

## CASE SERIES ON FOREIGN BODY INGESTION IN CHILDREN

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### Abstract

**Background:** Ingestion of foreign bodies is common in children but less so in older children and adults. This study aims to report on the types of foreign bodies ingested by children, focusing on detectable radiopaque foreign bodies. The study reviewed data from children who presented to the radiology department over one year with a history of foreign body ingestion. The foreign bodies were detected and interpreted using chest and abdomen radiographs. The study showed that the majority of foreign body ingestion events occurred in children between 6 months and three years of age, with rare occurrences beyond five years of age. A coin was the most commonly ingested foreign body, followed by batteries (both button and lithium). Rare cases involved ingesting toy parts, brass dice, sim card removers, and magnets in descending order. The study highlights the importance of radiographic evaluation in detecting ingested foreign bodies in children. The findings can guide clinical management decisions and prevent potential complications associated with foreign body ingestion.

## INTRODUCTION

Foreign body ingestion and food bolus impaction are frequent occurrences, with most cases happening in children, particularly between 6 months to 6 years. However, most foreign objects pass through the digestive system without causing any harm and are eventually expelled through bowel movements.<sup>[1]</sup> How foreign body ingestions are managed can differ depending on factors such as the patient's age, the type of object ingested, where it is located, any pre-existing mental or physical health conditions, and the symptoms that the patient is experiencing.<sup>[2]</sup> When the object ingested is a sharp foreign body, such as a nail, it is more likely to lead to complications. Here in the current study, we have reported the different foreign bodies that are ingested by children with the radiograph concentrating mainly on detectable radiopaque foreign bodies

Locations and imaging findings in various cases  
 Cricopharynx and esophagus

The most common location for ingested foreign body impaction is in the upper esophagus, at the cricopharynx or the narrowest part of the esophagus. The pharyngoesophageal junction is the constriction

produced by the cricopharyngeal part of the inferior constrictor muscle. This cricopharyngeal region is the narrowest part of the esophagus.

Foreign body impaction within the upper esophagus, at the level of the cricopharyngeus muscle (Fig. 1a and b), accounts for approximately 75% of all foreign body impaction cases. Coins, meat, and fish bones are the most common foreign bodies in the cricopharynx. Most cricopharynx and esophageal foreign bodies pass out spontaneously. Endoscopic removal is required for foreign bodies that do not pass out even after 24 hours. Retained cricopharynx and esophageal foreign bodies can result in major complications such as retropharyngeal/prevertebral abscess, esophageal obstruction/perforation, and mediastinitis. Rarely an aortoenteric fistula can occur with a button battery in the esophagus.

Foreign bodies at or above the cricopharyngeus muscle necessitate otorhinolaryngology consultation. If below the cricopharyngeus muscle, they can be removed by endoscopy.

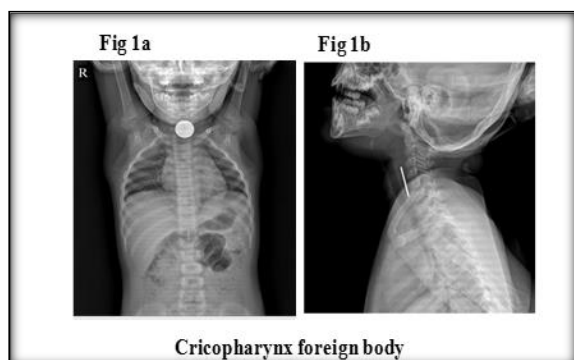
## MATERIALS AND METHODS

A prospective observational study was conducted at the Neonatal Intensive Care Unit in a tertiary care

hospital for one year. Neonatal patients with Congenital Heart Disease were the subjects of this study. Patients who met the inclusion and exclusion criteria were enrolled in the research to assess congenital heart disease in neonates. Fifty neonates were included in this study, and the study was carried out after receiving approval from the institutional ethics committee. A parent's written informed consent was required before a neonate was included.

