

## **Chapter 132: Foreign Bodies in the Upper Aerodigestive Tract**

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Foreign bodies in the upper aerodigestive tract are an important cause of morbidity and mortality in the two extremes of life. In the USA in 1985, accidental ingestion of foreign objects led to 170 deaths in infants under 12 months of age (Centers for Disease Control, 1985).

Acute respiratory obstruction secondary to inhaled foreign material obstructing the laryngeal inlet is not likely to occur in a hospital setting, where emergency equipment is available to establish an airway before removal of a foreign object. It usually happens to a person eating at home or in a restaurant, who suddenly stops breathing, cannot vocalize, and grasps at his or her larynx. Loss of consciousness ensues. The Heimlich maneuver should be performed immediately; it is highly successful in the rapid expulsion of foreign bodies (Heimlich and Patrick, 1990).

The majority of patients who seek medical help have obviously survived the acute phase and present with a mild degree of respiratory obstruction or difficulty in swallowing.

### **Incidence**

The incidence of foreign bodies in the aerodigestive tract is higher in older adults, who commonly have a piece of meat stuck in the esophagus. The older patient may have dentures and thus be unable to detect a small fish bone or piece of meat as easily as a person with normal dentition. Local lesions in the esophagus may contribute to the impaction of a foreign body. A carcinoma of the esophagus is sometimes initially indicated by an inability to swallow a piece of unchewed meat.

Children under 3 years of age require special attention, particularly when playing. They are likely to put small pieces of toys into their mouth. Children should never be allowed to play or run with food or other objects in their mouths. Any unconscious child who is not breathing and lacks signs of physical injury should be suspected of having inhaled a foreign body (Esclamado and Richardson, 1987).

### **Types of Foreign Bodies**

Fish and chicken bones are the usual foreign bodies lodged in the oropharynx. Coins are usually lodged in the upper end of the esophagus; meat and other soft foreign bodies may lodge above a stricture; and sharp foreign bodies may lodge anywhere but are more common in the upper third of the esophagus. Coins sometimes remain in the esophagus for many months and cause minimal symptoms; slow ulceration of the mucosa ensues. Meat and fish bones can more quickly give rise to ulceration, esophagitis, and possibly mediastinal complications.

Aspiration of a foreign body into the tracheobronchial tree usually occurs in children, the most common foreign body being a peanut. Other aspirated foreign bodies include missiles from toy guns and organic material. Latex balloons can burst during inflation and propel fragments into the distal airway (Henderson, 1989). Disk batteries (from hearing aids, cameras, video games) (Maves et al, 1984) pose special problems and possible esophageal perforation. Since the advent of disposable diapers, inhaled or digested open safety pins have become rare.

## **Clinical Manifestations**

### **Pharynx**

Foreign bodies are lodged in the lymphoid tissue and hypopharynx less frequently in the child than in the adult. Typically a fish bone protrudes from the medial surface of the tonsil or the posterior aspect of the lingual tonsils into the pharynx. This is characterized by a distinctive stabbing pain on swallowing. Uncommonly a chicken bone lodges in the horizontal plane of the hypopharynx with minimal symptoms apart from mild pharyngeal discomfort. A thin bristle from a toothbrush may also lodge in the lymphoid tissue in the posterior third of the tongue, giving rise to similar symptoms.

Clinical evaluation of the oral cavity, oropharynx, and hypopharynx in the adult can be easily accomplished with a mirror. In older children and adults the offending foreign may be seen protruding into the pharyngeal lumen. Under most circumstances swift removal of the foreign body is possible with the patient under local anesthesia. A large alligator forceps is used with an offset handle or, more commonly available, a Magill forceps. Only rarely is general anesthesia necessary to remove an oropharyngeal foreign body, except perhaps in young children.

### **Airway**

Foreign bodies inhaled into the respiratory tract rarely become impacted in the larynx but pass through into the trachea and bronchi. Most inhaled foreign bodies enter the right mainstem bronchus, which is larger and more directly continuous with the trachea than the left. Foreign bodies too large for the bronchial lumen remain in the trachea.

