Ingestion/Aspiration of Foreign Bodies

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Esophageal Foreign Bodies

Gastrointestinal Foreign Bodies

Special Topic Ingestions

Airway Foreign Bodies

Esophageal Foreign Bodies

Introduction

- More common in children ≤5 years of age.
- Vast majority are accidental.

Esophageal Foreign Bodies

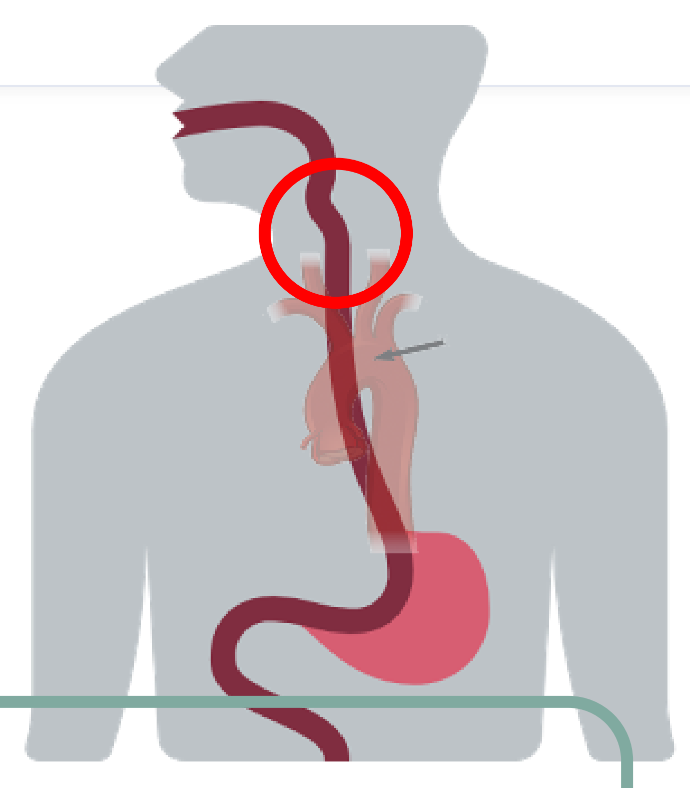
Introduction

- Most common type (by geographic region):
  - United States and Europe → **coins**
  - Marine areas → **fish bone**

- Other commonly ingested FBs:
  - toys, batteries, needles, straight pins, safety pins, screws, earrings, pencils, erasers, glass, fish and chicken bones, and meat.

Esophageal Foreign Bodies

Anatomy



- Esophagus is the narrowest portion of the GI tract
- Three main areas of narrowing:
  - cricopharyngeus sling (70%)
  - level of the aortic arch in the mid-esophagus (15%)
  - lower esophageal sphincter (GE junction) (15%)

- Other areas of potential impaction:
  - underlying esophageal **pathology** (i.e., strictures or eosinophilic esophagitis)
  - prior esophageal **surgery** (i.e., esophageal atresia)

Esophageal Foreign Bodies

Complications

- Sharp FBs may penetrate the mucosa at any level and cause:
  - Mediastinitis
  - Aortoenteric fistula
  - Peritonitis

Esophageal Foreign Bodies

Management

- **Hx:**
  - **Witnessed** event Or **disappearance** of an object
  - Symptoms can vary:
    - Completely asymptomatic
    - Drooling
    - Neck and throat pain
    - Dysphagia
    - Emesis
    - Wheezing, or respiratory distress
    - Abdominal pain

Esophageal Foreign Bodies

Management

- **PEx:**
  - Normal physical exam (**majority**).
  - Signs of complications, as:
    - oropharyngeal abrasions
    - crepitus
    - signs of peritonitis

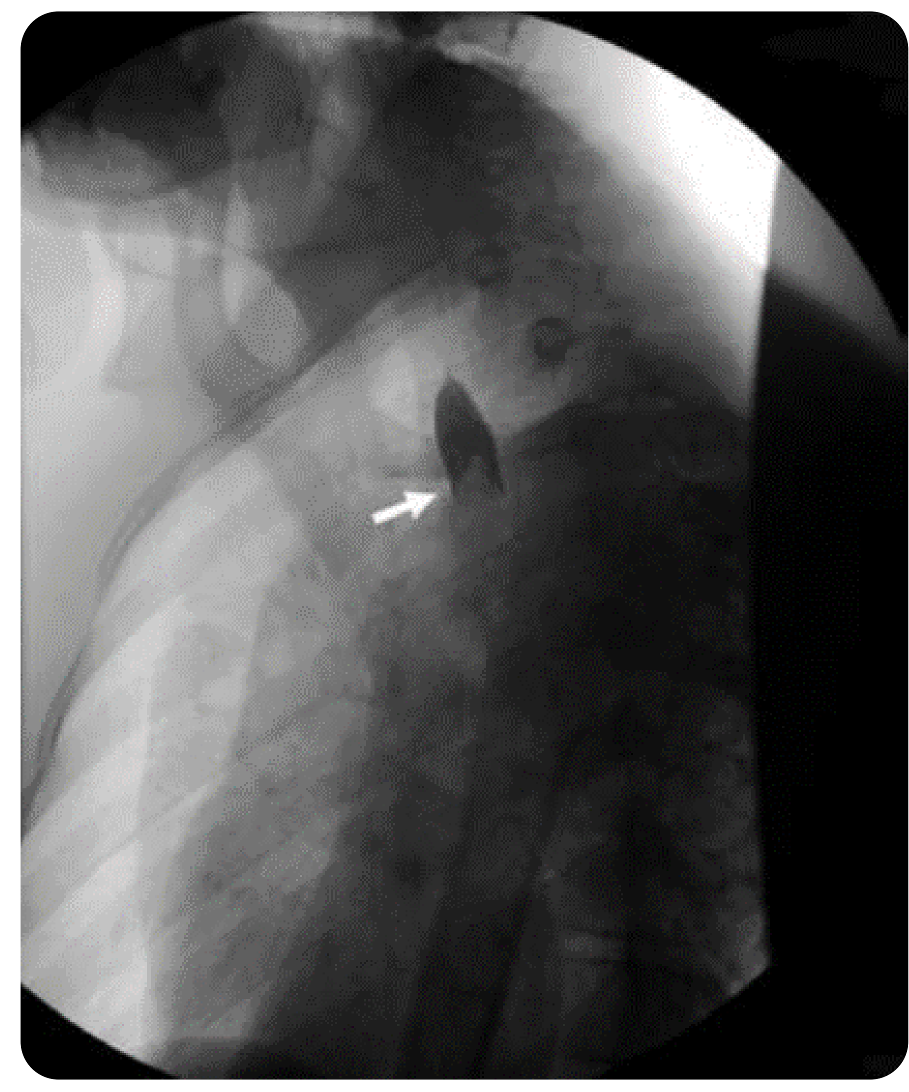
Esophageal Foreign Bodies

Management

- Neck and chest X-ray (AP and lateral)

  +/- Contrast esophagography

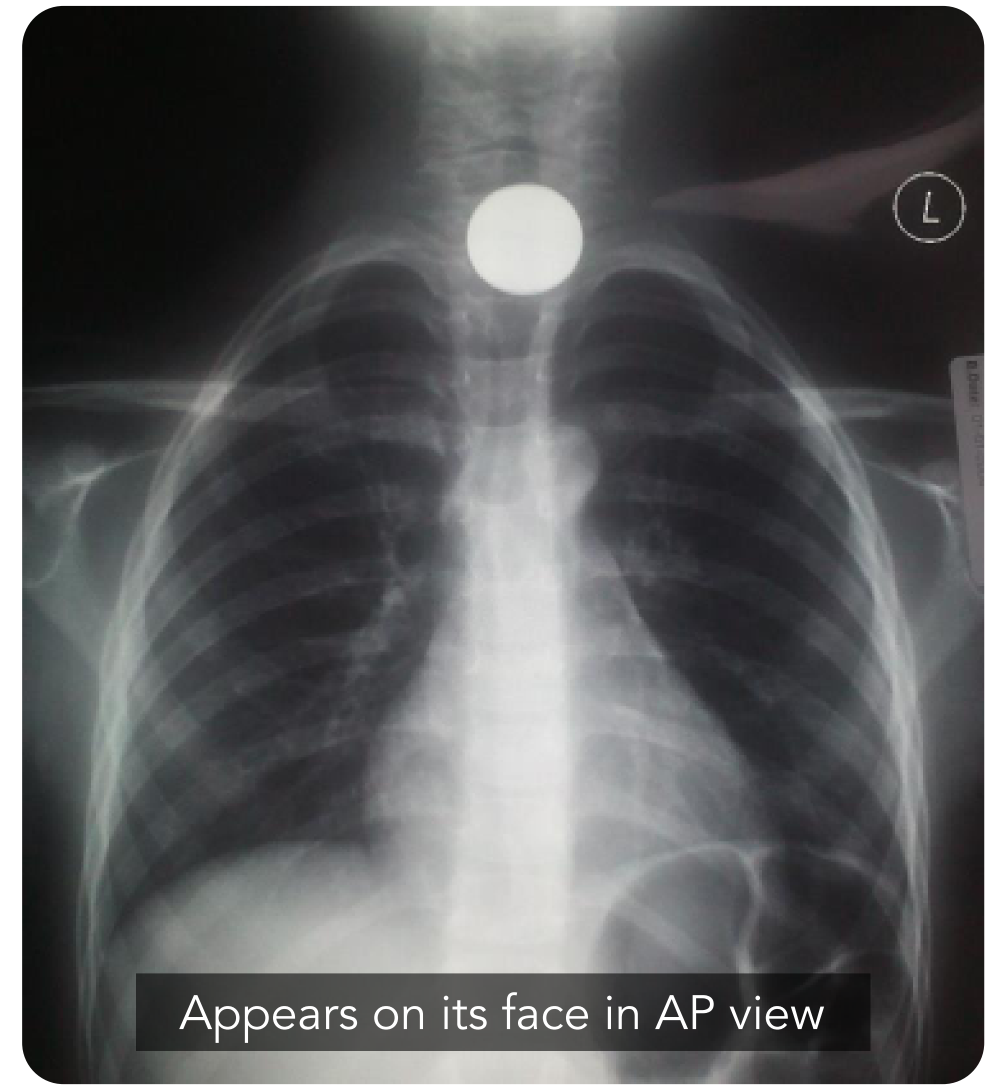
  +/- Esophagoscopy

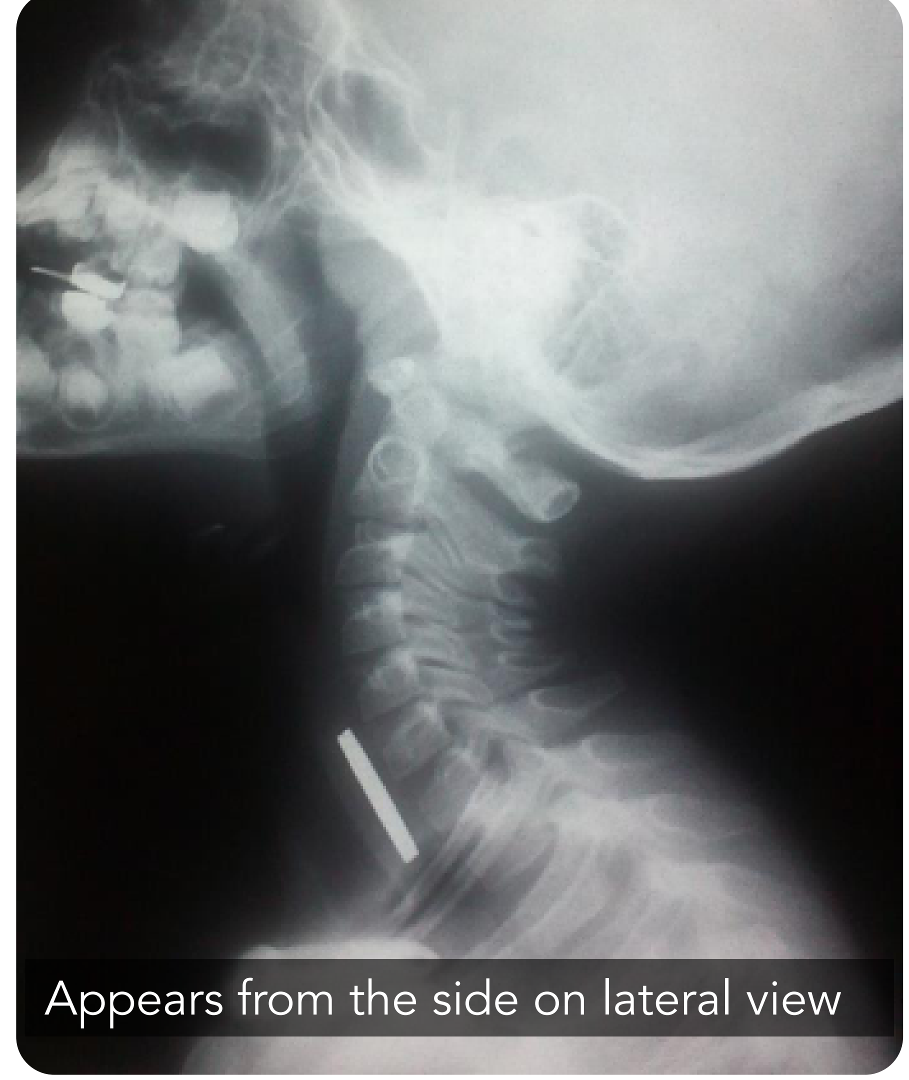


Esophageal Foreign Bodies

Coins

- Majority (of proximal) will remain entrapped and require retrieval.
- Options for retrieval:
  - Magill forceps
  - Endoscopy (rigid or flexible)
  - Foley balloon extraction with fluoroscopy