## RESULTS

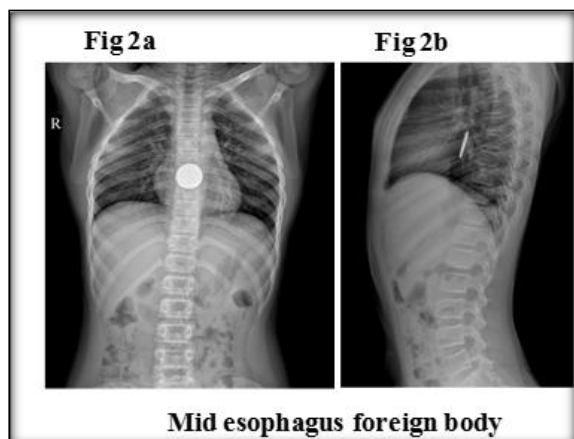
### Case -1



**Figure 1:**

Figure 1 (a) shows an AP view of the neck, which displays a round radiopaque foreign body (coin) lodged at the level of the cricopharynx. 1 (b), a lateral neck radiograph demonstrates the thickening of prevertebral soft tissue at the C5-C7 level associated with an impacted foreign body.

### Case -2



**Figure 2:**

Figure 2 (a) Displays an AP view of the chest, which depicts a round radiopaque foreign body (coin) lodged at the level of the mid-esophagus. (b), a lateral view shows the coin lodged at the mid-esophagus level, with the foreign body being coronally oriented and located behind the respiratory tract.



**Figure 3:**

Figure 3 depicts a lower esophageal foreign body. An AP view of the chest demonstrates a round radiopaque foreign body (coin) lodged at the level of the lower esophagus, located above the lower esophageal sphincter.

Lower esophageal foreign bodies typically lie proximal to the lower esophageal sphincter and above the diaphragmatic outline (Fig 3). Coins are the most common type of ingested foreign body in children. Fortunately, because they lack sharp edges and are generally non-toxic, ingested coins that reach the stomach can be managed conservatively. However, if ingested coins become lodged in the esophagus or stomach and cause symptoms or if they fail to pass out of the esophagus after 24 hours or the stomach after four weeks, endoscopic removal is usually required.

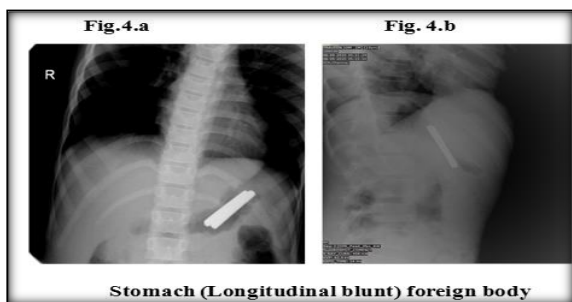
Unlike other blunt objects, button batteries in the esophagus require emergency endoscopic removal, even if there are no symptoms of severe impaction.

#### Stomach

In most cases, foreign bodies in the stomach typically resolve within 4 to 6 days and can be managed conservatively as an outpatient, although some experts recommend early endoscopic removal. For children who have ingested a foreign gastric body, such as a coin, it is advisable to encourage them to consume a regular diet and monitor their stools for signs of object passage. For small, blunt objects that have not yet passed, regular weekly radiographs are typically sufficient to track their progression, which may take up to four weeks, provided that the patient is asymptomatic [Figure 4a and 4b].

### Case-3

Button batteries may mimic coins on radiographs. A double contour, a "halo" sign on the frontal projection, is a helpful way to differentiate the two. Figure 5 (a) or a "step-off" sign on the lateral projection—Figure 5 (b). Step-off signs means the asymmetry of both sides of the button battery because the negative terminal diameter is smaller than the positive terminal's.

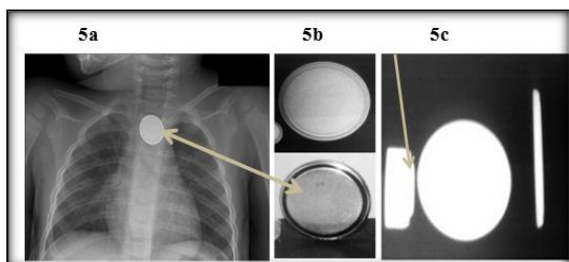


**Figure 4:**

Figure 4 (a). AP view of the lower chest with abdomen shows a longitudinal blunt radio-opaque (metal) foreign body (longitudinal brass dice) lodged within the stomach air shadow, (b). The lateral view confirms the foreign body is within the stomach air shadow. Note the foreign body is oriented and lies within the stomach lumen.