The child or infant who has aspirated foreign material can come to the physician's attention in several ways. In the conscious child a foreign body, before entering the tracheobronchial tree, will almost certainly produce coughing, gagging, or spasmodic choking. The symptoms associated with aspiration are in two categories: those associated with acute episodes and those resulting from chronic mucosal irritation or bronchial obstruction. The acute signs and symptoms may be immediate and result from complete occlusion or irritation of the supraglottic larynx. The patient presents with cough and inspiratory stridor and may have experienced color changes, such as cyanosis. The physical examination may reveal tachypnea, tachycardia, inspiratory stridor, localized wheezing, and areas of decreased breath sounds or atelectasis. Occasionally the patient develops respiratory distress from an impacted foreign body in the esophagus and demonstrates drooling, protrusion of the mandible, and dysphagia. After the object enters the trachea, a symptomless interval may last for days or weeks, during which time clinical examination shows no stridor and examination of the chest

is unrewarding. Any history of choking or gagging, especially while the infant had something in his or her mouth, should be investigated thoroughly. Although most patients who aspirate foreign material are between 1 and 5 years of age, aspiration should also be suspected in younger infants whose symptoms follow a play period with older children. Occasionally, on physical examination or routine chest radiography, an asymptomatic child with no history of aspiration is found to have a foreign body.

Foreign material present for a long period in the mainstem bronchus causes symptoms and signs that depend on the nature of the aspirated material. Frequently localized or generalized wheezing can be heard. Recurrent pneumonia in the same or different pulmonary segments can also occur. A single foreign body may move from one pulmonary lobe to another. The clinical signs are unilateral obstructive emphysema or atelectasis.

### **Esophagus**

The patient may be able to give exact details of the swallowed foreign body. If the foreign body is lodged in the upper esophagus, the patient can point to the exact site of obstruction. However, when the foreign body is in the lower esophagus, localization is not as accurate and pain is usually referred to the sternum. Dysphagia almost always exists, its degree depending on the size of the foreign body and the surrounding inflammatory reaction. Regurgitation of food, blood-stained saliva, and mucus may occur.

Esophageal foreign bodies may also cause respiratory symptoms in the young child. The party wall between the trachea and the esophagus is thin, and therefore a large, impacted foreign body may infringe on the airway. In these cases one must never induce vomiting because this may dislodge the foreign body with possible aspiration into the airway.

The patient should be observed during the act of swallowing. When a sharp foreign body is lodged in the upper esophagus, examination of the neck demonstrates a tenderness in the lower part of the neck medial to the sternocleidomastoid muscle. Swelling in this area is seen 2 to 3 weeks after an impaction of a foreign body in the esophagus and is caused by an inflammatory reaction around the foreign body. Inspection of the oral cavity, oropharynx, and hypopharynx may reveal regurgitated material or pooling of secretions in the hypopharynx.

### **Radiologic Evaluation**

Plain radiographs of the neck and chest are basic to the evaluation. An opaque foreign body is immediately visible. Radiologic detection of a foreign body in the chest requires a high index of suspicion and a knowledge of the basic pathophysiologic events that follow such inhalation.

## **Airway**

The cross-sectional area of the airway increases during inspiration and decreases during expiration; thus the foreign body moves peripherally on inspiration.

If the foreign material is thus positioned to allow airflow during inspiration with occlusion of the airway on expiration, it will act as a check valve. This action results in overinflation of the lung distal to the foreign body, depression of the ipsilateral hemidiaphragm, and shift of the mediastinal structures to the opposite side.

If the foreign body completely obstructs the airway as it progresses distally, a different clinical and radiological situation exists. Classically this complete endobronchial obstruction acts as a ball valve, with resulting atelectasis (Jackson, 1950). The mediastinum shifts during inspiration to the side of the foreign body. Frontal radiographs taken during full inspiration and expiration may thus reveal abnormalities on expiration only. Finally, a normal chest radiograph does not rule out a foreign body; 35% of bronchial foreign bodies may not be apparent on radiographs (Mu et al, 1991).

In infants fluoroscopy is the radiologic method of choice. Diaphragmatic movement on both sides and both lung volumes are compared. Any vascular markings are examined to detect air trapping. A barium swallow radiograph is often performed when recurrent airway disease is atypical or when the cause is not apparent, since an esophageal foreign body may mimic the symptoms of a tracheobronchial foreign body.

## **Esophagus**

Plain radiographs of the neck and chest identify radiopaque foreign bodies in the esophagus. Contrast material in the evaluation of esophageal foreign bodies should be used with caution. With complete obstruction by a nonradiopaque foreign body, this contrast material may be aspirated into the respiratory tract. If the contrast material cannot be dislodged by further swallowing or washed down with water, the presence of a foreign body should be strongly suspected.

