

# CT evaluation of pediatric airway foreign bodies: Emphasis on the role of CT scanning in foreign body removal with bronchoscopy

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## Abstract

A foreign body that enters the airway through aspiration may become lodged in the trachea, bronchi, or larynx. The size, shape, and type of the foreign body determine where it should be lodged. Children are more frequently impacted. Unexpected inspiration during play or fighting while holding something in their mouths can result in accidents. The first study of choice for any child being evaluated for foreign body aspiration is still a plain film chest X-ray. Computerized tomographic examinations have a slightly higher sensitivity. We report a case of aspiration foreign body in a 12-year-old boy with the main complaint of choking. On physical examination, there were decreased breath sounds and wheezing in the upper left lung area. Chest x-ray revealed a radioopaque needle pin-like foreign body and no abnormalities in both lung. The results of a chest computed tomography (CT) scan showed a needle was about 4cm long and located in left bronchus. Once the diagnosis is made, removal of the foreign body with bronchoscopy is performed in these cases. Chest CT scans may need less time for evaluation and provide finer image resolution, making it easier to identify the position, size, and form of AFBs. As a result, chest CT scans offer great potential usefulness in the investigation of suspected AFBs.

**Keywords:** airway foreign bodies, ct scan, case report

## Introduction

A foreign body that enters the airway through aspiration may become lodged in the trachea, bronchi, or larynx. The size, shape, and type of the foreign body determine where it should be lodged. A smaller foreign body will lodge in the trachea or bronchi, but a larger one will lodge in the supraglottic area. Pins, needles, fish bones, and other sharp-pointed foreign objects can become lodged in any part of the tracheobronchial tree or larynx.<sup>1</sup> According to research conducted in 2007 by the National Safety Council, 4,344 injury deaths involving people of all ages in the US were caused by choking. Choking is the fourth most common cause of injury mortality for kids under five. The "gag reflex" and "cough reflex," which can both occasionally result in abrupt closure of the vocal folds (laryngospasm), are two protective physiological processes that assist avoid aspiration in youngsters. In 2001, 17,537 children under the age of 14 received treatment for episodes associated to choking in emergency rooms across the United States, despite these physiological limitations.<sup>2</sup>

Children are more frequently impacted. Unexpected inspiration during play or fighting while holding something in their mouths can result in accidents. The most prevalent vegetable foreign body in children's diets is peanuts; other typical foods include almond, pea, bean, gram, or wheat seeds, watermelon, carrot, or apple bits. Plastic toys, plastic whistles, safety pins, nails, all-pin, twisted wires, and ball bearings are examples of non-vegetable materials.<sup>1</sup> It can be determined by a thorough history of the "ingestion" of the

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foreign body and a physical examination of the chest and neck. A classic triad consists of a history of abrupt beginning of coughing, wheezing, and decreased air admission into the lungs during auscultation. Children who have asthma, stridor, coughing, wheezing, or recurring chest infections that are being treated with steroids and antibiotics should be highly suspicious. Radiology is quite beneficial. The first study of choice for any child being evaluated for foreign body aspiration is still a plain film chest X-ray (CXR). Computerized tomographic examinations are felt to have a slightly higher sensitivity.<sup>3</sup> CT is an accurate and reliable diagnostic tool in the evaluation of FBA that can increase the rate of positive bronchoscopy.<sup>4</sup> When an aspirated foreign object is suspected based on a history, physical examination, or radiologic testing, endoscopy should be taken into consideration for a final diagnosis and course of therapy. When evaluating and removing foreign objects from the airway, rigid endoscopy is still the method of choice.<sup>3</sup>

## Case Report

A 12 year old boy patient was admitted to the emergency department after choking on a needle pin. The patient has no history of certain diseases. According to the mother's statement, the child was playing and suddenly he experienced an episode of coughing and choking. The mother saw the child playing with a needle pin. As the symptoms did not improve, he was referred to us for further investigation. On physical examination, there were decreased breath sounds and wheezing in the upper left lung area.

Initially, a chest radiograph was taken and the needle was observed in the left bronchus. Chest radiograph revealed a radioopaque needle pin-like foreign body and no abnormalities in both lungs (Figure 1). Computed tomography was performed in order to define the exact location of the needle. In computed tomography of the chest, the needle was about 4 cm long and was located in the left bronchus (Figure 2).