**Case-4**

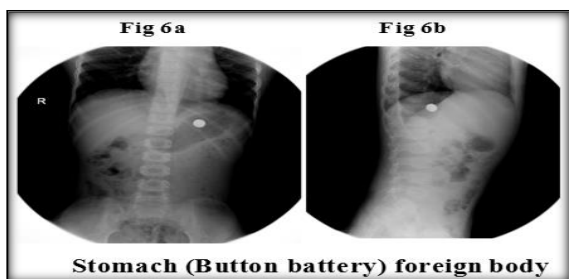
In most cases, button batteries, as depicted in Figures 6c and 6d, pass through the esophagus without any issues and can be monitored through radiographs every 3 to 4 days. However, endoscopic removal is advised. Once the batteries have passed the gastroesophageal junction, an initial follow-up radiograph should be taken after 48 hours. Radiographs should be taken every 3 to 4 days when a foreign body crosses the pylorus to ensure continued movement.



**Figure 5:**

In figure 5 (a), the arrow points to the double halo or rim sign. Figure 5(b), coins will appear as a singular rectangular opacity on the lateral view. On the other hand, a button battery will have a subtle step-off due to the negative terminal diameter being smaller than the positive terminal's diameter.

**Case-5**



**Figure 6:**

Figure 6 (c). AP view lower chest with abdomen shows a round radio-opaque (metal) foreign body (button battery) lodged within the stomach air shadow (d). The lateral view confirms the foreign body is within the stomach air shadow. Note the "step-off" sign on the lateral projection.

**Duodenum**

Coins and batteries usually pass through the duodenum without any issues. However, sharp objects longer than 6 cm and located near the duodenum (Fig 7) often get stuck in the duodenal C-loop and can cause problems. Such objects will likely perforate the Treitz ligament, so they should be removed immediately. Examples of long foreign bodies that are difficult to swallow include brushes, pencils, and utensils. It's worth noting that these incidents are often intentional and are more common in patients with psychiatric illnesses. On the other hand, short and long blunt objects can typically be managed conservatively, and imaging follow-up can be used to monitor their progress.

**Case-6**



**Figure 7:**

Figure 7, the AP view of the abdomen, shows a sagittally oriented radiopaque metal foreign body, specifically a coin, lodged within the first part of the duodenum.

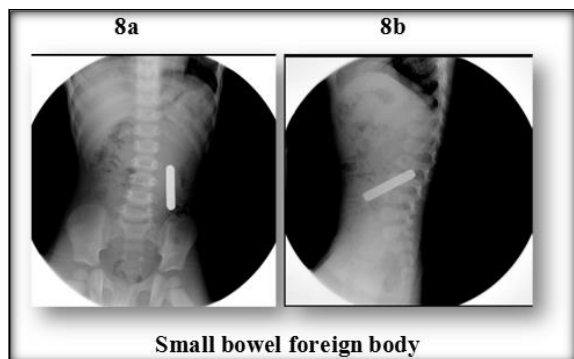
**Small bowel**

In the anteroposterior view, foreign bodies in small bowel loops appear to lie in midline or paramedian locations [Figure 8a]. In the lateral view, the foreign body lies anterior to the spine, and sometimes large foreign bodies overlap the spine shadow [Figure 8b].

Most FBs in the small bowel are passed spontaneously without complications. Therefore, physicians should reassure the children or caregivers and advise them to check the children's stool for FB. If the FB is not eliminated even after a week, children need to visit the hospital and obtain an X-ray to identify the accurate location of the FB. Children should be advised to visit the hospital earlier if they develop signs of perforation or

intestine obstruction, such as vomiting, severe abdominal pain, fever or intestinal bleeding.

**Case-7**



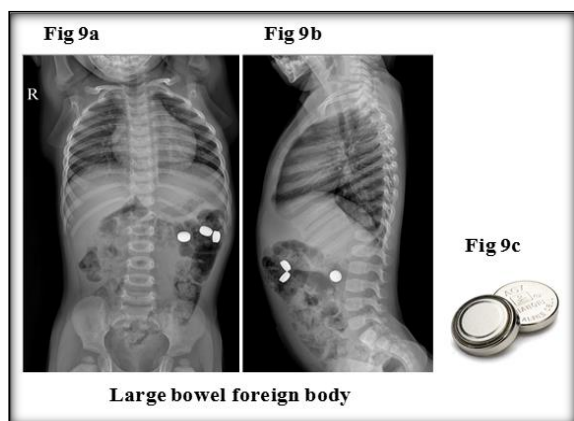
**Figure 8:**

Figure 8 (a). AP view lower chest with abdomen shows a longitudinal blunt radiopaque (metal) foreign body (longitudinal brass dice) lodged within the small bowel loops (b). The lateral view confirms the foreign body is within the small bowel. Note: The foreign body is oriented craniocaudal and anteroposterior, overlapping the spine (posteriorly) and the small bowel loops (anteriorly).

