patients, the chest radiograph was normal. The foreign bodies were removed by rigid bronchoscopy. In 29 out of the 37 children the foreign body was non-food product. One patient had a tension pneumothorax and surgical emphysema which settled with a chest drain. **Conclusion:** An early bronchoscopy, done by a competent surgeon with a rigid bronchoscope deals effectively with the problem of aspirated foreign body, with minimum morbidity. The ability to safely remove an aspirated foreign body is an essential skill to be acquired as part of the training of paediatric surgeons in the developing world.

**Key words:** aspirated foreign body; rigid bronchoscopy; paediatric surgeon; training; developing world.

## INTRODUCTION

South Africa still has a dual healthcare system where 85% of the population depends on the public sector (state) hospitals for health care. There is a critical shortage of doctors especially, specialists, in the public sector hospitals.<sup>1,2</sup> The East London Hospital Complex (Frere and Cecilia Makiwane hospitals) serve the central region of the Eastern Cape Province with a population of approximately 3 million people, one-third of which are children under the age of 15 years.<sup>1</sup> Due to the lack of thoracic surgeon specialist at these hospitals, paediatric surgeons

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have taken over the responsibility of the retrieval of aspirated foreign bodies in children. In this article we aim to analyse our experience in the management of aspirated foreign bodies and share the lessons we have learnt during the management of these patients.

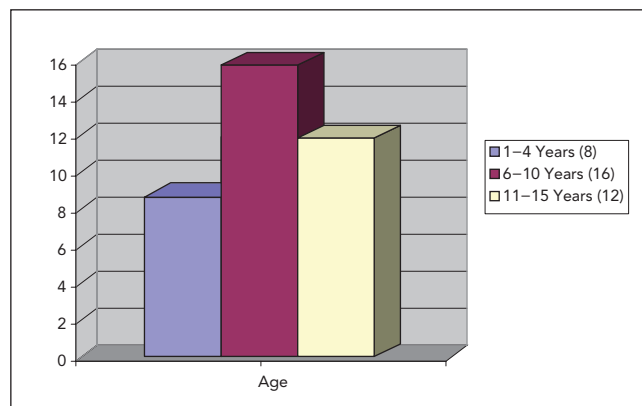
## MATERIALS AND METHODS

This is a retrospective audit of the cases of aspirated foreign bodies in children up to 15 years of age managed in our unit during the 16-year period from 1 February 1995 to 31 January 2011. The inpatient database, copies of the discharge summaries, patient records including the operation notes and their radiographs were analysed. Variables studied included the distance of the patient's home from our hospitals, the clinical presentation, the radiographic findings, and the operative findings—whether or not the foreign body could be removed, the nature of the foreign bodies, and the immediate postoperative complications. Then, we compared our data with those available in the English language literature on PubMed, eMedicine, and Google search using a search strategy (child OR adolescent OR infant) AND (foreign body aspiration OR foreign body inhalation) AND (rigid bronchoscopy) for the period 1960–2011. Approval was achieved from the ethical committee of the East London Hospital Complex before undertaking the study.

## RESULTS

There were 37 children, 25 boys and 12 girls. The age ranged from 14 months to 14 years with the mean age of 7.5 years. Twenty-eight out of 37 (76%) children were older than 4 years of age (Fig. 1).

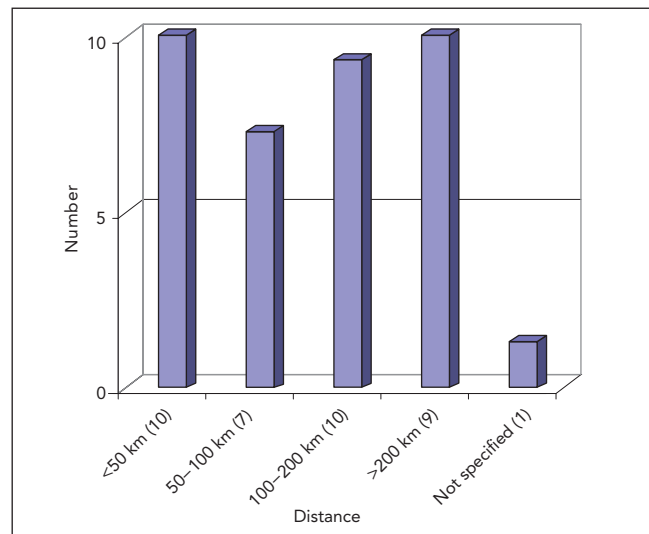
Twenty-seven out of 37 (73%) patients were referred from peripheral hospitals, some of which were more than 200 km away from our hospitals (Fig. 2).



