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ORIGINAL ARTICLE

Inhaled foreign bodies in adolescents and adults

S.M. Tariq[1], J. George[1], S. Srinivasan[2]

ABSTRACT: ***Inhaled foreign bodies in adolescents and adults. S.M. Tariq, J. George, S. Srinivasan.***

Background. **Accidental foreign body inhalation is not uncommon. The incidence is high in children, especially the very young ones. We evaluated the management of inhaled foreign bodies in an adult respiratory medical unit, highlighting circumstances leading to inhalation, associated complications and difficulties encountered at bronchoscopic retrieval.**

Methods. **We reviewed all cases of inhaled foreign bodies presenting over a period of 12 years (1991-2003).**

Results. **5 of 8 cases were teenagers whereas 3 were aged over 55 years. The older patients had co-morbidities and had aspirated food particles. In 2 cases, a bronchoscopy was performed primarily to exclude lung cancer, and the discovery of a foreign body was a surprise. Pulmonary complications related to foreign body inhalation were common among this group. All 5 teenage patients presented after inhalation of small objects. 4 patients from the teenage group had general anaesthesia; in 2 of them a laryngeal mask airway was employed, whilst 2 had endotracheal intubation. Only one patient was given a rigid bronchoscopy following failure of the fiberoptic instrument. Difficulties at retrieval of foreign body were frequently encountered.**

Conclusions. **In the adolescent and adult patients, most inhaled foreign bodies are retrievable by flexible bronchoscopy. However, facilities for rigid bronchoscopy should be available as a back-up. Pulmonary complications are common after foreign body inhalation especially in the older patients. Difficulties at bronchoscopic removal may occur due to late presentation or to the site and/or position of the foreign body within the tracheobronchial tree.** ***Monaldi Arch Chest Dis 2005; 63: 4, 193-198.***

Keywords: Flexible bronchoscopy, inhaled foreign bodies, laryngeal mask airway, rigid bronchoscopy.

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Introduction

Accidental foreign body inhalation is a relatively common occurrence in the paediatric population [1, 2] and may lead to asphyxiation and death especially among those younger than 4 years of age [3]. In 1996, ingestion or inhalation of a foreign body was reported as responsible for 12% of all toy-related injuries in children in the United States [4]. Foreign body inhalation has also been reported in the adult population [5-7]. However, being a less frequent problem in adults, there is a paucity of data as to the circumstances of foreign body inhalation, patient characteristics such as co-morbidities, complications directly attributable to the inhaled foreign body (IFB), and technical difficulties at bronchoscopic removal. We describe a series of cases presenting to our adult respiratory unit over a period of 12 years concentrating mainly on the circumstances leading to accidental foreign body inhalation, complications directly attributable to the IFB, and difficulties encountered during its bronchoscopic removal.

Patients and Methods

We retrospectively reviewed all bronchoscopies performed over a period of 12 years (1991-2003) at our unit. The admissions registers of medical wards were also checked for any patients who had entered with a diagnosis of inhaled foreign body. Patients were included in the study if they had presented with IFB or if a foreign body within the tracheobroncheal tree was an unsuspected finding at bronchoscopy. Of the 1791 bronchoscopies performed during the 12-year period, 8 cases of inhaled foreign bodies (0.45%) were identified. Occasional bronchoscopies performed on the critically ill, ventilated patients in the intensive care unit were not included. Six cases were registered as IFB in both the bronchoscopy and the wards admissions registers, whereas 2 elderly patients, who had IFB as a surprise finding at bronchoscopy, had their co-morbid disease entered as the diagnosis in the ward register (table, Cases 6 and 8). Two paediatric age group patients (Cases 1 and 4) were included as the official age cut-off in our hospital be-

Table 1 - Patient characteristics, the type of anaesthesia given for bronchoscopy, the nature and site of inhaled foreign body and complications resulting from it

