Ingestion/Aspiration of Foreign Bodies

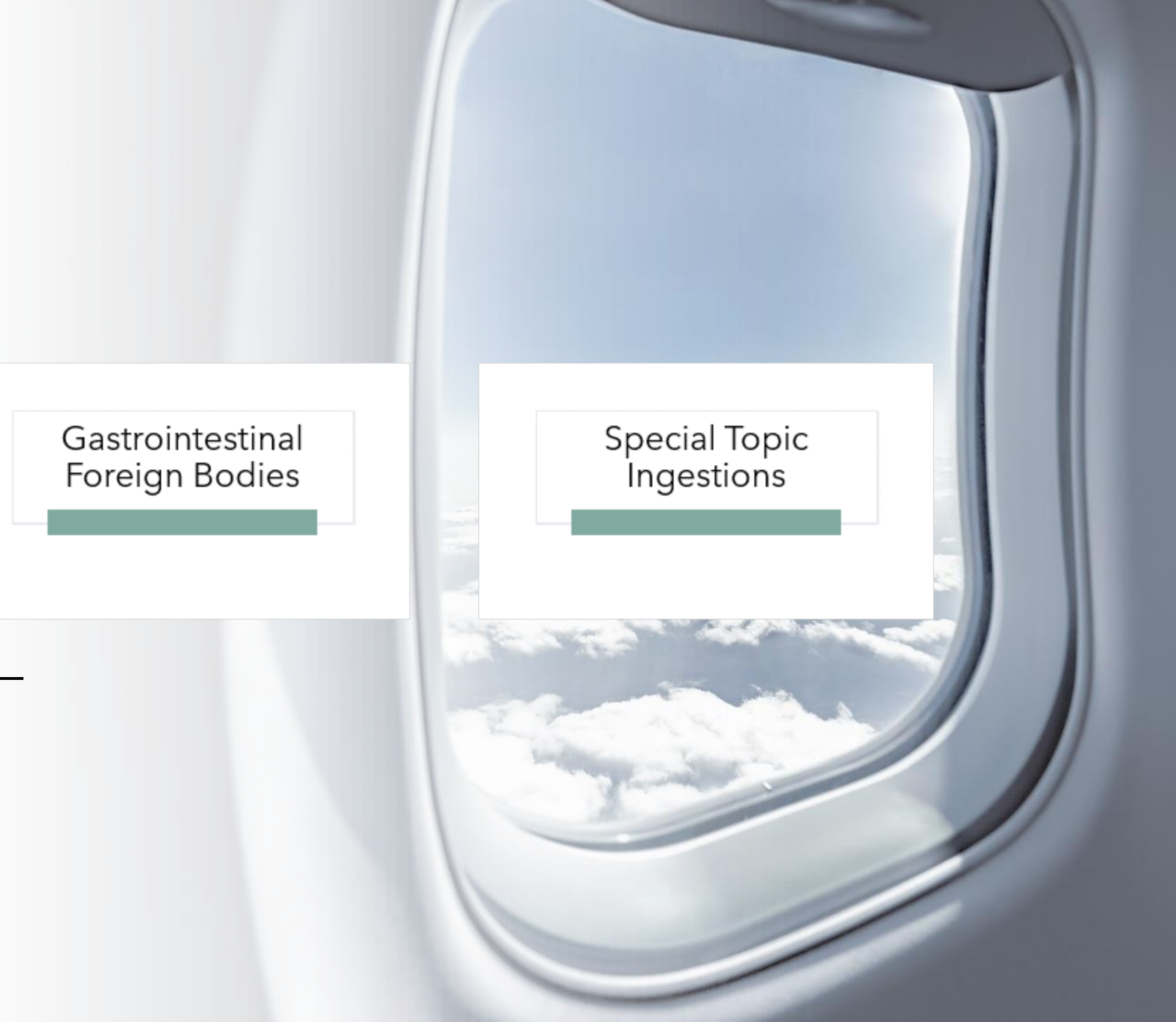
Raed Al-Taher, MD

Esophageal Foreign Bodies

Gastrointestinal Foreign Bodies

Special Topic Ingestions

Airway Foreign Bodies



Esophageal 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

Anatomy

- 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

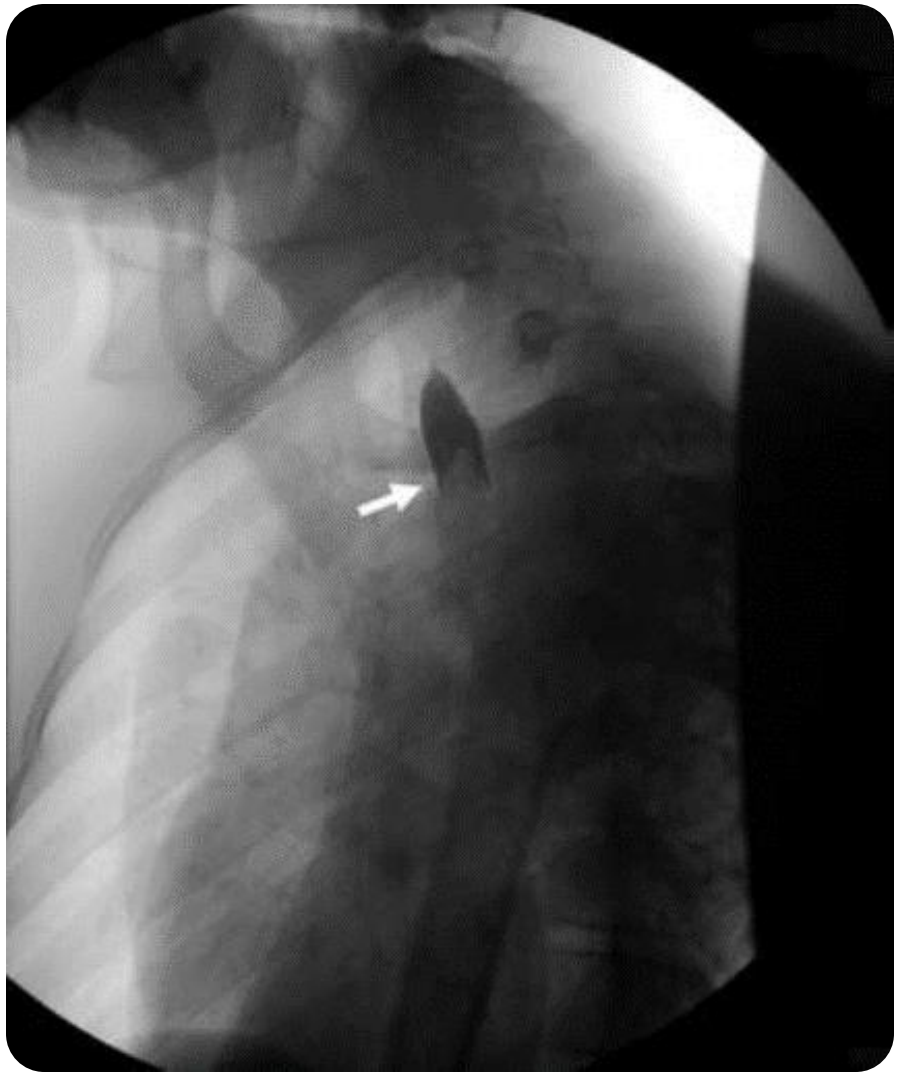
Esophageal Foreign Bodies

Management

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

+/- Contrast esophagography

+/- Esophagoscopy

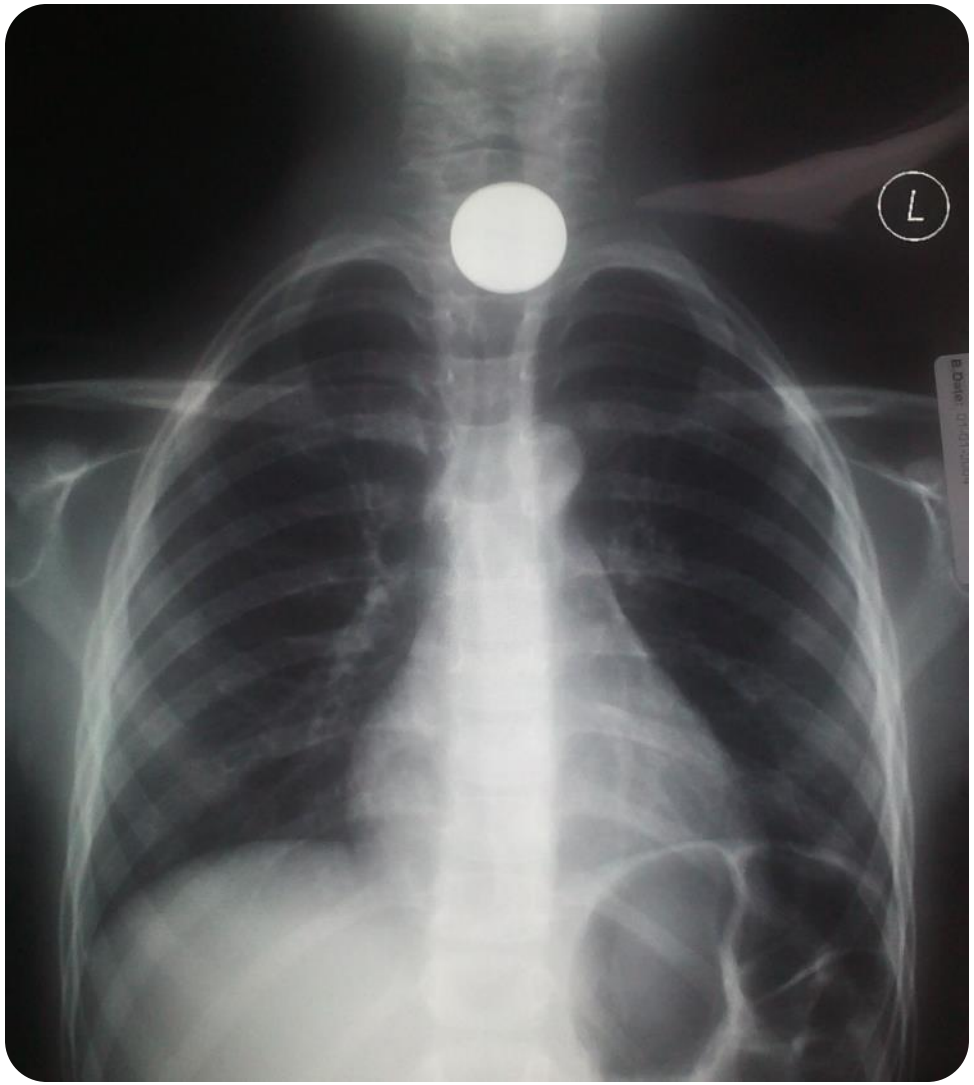


Esophageal Foreign Bodies

Coins

- Appear on face in x-ray (AP view).
- Appear from the side on lateral view.

- Most located in the proximal esophagus.


L

Esophageal Foreign Bodies

Coins

- Majority (of proximal) will remain entrapped and require retrieval.

- Options for retrieval:
  - Endoscopy (rigid or flexible)
  - Foley balloon extraction with fluoroscopy (80% success rate)

