Ingestion/Aspiration of Foreign Bodies

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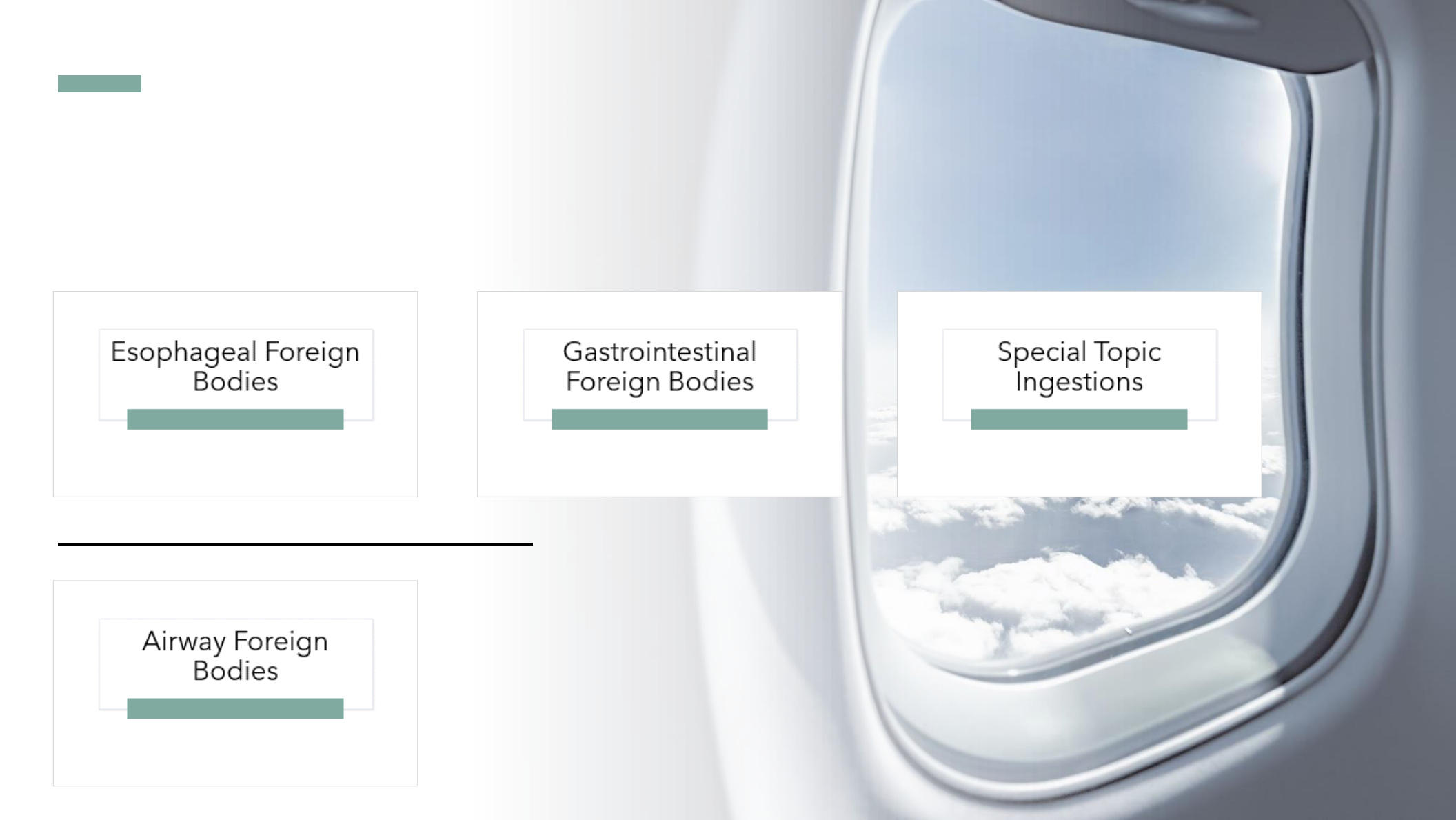
Esophageal Foreign Bodies

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 upper
  - Aortoenteric fistula middle
  - Peritonitis lower

Esophageal Foreign Bodies

Management

- **Hx:**
  - Witnessed event Or disappearance of an object
  - Symptoms can vary:
    - Completely asymptomatic
    - Drooling → if the object stucked in the upper esophagus, saliva will accumulate
    - Neck and throat pain → sometimes chest pain
    - Dysphagia
    - Emesis
    - Wheezing, or respiratory distress
    - Abdominal pain

esophagus is a smooth structure posteriorly separated from trachea anteriorly by a thin membrane so any foreign body can compress the trachea easily

Management

- **PEx:**
  - Normal physical exam (majority). → patient looks well, normal vital signs
  - Signs of complications, as:
    - oropharyngeal abrasions → جروح وخدوش
    - crepitus فقاعات تحت الجلد ← if perforated esophagus or pharyngeal injury
    - signs of peritonitis → if lower part of esophagus is involved