**Large bowel**

On the lateral view, foreign bodies within the large bowel are visible. Figures 9a and 9b show those in the transverse colon are anteriorly situated. In contrast, those in the ascending or descending colon and flexure appear posteriorly, as seen in Figure 9c for button batteries. Most foreign bodies entering the large bowel are expelled spontaneously and without complications. However, obstacles can occur at specific points in the large bowel, such as the hepatic flexure, splenic flexure, rectosigmoid junction, and anal canal. Despite this, most foreign bodies can easily pass through these areas. The shape and appearance of the foreign body can assist in identifying the ingested object and determining whether it is blunt or sharp [Figure 10a and 10b].

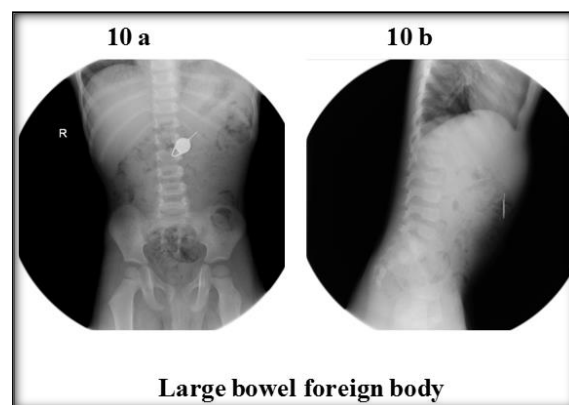
**Case-8**



**Figure 9:**

Figure 9 (a). AP view of the abdomen shows a round radiopaque (metal) foreign body (button batteries) lodged within the distal transverse colon and splenic flexure region. All the button batteries are within the large bowel, as there is no interposed soft tissue between the two opacities. (b). the lateral view confirms the foreign body is within the distal transverse colon and splenic flexure region air shadow. Note the foreign body lies within the bowel air anteriorly (transverse colon) and has no overlap on the spine. Also, Note the step-off sign (Both sides of the button battery look asymmetric, unlike the coin) on the lateral projection.

**Case-9**



**Figure 10:**

Figure 10 (a). AP view of the abdomen shows a radiopaque (metal) foreign body (Sim card remover) lodged within the transverse colon region (b). The lateral view confirms that the foreign body is within the air shadow of the transverse colon region. Note the foreign body lies within the bowel air anteriorly (transverse colon) and has no overlap on the spine. Also, note the foreign body is coronally oriented at present. When multiple magnets or a pair of magnetic and metal objects are ingested, there is a risk for bowel wall pressure necrosis caused by the attractive force between the two objects [Figure 11]. Devastating complications such as fistula, perforation, obstruction, volvulus and peritonitis have been reported. It may be difficult to discern the number of ingested objects from radiographs.

**Case-10**



**Figure 11:**

Figure 11. AP view of the abdomen shows a radiopaque foreign body (neodymium magnets) lodged within the transverse colon region. The shape and appearance of the foreign body help us identify the object ingested and the idea of a sharp or blunt foreign body. Serial radiographs carefully monitor piled-up neodymium magnets. If no distal progress is noted, then immediate surgical removal is needed

### Sharp foreign body

In cases where a sharp foreign body is detected in the esophagus, prompt endoscopic removal is recommended. Similarly, if the object has traversed the gastroesophageal junction and is still accessible by endoscopy, urgent retrieval should be performed, provided it can be done safely. For sharp objects that have passed through the duodenum, up to 35% of cases may result in perforation, necessitating daily radiographic monitoring to monitor passage. Surgical intervention is recommended if the patient exhibits symptoms or if sharp objects remain stationary beyond endoscopic reach for over three days. Radiographic imaging can effectively determine the sharpness of the foreign body and guide subsequent management decisions [Figure12].