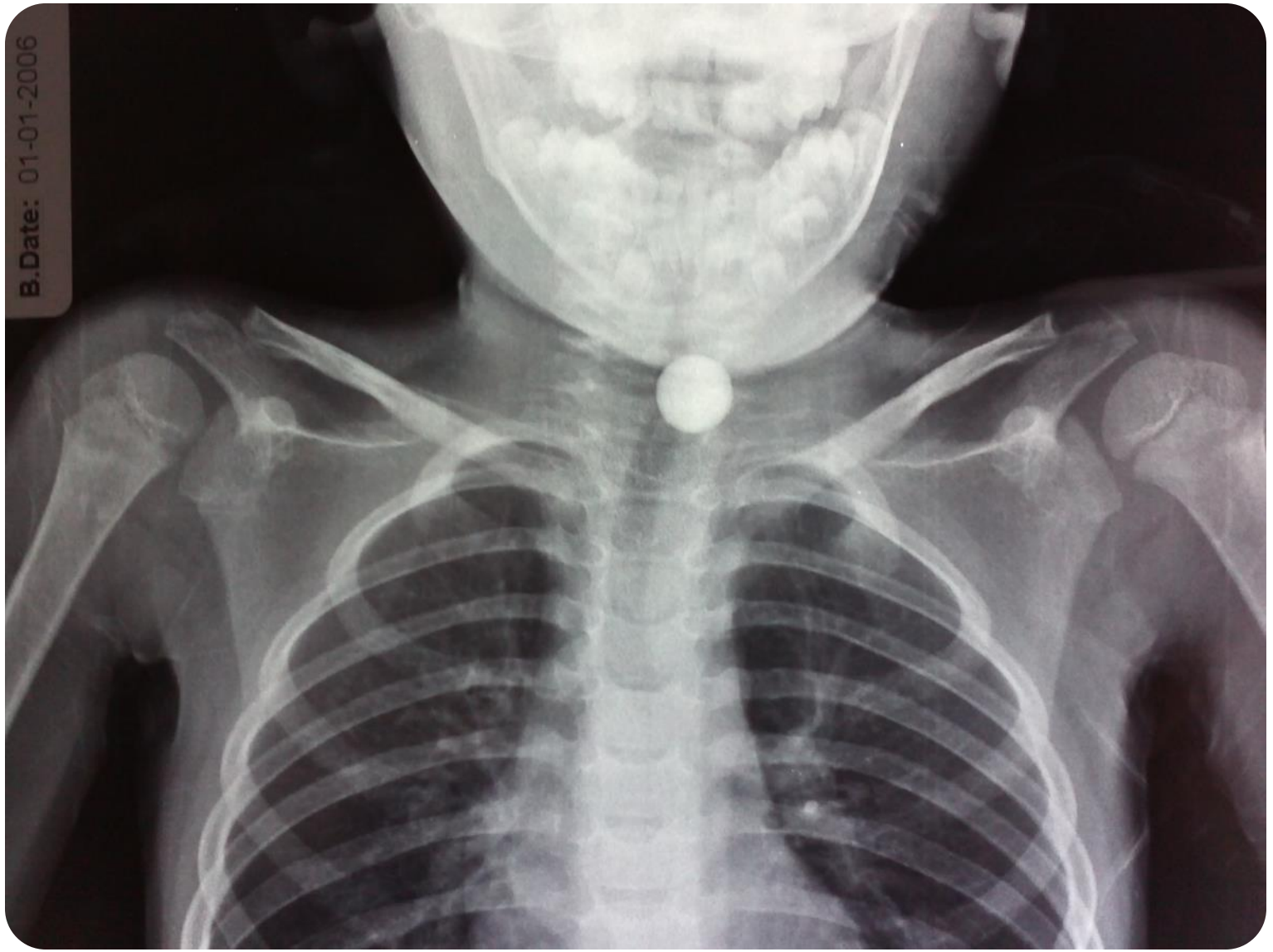
Esophageal Foreign Bodies

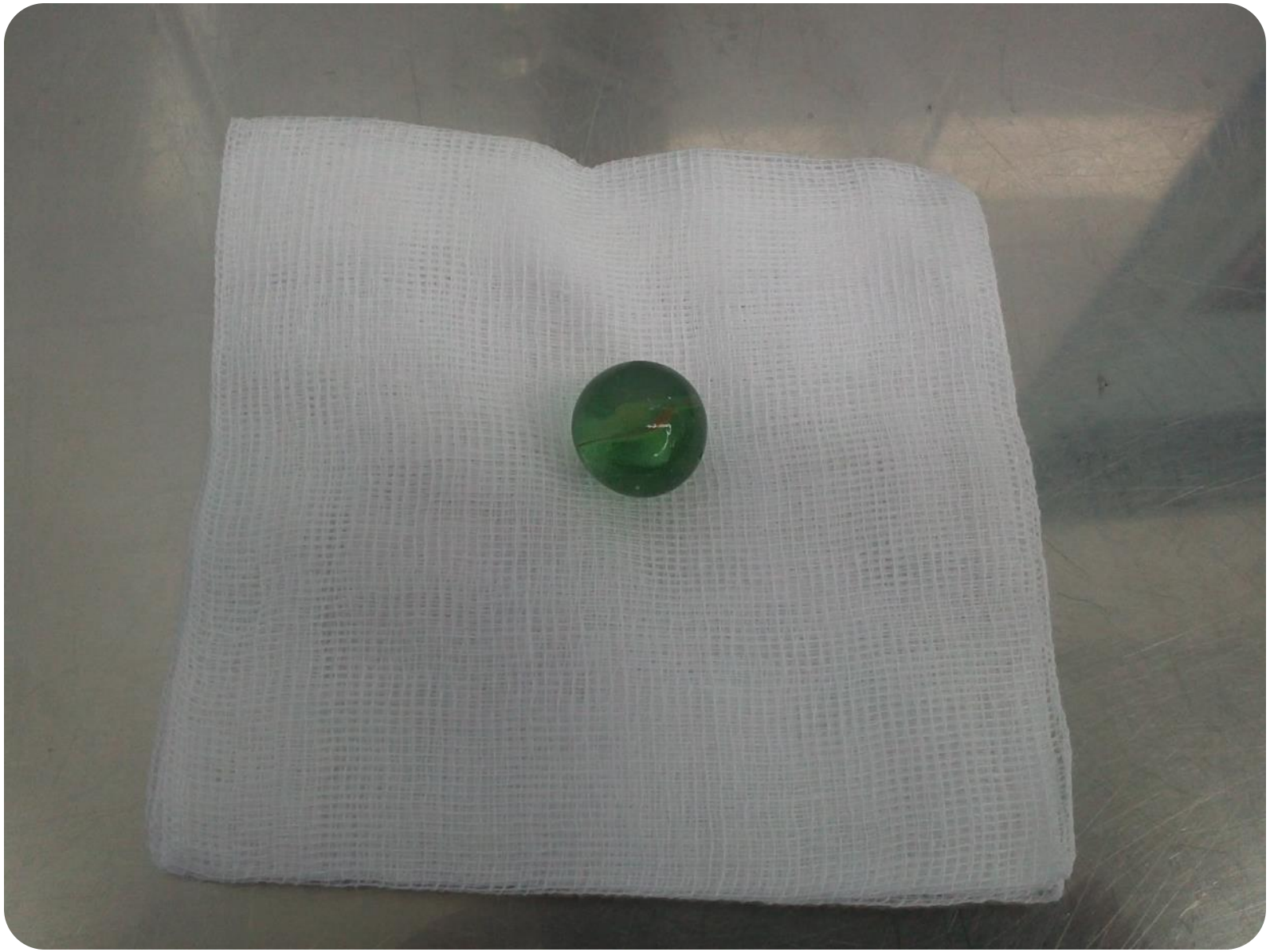
Coins

- If reached the lower esophagus:
  - often spontaneously 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)

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

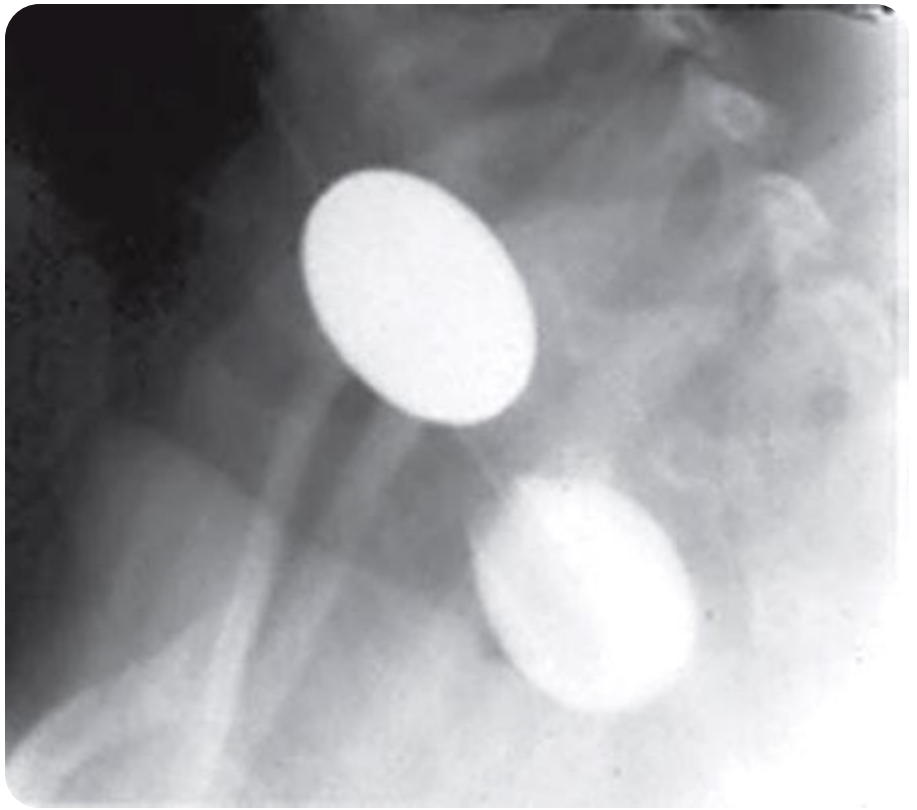

B.Date: 01-01-2006