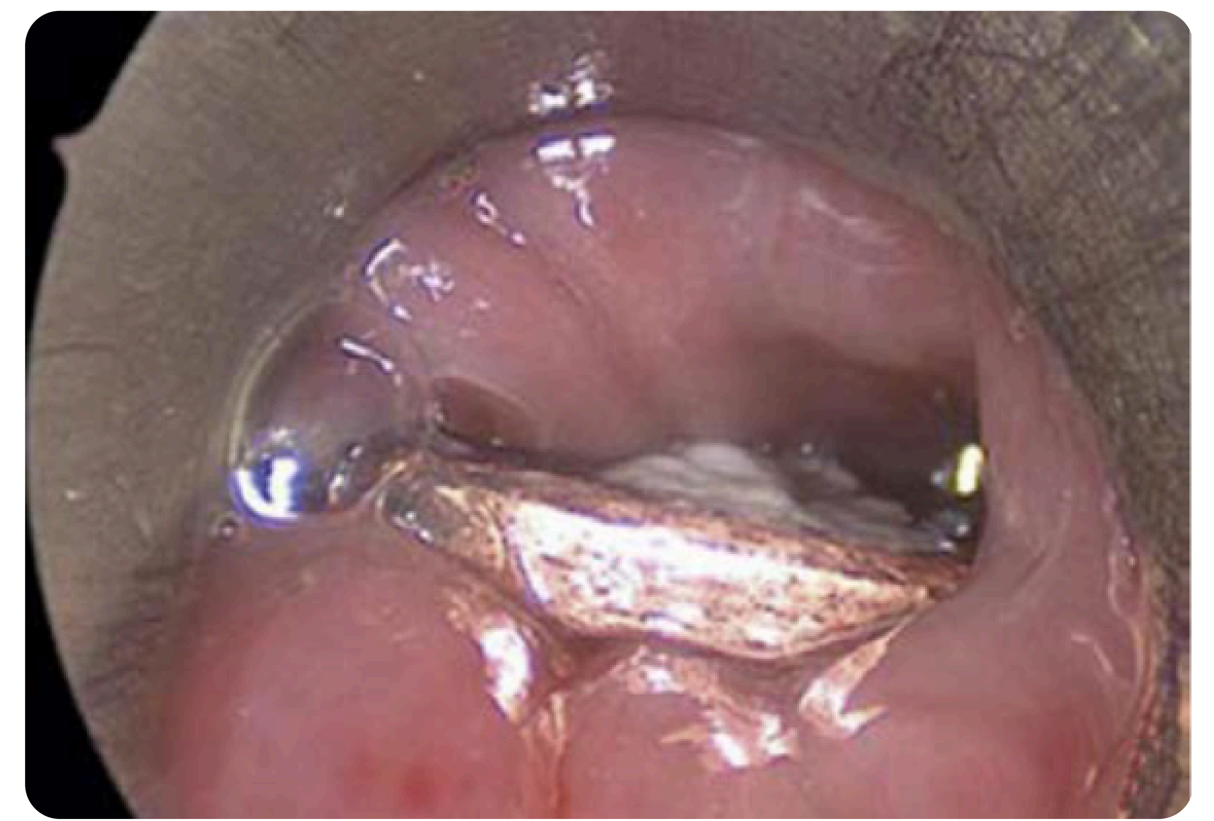

Appears on its face in AP view

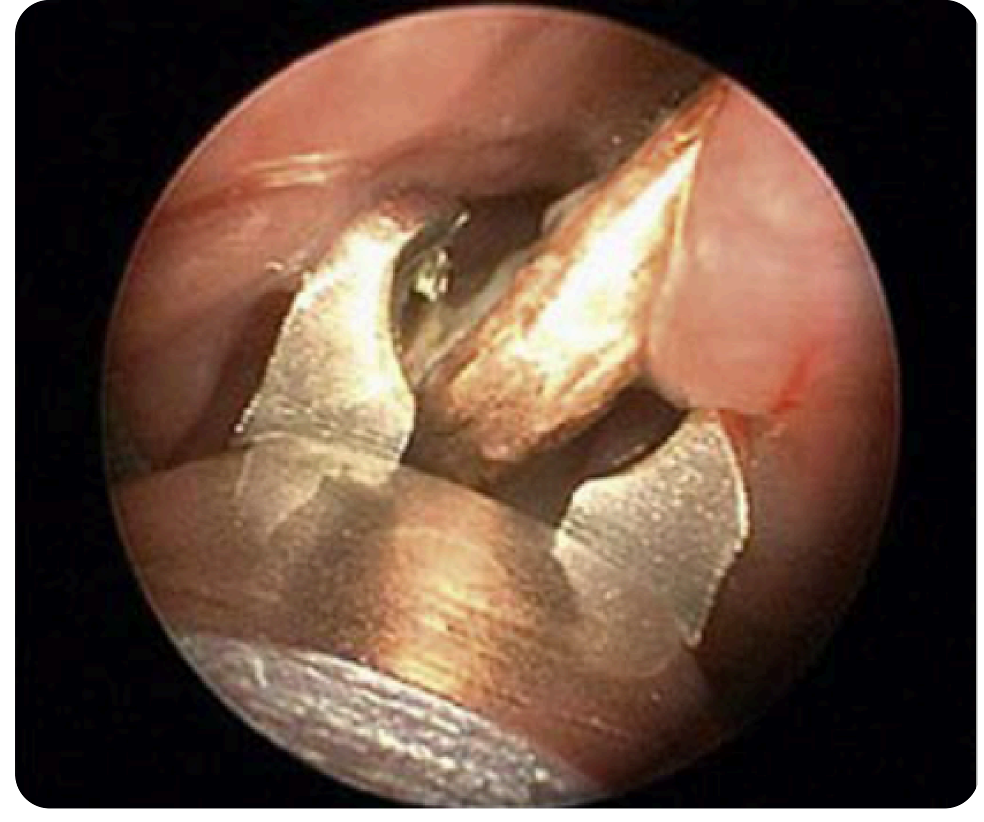

Appears from the side on lateral view

Esophageal Foreign Bodies

Coins

- If reached the lower esophagus:
  - often pass into the stomach
  - can be observed
  - can be advanced into the stomach (with NGT in ER)





Rigid esophagoscopy □ optical grasper used □ coin extraction (safety and success rate approaches 100% with minimal complications)

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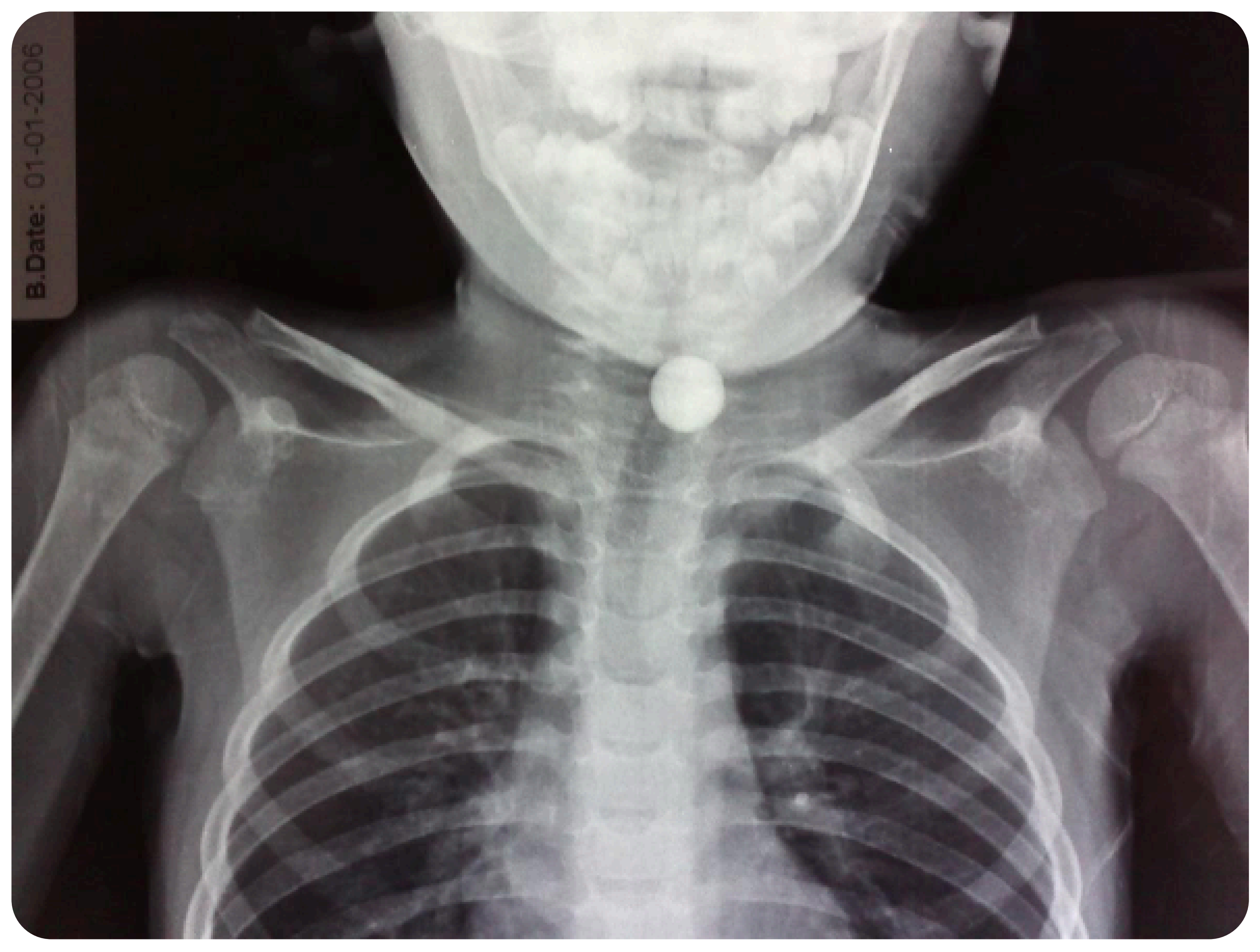
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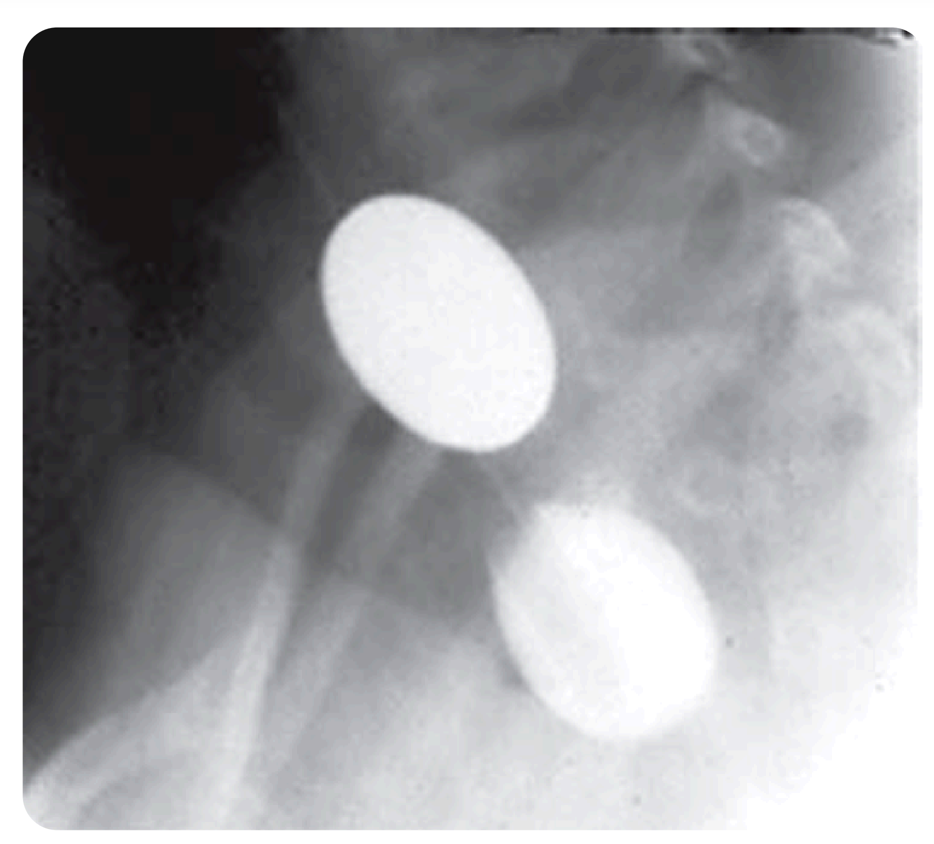
Foley catheter technique

- The balloon is filled with contrast
- Under fluoroscopy
- Care to avoid aspiration



Holcomb, G. W., Murphy, J. P., & Peter, S. D. S. (2019). Holcomb and Ashcraft's Pediatric Surgery.