Case No.	Age (yrs)	Sex	Nature of foreign body	Duration	Site†	LA/GA‡	Comorbidity	Complications
1	14	M	plastic whistle	1.5 hour	BI	GA	-	asphyxia, non-cardiogenic pulmonary oedema
2	16	F	hatpin	28 hours	LUL	GA*	-	-
3	19	F	hatpin	3 hours	LLL	GA*	-	-
4¶	13	M	Cluedo® peg	2 hours	BI	GA	-	-
5	65	M	a pea	4 hours	BI	LA	COPD	pneumothorax
6*f*	68	M	a piece of orange	3 months	BI	LA	coronary heart disease, left ventricular failure	pneumonia with pleural effusion
7	16	M	safety pin	3 weeks	LLL	LA	-	-
8	57	M	peanut	4 months	RLL	LA	alcoholism	recurrent pneumonia

†BI = bronchus intermedius, LUL = left upper lobe, LLL = left lower lobe, RLL = right lower lobe.
‡LA = local anaesthesia, GA = general anaesthesia. *Laryngeal mask airway used.
¶Rigid bronchoscopy performed after a failed fiberoptic procedure.
*f*Two fiberoptic bronchoscopies performed.

tween paediatric and adult patients is 13 years. Children aged less than 13 years suspected of IFB are referred routinely to another hospital in Muscat for its removal.

Information regarding the circumstances leading to accidental foreign body inhalation, the nature of the foreign body, the duration between the inhalation and presentation (or bronchoscopy), the site of the foreign body within the tracheobronchial tree, the type of anaesthesia given for bronchoscopy, whether a rigid or fiberoptic instrument was used, and the presence of coexisting disease was gathered. Any difficulties encountered at retrieval and complications attributable to the IFB were also noted.

Results

Of the 8 cases of IFB, 5 were teenagers and 3 much older (table 1). There was a clear difference between the teenage patients and the older patients regarding the nature of IFB. All cases in the teenage group had inhaled small objects whereas the older patients had presented after aspiration of food particles. All older patients had co-morbidities (table). In 5 cases, the IFB had entered the right lung with bronchus intermedius being the most common site (4 cases). A fiberoptic bronchoscope (Olympus®, Tokyo, Japan) was used to remove the IFB in 7 cases. In 6 of them, either of the two available adult bronchoscopes (external diameter 5.0 mm and 5.5 mm respectively) was used. In Case 1 the foreign body was removed with a paediatric fiberoptic bronchoscope (external diameter 3.7 mm) which was passed through the endotracheal tube (ET). The foreign body was grabbed by a biopsy forceps and removed *en mass* with the ET and the bronchoscope. The patient was re-intubated immediately after the procedure for elective ventilation.

Four patients had general anaesthesia for bronchoscopy. In 2 of them (Cases 2 and 3) a laryngeal mask airway (LMA; The Laryngeal Mask Company Limited, Nicosia, Cyprus) was used to give ventilation during bronchoscopy. In both of these cases, the foreign body was grabbed with forceps and removed *en mass* with the bronchoscope but leaving the LMA in place. In case 3, an initial fiberoptic procedure under sedation was abandoned because of excessive coughing and transient hypoxia. Subsequent fiberoptic bronchoscopy through LMA under general anaesthesia was successful. Only Cases 3 and 4 took more than an hour for bronchoscopic removal of the foreign body. All bronchoscopies were performed after obtaining informed written consent.

Patients who had local anaesthesia for bronchoscopy were pre-medicated with sedative drugs: intramuscular pethidine and oral diazepam at least half an hour before bronchoscopy in Cases 5 and 8; intravenous midazolam in Case 6, and intravenous midazolam and fentanyl in Case 7 immediately prior to the procedure. Cases 3 and 4 initially had intravenous midazolam for a fiberoptic procedure under local anaesthesia, but this was later superseded by general anaesthesia. In Cases 1-5 the bronchoscopy was performed as an emergency procedure whereas cases 6, 7 and 8 were bronchoscoped on our routine weekly list.