Esophageal Foreign Bodies

Foley catheter technique

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



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

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

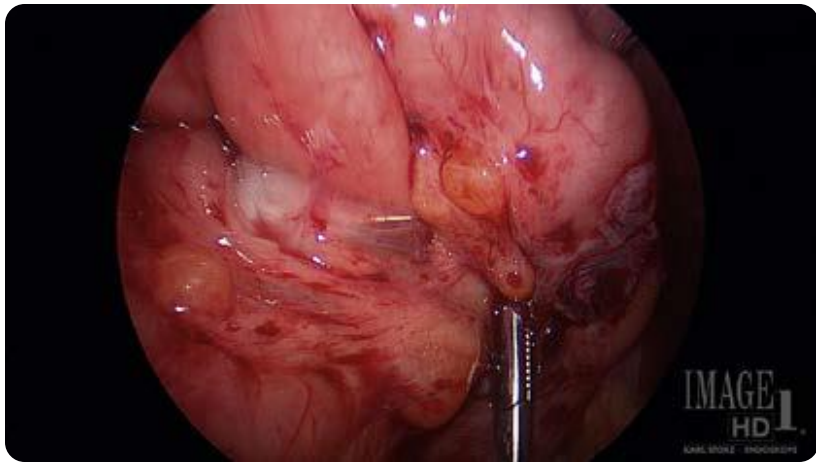
Gastrointestinal Foreign Bodies

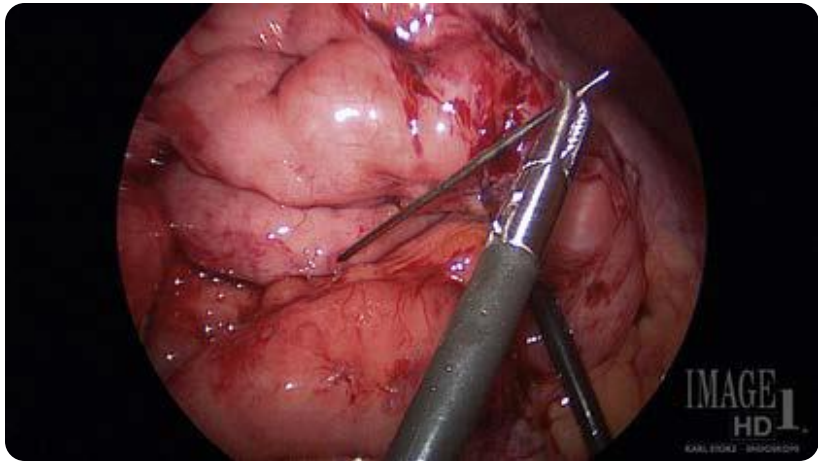
FBs that pass into the stomach..