Gastrointestinal Foreign Bodies

Gastrointestinal Foreign Bodies

- FB ingestions distal to the esophagus are usually **asymptomatic**

- Possible signs and symptoms:
  - Abdominal pain
  - Nausea/vomiting
  - Fevers
  - Abdominal distention
  - Peritonitis

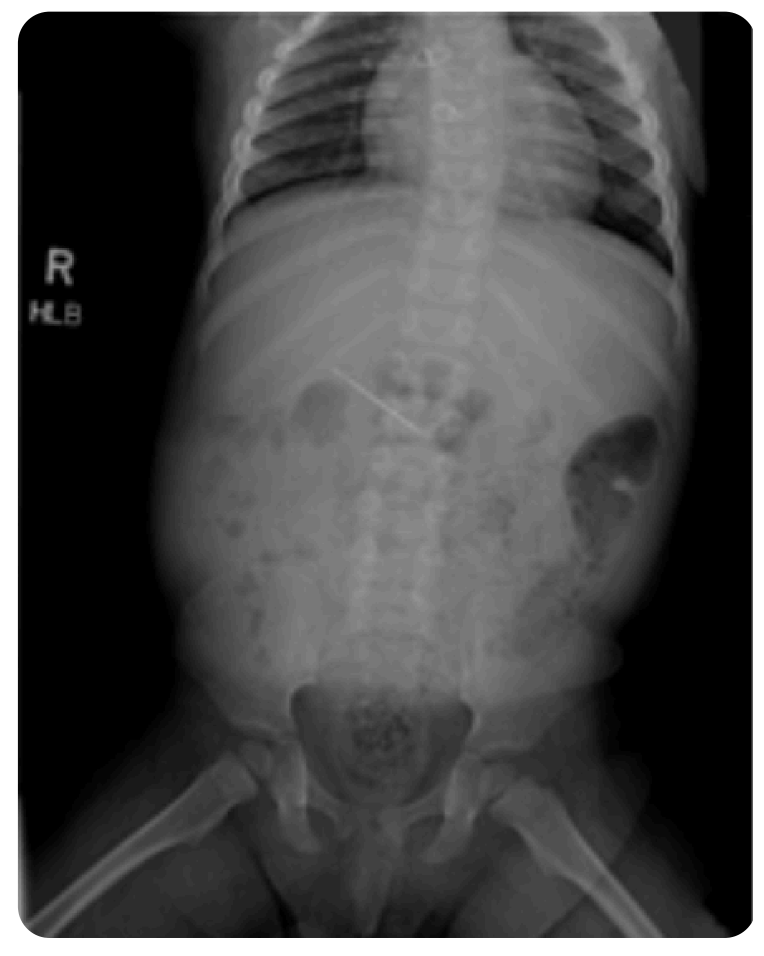
Gastrointestinal Foreign Bodies

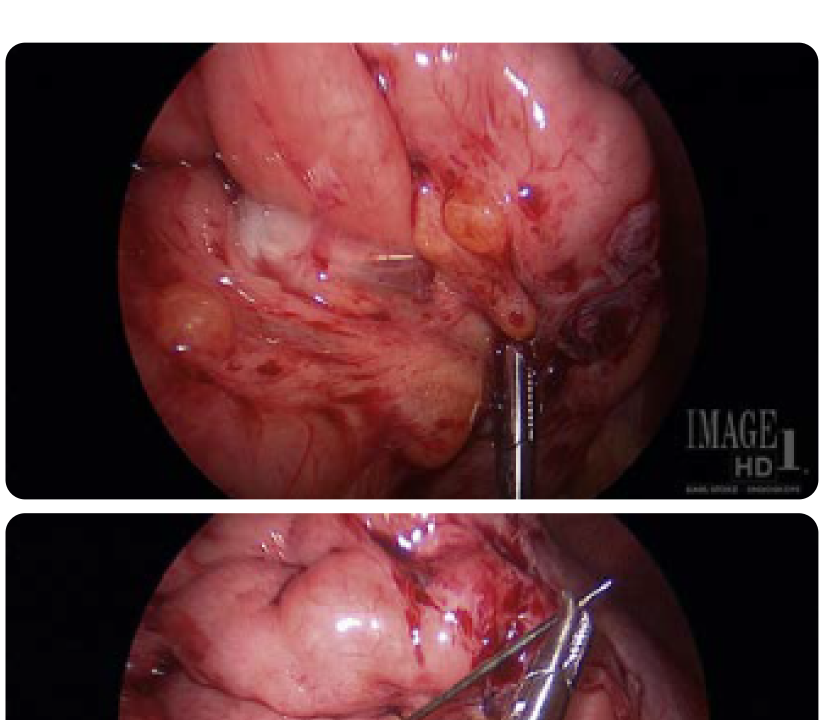
FBs that pass into the stomach..

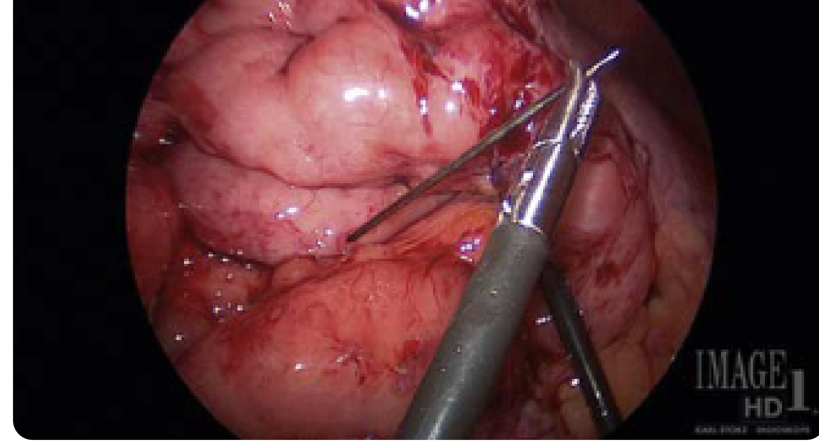
 usually pass through the rest of GI tract uneventfully

Gastrointestinal Foreign Bodies

- Can be managed as an **outpatient**.
- (?) Prokinetic agents and cathartics (not found to improve gut transit time and passage of FB).
- If did not pass **endoscopy** (usually deferred for 4–6 weeks).
- Sometimes **laparoscopy** is needed.







sewing needle was ingested □ diagnostic laparoscopy □ penetrated the proximal jejunum □ extracted

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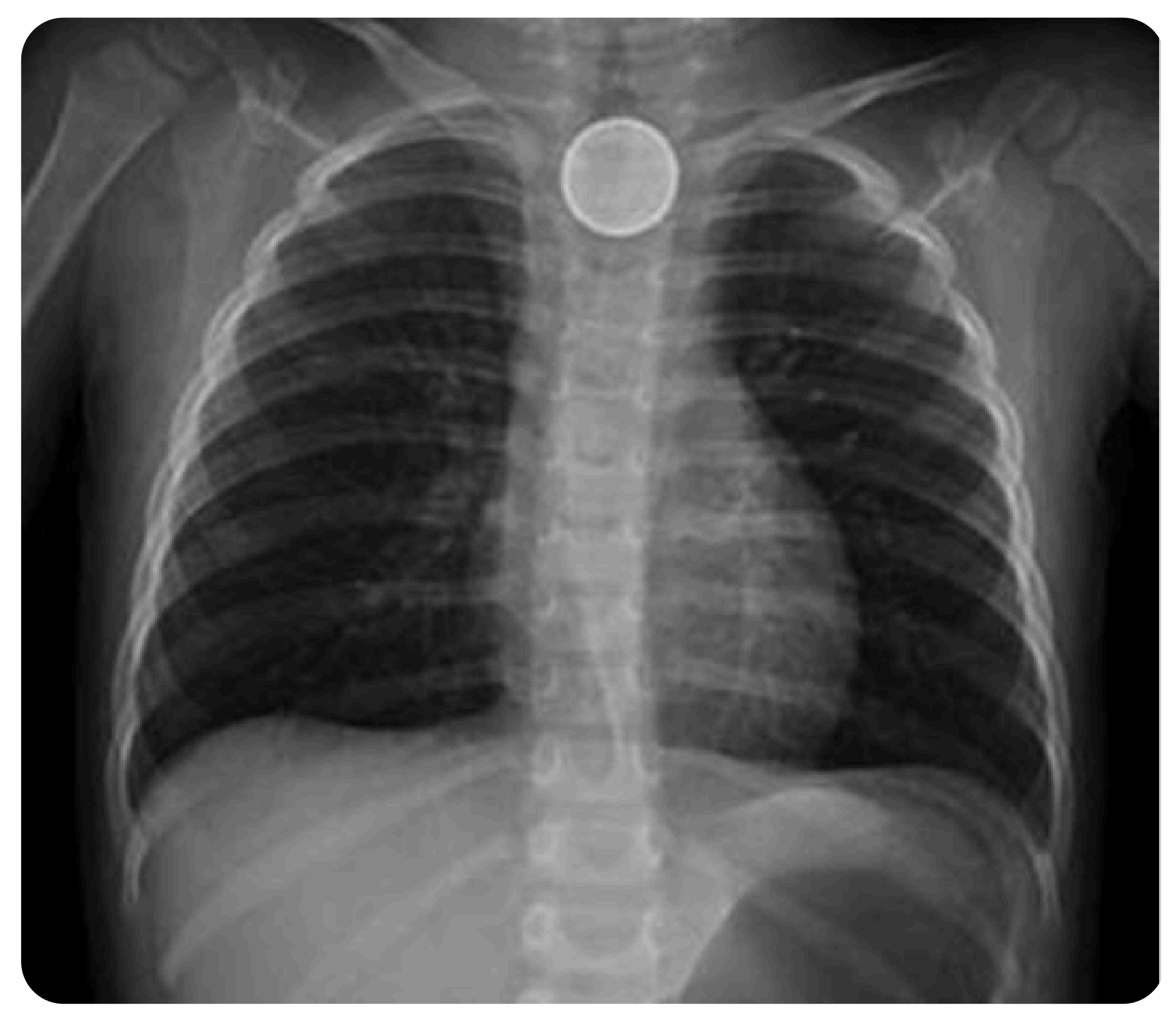
Special Topic Ingestions

BATTERIES

- Button batteries > cylindrical.
- Symptoms occur in <10% of cases.
- On radiographs:
  - Round, smooth object (often misdiagnosed as coins)
  - Can demonstrate a **double contour rim**



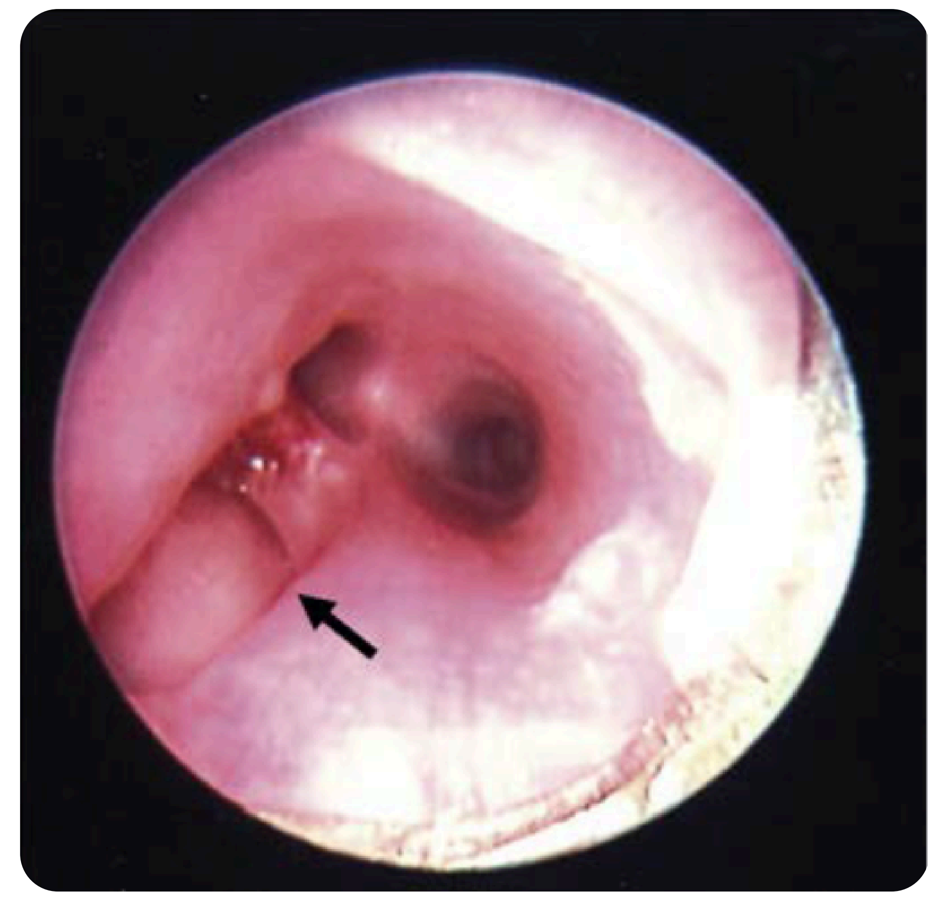
double contour rim (button battery)

BATTERIES

- **Esophageal batteries:**
  - associated with **increased morbidity**
  - tissue injury through:
    - pressure necrosis
    - release of low-voltage electric current
    - leakage of alkali solution (liquefaction necrosis)
  - mucosal injury may occur in 1 hour of contact time **AND** may continue even after removal
  - Rx: **immediate removal**

BATTERIES

- Early and late complications:
    - esophageal perforation
    - tracheoesophageal fistula
    - stricture and stenosis
    - mortality



Lithium battery was removed
 1 week later, respiratory distress bronchoscopy: tracheoesophageal fistula