Circumstances leading to foreign body inhalation

Case 1, a 14 year-old boy, presented after inhaling a small plastic whistle (figure 1). He had

Fig. 1. - Plastic whistle removed from the bronchial tree of case 1.

removed this whistle from the sole of his 3 year-old sister's shoe. Such shoes are popular for the squeaky noise they produce with every step the toddler takes. He initially blew the whistle by blowing out into it. Later, he put the whistle in his mouth in reverse, and tried to produce the whistling sound by sucking air in through it. This resulted in its accidental inhalation. The two young girls who had aspirated a hatpin were both holding the pin in their mouth while adjusting their head scarves when it accidentally slipped and was inhaled. Figure 2 shows the PA chest radiograph of Case 2, with the hatpin seen within the left upper lobe bronchus. Case 4 had inhaled a plastic peg from the board game Cluedo® (Hasbro, Newport, UK). He was wrestling with his younger brother whilst holding the peg in his mouth, leading to its inhalation. Case 5 with underlying chronic obstructive pulmonary disease, simply suffered a coughing episode while having his meal. Case 7 suffered accidental inhalation of a safety pin when he was holding it in his mouth and running at the same time. In cases 6 and 8, a detailed history to ascertain the approximate time and the circumstances of the foreign body inhalation, was taken only after the bronchoscopy. Case 6 gave a history of choking while eating an orange 3 months before presenting with pneumonia. The history was less clear for Case 8. However, he recalled eating peanuts while drinking alcohol about 4 months before.

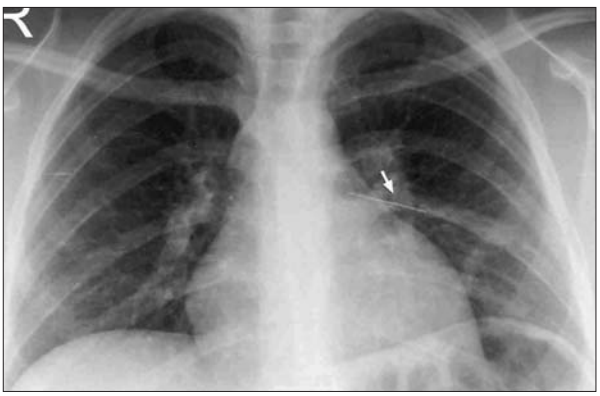

Fig. 2. - Posteroanterior chest radiograph showing hatpin (arrow) lodged in left upper lobe bronchus (case 2).

Difficulties upon removal and other complications

At presentation Case 1 had a cough and his chest whistled with every inspiration. Within minutes of arrival to the accident and emergency department, the whistling stopped abruptly, and he choked, became cyanosed, and lost consciousness. He was promptly intubated and given respiration via an Ambu® bag. For a few initial breaths, the pressure needed to ventilate was high. Then something gave and bagging became much easier. As per the on-call doctor and the attending anaesthetist, the plausible sequence of events was as follows: The whistle was initially patent and was probably lodged in the trachea; hence he was able to breathe, albeit with an inspiratory squeak; asphyxiation followed when mucus blocked the whistle's hole; and finally, the act of forceful bagging after intubation, facilitated ventilation by pushing the whistle down from the trachea to a new site in the bronchus intermedius. This patient, as a result of asphyxiation, developed non-cardiogenic pulmonary oedema following removal of the IFB, and was ventilated overnight. He also had low-grade fever lasting less than 24 hours.

Case 2 had the proximal sharp end of the hatpin embedded in the bronchial wall. The pin was first pushed distally to free the sharp end, and then removed. The pinhead in Case 3 was stuck inside the posterior segmental bronchus of the left lower lobe (figure 3). The shaft of the pin was gripped firmly with an 'allegator' biopsy forceps (with saw-tooth jaws) and the pin was removed. This patient suffered transient hypoxia during the procedure.