➔ usually pass through the remainder 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

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

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

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

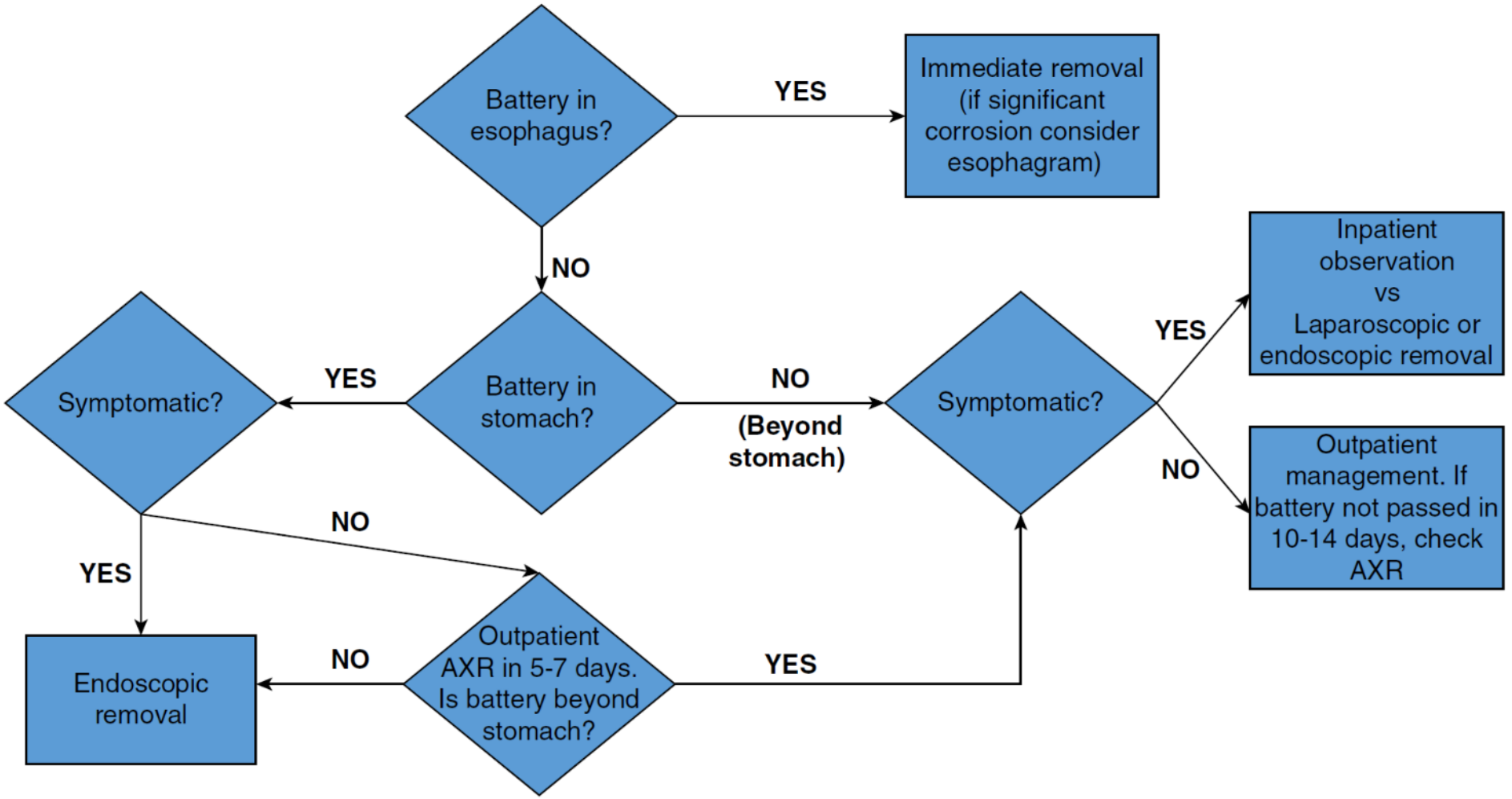
BATTERIES

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)

Battery Ingestion Treatment Algorithm



Don't memorize this slide

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

MAGNETS

- Significant morbidity when:
  - multiple magnets
  - **OR** single magnet + second metallic FB

- most common symptom is abdominal pain
- <40% symptomatic

- Plain radiographs (most commonly used to confirm diagnosis)

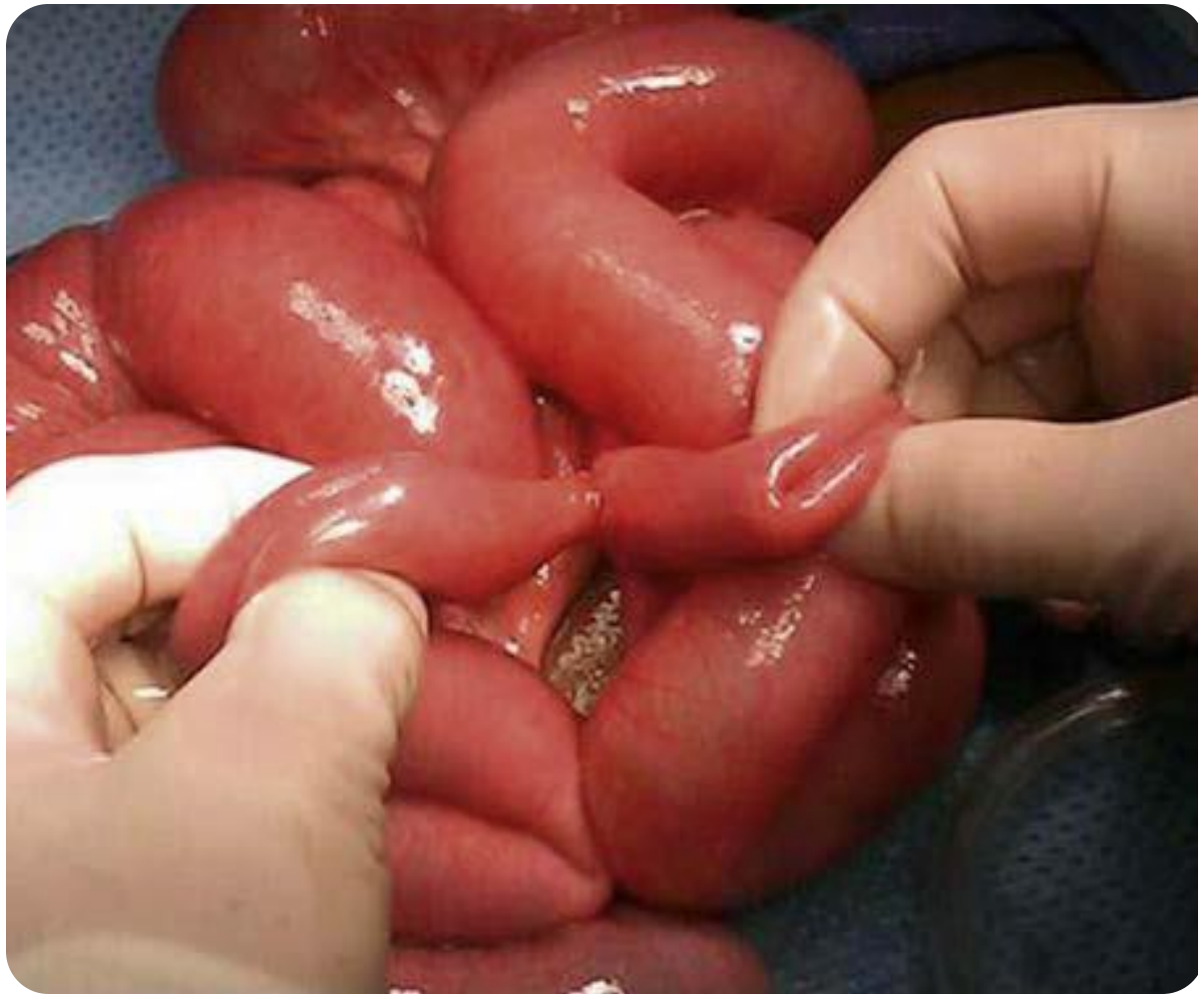
[but.. be careful!!]