## **Management**

### **General considerations**

Once the presence of a foreign body in the aerodigestive tract has been established, arrangements should be made for its safe removal, usually with the patient under general anesthesia. When the acute phase of ingestion or aspiration has passed, these management details should proceed in an orderly fashion. The physician must be constantly aware of the danger of converting a partial airway obstruction to a complete obstruction by a careless manipulation.

No attempt should be made to use an instrument on the oropharynx or hypopharynx of a child who has inhaled a foreign body. This can only impact the foreign body in the supraglottic larynx, thus converting a partial obstruction into a complete respiratory obstruction. Turning an infant upside down and smacking him on the back may dislodge

aspirated foreign material. However, if the aspirated material is below the vocal cords, this maneuver can cause the foreign material to lodge in the subglottic space and precipitate complete obstruction. Proponents of postural displacement or bronchodilators for bronchial foreign bodies may indeed precipitate such a total obstruction.

Complications may also result from the nonendoscopic removal of esophageal foreign bodies. Papain and enzymatic meat tenderizers have been used to digest impacted meat in the esophagus for the past 15 years. Used on an impacted, sharp, bony foreign body, this treatment may cause further ulceration of the esophageal mucosa and esophageal rupture (Anderson et al, 1959). The use of the Fogarty catheter to extract smooth foreign bodies from the esophagus has also been popular in the past 15 years. In this method, carried out in the radiology suite, the catheter is advanced beyond the foreign body while the patient is sedated and lying in Trendelenburg's position. The balloon is filled with a radiopaque contrast material, and the catheter is withdrawn. The foreign body is usually delivered to the pharynx and then expectorated. Aspiration of the foreign body under these circumstances is a real possibility, and at least one death has occurred under these circumstances (Ritter, 1974). This method of removing esophageal foreign bodies in children should be performed only when a skilled endoscopist and an anesthesiologist are present to establish a stable airway (laryngoscopy, endotracheal tubes, and so forth).

### **Removal of esophageal foreign bodies**

The safest method to remove an impacted esophageal foreign body is with a rigid esophagoscope used on a patient under general anesthesia. The patient is induced in a rapid sequence with thiopental (Pentothal) and succinylcholine, and an appropriate-sized orotracheal tube is introduced. Once an adequate depth of anesthesia and a stable airway are obtained, the endoscopy can proceed in an orderly evaluation of the oropharynx, hypopharynx, and esophagus.

Commonly the foreign body is seen impacted at the level of the cricopharyngeus and can easily be removed, making certain that no esophageal mucosa is contained within the bite of the forceps. An esophagoscope is then advanced to examine the distal esophagus. Coins may be found at any level of the esophagus. The esophagoscope is pushed down to meet the coin, and the forceps and the esophagoscope are removed together. The coin should not be pulled up to meet the esophagoscope lest a fold of esophageal mucosa be nipped (Jackson and Hawkins, 1986). Irregular objects, such as pins or sharp pieces of bone, may have to be rotated into a favorable position and the sharp end then introduced into the esophagoscope before removal. Sharp objects such as pins always have to be disimpacted from the esophageal mucosa and rotated before removal (Hollinger, 1962). The classic methods of removal include endogastric version; this technique should be practiced in the animal laboratory.

## **Removal of airway foreign bodies**

The possible complications involved in endoscopic removal of a foreign body from the tracheobronchial tree should be succinctly discussed with the anesthesiologist. The most common problem is hypoventilation during removal of the foreign body leading to hypoxia, hypercarbia, and cardiac arrhythmias. The surgeon must be diligent in sharing the airway with the anesthesiologist. The most common problem is hypoventilation during removal of the foreign body leading to hypoxia, hypercarbia, and cardiac arrhythmias. The surgeon must be diligent in sharing the airway with the anesthesiologist. Hypoventilation occurs when a 3.5 mm or smaller bronchoscope is used with a Storz telescopic rod, which can severely reduce the cross-sectional area of the ventilating bronchoscope. Hypoventilation can also occur when a large bronchial foreign body is removed from the bronchus and is reloaded in the trachea. Immediate attempts should be made to remove the tracheal foreign body or push the object back into a bronchus. If this is not possible, the foreign body may have to be broken into pieces before removal.

