

# Foreign Body Ingestion and Aspiration

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Ingestion of foreign objects and substances is a danger to children once they become mobile in their environment through crawling and before they develop the knowledge to avoid putting non-food objects in their mouths. Some ingestions cause serious and lasting damage to the aerodigestive tract.

## 1. Pathophysiology:

### (a) Demographics and risk factors:

- (i) Uncommon in age less than 6-months-old because children usually cannot find objects to swallow until they are able to crawl around. An exception to this rule is when older siblings provide objects for younger children to ingest.
- (ii) The behavior is uncommon after age 2-years-old; however there are exceptions due to children acting out or taking dares with peers at older ages.
- (iii) In households where cleaning products or other caustic substances are stored in containers intended for food or drink, there is an increased risk of ingestion by children.

### (b) Ingestion of foreign objects:

- (i) Coins are the most commonly swallowed objects.
- (ii) Button batteries are particularly dangerous. They can cause tissue damage within a few hours. Potential injuries are burn, stricture, perforation, and fistula to vocal cord, trachea, esophagus, and arterial structures. Death is possible, in particular with aortoenteric fistula.

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All swallowed objects must be evaluated to determine if they are a button battery or similar injurious object.

- (iii) Swallowed magnets can be a danger. A solitary magnet will usually pass easily if it is small enough, but when multiple magnets are swallowed, they can cause perforation when magnets in neighboring loops of bowel cause pressure necrosis of the bowel walls between them. Magnets are present in household objects, jewelry, and some toys.
  - (iv) Food impactions can lodge in the esophagus. This may be due to poor chewing, motility disorder or anatomic obstructions such as webs or strictures.
  - (v) Children can swallow narcotic packets either through error when they are left in reach or through intentional exploitation of the child for drug smuggling.
  - (vi) Any object that passes the lower esophageal sphincter will usually pass through the entire gastrointestinal tract.
  - (vii) Sharp objects such as fish bones, pins, needles, and screws can lodge in the wall or cause perforation of the esophagus. If they pass to the stomach, most will pass through the gastrointestinal tract. Rarely can lodge in the appendix.
- (c) Ingestion of caustic substances:
- (i) Poison control should be contacted to determine components of ingested substances, determine potential for injury, and discuss treatment options.
  - (ii) American Association of Poison Control Centers: 1-(800)222-1222.
  - (iii) Acids:
    - 1. Battery acid, cleaning products.
    - 2. Cause coagulation necrosis of mucosa.
    - 3. Appears hemorrhagic or erythematous.
    - 4. Usually injure stomach more than esophagus.
  - (iv) Alkalis:
    - 1. Lye, drain cleaner.
    - 2. Cause liquefaction necrosis.
    - 3. Injure esophagus more than stomach.
    - 4. Cause deeper injuries and are prone to scarring and stricture.
    - 5. Appear as pale tissue, sometimes with denuded ulcers.
- (d) Aspiration of foreign object:
- (i) Objects commonly aspirated are seeds, nuts, small toys, and coins.
  - (ii) Represent a true emergency, and small movements in the position or orientation of the object can turn a partial airway obstruction into a complete asphyxiation.

- (iii) Blockage of the trachea is immediately apparent; blockage of a bronchial branch may not become apparent until pneumonia develops.
- (iv) Some objects with natural oils or chemicals can cause a chemical or allergic pneumonitis.

2. Clinical presentation:

- (a) Parents will usually present after witnessing child swallowing object.
- (b) Patient may present with difficulty eating, swallowing, or breathing.
- (c) Patient may present with recurrent pneumonias.
- (d) Perforation of a hollow viscus will cause presentation with abdominal pain, vomiting, and sepsis.

3. Diagnosis:

(a) History:

- (i) Parents may have witnessed child swallowing object/substance.
- (ii) Difficulty eating, swallowing and copious saliva.
- (iii) Vomiting, hematemesis.
- (iv) Coughing, difficulty breathing, chest pain.
- (v) If perforation, abdominal pain.
- (vi) There may be a history of chronic, recurrent pneumonias.