MAGNETS

- Mx:
  - Close **inpatient** observation (if 2 magnets **OR** 1 + metallic FB **OR** if in doubt)
  - **Outpatient** observation (if 1 magnet)

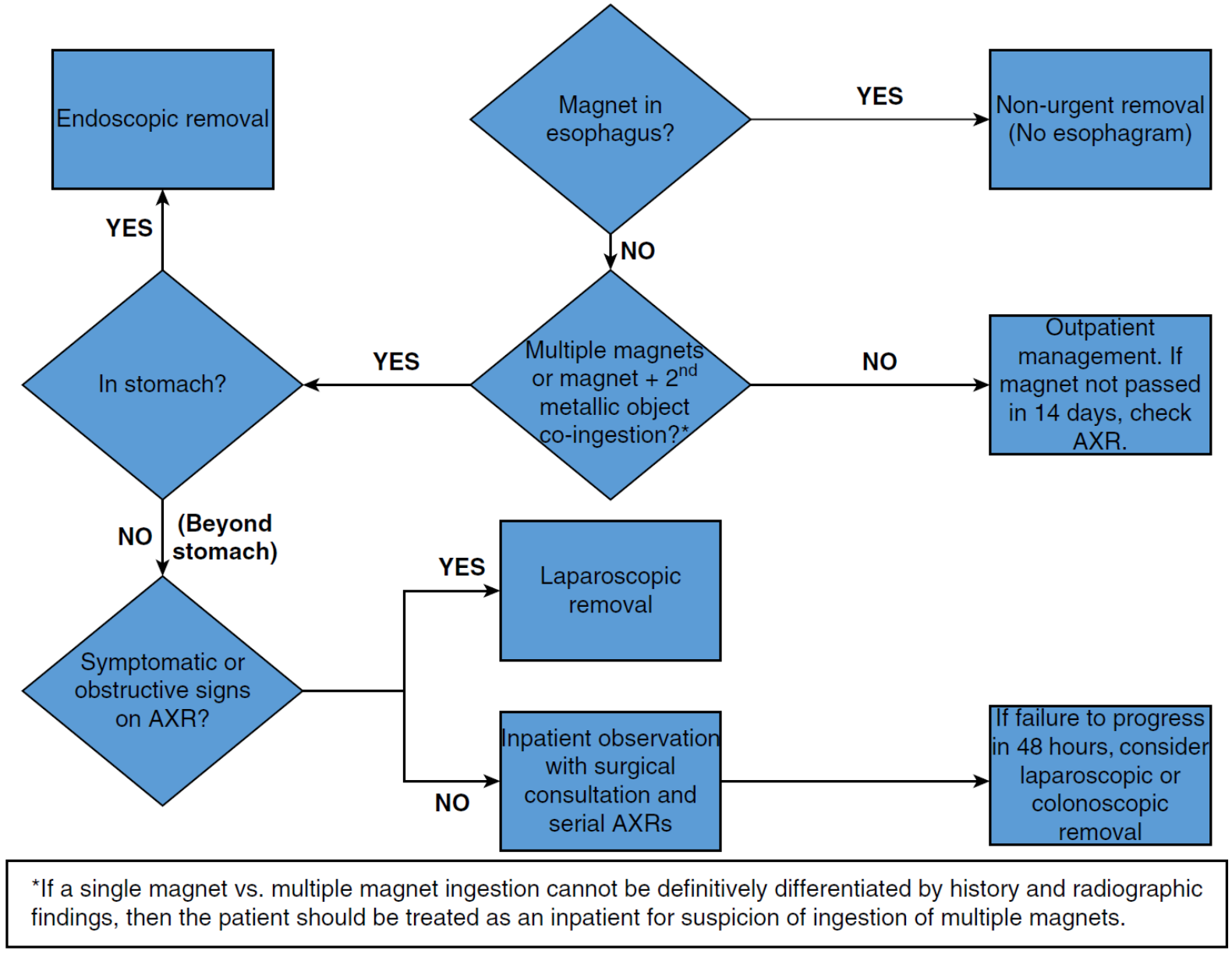
  - +/- endoscopy (to prevent complications)
  - +/- laparoscopy or laparotomy (to treat complications)

- 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

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



Management algorithm for ingested magnets

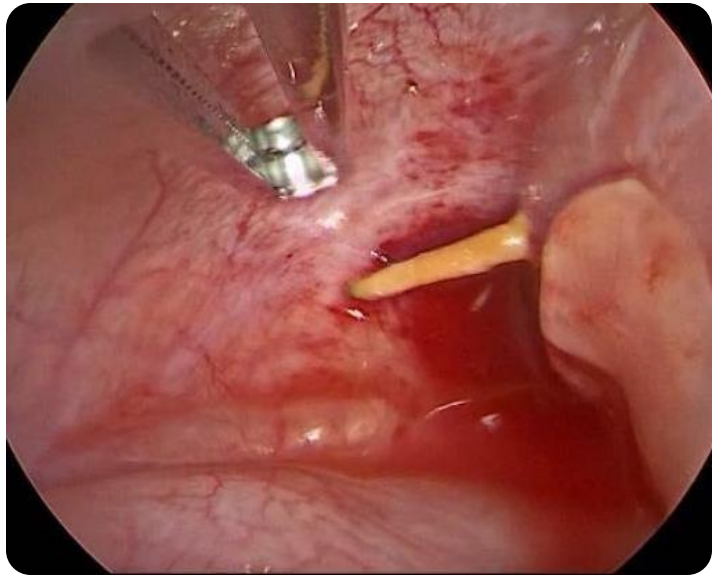
Don't memorize this slide

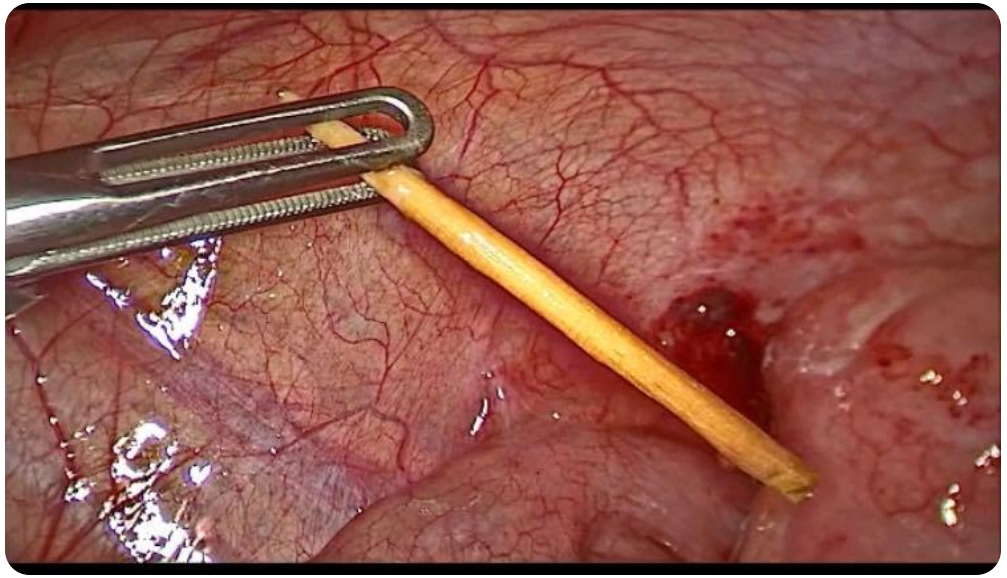
Holcomb, G. W., Murphy, J. P., & Peter, S. D. S. (2019). Holcomb and Ashcraft's Pediatric Surgery.

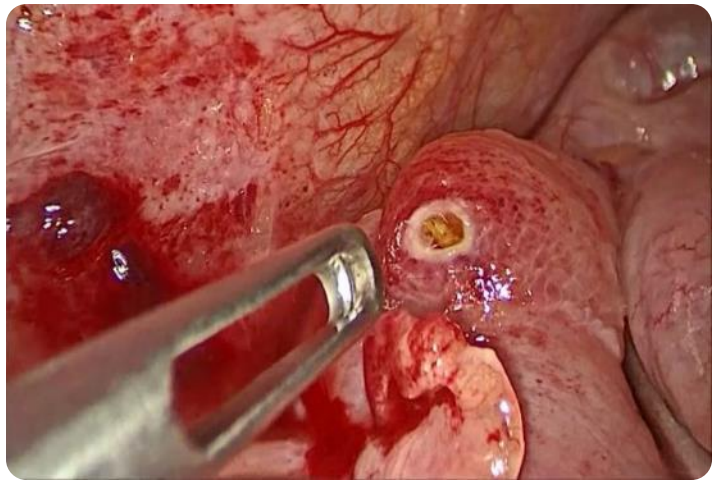
SHARP FOREIGN BODIES

- 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)







Al-Addasi, R., Al-Taher, R., Elmuhtaseb, M. S., Al-Natsheh, W., Qarkash, D., Al-Khlifat, H., Al-Soub, F., & al Zoubi, H. (2021). Toothpick perforation of the cecum in a child mimicking acute appendicitis. *Journal of Pediatric Surgery Case Reports*, 101845. https://doi.org/10.1016/j.epsc.2021.101845