In Case 4, an initial fiberoptic bronchoscopy was unsuccessful because the foreign object (a Cluedo® peg) was stuck upside down in the bronchus intermedius, underneath a cartilage ring. Hence there was no free edge on the IFB available to grasp. The fiberoptic instrument was therefore

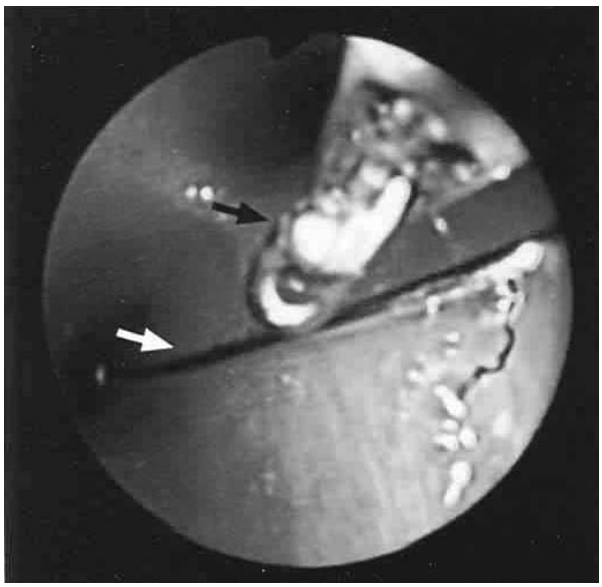

Fig. 3. - Bronchoscopic view of the hatpin in left lower lobe brochus (case 3). Note the grasping forceps (black arrow) and the hatpin (white arrow).

removed, the patient given general anaesthesia, and a rigid instrument (Karl-Storz, Tuttlingen, Germany**)** was inserted. Using the angled rigid biopsy forceps, the peg was first pushed down from one side. This made the edge on the opposite side pop out from beneath the cartilage ring which was then grabbed by the forceps and the peg removed successfully.

Case 5 was complicated by a right pneumothorax developing after the accidental foreign body inhalation. A chest tube was inserted and connected to an underwater seal. Bronchoscopic removal of the inhaled boiled green pea was performed only after confirmation of full expansion of the right lung by a chest radiograph.

In Case 6, foreign body inhalation was complicated by a right basal pneumonia and para-pneumonic pleural effusion. The effusion was tapped and found to be exudative (pleural fluid albumin 38 gm/L) but sterile. A computed tomography scan of the thorax showed, apart from the pleural effusion, collapse of the right lower and middle lobes. As he was an ex-smoker, a provisional diagnosis of lung cancer was considered and he was given a diagnostic bronchoscopy. The rind of orange in the bronchus intermedius was initially thought to be a polypoid tumour and biopsied. The histology, however confirmed the material to be a pip of a citrus fruit. The patient was therefore given a second bronchoscopy, and the orange rind was snared in a wire basket and removed.

The safety pin in Case 7 had rusted and it crumbled during its removal. After removing the larger pieces by forceps, the remainder was removed via suction. To allow additional gravitational drainage, the patient was put in a head down and right lateral position during suction.

The final case had 2 hospital admissions with right basal pneumonia, 4 months apart. He had a history of alcoholism and the recurrent pneumonia was initially attributed to it. However, as he had also smoked more than 35 pack years, underlying bronchogenic carcinoma was suspected and a bronchoscopy performed. The presence of one-half of a peanut in the anterior segmental bronchus of right lower lobe was an unexpected finding.

All patients were given short courses of a broad-spectrum antibiotic post-bronchoscopy to counter infection. Case 1 also received a 3-day course of systemic corticosteroid. They all made complete recovery with no long-term sequelae.

Discussion

Accidental foreign body inhalation is common amongst children (1-4). In one report from the United States, a total of 40 IFBs were removed from 39 children, most of them in early childhood (mean age 47.3 months), over a period of 11 years [1]. Baharloo *et al* from Belgium reported cases of IFB in all ages from a single institution over a period of 20 years, and found that only 28 of 112 cases were older than the age of 8 [5**]**. In our adult respiratory medical unit, only 8 cases of IFB were managed over a period of 12 years, suggesting likewise, that accidental foreign body inhalation is less frequent among adults than children. If 2 of the cases less than 16 years of age are taken as paediatric patients and excluded, the incidence of IFB in the adults in this series would be even lower.