**Figure 1:** Age distribution of patients

The commonest presentation in 21 (57%) children, was an acute onset of respiratory distress without a history suggestive of foreign body aspiration. In 13 (35%) children there was a definite history of an episode of choking or aspiration of a foreign body, while 3 (8%) children had a chronic cough.

All the patients had postero-anterior and lateral chest radiographs on admission. Lateral decubitus radiographs were not done. In 14 (38%) children the radiographs were normal. A radio-opaque foreign body was seen only in 13 (35%) children (Fig. 3). In 10 (27%) children there were



**Figure 2:** The distance of referral hospital from our institution



**Figure 3:** Chest radiograph showing a drawing pin in the right main bronchus



**Figure 4:** Chest radiograph showing right lower lobe collapse due to a foreign body in the right lower lobe bronchus

changes such as hyperinflation, atelectasis, or consolidation of the affected lobe (Fig. 4).

In total, 29 (78%) of the foreign bodies removed were non-food products (Table 1).

Out of 37 patients, foreign bodies could be removed only in 35 (95%) children. In two children despite two attempts (24–48 hours apart), foreign bodies could not be removed.

**Table 1:** Different foreign bodies removed

Pen tip	6
Plastic whistle	3
Piece of plastic	8
Piece of metal	3
Drawing pin	4
Screw	3
Metal spring	1
Torch bulb	1
Fish bone	3
Nuts	4
Bean	1
Total	37

Both these children had foreign bodies deeply embedded in their bronchial wall that were not visible on bronchoscopy due to the granulation tissue. One of those children had a foreign body for 7 months. Both these children were referred to the thoracic surgical centre, 300 km away from our hospitals. The thoracic surgeons removed the foreign body in one child by rigid bronchoscopy. In the second child, they did a thoracotomy and lobectomy of the destroyed lobe.

Only one patient had a tension pneumothorax and surgical emphysema that responded to insertion of an intercostal drain. There was no mortality.

## DISCUSSION

Infants and young children have a natural curiosity about their environment and an inclination for exploration. This results in significant problems of aspiration, insertion, and ingestion of foreign bodies. The complications of foreign bodies in the upper and lower airway carry a significant morbidity and mortality even in the developed countries. Foreign body aspiration is the cause of 160 annual deaths in children younger than 14 years in the United States and of approximately 24 children each year in the United Kingdom.<sup>4,5</sup> The number of children presenting to the emergency rooms with foreign body aspiration is estimated as being at least 100-fold higher.<sup>5</sup> Even though we encounter these patients in clinical practice regularly, the overall burden of this problem and its morbidity and mortality data is not available in South Africa. After a search on Google and PubMed, the only available study from South Africa showed the incidence of foreign bodies (ingested and aspirated) to be 4.2% of all the cases presenting to the trauma unit of a tertiary care children's hospital.<sup>6</sup>

According to the literature, approximately 75% of the foreign body aspiration events in the paediatric age group occur in children younger than 3 years. In contrast, we had more children above 5 years of age. The type of airway foreign body varies from generation to generation and country to country. Food matters (like nuts, beans, pieces of chicken, and meat) are the most commonly aspirated foreign body for all generations and nations.<sup>4</sup> However, in contrast, in our study the majority (78%) of the aspirated foreign bodies were non-food products. We believe these differences are due to the lack of supervision of children in our patient population.