BEZOARS

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

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

BEZOARS

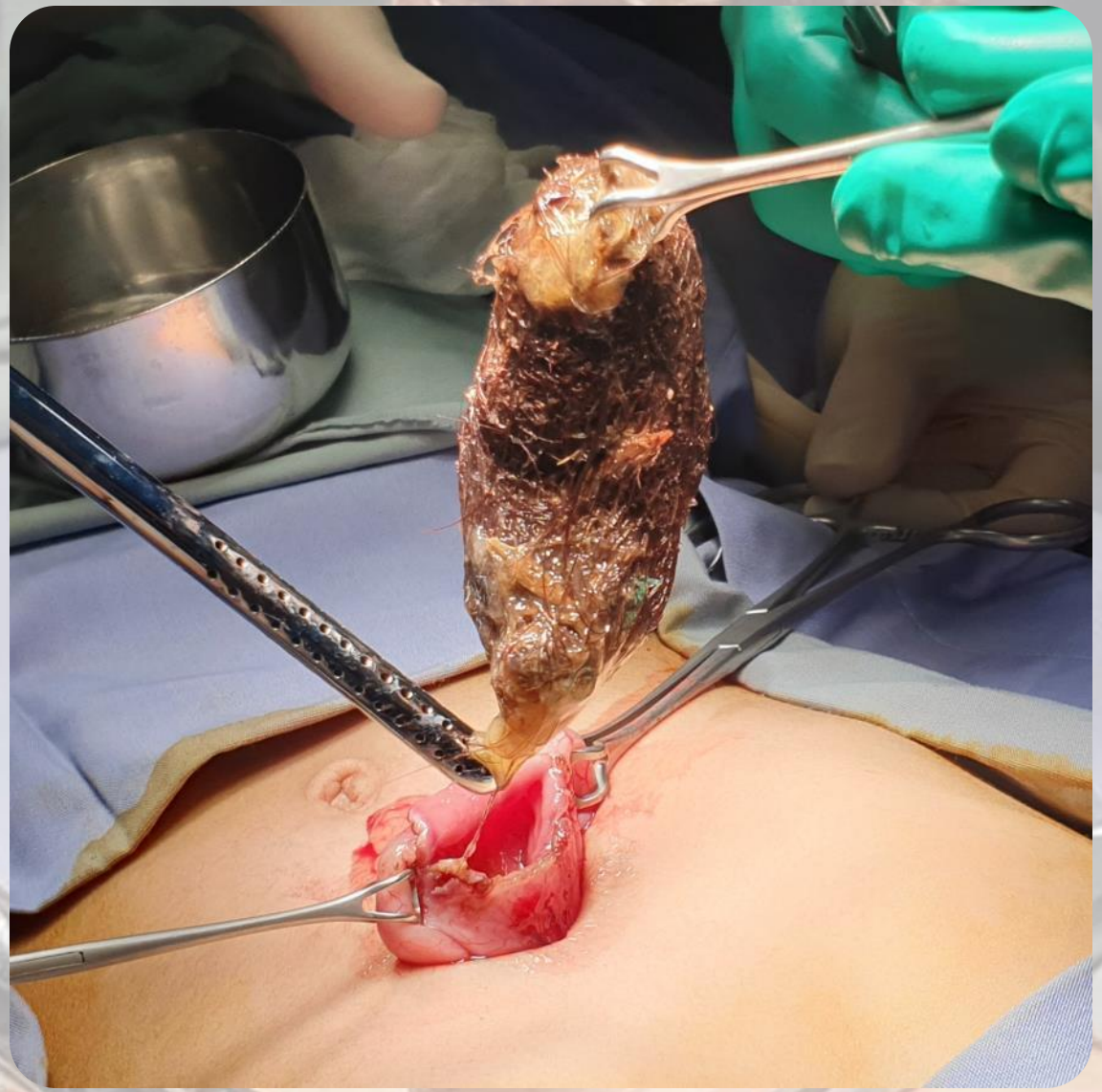
- **Presenting symptoms**: nausea, vomiting, weight loss, and abdominal distention.
- **Diagnostic imaging**: plain radiographs, upper GI contrast studies, or endoscopy.
- **Mx**:
  - Operation is necessary (phyto- & tricho-)
  - Often medical management and endoscopic removal are unsuccessful

BEZOARS

- **Phytobezoars**:
  - are composed of vegetable matter.
  - usually causes obstruction at the ileo-cecal valve level.

BEZOARS

- **Trichobezoars**:
  - formed by hair that is swallowed
  - Rapunzel syndrome (when involves stomach + small bowel)
  - associated with trichotillomania (irresistible urge to pull out hair and chewing or eating it)
  - typically removed through a gastrotomy at laparotomy or laparoscopy



Gastric bezoar with extension into the proximal duodenum

Airway Foreign Bodies

Airway Foreign Bodies

- Anatomical differences in the airway of **young children** compared with older children:
    - shorter airway, smaller in calibre.
    - anteriorly positioned larynx (increases difficulty with 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)

Don't memorize this slide

Airway Foreign Bodies

- Common **presenting symptoms**:
  - Respiratory distress
  - Stridor
    - Inspiratory → laryngeal FBs
    - Expiratory → tracheal FBs
  - Wheezing
  - +/- Dysphonia

- Many children will 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

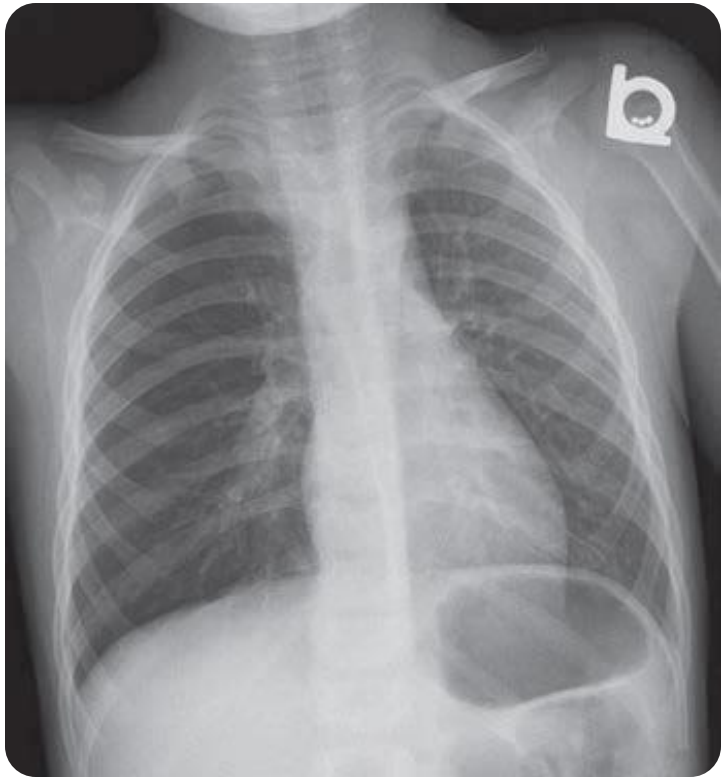
Airway Foreign Bodies

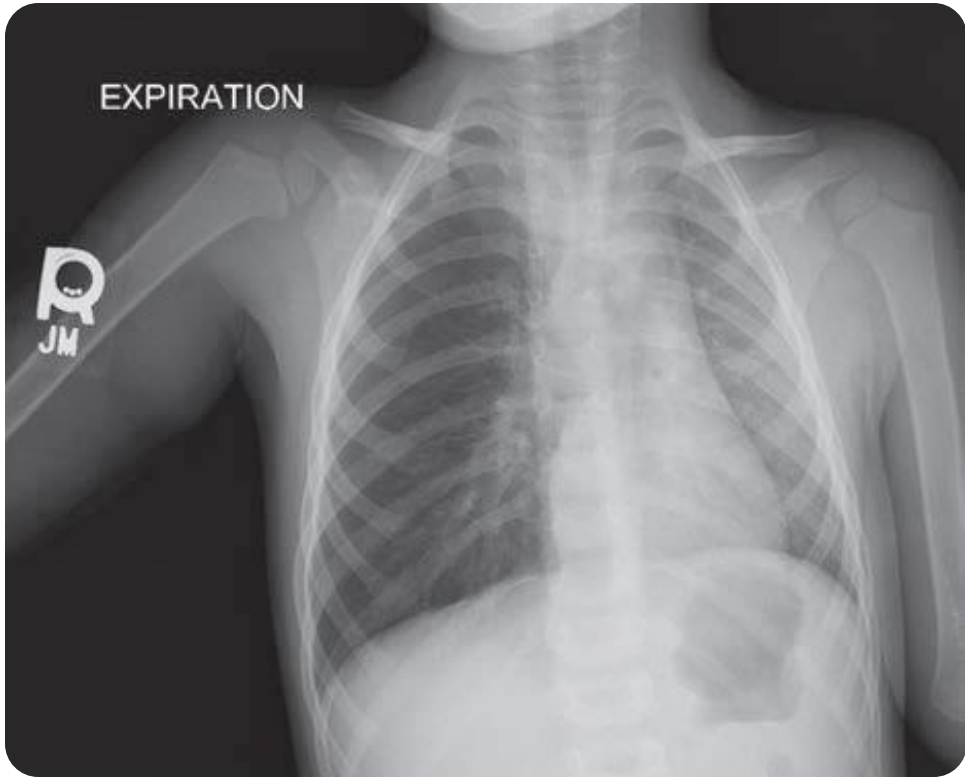
AP and lateral films of the neck and chest (inspiratory and expiratory)