Our cases of IFB show a bimodal age distribution being either teenagers or much older (> 55 years). The absence of cases between the ages of 20 and 50 years may reflect the fact that alcohol consumption and narcotic drug abuse among young adults is uncommon in Oman. These habits have been reported as a potential risk factor for accidental foreign body inhalation [9].

The two age groups in this series differed in terms of the nature of foreign body inhaled and in the presence of co-morbidity. The teenage patients had invariably inhaled small objects whereas in the older patients food particles were retrieved from the tracheobronchial tree. In addition, those in early teen age had inhaled bits which they used as toys whilst pins were inhaled by the older teenagers. The accident of foreign body inhalation in the teenage patients invariably followed a seemingly unwise spontaneous act, for example, Case 1 sucking at a whistle, and the other cases keeping the offending object in their mouth and engaging simultaneously in another physical activity. In contrast, all the patients in the older age group had co-existing diseases which may have contributed to the accident.

In the past, the technique of rigid bronchoscopy was employed routinely for the retrieval of IFBs [8, 9]. However, recent reports suggest that, in many cases, especially in the adult age group, foreign bodies can be removed successfully from the tracheobronchial tree by fiberoptic bronchoscopy [1, 10]. Some authors now consider fiberoptic bronchoscopy under sedation and local anaesthesia as the procedure of choice [9-10]. Fiberoptic bronchoscopy has been a safe and effective method for removal of IFBs in our experience as well. In our unit, one of the authors (SMT) is skilled in both the rigid and fiberoptic techniques. We believe that fiberoptic removal of IFBs has become easier because of two key advances. First, a wide range of accessories, including various grasping forceps and wire baskets, are now available. For example, we have special forceps with rubber-lined jaws to grasp needles, and those with 'rat-tooth' jaws to remove small coins. Still, we believe, there remains a need for an electromagnetic probe designed for bronchoscopic removal of small metallic objects. The second advance in recent years is the ever-improving quality of the magnified real-time image projected on a large video display screen. Despite these advances, occasional patients may still pose difficulty and require a rigid bronchoscopy, as was true in Case 4 with the inhaled Cluedo® peg stuck upside down under a cartilage ring. In retrospect, the first choice approach in this patient should have been a rigid bronchoscopy which surely would have saved considerable time in the retrieval of the peg.

Case 3, the 19 year old lady who inhaled a hatpin, might have been better managed if a rigid bronchoscopy under general anaesthesia had been performed, as sedation for the fiberoptic procedure was inadequate. However, after giving her general anaesthesia, it was relatively easy to perform a fiberoptic bronchoscopy through the laryngeal mask airway and the hatpin was readily removed.

The hatpin as a foreign body is of particular relevance to Arab women who wear a head scarf termed *hejaab*. It is usually secured with one or two hatpins. An increasing number of young women in Oman now have regular full-time employment and they regard *hejaab* as an integral part of their working attire. During a long working day, the *hejaab* often slips partly and requires adjustment. It is during this adjustment, especially if performed while on the go with the pin held between the teeth, that an accident may happen. In 2003, the risk to Arab women, of accidental ingestion or inhalation of a hatpin, was highlighted in an Omani national newspaper report, with a clear advice never to hold the pin in the mouth [12].

A number of reports have described complications, including exotic infections, directly attributable to IFB [6, 13]. In this series, 1 of the 5 teenage patients suffered a life-threatening complication as a direct result of the IFB. In contrast, complications attributable to IFB, albeit non-life-threatening, affected each of the 3 older patients. The teenager (Case 1) was fortunate to have suffered asphyxia only after reaching the hospital and was treated promptly. Certainly, for this patient the procedure of choice was an emergency rigid bronchoscopy for rapid and efficacious removal of the IFB which was initially lodged proximally in the trachea [5, 13]. However, following intubation and ventilation his condition stabilised promptly. Subsequently, the passage of a flexible bronchoscope through the endotracheal tube was deemed an easier option than extubation to allow a rigid bronchoscopy.