Figure 1. Chest x-ray showed radioopaque needle pin-like foreign body (arrow) in the left bronchus.

After the diagnosis is made, the patient is planned to undergo bronchoscopy. The needle was removed in the operating room with bronchoscopy under general anesthesia. There are no complications during the removal process. The foreign body was successfully extracted. Post-operative period was uneventful. The child was put under observation status for 24 hours, and was discharged home in good condition. The patient was prescribed antibiotics and analgesic treatment and was discharged with recommendations.

## Discussion

The majority of cases of foreign body aspiration involve children under three years old, and they are more common in the male population.<sup>1</sup> The most frequently aspirated substance is organic material, while most programs show a variety of potential objects. Aspirating a foreign body is a serious emergency. It continues to be a significant cause of death for kids. In the United States, emergency rooms treated 17,537 children under the age of 14 for incidents linked to choking in 2001. The bulk of choking incidents happen when toddlers are still oblivious to danger, refuse supervision, and venture off on their own. When it comes to aspiration and ingestion, boys are marginally more likely than girls to experience these injuries since they are often more active and curious about their surroundings. Small objects found in the child's surroundings are often reflected in the types of FBs that are inhaled. Safety pins, marbles, and jacks are among the items that are becoming rare.<sup>2</sup> In this case, a 12 year old boy patient was admitted to the ED after choking on a needle pin.

Inhaled foreign body presentation may vary depending upon the exact site of obstruction with the airway. The history may present with a witnessed foreign body in the mouth or even no apparent foreign body presentation in a young child, and this can delay diagnosis. The following are indications and symptoms of inhaling a foreign body: difficulty breathing, cyanosis, hypoxia, death, wheezing, coughing,

hoarseness, shortness of breath, and choking. A foreign body in the larynx can cause hoarseness, however this is less common when the object is in the right major bronchus.<sup>5</sup> Most patients (58–91%) arrive after an initial episode of coughing and choking that was observed. A thorough report of the incident should be gathered from the parent or another observer if the patient is not experiencing acute respiratory distress. When a choking incident is not observed, it may mislead and give rise to a false sense of security. An alternate description from parents can be of a sudden onset of noisy breathing, drooling, wheezing, noisy breathing, and loss of consciousness.<sup>2</sup>

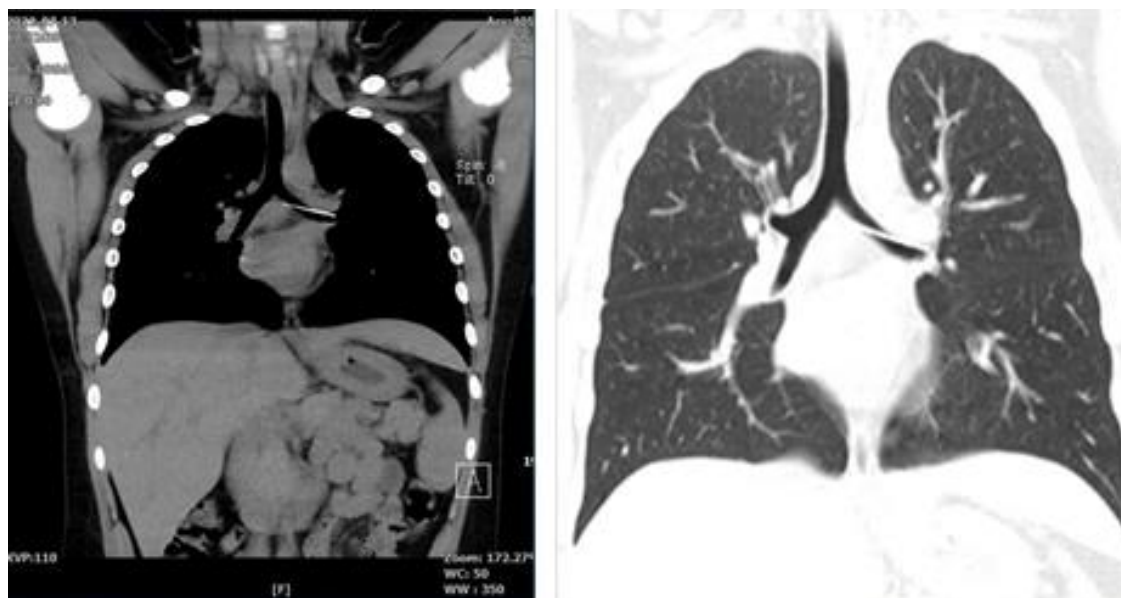


Figure 2. Chest CT scan revealed a needle was about 4 cm long and located in left bronchus