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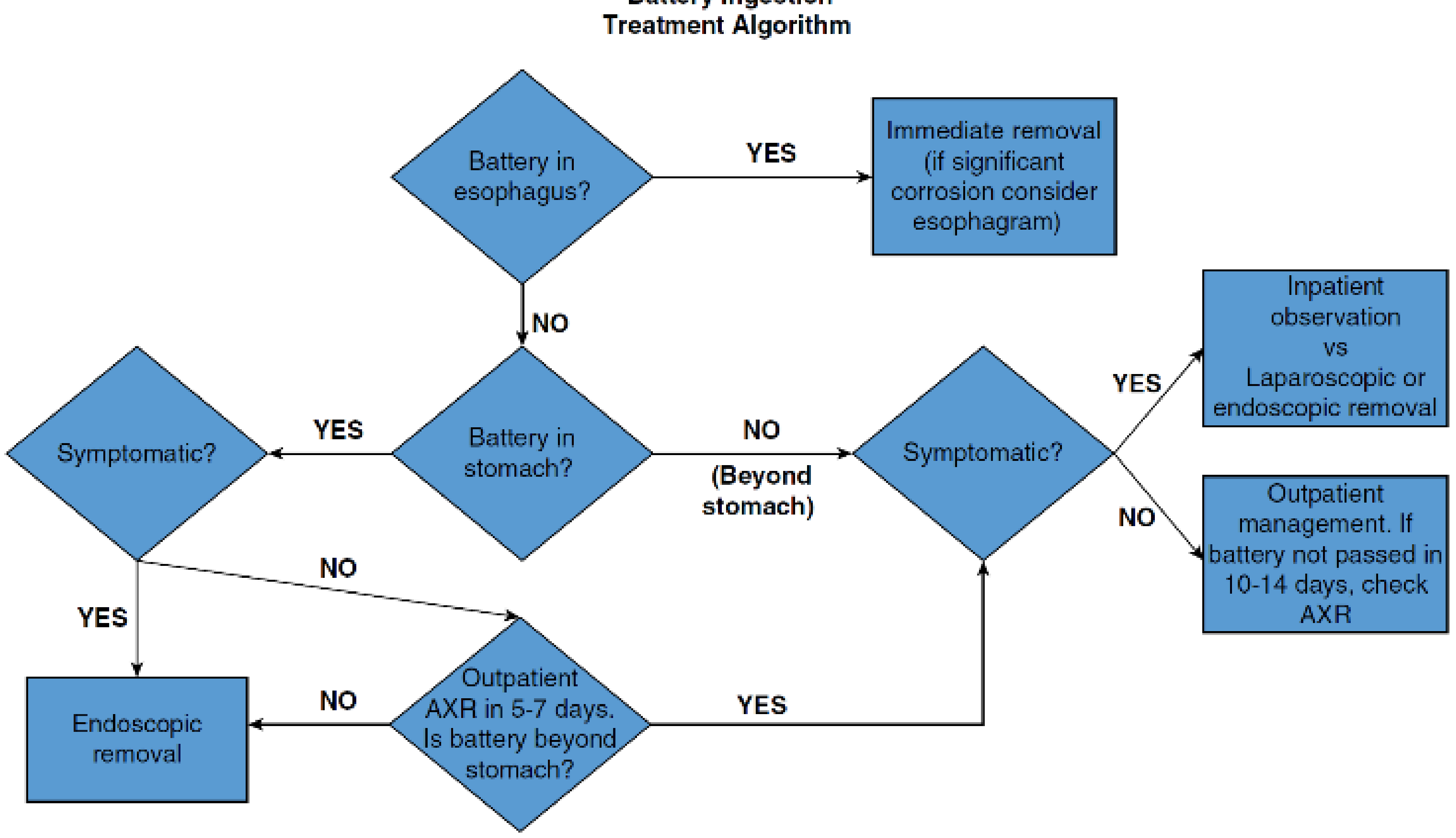
BATTERIES

If the battery is confirmed to be distal to the esophagus

AND the patient is asymptomatic

� it can be observed (>80% pass uneventfully within 48 hours)



Don't memorize this slide

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MAGNETS

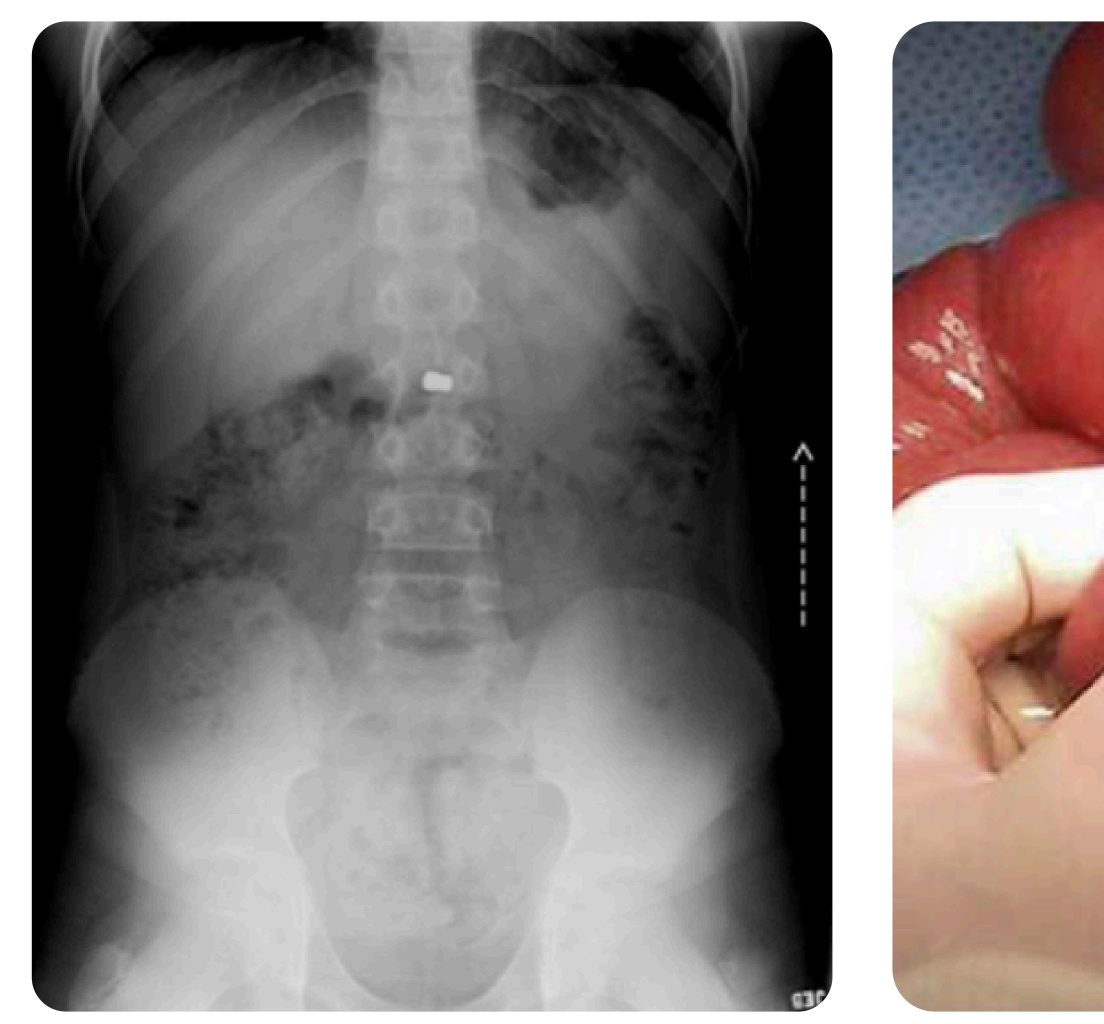
- **Significant morbidity when:**
  - multiple magnets
  - Single magnet + second metallic FB
- **Symptoms:**
  - Asymptomatic (60%)
  - Abdominal pain
- **Dx:**
  - Plain radiographs (most commonly used to confirm diagnosis)

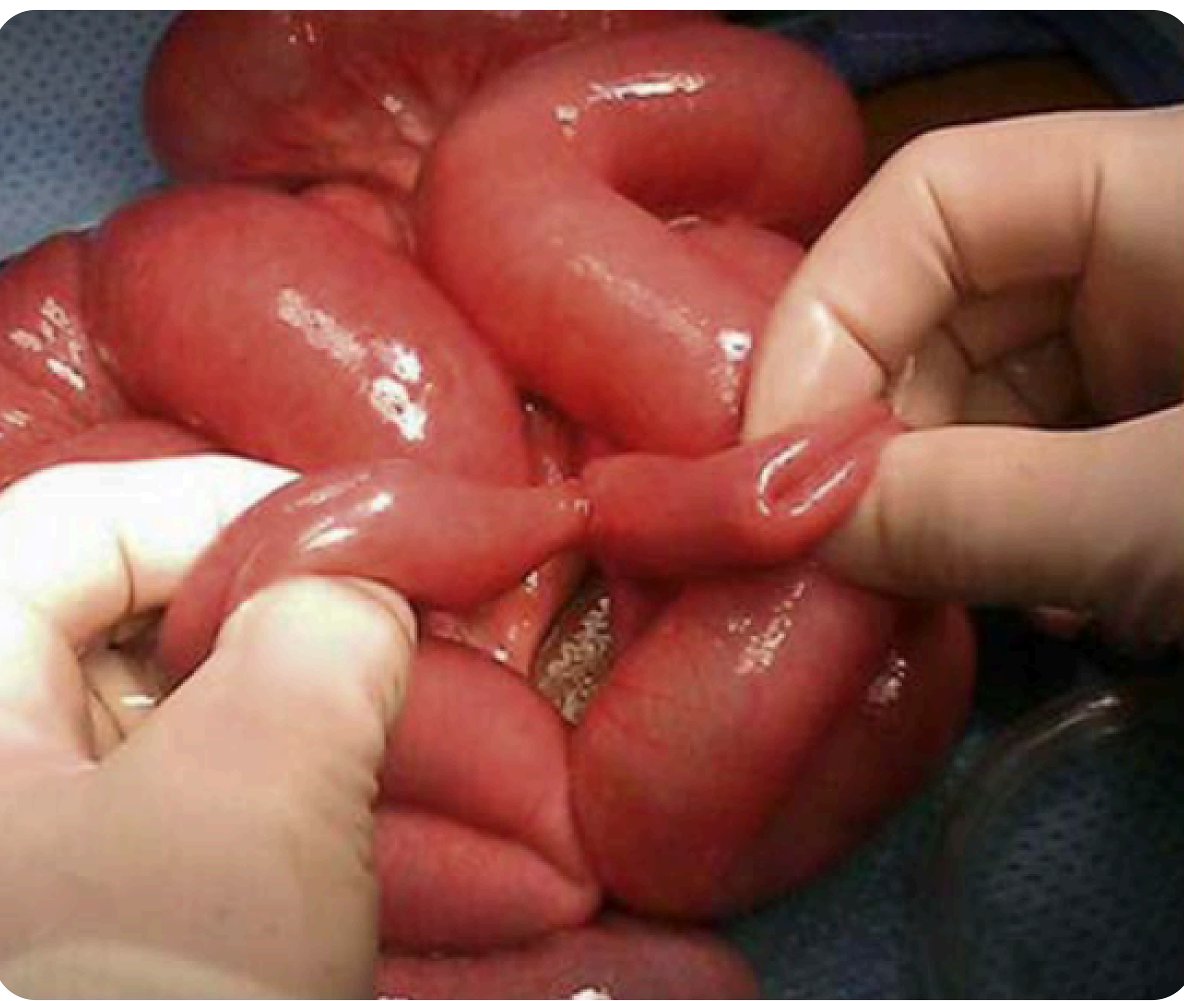
[but.. be careful!!]

MAGNETS

- **Mx:**
  - Close **inpatient** observation (if 2 magnets **OR** 1 + metallic FB **OR** if in doubt)
  - **Outpatient** observation (if 1 magnet)
  - +/- endoscopy (to prevent complications)
  - +/- laparoscopy or laparotomy (to treat complications)

- They may attach to each other and lead to: obstruction, volvulus, perforation, or fistula





two small magnets □ exploratory laparotomy □ in two separate bowel lumens causing the bowel obstruction and fistulization.