Esophageal Foreign Bodies

Management

* No actual value for labs (we can make CBC just as a baseline)

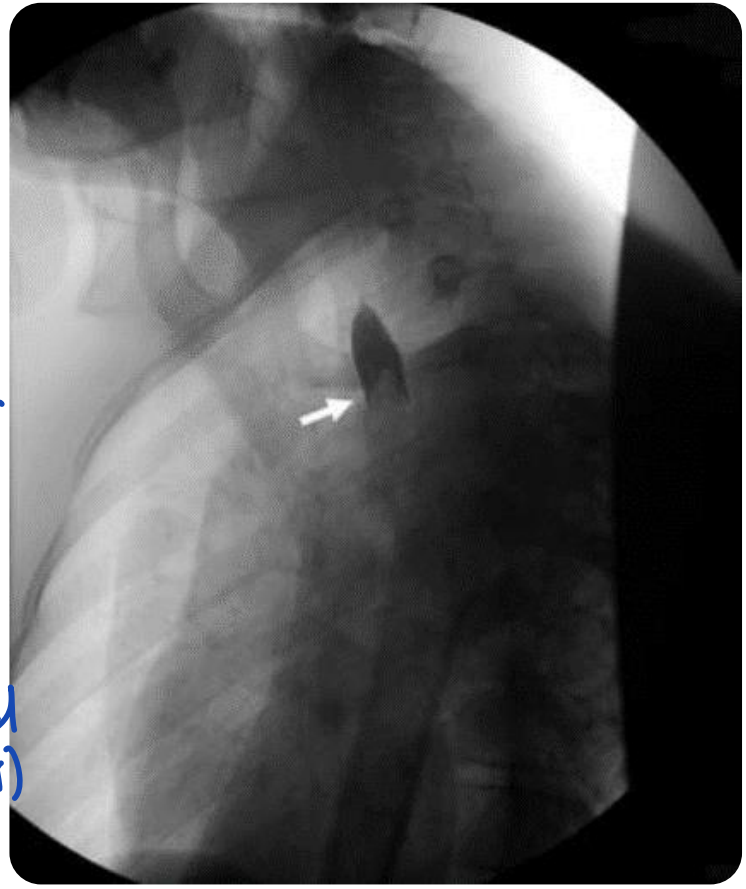
- Neck and chest X-ray (AP and lateral) → to make sure it's not in the pharynx to avoid obstruction of vocal cords and sudden death

↓ if query

+/- Contrast esophagography

+/- Esophagoscopy

Contrast esophagography ماظهرت



swallowed ← chicken in chest x-ray could be observed (translucent)

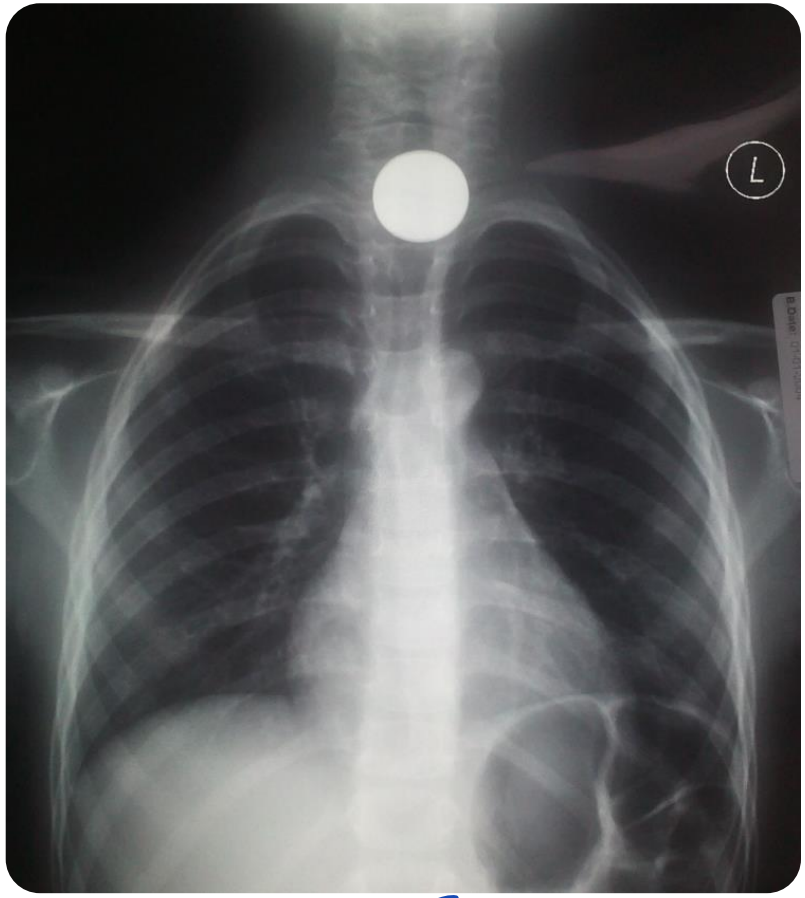
الاخر عملنا esophagoscopy (diagnostic and treatment)