(b) Physical examination:

- (i) Burns or cuts on lips and mouth.
- (ii) Changes in breath sounds, unequal breath sounds, wheeze.
- (iii) Unable to speak or hoarse voice/cry.
- (iv) Abdominal tenderness.
- (v) Fever.

(c) Diagnostic imaging:

(i) Chest x-ray:

1. Can detect radio opaque foreign objects and their position.
  - (a) Antero-posterior and lateral views allow the object location to be determined in two planes.
  - (b) Consideration must be given to determine if the foreign object is a button battery as this will make removal of the object an urgent necessity.
2. X-ray cannot detect a radiolucent foreign object.
  - (a) Presence of object in bronchus can be suspected if air trapping in bronchus is present.
  - (b) Decubitus antero-posterior x-rays of the chest for both right and left decubitus position can make air trapping more apparent.

- (c) If a child has multiple episodes of lobar pneumonia in the same lobe of lung, an aspirated foreign object should be suspected.
  - 3. Can reveal perforation and mediastinal or neck air:
  - 4. Foreign objects in the esophagus will bulge out to the sides of the esophagus because of the hard spine behind it and the stiff rings of the trachea anteriorly. This will cause coins in the esophagus to be positioned in a coronal plane.
  - 5. Foreign objects in the trachea will bulge out posterior toward the soft muscular wall of the trachea in the in the direction of the esophagus. This will cause coins in the trachea to be positioned in a sagittal plane.
- (ii) Contrast esophagram:
    - 1. Will demonstrate perforation if present
    - 2. Can detect fistula between esophagus and trachea.
    - 3. Can show if an acute or chronic stricture is present.
  - (iii) Computed tomography:
    - 1. Computed tomography can identify the location of swallowed or aspirated radiopaque foreign objects.
    - 2. It can detect perforation and leak of air or succus from a loop of bowel.
- (d) Endoscopy:
- (i) Rigid esophagoscopy: useful for both diagnosis and treatment of foreign objects. The wider channel of rigid esophagoscopy allows use of larger instruments for retrieval of foreign objects. Rigid esophagoscopy also allows visualization of the wall of the esophagus without the necessity of air insufflation which can worsen a perforation of the esophagus.
  - (ii) Flexible endoscopy: Useful for seeing past the length of a rigid scope, such as into the stomach or the duodenum. Small flexible graspers can be inserted through the suction port of the instrument.
  - (iii) Bronchoscopy: Both rigid and flexible available. Use of a rigid bronchoscope can be set up so that the patient can be ventilated through the bronchoscope during the procedure, and optical grasper can be inserted to retrieve aspirated foreign objects through the bronchoscope.
4. Treatment:
- (a) Initial assessment:
    - (i) If patient has respiratory or cardiac arrest, provide basic life support with maneuvers for airway, breathing, and circulation.
    - (ii) Make child NPO.