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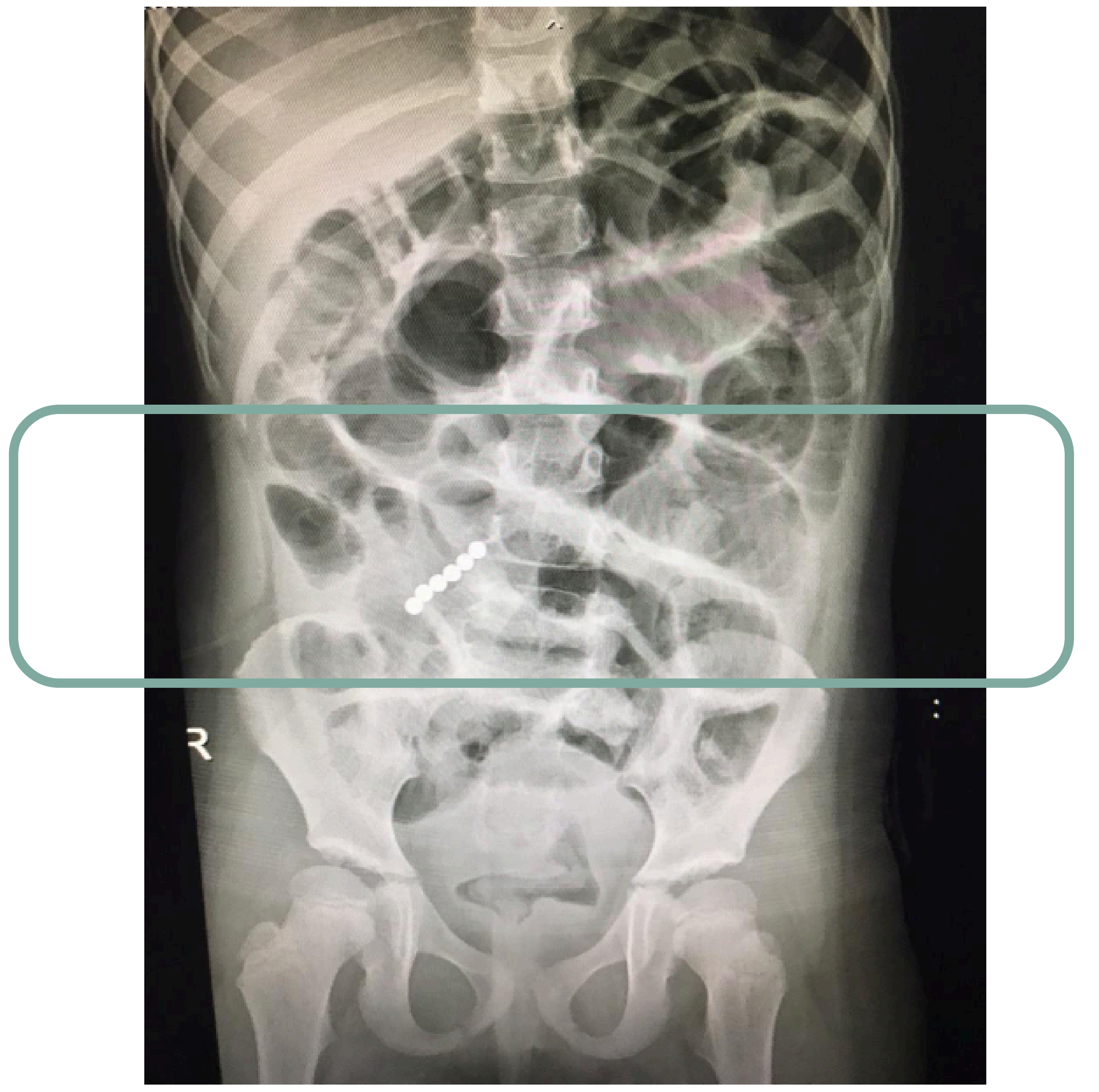
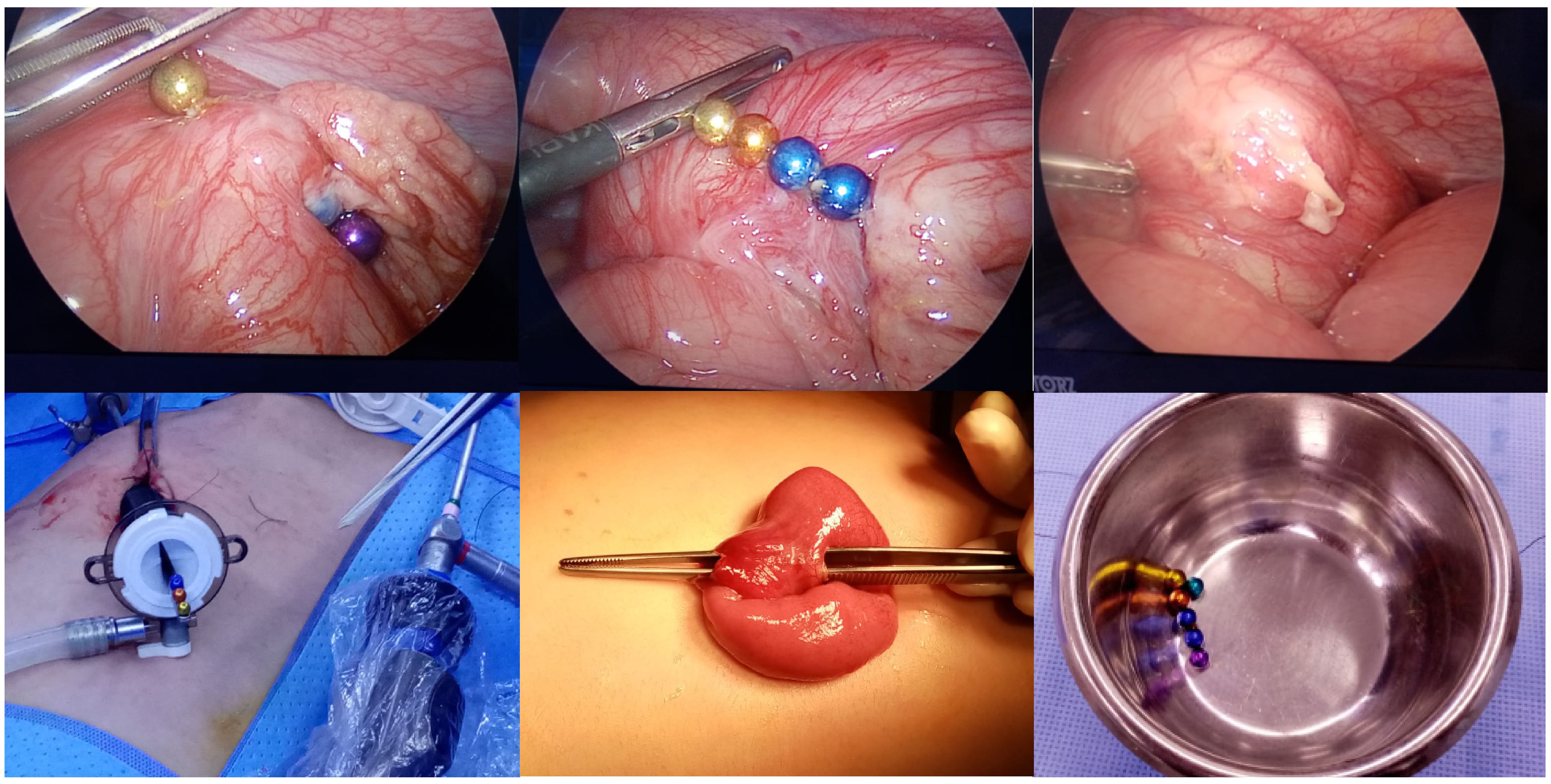




Magnet in esophagus?

YES → Non-urgent removal (No esophagram)

NO ↓

Multiple magnets or magnet + 2nd metallic object co-ingestion?*

NO → Outpatient management. If magnet not passed in 14 days, check AXR.

YES → In stomach?

YES → Endoscopic removal

NO (Beyond stomach) → Symptomatic or obstructive signs on AXR?

YES → Laparoscopic removal

NO → Inpatient observation with surgical consultation and serial AXRs → If failure to progress in 48 hours, consider laparoscopic or colonoscopic removal

*If a single magnet vs. multiple magnet ingestion cannot be definitively differentiated by history and radiographic findings, then the patient should be treated as an inpatient for suspicion of ingestion of multiple magnets.

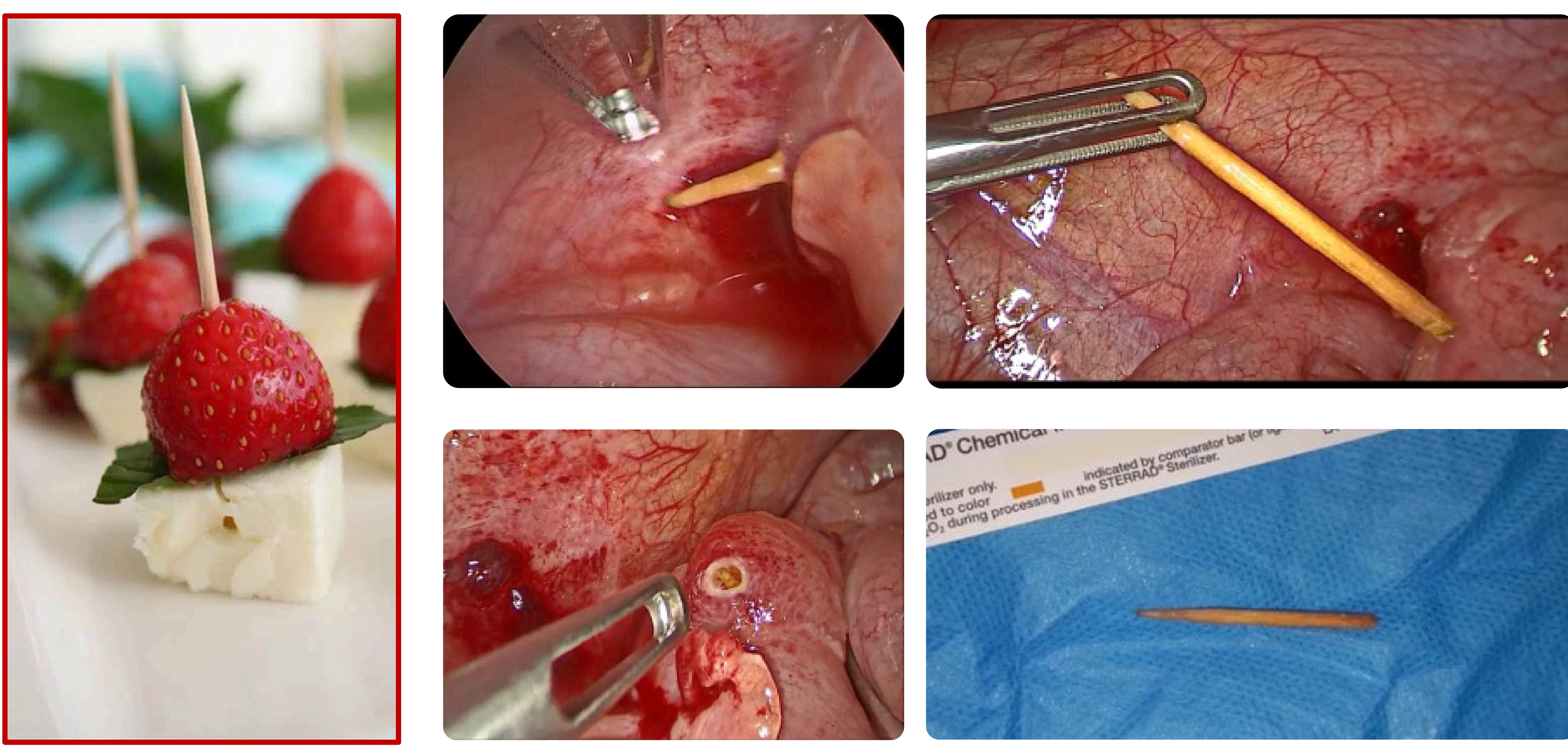
Management algorithm for ingested magnets

Holcomb, G. W., Murphy, J. P., & Peter, S. D. S. (2019). Holcomb and Ashcraft's Pediatric Surgery.

SHARP FOREIGN BODIES

- Significant morbidity
- **15–35% risk of perforation** (mostly in narrowed portions or areas of curvature)

- **Mx:**
  - Conservative: smaller objects and straight pins (lower rates of perforation)
  - Endoscopic retrieval
  - Close inpatient observation (for potential development of complications)



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BEZOARS

- **Bezoar:** is a tight collection of undigested material.

- **Include:**
  - lactobezoars (milk)
  - phytobezoars (plant)
  - trichobezoars (hair)

BEZOARS

- **Presenting symptoms**: nausea, vomiting, weight loss, and abdominal distention.

- **Diagnostic imaging**: plain radiographs, upper GI contrast studies, or endoscopy.

- **Mx**:
  - Operation is necessary (phyto- & tricho-)
  - Often medical management and endoscopic removal are unsuccessful

BEZOARS

Phytobezoars

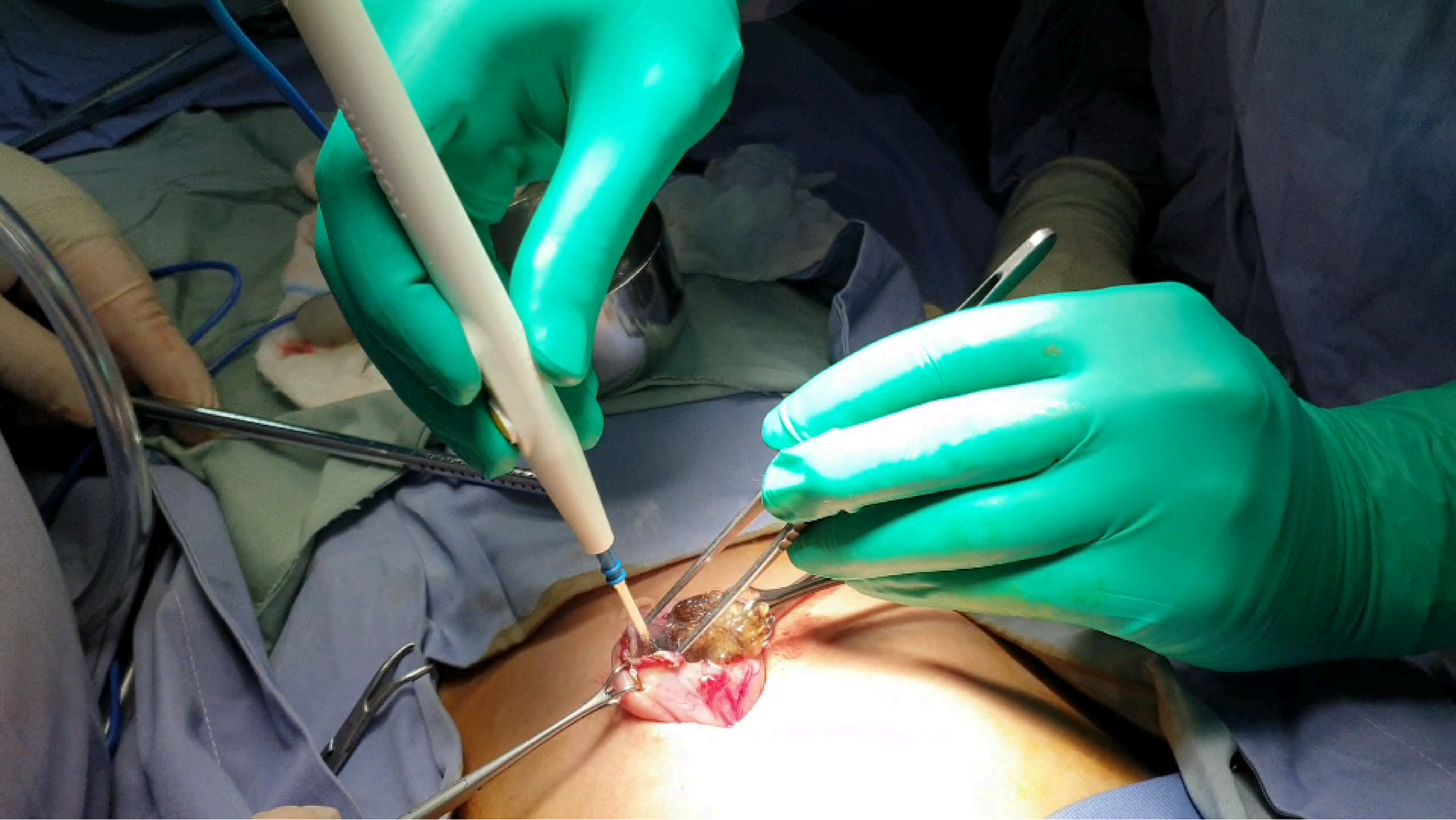
- Composed of **vegetable** matter.
- Usually causes obstruction at the **ileo-cecal valve** level.