→ can reveal hyperinflation or "air trapping"

- up to 60% of children
- FB acts as a one-way valve

→ +/- mediastinal shift



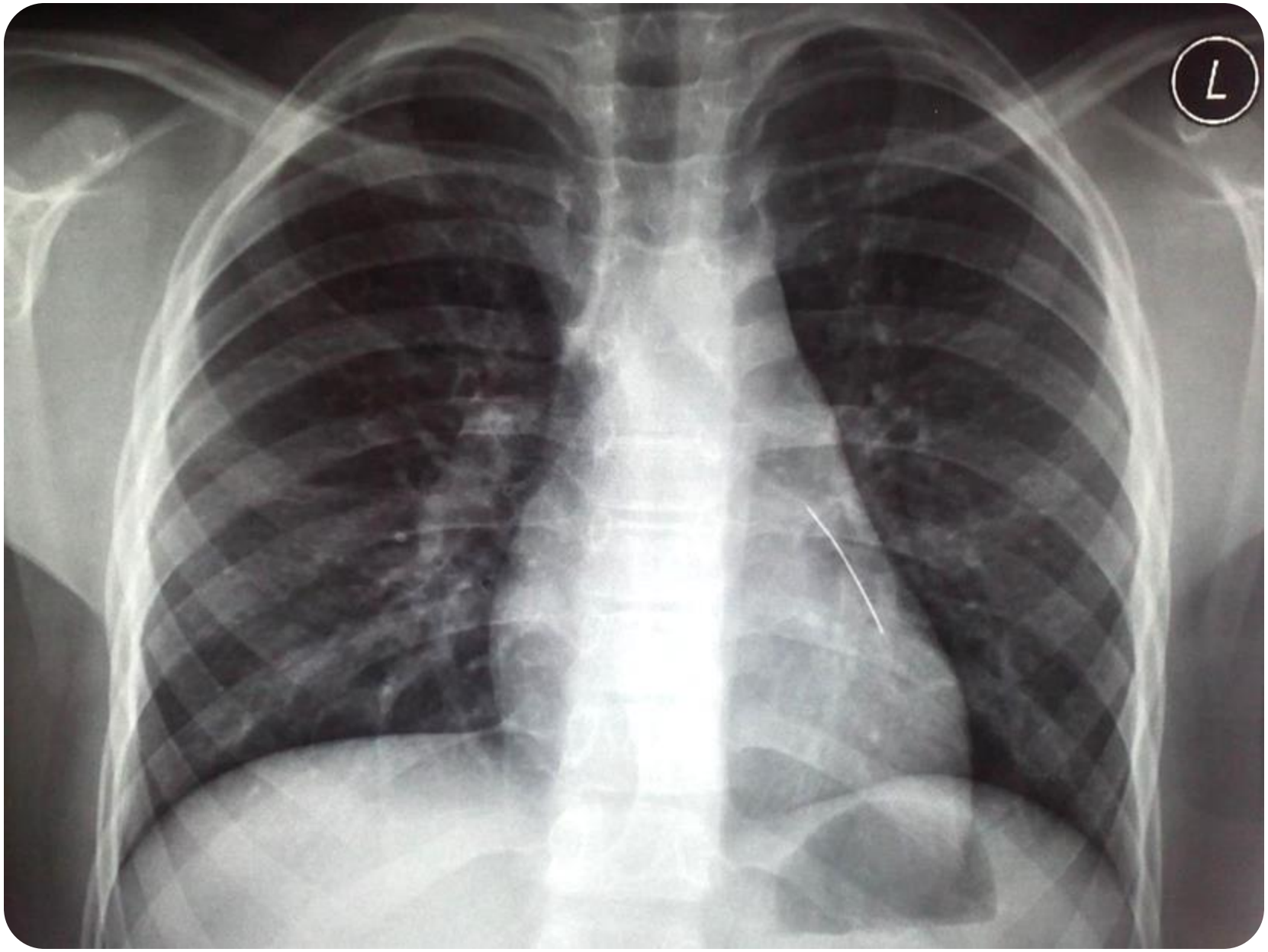


slight hyperexpansion of the right lung | expiratory film, with hyperlucency of the right lung due to air trapping

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

Airway Foreign Bodies

- 56% 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.


L

Airway Foreign Bodies

- Radiographic imaging remains helpful in children with a history of **choking**

- Definitive diagnosis requires **bronchoscopy**

Airway Foreign Bodies

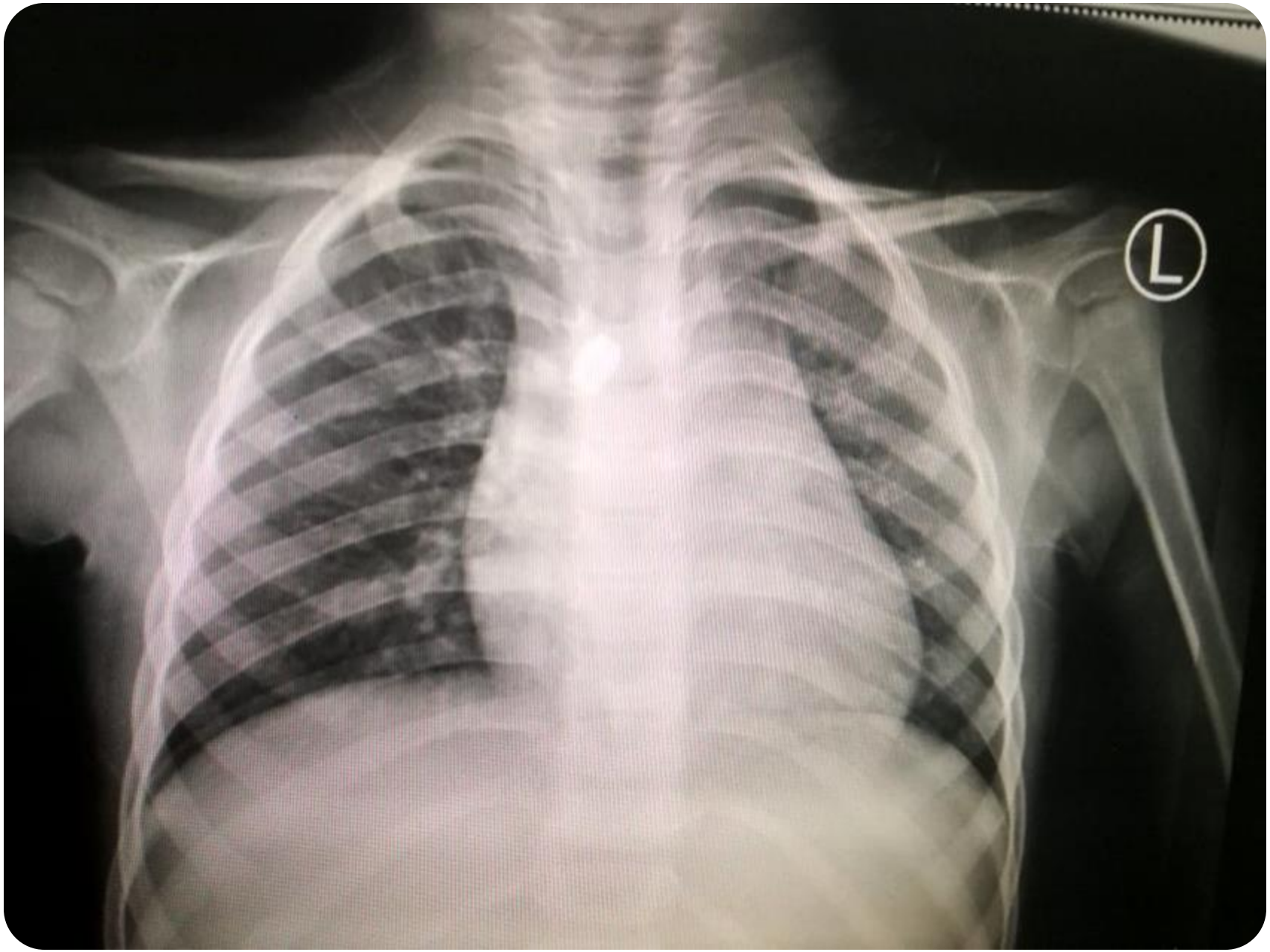
- Common practice:
  - The use of **flexible** bronchoscope (mainly to diagnose a FB)
  - **Rigid** bronchoscopy for removal of FBs (diagnostic & therapeutic)