The most important factor in evaluating a child who has possibly aspirated a foreign body is an accurate history. Symptoms are mild or absent in 40–60% patients. A history of choking without initial physical findings of reduced air

entry requires a high degree of suspicion if a timely diagnosis is to be made.<sup>4</sup> Eighty percent of the asymptomatic patients have normal findings on physical examination. The larynx, trachea, and bronchi can initially accommodate foreign bodies with minimal physical findings. This may account for the fact that 20% to 50% of foreign bodies are detected more than 1 week after aspiration.<sup>4</sup> In our series, only 35% patients had a clear-cut history of a choking or aspiration episode. Out of the 37 patients, 21 (57%) patients presented with an acute onset of respiratory symptoms, without a definite history of choking or aspiration.

Because an unwitnessed choking event may not produce initial symptoms or physical findings, radiographic evaluation is essential for diagnosis and treatment. Radiographic examination consists of anteroposterior and lateral views of the extended neck and chest. Chest radiographs in inspiration and expiration are beneficial in demonstrating unilateral air trapping resulting in unilateral emphysema. In younger patients, left and right lateral decubitus radiographs may be helpful because the obstructed lung will not deflate while it is in the dependent position. Although 50% of patients will have a normal chest radiograph within 24 hours of aspiration, others will demonstrate variable signs such as mediastinal shift, consolidation, pneumonia, atelectasis, or the presence of a radiopaque object. The benefit of the radiographic assessment is dependent on the location of the foreign body. In cases of bronchial foreign bodies, chest radiograph is less diagnostic with 65% to 75% of sensitivity and specificity.<sup>4</sup> Our experience is similar to the other published series. In 37% of our patients, the chest radiograph was normal and a radiopaque foreign body was visible on the radiograph only in 36% of the patients. Radiographic evaluation is helpful in evaluating the patient with a choking history, but the definitive diagnostic assessment remains bronchoscopy.

Endoscopic extraction of foreign bodies from children requires a gentle, experienced hand. The rigid bronchoscope is the primary instrument for evaluating the tracheo-bronchial tree for a foreign body. The length and diameter of the endoscope is dictated by the patient's age and size. In general, one should use the largest scope possible that will not cause trauma. The ventilating fibre-optic illuminated bronchoscope is ideally suited for this purpose. The rigid instrument allows the use of a diverse number of grasping forceps. The combination of an optical and/or illumination system with the forceps allows the greatest visibility.<sup>4</sup> We used Storz™ ventilating and fibre-optic illuminated rigid

bronchoscopes and self-illuminating “peanut grasping forceps.” We also found an additional telescope useful for better visualization of the distal bronchi and the foreign bodies lodged there.

All the bronchoscopies in our series were done by consultant paediatric surgeons or senior registrars under supervision of consultants. The safe removal of an inhaled foreign body depends on close co-operation between an experienced anaesthetist and the surgeon. Most of these procedures are done after hours. Bronchoscopy for removal of a foreign body can be a daunting task especially due to the frequent loss of airway due to the impaction of the foreign body before or during the procedure. Permanent brain damage and death due to hypoxia during the procedure have been reported.<sup>7</sup>

The main reasons for failure to remove an aspirated foreign body are inexperience of the operating surgeon, inadequate equipment and an impacted foreign body obscured by granulation tissue. We failed to remove two foreign bodies due to the granulation tissue obscuring their visualization. These cases were referred to a thoracic surgeon at another public sector institution in the province.

One patient had a metal spring lodged in the right main bronchus. Its removal proved difficult. During recovery from anaesthesia, the patient had respiratory distress and surgical emphysema. A clinical diagnosis of spontaneous pneumothorax was made and an intercostal drain was inserted. The patient made full recovery. There was no mortality in our series.

## CONCLUSIONS

Foreign body aspiration is a common emergency in children. The typical history of choking and/or foreign body aspiration may not always be present. A normal chest radiograph does not rule out an aspirated foreign body. An early rigid bronchoscopy done by a surgeon trained in the procedure can effectively deal with the problem with minimum morbidity. Thoracic surgeons are not available in all the institutions in many parts of the world. The ability to safely remove an aspirated foreign body is an essential skill which should therefore be acquired by those trained in paediatric surgery in the developing world.

## DISCLOSURE STATEMENT

No competing financial interests exist.

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