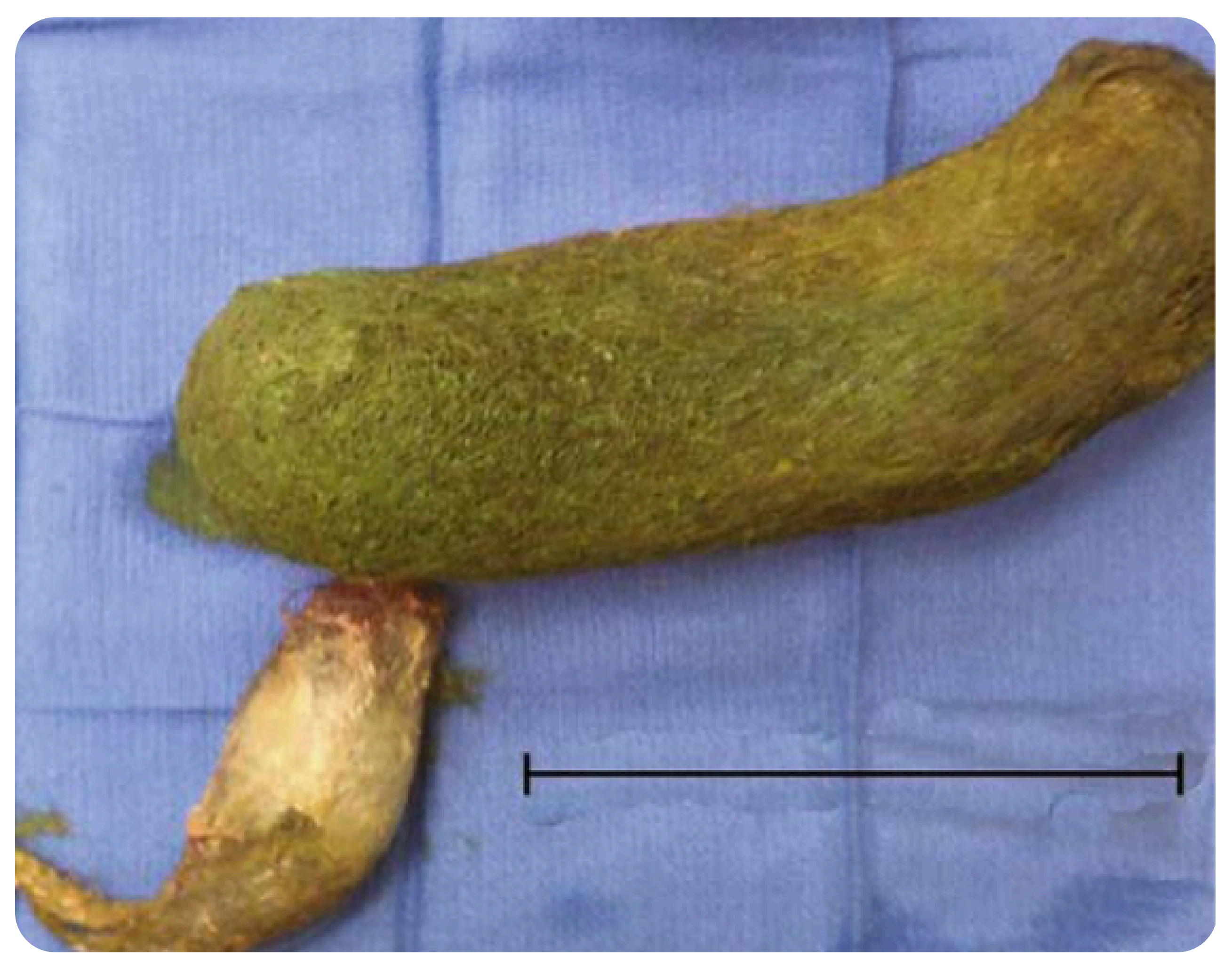
BEZOARS

Trichobezoars

- formed by **hair** that is swallowed
- associated with trichotillomania (irresistible urge to pull out hair and chewing or eating it)
- removed via a gastrotomy at laparotomy or laparoscopy

- Rapunzel syndrome (when involves stomach + small bowel)





Gastric bezoar with extension into the proximal duodenum
(Rapunzel syndrome)

Airway Foreign Bodies

Airway Foreign Bodies

- **Anatomical differences:** young vs older children
  - shorter airway, smaller in calibre.
  - anteriorly positioned larynx (increases difficulty of oral intubation).
  - subglottic region is the narrowest part.

Airway Foreign Bodies

- FBs tend to find the **right main stem bronchus**:
  - Larger in diameter
  - Airflow is generally greater
  - Smaller angle of divergence from the trachea

Airway Foreign Bodies

- Most occur while **eating** or **playing**.

- Curious children (in oral exploration phase of development)
  - everything tends to go into the mouth.
  - immature coordination of swallowing.
  - less developed airway protection.

Airway Foreign Bodies

A high index of suspicion is required

Airway Foreign Bodies

- **Boys**:girls **2**:1
- Suffocation following FB aspiration leading cause of mortality from unintentional injury in infants.
- Victims of **child abuse** at **higher risk**

Airway Foreign Bodies

- **Geographical differences:**
  - Sunflower seeds (m.c. in USA)
  - Watermelon seeds (m.c. internationally)
  - Nuts (m.c. in children from non-English-speaking backgrounds)

Airway Foreign Bodies

- Common **presenting symptoms**:
  - Respiratory distress
  - Stridor
  - Wheezing
  - +/- Dysphonia

- Many children can be **asymptomatic**.

Airway Foreign Bodies

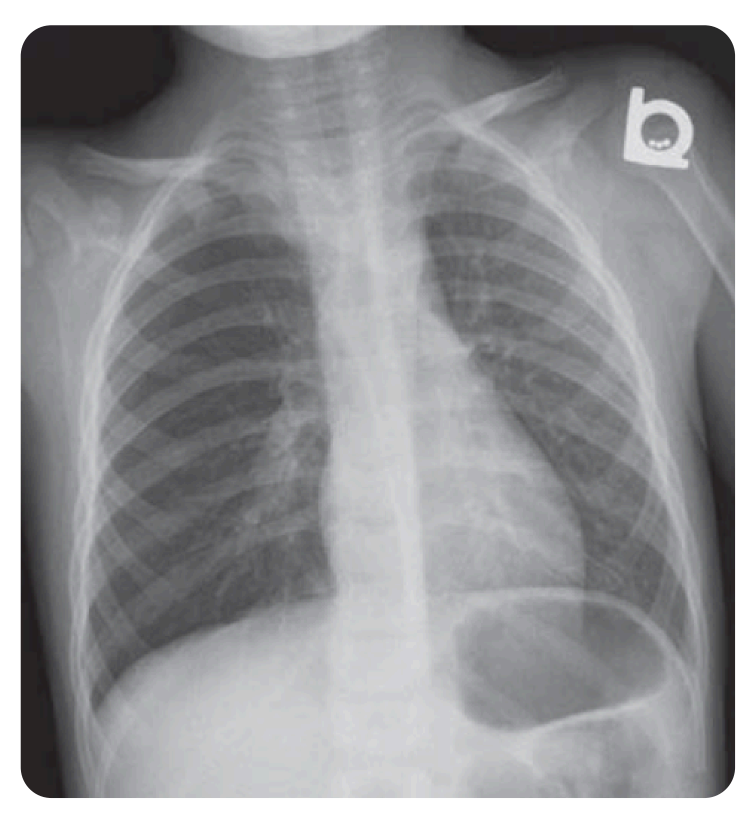
- Many aspiration events go **unwitnessed**.
- Albeit rare, FBs may completely obstruct the larynx or trachea producing **sudden death**.
- **Chronic FBs**:
  - Persistent cough and atelectasis
  - Bronchiectasis
  - Recurrent pneumonia
  - Hoarseness
  - Granulation tissue and strictures
  - Perforation

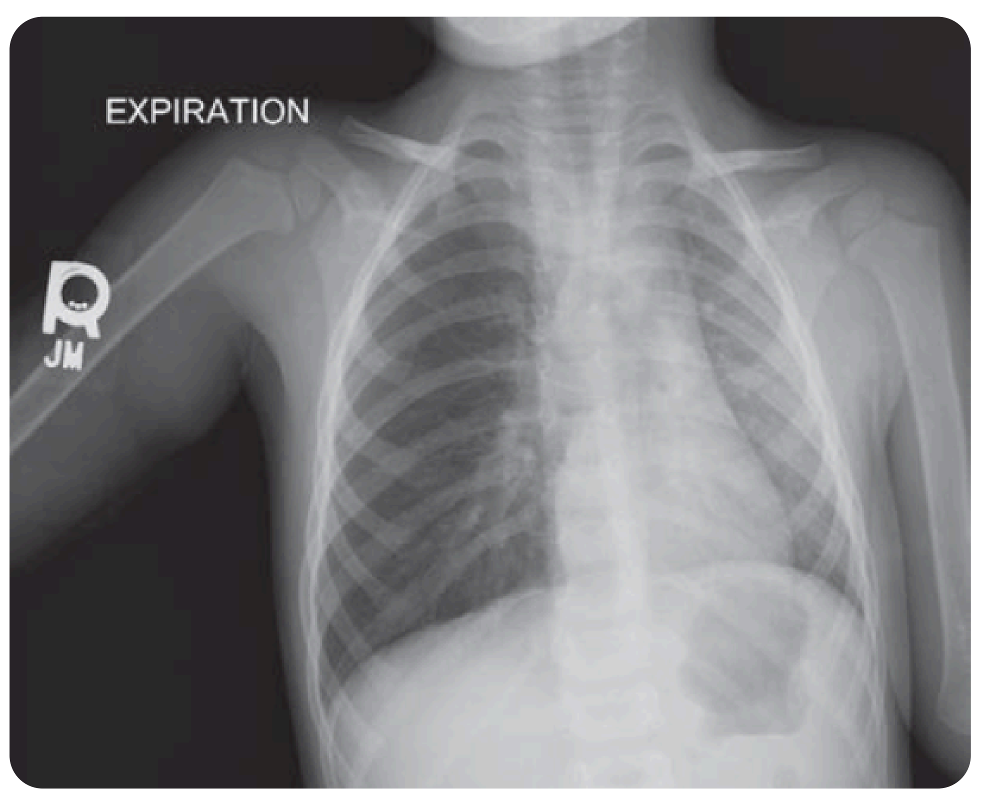
Airway Foreign Bodies

AP and lateral films of the neck and chest (inspiratory and expiratory)

- can reveal hyperinflation or "air trapping"
  - up to 60% of children
  - FB acts as a one-way valve

- +/- mediastinal shift





slight hyperexpansion of the right lung | expiratory film, with hyperlucency of the right lung due to air trapping

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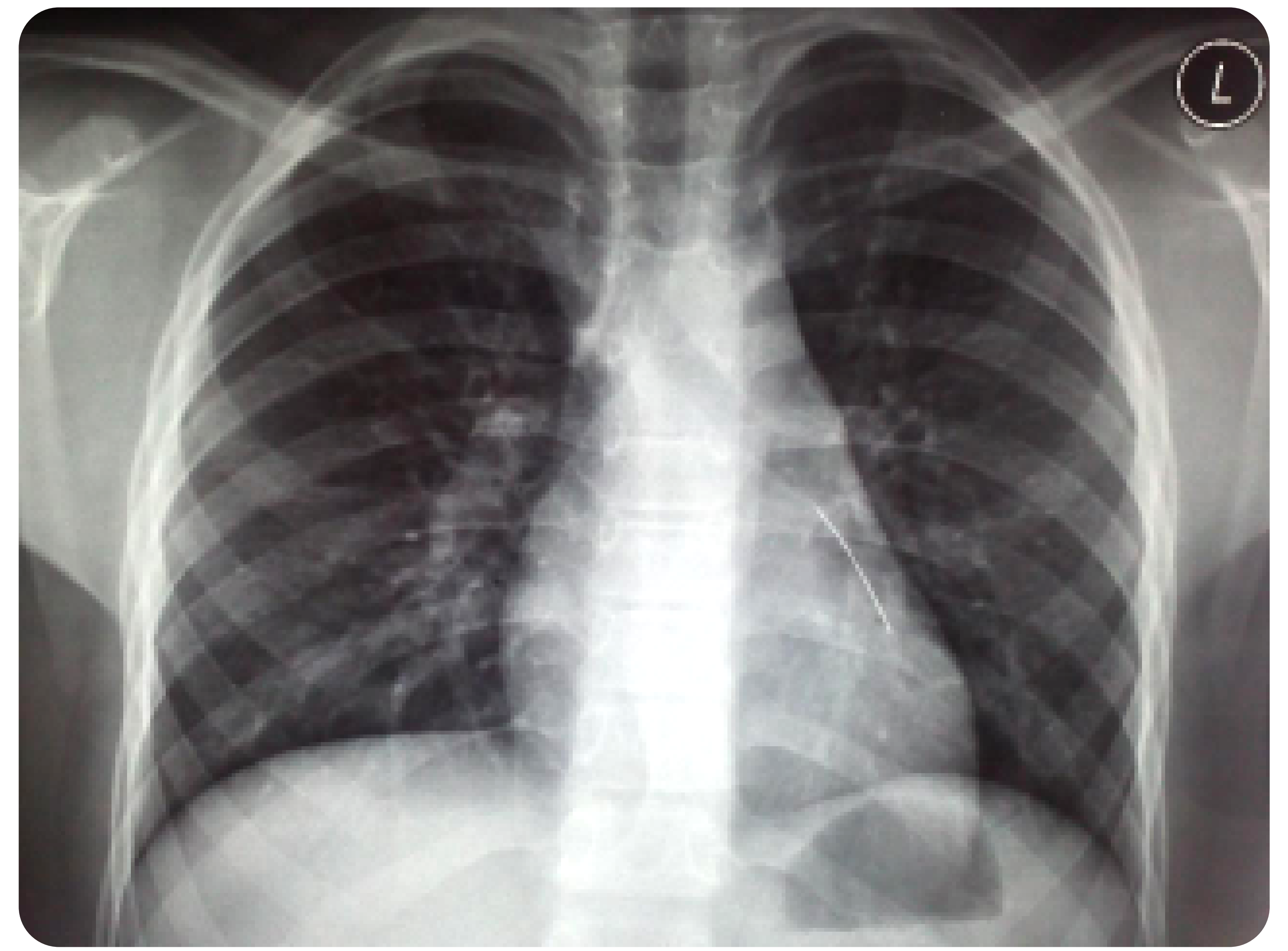
Airway Foreign Bodies