In 1997, Martinot and colleagues highlighted that in toddlers and children, the rigid and fiberoptic procedures may compliment each other in the successful removal of IFB [14]. They proposed an algorithm indicating that in patients with asphyxia, a visible radio-opaque IFB on the chest radiograph, or unilateral decreased breath sounds and obstructive emphysema, a rigid bronchoscopy should be performed. Fortunately, the presentations of asphyxia or obstructive emphysema are relatively uncommon in adult patients [5, 10]. However, one cannot be too complacent, as a case fatality from aspirated chewing gum was recently described in an adult patient [15]. An additional factor precluding a rigid bronchoscopy is the fact that IFB may be an unexpected (occult) finding in some adult patients [16].

The procedure of rigid bronchoscopy is now restricted to certain specialised centres, and it is performed increasingly sparingly. Hence, a whole new generation of bronchoscopists have limited experience of this procedure, as they have only had formal training in the fiberoptic technique. Another factor favouring the fiberoptic technique is that simulated computer-based training programmes on fiberoptic bronchoscopy have become increasingly available. Hence it is likely that, in the future, fiberoptic bronchoscopy, as a first choice procedure, would be performed more often for the removal of IFB. To us, this seems a reasonable approach in non-asphyxiating foreign bodies, although it may cause unnecessary delay in a minority of cases.

In our series**,** teenage patients generally presented early and the initial diagnosis of inhaled foreign body was the correct one in all of them. However, bronchoscopy was delayed in 2 of the 3 older patients as foreign body inhalation was not suspected and their respective co-morbid conditions were held responsible in part for the pneumonia at presentation. In both these patients, a bronchoscopy was performed primarily to exclude a bronchogenic carcinoma. On the other hand, there were no cases of clinically suspected foreign body with a negative bronchoscopy. Such an event is well-described in paediatric practice but seems unusual in adult patients [1, 3].

It certainly is a pleasant surprise if a patient, initially suspected of having bronchogenic carcinoma, is found to have an IFB instead. Nonetheless, there is potential for unwarranted stress and embarrassment if such a patient (and the family), in all honesty, is erroneously prepared for bad news and told of the likelihood of lung cancer prior to bronchoscopy.

A laryngeal mask airway (LMA) may be used instead of an endotracheal tube for positive pressure ventilation during fiberoptic bronchoscopy [1, 17]. It may provide a larger calibre for fiberoptic intubation than an endotracheal tube albeit at the expense of a relatively less efficient mechanical ventilation [17]. Our experience with the LMA is limited. In the 2 patients who had LMA for positive pressure ventilation, fiberoptic intubation through the LMA for removal of IFB was uneventful.

In conclusion, we observed a bimodal age distribution for accidental foreign body inhalation - teenagers and those over the age 55 years. Older patients with IFB are likely to have co-morbid conditions which may contribute to accidental foreign body inhalation. Most foreign bodies in adolescent and adult patients can be successfully removed from the tracheobronchial tree by fiberoptic bronchoscopy. However, the rigid instrument should always be available as back-up for the occasional difficult case. Pulmonary complications due to the inhaled foreign body are not uncommon especially in the older patients.

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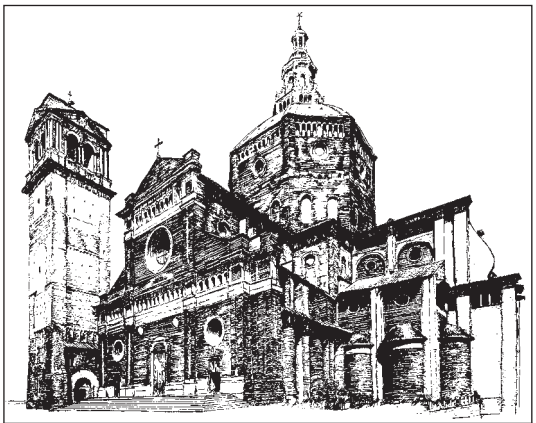

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