### Case-11



Figure12:

Figure 12. The AP view of the abdomen shows a radiopaque (metal) foreign body (sharp needle) overlapping the liver, which probably pierced the duodenum and entered the liver parenchyma. A minimal right subdiaphragmatic air pocket is seen. The radiograph depicts the foreign body's sharp appearance, which helps to decide the further management course.

Rectal foreign bodies are rare in children and seen in adults.

Table 1: Summary of recommendations for imaging follow-up for various ingested foreign bodies.

Foreign body types	Imaging follow-up protocol
Sharp foreign body	Daily radiograph for up to 3 days Consider CT for radiographically invisible FB or evaluation of complications (e.g. abscess)
Blunt foreign body	Weekly radiograph for up to 4 weeks
Coins	Weekly radiograph for up to 4 weeks
Batteries	Once batteries pass the GE junction, initial follow-up radiograph at 48 hours Once past the pylorus, repeated radiograph every 3-4 days
Magnets	Close follow-up with frequent serial radiographs to ensure mobility and multiple magnets need immediate referral

## DISCUSSION

Infants tend to put almost anything they come across into their mouths. Foreign body ingestion in the upper gastrointestinal (GI) tract is commonly seen in three categories of patients: children, psychiatric patients and prisoners, and edentulous patients.<sup>[3]</sup> Children constitute the majority of patients with foreign body ingestion in the upper GI tract, accounting for 75-85% of cases. However, edentulous adults are also at an increased risk of ingesting foreign bodies, such as an obstructing food bolus or dental prosthesis.<sup>[4]</sup>

Fortunately, the mortality rates associated with foreign body ingestion are extremely low. Several studies, including two large series, have compiled data on foreign body ingestion and reported no deaths in 852 adults and only one in 2206 children.<sup>[5]</sup> The esophagus is part of the gastrointestinal tract with the narrowest diameter, which makes it the most common site of foreign body impaction. Foreign bodies can become lodged

in different oesophagus areas, including the thoracic inlet, around the aortic arch, or the gastroesophageal (GE) junction. Among these locations, the thoracic inlet is the most frequent site of impaction, followed by the GE junction and then the aortic arch.<sup>[6]</sup>

Objects in the esophagus can cause different symptoms like difficulty swallowing, excess saliva, and sometimes difficulty breathing. When foreign bodies are in the gastrointestinal tract, symptoms are less clear and can include stomach ache, dark or bloody stool, and bleeding from the rectum.<sup>[7]</sup>

The current study recommends conducting neck, chest, and abdomen radiographic evaluations for all children with a history of swallowing foreign objects. If the object is radiolucent, meaning it cannot be seen on X-ray, then direct visualization or contrast radiographs may be necessary to detect its location. The imaging follow-up protocol for foreign body ingestion depends on the type of foreign body. Daily radiographs for up to three days are recommended for sharp foreign bodies to assess for any signs of perforation or obstruction. Additionally, CT imaging should be considered for

radiographically invisible foreign bodies or complications such as abscess formation.

In cases of blunt foreign bodies, such as coins, weekly radiographs for up to four weeks are recommended to assess for any signs of obstruction or perforation. Similarly, imaging follow-up is crucial for batteries, and the protocol varies depending on the location of the battery. Once a battery has passed the gastroesophageal junction, an initial follow-up radiograph should be obtained at 48 hours. Repeated radiographs should be obtained every 3-4 days to ensure its safe passage through the gastrointestinal tract if the battery has passed the pylorus.

Magnets, particularly if multiple magnets are ingested, require close follow-up with frequent serial radiographs to ensure mobility and avoid complications such as bowel obstruction or perforation. An immediate referral to a specialist is recommended if multiple magnets are ingested.

## CONCLUSION

Conducting imaging after FB ingestion is crucial to ensuring its safe passage through the GI tract and identifying potential complications, such as perforation or obstruction. It is recommended to adhere to specific measures to minimize the

morbidity and mortality associated with foreign body ingestion. The appropriate imaging follow-up procedure may differ depending on the nature of the foreign body. Hence, healthcare providers should recognize the importance of timely and efficient radiographic assessment and monitoring to ensure effective management of suspected cases of foreign body ingestion.

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