- >50% of patients had a **normal chest film** within 24 hours of aspiration.
- **Radiopaque FBs** are easily identified.
- **Radiolucent FBs** have indirect radiographic clues such as hyperexpansion.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Airway Foreign Bodies

- Radiographic imaging remains helpful in children with a history of **choking**
- Definitive diagnosis requires **bronchoscopy**

Airway Foreign Bodies

- Common practice:
  - The use of **flexible** bronchoscope (mainly to diagnose a FB)
  - **Rigid** bronchoscopy for removal of FBs (diagnostic & therapeutic)

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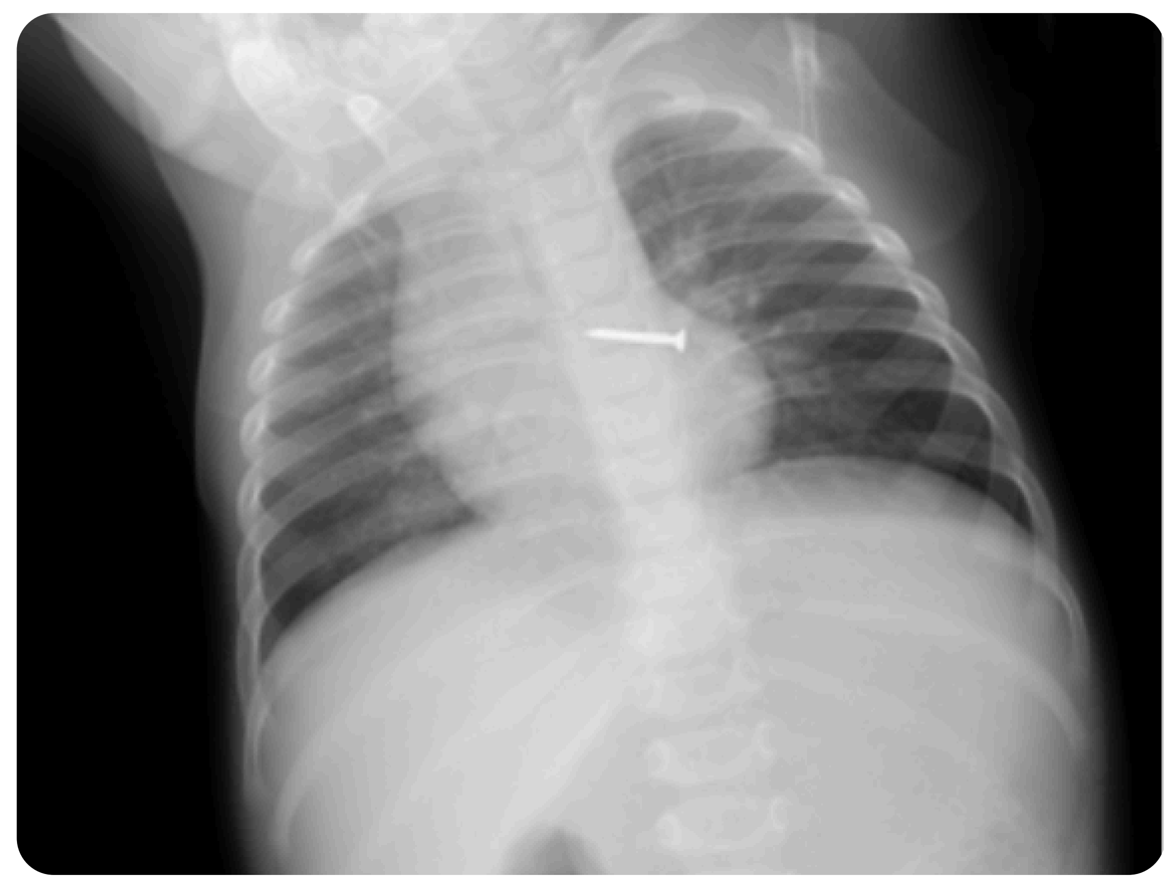

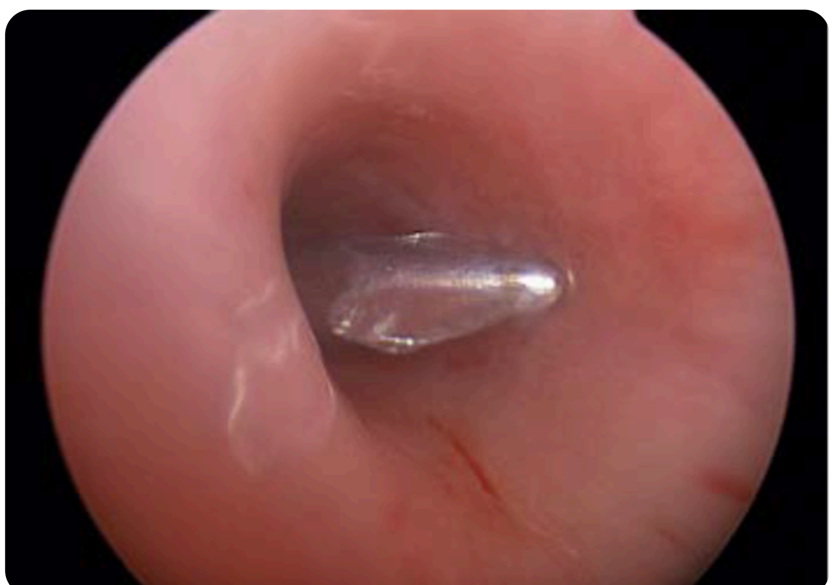

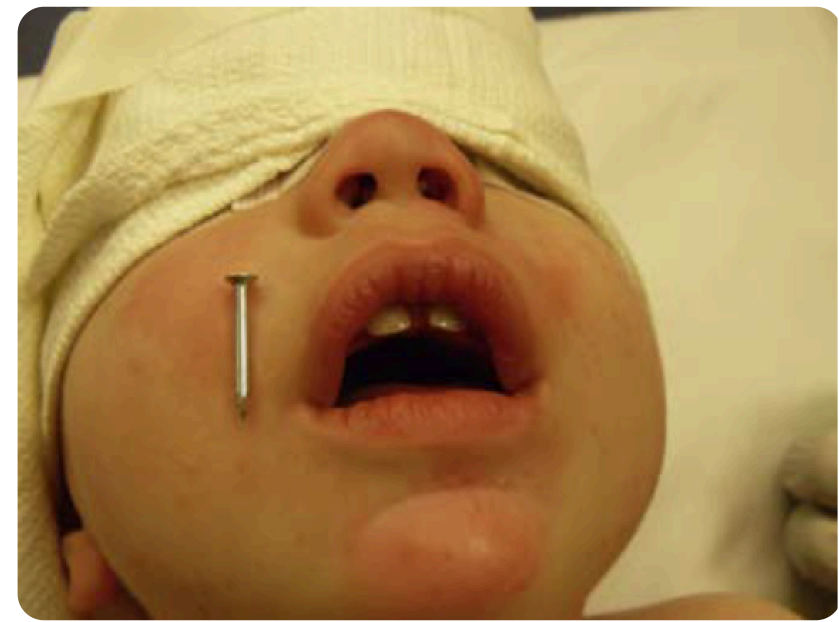

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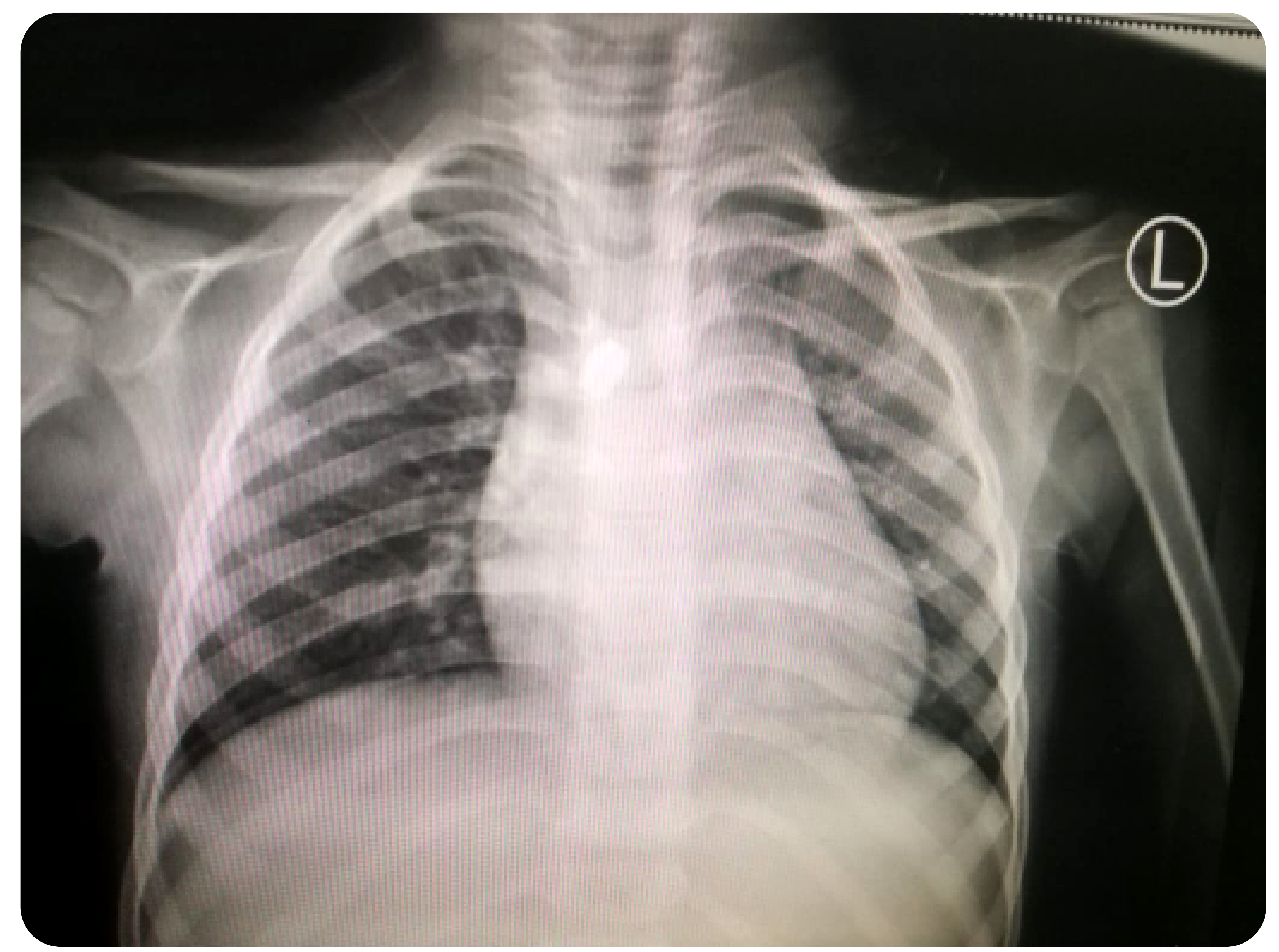
BRONCHOSCOPY