Most FBs do not cause complete obstruction, and so the signs and symptoms at presentation are variable depending on the location of the FB. The most typical physical examination findings include cough, wheezing, stridor, and reduced breath sounds. The most sensitive characteristics are new onset cough and a choking event (80% and 100%, respectively), however their specificity is limited. The most precise indication is the stridor (88% specificity). The most common presenting bronchial FB symptom is a cough and choking episode (92%), which is followed by an abrupt unilateral wheeze (84%). About half the time (57%), the characteristic trio of unilateral wheezing, coughing, and diminished or feeble breath sounds are present. For that reason, FBs may or may not produce stridor, depending on their position and size.<sup>2</sup>

The history, physical exam, and radiographs help guide clinical decision making. On physical examination alone, foreign bodies can occasionally be difficult to diagnose. Radiographic imaging can sometimes detect them more easily in stable patients. In comparison to computer tomography (CT) and bronchoscopy, chest radiographs have a sensitivity of 25% and a specificity of 62.5%. In 67.7% of patients, plain chest radiography reveals the presence of a foreign body or a pleuroparenchymal lesion consistent with a foreign body.<sup>2</sup> Chest films radiography results are typically normal (11%–26%) unless there is a radiopaque foreign body present. Pneumothorax, pneumonia, atelectasis, hyperinflation, and mediastinal shift are other radiographic findings. Traditionally, the "ball-valve" effect causes the lung on the foreign body side to hyperinflate. Upon inspiration, the intrathoracic pressure drops, allowing air to pass into the bronchus. As the bronchus (partially) compresses around the foreign body during expiration, the intrathoracic pressure decreases.<sup>5</sup>

When diagnosing foreign bodies, standard radiographs are frequently the first screening method used. However, there is a significant danger of false negatives because of the inherent limits of this approach, particularly for radiolucent foreign substances. Only 15% of foreign entities are radio opaque, according to Moskowitz et al.<sup>6</sup> If there is no visible foreign body in direct radiography or if pinpointing the precise location of the needle proves to be challenging, bronchoscopy or computed tomography may be necessary. In some cases, three-dimensional computed tomography is used for better visualization of

foreign bodies.<sup>7</sup> CT scan is a more sensitive diagnostic tool and is increasingly becoming the imaging of choice. According to Hong et al., CT scans had an overall sensitivity and specificity of 100% and 66.7%, respectively.<sup>6</sup>

The location of the foreign body in this case was uncommon. Because of this, it lodges in the right major bronchus more frequently than the left, which is comparatively straighter, wider, shorter, and closer to the trachea. The less common occurrence of a foreign body lodged in the left bronchus can be explained by Bernoulli's effect. Coughing, laughing, or speaking causes higher negative suction pressure in the left main bronchus due to its smaller diameter than the right, which causes the foreign body to aspirate to the left side.<sup>8</sup> When compared to alternative methods like chest X-rays, simple chest CT scans may need less time for evaluation and provide finer image resolution, making it easier to identify the position, size, and form of AFBs. As a result, chest CT scans offer great potential usefulness in the investigation of suspected AFBs, helping to prevent needless bronchoscopy and its related complications. But it's crucial to remember that a CT scan of the chest has certain drawbacks as well. Unlike microlaryngobronchoscopy, which can be used for both diagnostic and therapeutic purposes, it is not a useful technique for the removal of foreign materials. Second, a number of conditions can still result in false positives, including mucus plugging, airway infections, tumors in the airways, tracheobronchial malacia, and tracheobronchial stenosis.<sup>9</sup>

## Conclusion

We report a case of a 12 years old boy was admitted to the emergency department after choking on a needle pin. The patient shows indications and symptoms of foreign body aspiration. Then the patient underwent a chest x-ray and CT scan. Once the diagnosis is made, removal of the foreign body with bronchoscopy is performed in these cases. Chest CT scans may need less time for evaluation and provide finer image resolution, making it easier to identify the position, size, and form of AFBs. As a result, chest CT scans offer great potential usefulness in the investigation of suspected AFBs.

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