- (iii) Assist child to remain calm.
  - (iv) Provide humidified oxygen if child has difficulty breathing.
  - (v) Maintain child in seated position, or if more comfortable, lying down on side, so that an object coughed or vomited out does not fall back into airway.
  - (vi) Start IV for access to provide rapid medication and anesthesia.
- (b) Treatment of specific swallowed objects:
- (i) Button batteries should be immediately removed if in the esophagus, and within 24 h if in the stomach or intestine and do not pass spontaneously per anus.
  - (ii) Coins which lodge in the esophagus are removed endoscopically, and allowed to pass if they progress distal to the lower esophageal sphincter. If there is any possibility that the object is a battery, it is removed immediately.
  - (iii) Sharp objects are removed if in the esophagus or stomach, and allowed to pass if distal, unless they cause perforation or fail to pass. When removed, they are drawn out with the sharp end trailing.
  - (iv) Objects longer than 5 cm are prone to become lodged in the GI tract and should be removed.
  - (v) Food impactions in the esophagus are pulled out piecemeal, or pushed into the stomach. If past lower esophageal sphincter, no treatment necessary unless large enough to be a bezoar.
  - (vi) Ingestion of one magnet is safe, but ingestion of more than one magnet can result in perforation and requires immediate removal.
  - (vii) Narcotic packets will usually pass spontaneously, but if rupture of packet is suspected, surgical removal is necessary.
- (c) Retrieval of foreign object from esophagus:
- (i) Perform in OR under general anesthesia.
  - (ii) Rigid esophagoscopy provides best view, greatest range of instrumentation, largest diameter for extraction.
  - (iii) Position patient with shoulder roll and neck extended.
  - (iv) Take care not to injure mouth or throat.
  - (v) An alternative to esophagoscopy is use of a Foley catheter.
    1. Procedure is monitored with fluoroscopy.
    2. Foley catheter is passed distal to esophageal foreign object.
    3. Balloon is inflated.
    4. Catheter is pulled up and out of esophagus, pulling foreign object before it.
    5. Care is taken to grasp the foreign object in the mouth, and prevent it from entering the trachea.

- (d) Foreign object in stomach or more distal:
  - (i) Flexible esophagoscopy/gastroscopy has reach to a greater distance.
  - (ii) Graspers, biopsy forceps, shares, and baskets are smaller, flexible, and must fit through port of scope.
  - (iii) Provide better magnification and lighting for view.
- (e) Retrieval of foreign object from trachea:
  - (i) Procedure is emergent, delicate, and high risk.
  - (ii) Team must be ready for rapid delivery of CPR and other emergency support.
  - (iii) Prepare instruments for tracheostomy and sternotomy, in case these maneuvers are needed.
  - (iv) Take care not to convert a partial obstruction to a complete obstruction, for example, by tipping a coin in the trachea from a position that allows air passage to one that allows none.
  - (v) Rigid bronchoscopy is best as it allows viewing of the bronchial tree and instrumentation for removal of foreign objects.
  - (vi) Use a ventilating bronchoscope which can be hooked up to the circuit of the anesthesia cart.
  - (vii) Particularly helpful is a lighted grasper, which gives a close-up view from just behind the jaws of the grasper.
  - (viii) Take care not to crush and fracture objects such as nuts into multiple fragments.
  - (ix) Suction cannulae and balloon catheters can be used to remove some foreign objects from the trachea.
- (f) Care of a caustic ingestion:
  - (i) Patient is evaluated for aspiration and perforation with chest x-ray and abdominal x-ray.
  - (ii) Bronchoscopy is used to evaluate for chemical burn to trachea and bronchi.
  - (iii) Rigid esophagoscopy is used to evaluate extent of burn in esophagus: it is less traumatic than flexible esophagoscopy because insufflation is not needed.
  - (iv) Flexible endoscopy is used to evaluate stomach after ensuring there is no esophageal perforation.
  - (v) Patients are evaluated with fluoroscopic swallow study to ensure there is no perforation.
  - (vi) If perforation is present, patients are maintained NPO and given broad spectrum antibiotics.
  - (vii) If there is perforation with extensive leaking and soilage in chest, thoracotomy is performed for drainage, and repair if possible.
  - (viii) Perforation in the abdomen is treated with laparotomy and repair.
  - (ix) If there is no leakage, clear liquids are given, and diet is slowly advanced.

- (x) Patients are monitored for development of esophageal stricture.
- (xi) Some patients will require late dilation of stricture and when damage to the esophagus is extensive, repair or replacement of the esophagus may become necessary.

5. Outcome:

- (a) Most objects pass through the entire gastrointestinal tract without assistance.
- (b) Button batteries and multiple magnets are a particular danger for perforation, fistula, hemorrhage, and sepsis.
- (c) Ingestion of caustic substances, particularly alkalis, has the potential to cause extensive and chronic scarring and stricture of the esophagus requiring operative treatment.