Before removal of a foreign body an adequate discussion should be undertaken with the patient and/or his or her parents to ascertain the exact nature of the foreign body. If possible, an exact replica should be obtained. After possible sites of impaction in the tracheobronchial tree are considered, an attempt should be made to replicate the endoscopic view of the foreign body. Only then it is possible to select the most appropriate instruments for the removal of this foreign body.

The bronchoscope, which must be small enough to reach the foreign body, must at the same time have enough room for its endoscopic removal. The Storz-Hopkins bronchoscope with telescopic rod has significantly improved the visualization of the tracheobronchial tree and is of considerable help in the operative assessment of a foreign body. Consideration should be given to the type of foreign body and the possible biochemical interaction between the foreign body and the tracheobronchial mucosa (Tucker, 1966). Vegetable foreign bodies, such as a peanut, can produce a severe chemical irritation, and prolonged impaction can give rise to surrounding granulation tissue that bleeds easily on manipulation. In contrast, an inert foreign body (such as a plastic toy) causes minimal inflammatory response.

When possible, practicing the removal of a duplicate foreign body through the bronchoscope is highly desirable. Such problems as foreign body presentation, exposure, and change in its rotation may become obvious under these circumstances. Solutions to these problems can therefore be considered before endoscopy.

A general anesthetic is administered through a mask, and when the patient is breathing regularly and deeply, an introducing laryngoscope is inserted to facilitate the introduction of a ventilating bronchoscope. Once adequate respiration has been established through the ventilating bronchoscope, a telescopic rod is inserted to provide the necessary magnified view of the tracheobronchial tree. The bronchoscope with telescope attachment is advanced slowly down the trachea and into the orifices of the mainstem bronchi. Once the foreign body has been visualized, avoiding any manipulation that may further displace the foreign body peripherally is important. Surrounding secretions should be gently removed. A detailed examination of the foreign body and its relationship to the surrounding bronchial wall should be undertaken (Fig. 132-1). Following this careful examination, the bronchoscope is then

withdrawn into the trachea, and the rest of the tracheobronchial tree is examined.

The presentation of the foreign body in the bronchus should be compared to a duplicate foreign body. Surface and sharp points that are hidden from the endoscopist can thus be considered (Fig. 132-2). An inert foreign body, such as a plastic toy, can easily be grasped by the microoptical forceps and removed without difficulty.

In contrast, removal of a more common foreign body, such as a peanut, presents a much more difficult problem. After selection of the appropriate forceps, the telescope is removed, the forceps is introduced into the bronchoscope, and both distal ends of the forceps are advanced between the peanut and the wall of the bronchus. When a purchase has been achieved, the foreign body is very gently withdrawn toward the bronchoscope. In most instances it is too large to be removed through the bronchoscope, and under this circumstance the bronchoscope and trailing foreign body have to be removed as one. Cooperation is required at this time between anesthesiologist and endoscopist. Under these circumstances it is possible for the foreign body to dislodge into the trachea or to lodge at the level of the glottis. Rarely should fragmenting a peanut before removal be necessary. Multiple foreign bodies are seldom found within the tracheobronchial tree.

Meticulous submucosal dissection may be necessary to facilitate removal of inhaled pine needles that have migrated into the mucosa. One child had an 18-month history of asthma after he was found playing with a Christmas tree.

With the most recent advances in optical equipment, safe general anesthesia, and ventilating bronchoscopes, most bronchial foreign bodies can be safely removed with the patient under general anesthesia. This rarely requires more than 30 minutes, and if the procedure is more prolonged, consideration should be given to possible postoperative subglottic edema. Chest physical therapy should be continued for 24 hours after endoscopy to encourage the expectoration of inspissated tracheobronchial secretions.

### **Complications**

Complications appearing after the endoscopic removal of foreign bodies are rare. Pneumothorax and pneumomediastinum have been reported after esophagoscopy for removal of foreign bodies. The most significant factors are the foreign body itself and peculiarities of presentation, including the length of time the foreign body has been impacted in the esophagus. Laryngospasm and subglottic edema are preventable postoperative complications of bronchoscopy. Laryngeal edema is prevented by the use of an appropriate size of bronchoscope for the individual, minimal manipulation, and reduction of the length of the operative procedure to a minimum. Dexamethasone (Decadron), 1.4 mg/kg up to a maximum of 20 mg given as a bolus intravenously, is used routinely to prevent subglottic edema.