- In difficult cases, with FBs lodged distal to the main bronchus, a **Fogarty catheter or Dormia basket** may be helpful.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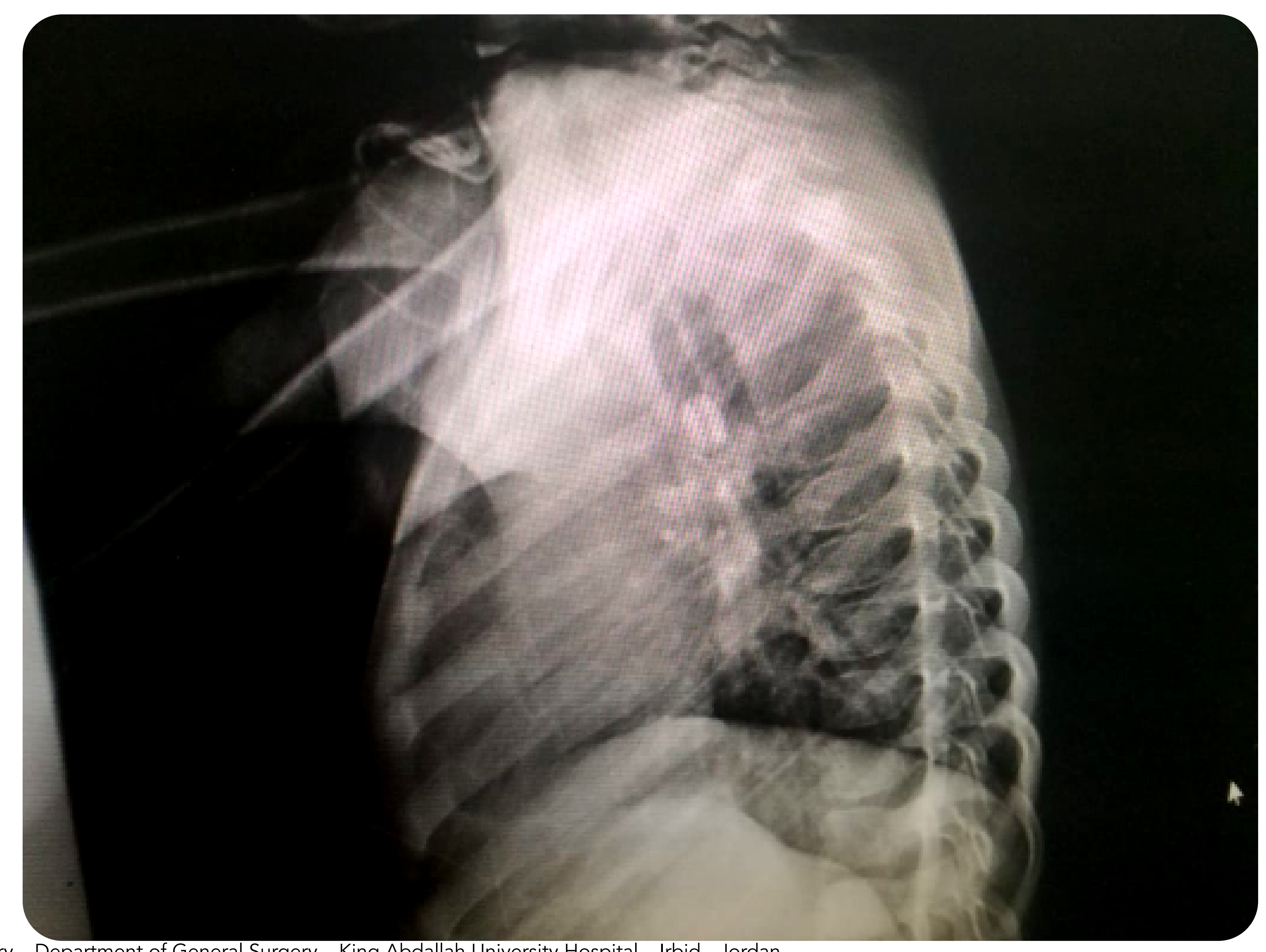

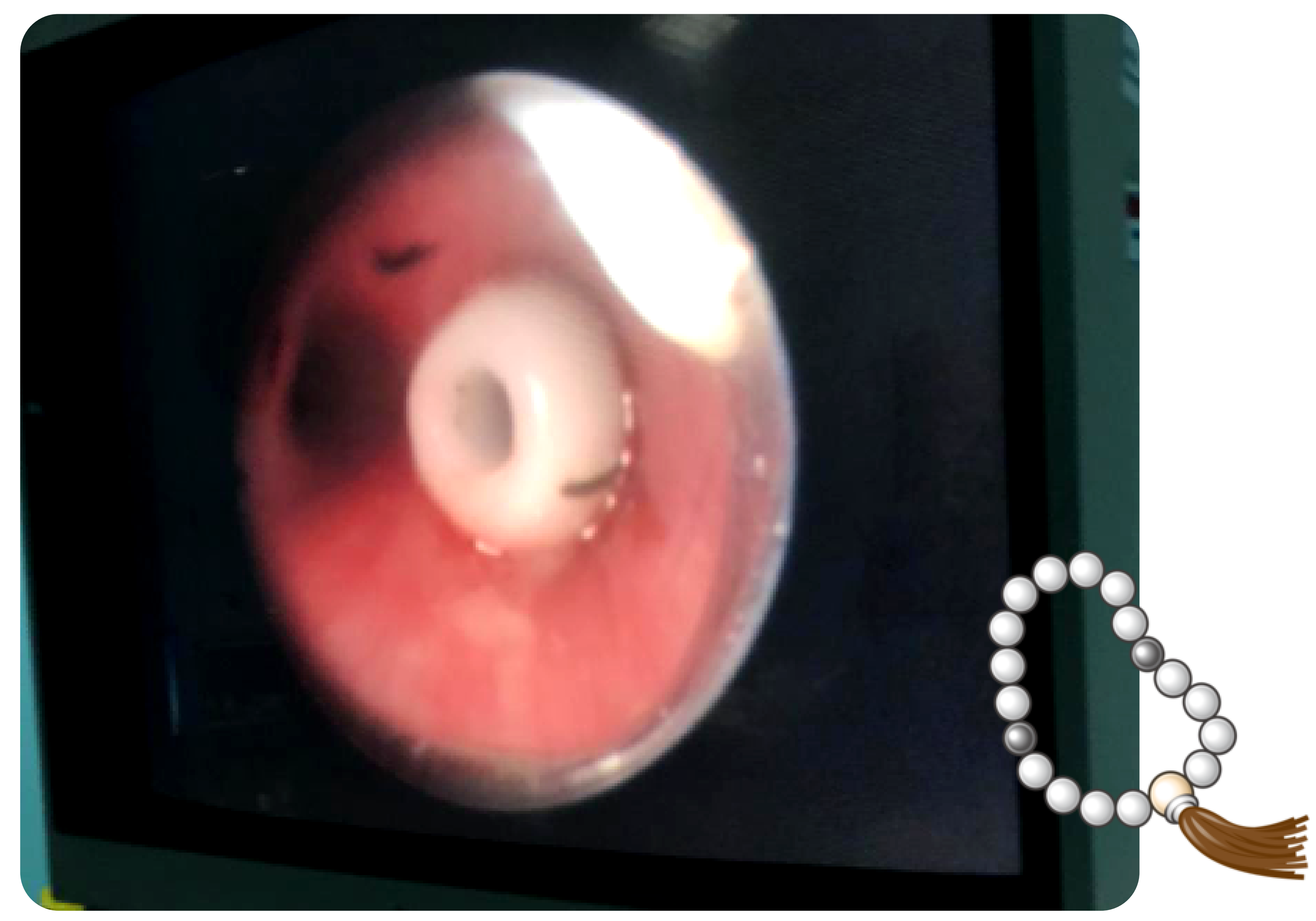

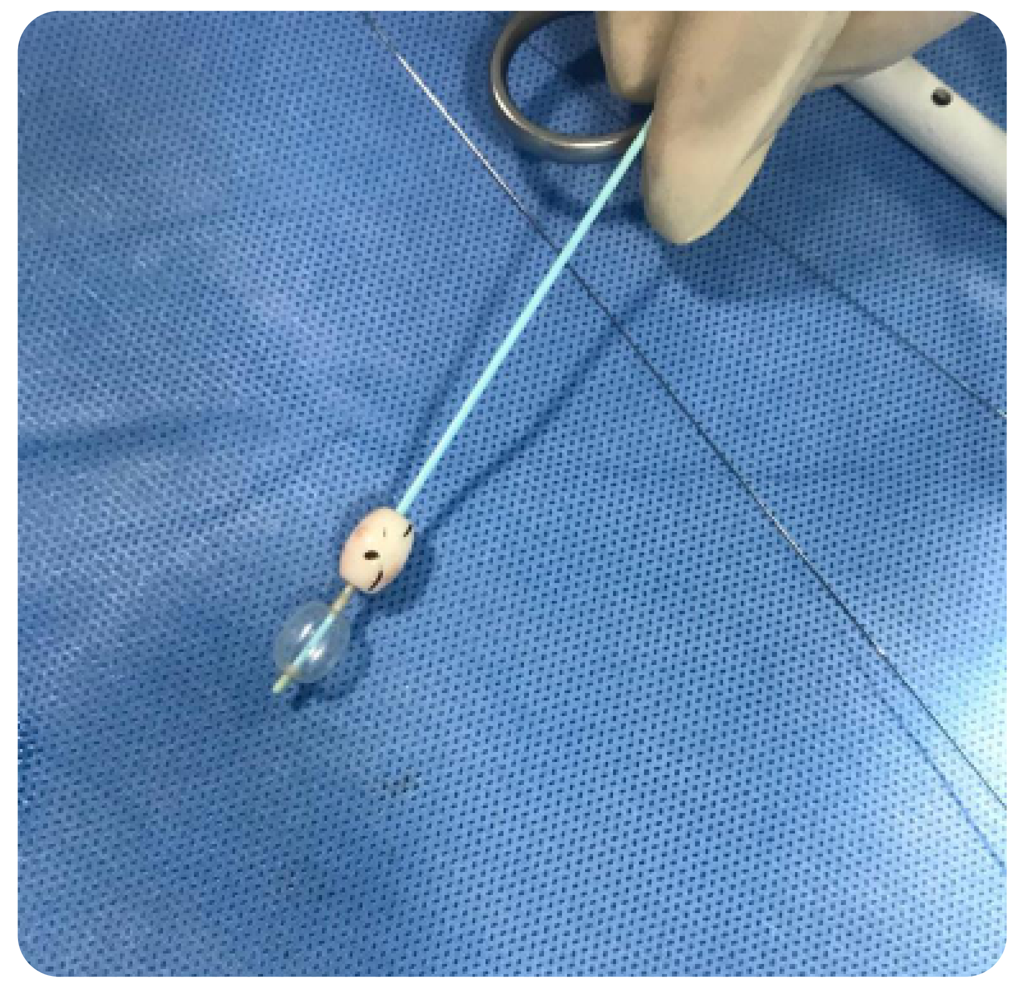

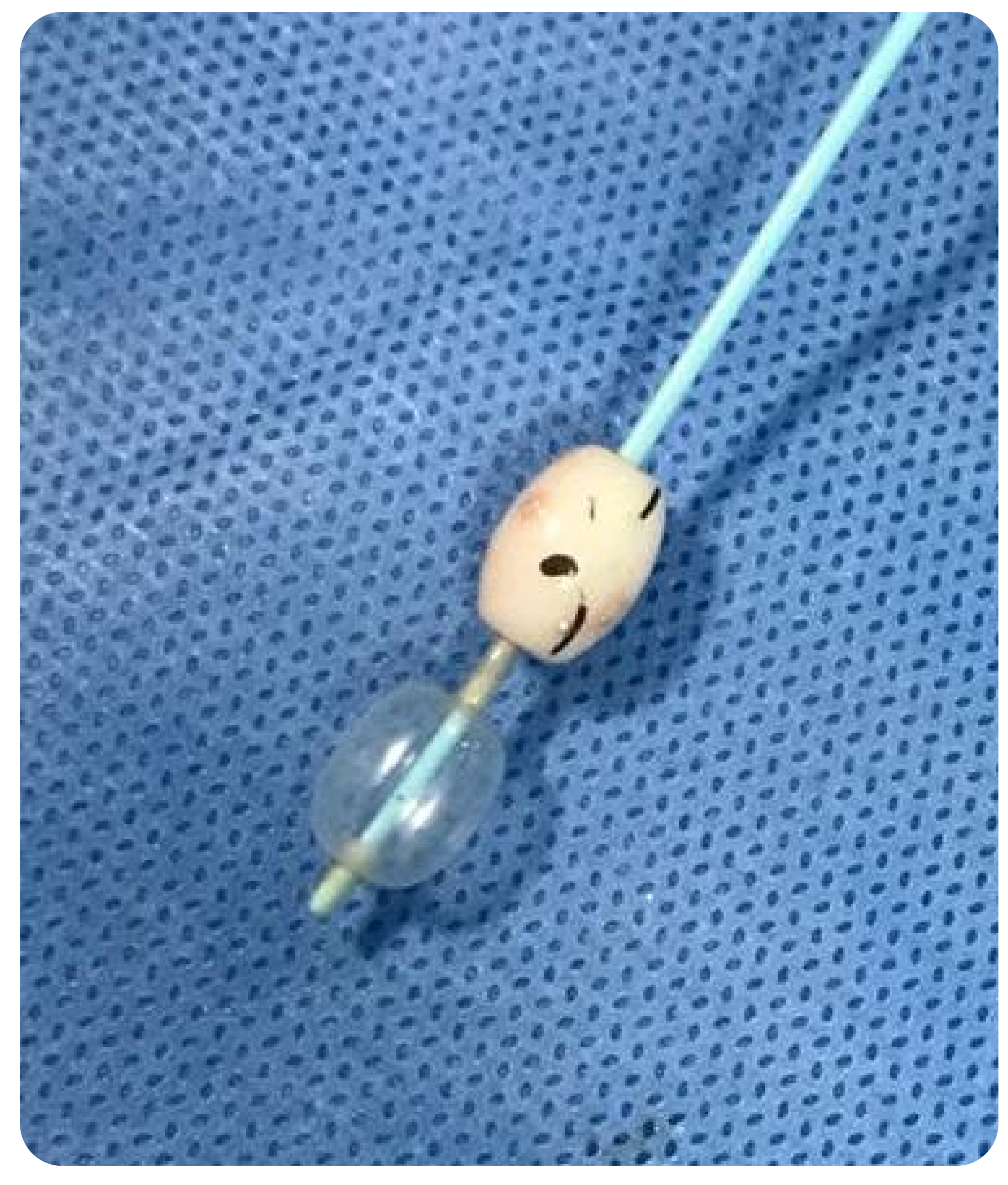

BRONCHOSCOPY

- Overall **complications** of rigid or flexible bronchoscopy:
  - Bleeding from local inflammation
  - Laryngospasm
  - Pneumothorax
  - Hypoxia

BRONCHOSCOPY

- Rarely a thoracotomy with bronchotomy or lobectomy is required.

Reference

- Holcomb, G. W., Murphy, J. P., & Peter, S. D. S. (2019). Holcomb and Ashcraft’s Pediatric Surgery.