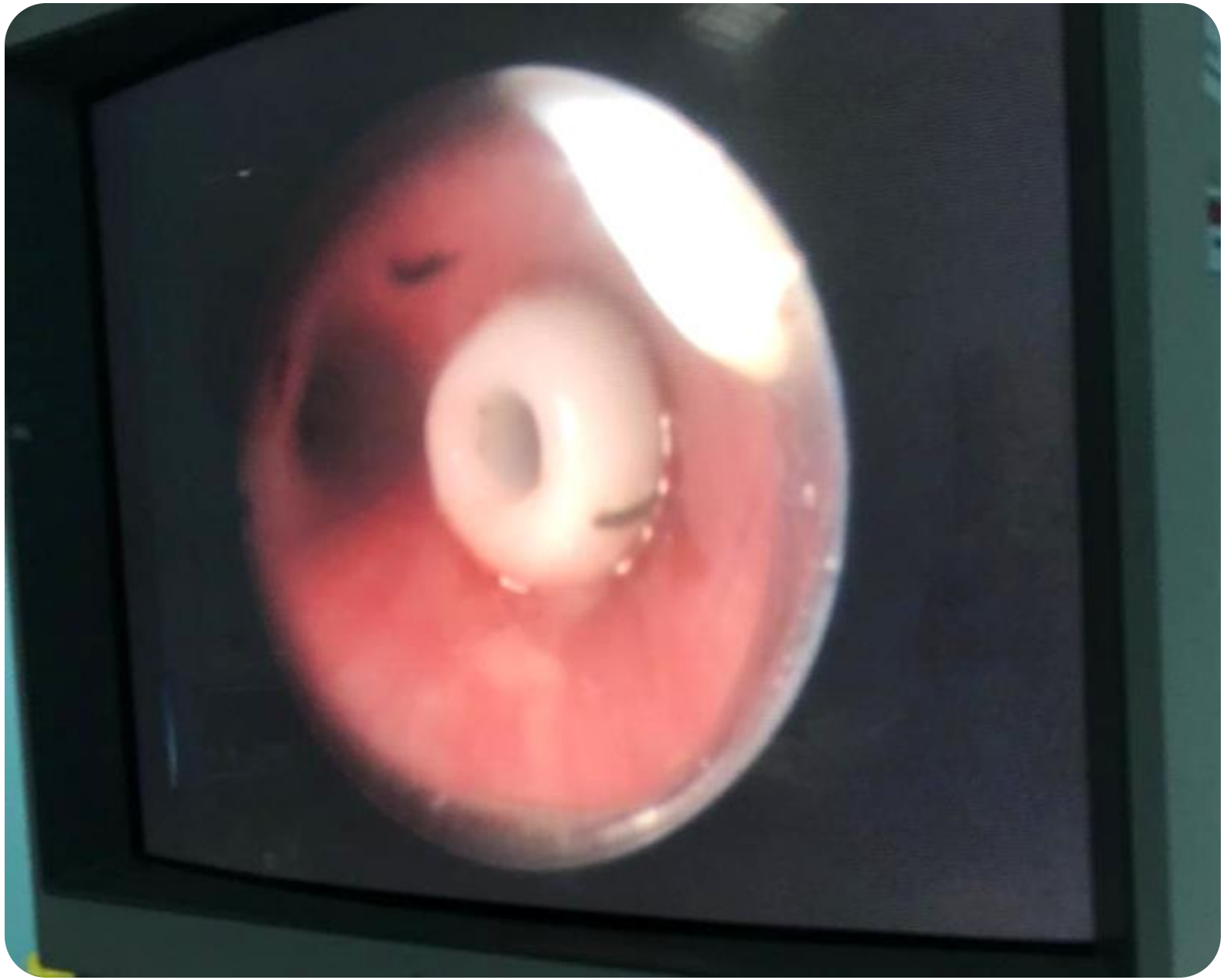
Holcomb, G. W., Murphy, J. P., & Peter, S. D. S. (2019). Holcomb and Ashcraft's Pediatric Surgery.

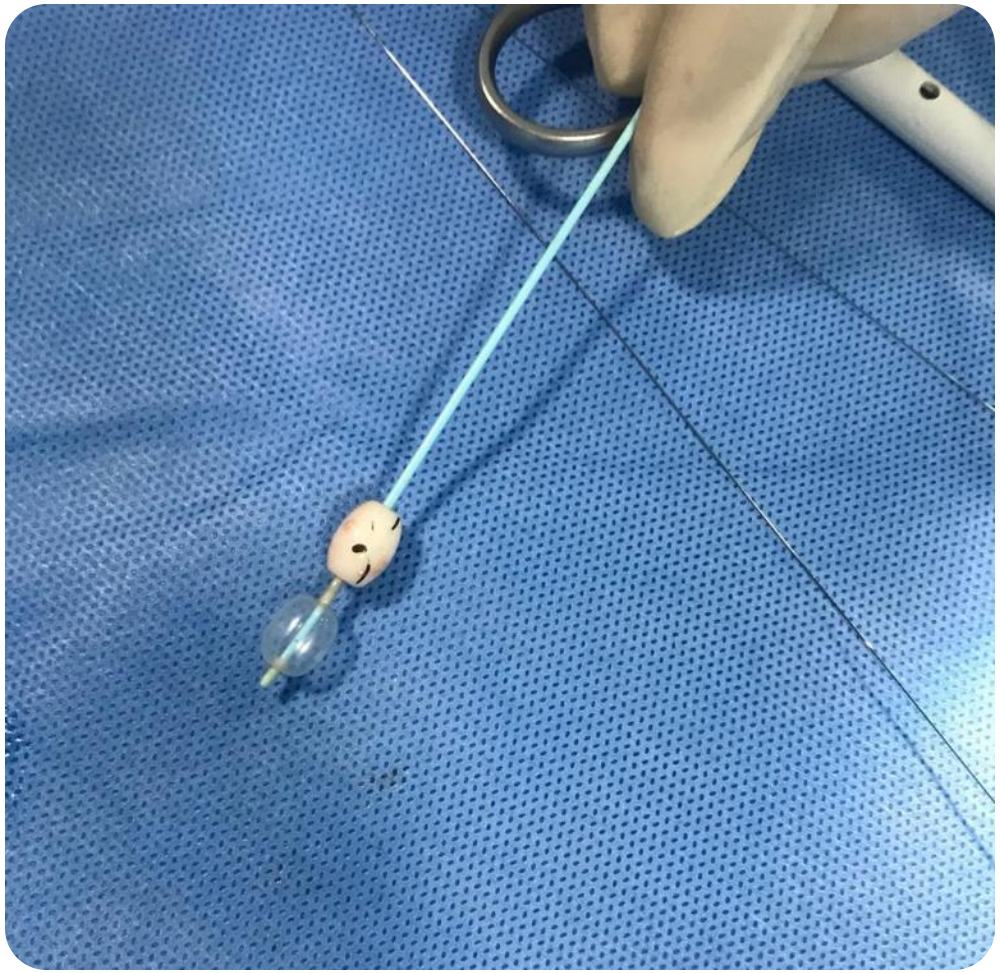
Holcomb, G. W., Murphy, J. P., & Peter, S. D. S. (2019). Holcomb and Ashcraft's Pediatric Surgery.

BRONCHOSCOPY

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


L





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.