Esophageal Foreign Bodies

Coins

- Appear on face in x-ray (AP view).
- Appear from the side on lateral view. → بيشوف حضيرها بالزبط كأنها نازلة
- Most located in the proximal esophagus. overall و oblique لا بيشوفها straight

level of upper esophageal sphincter



استقاصة كاملة

الحقنة كاملة جيدة

Esophageal Foreign Bodies

Coins

- Majority (of proximal) will remain entrapped and require retrieval. (لا بطلعوا لحالهم، ولا بنزلوا لتحت أكثر)

*Usually don't cause further symptoms → drooling, respiratory distress, or derangement of child's hemodynamic status

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

(contrast added to make sure that's the balloon is moving toward the right direction)

→ Disadvantage: uncontrolled especially if the foreign body is small → could move toward the trachea

could be removed by hand

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)

We push it especially if not sharp

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

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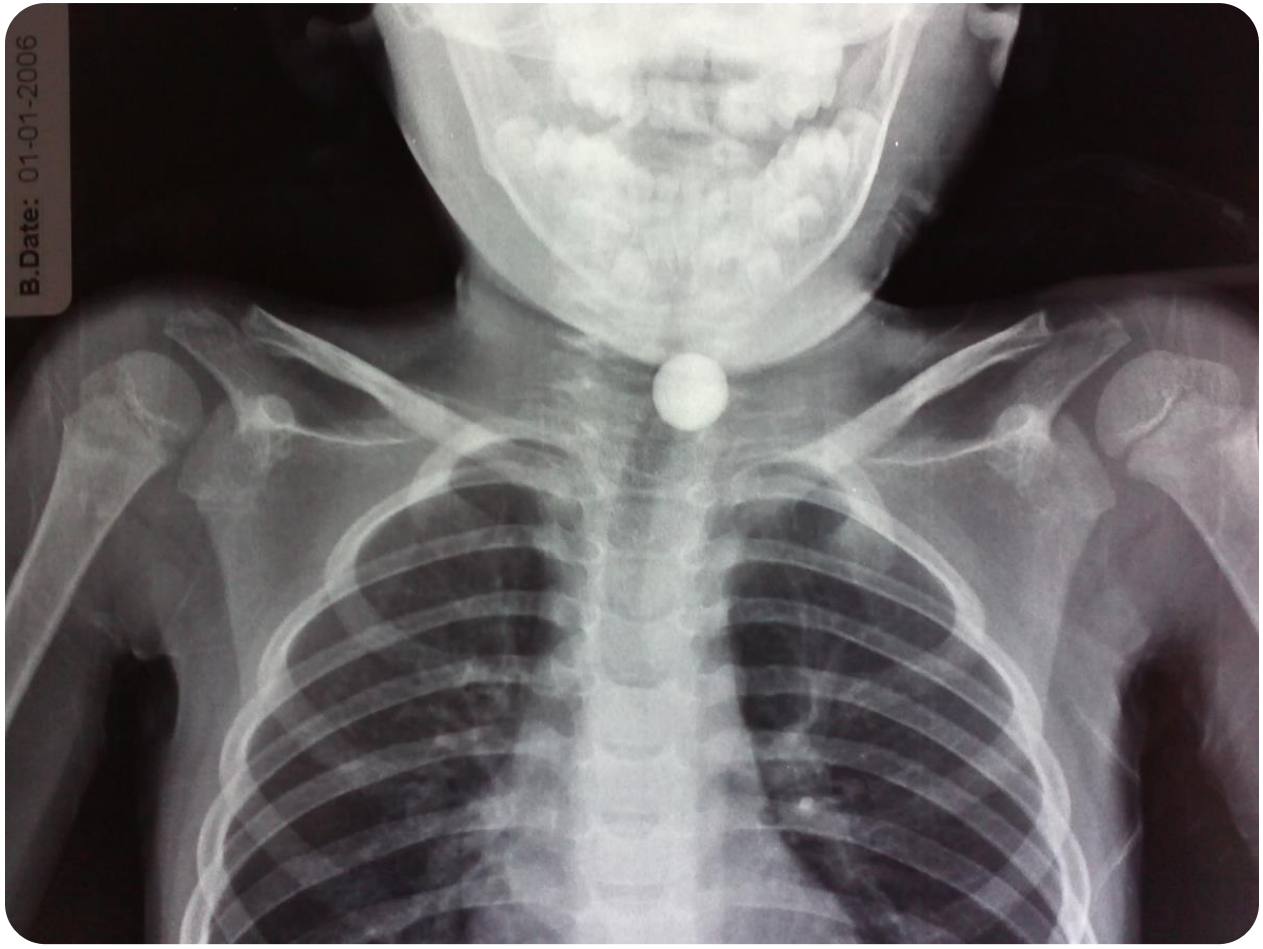
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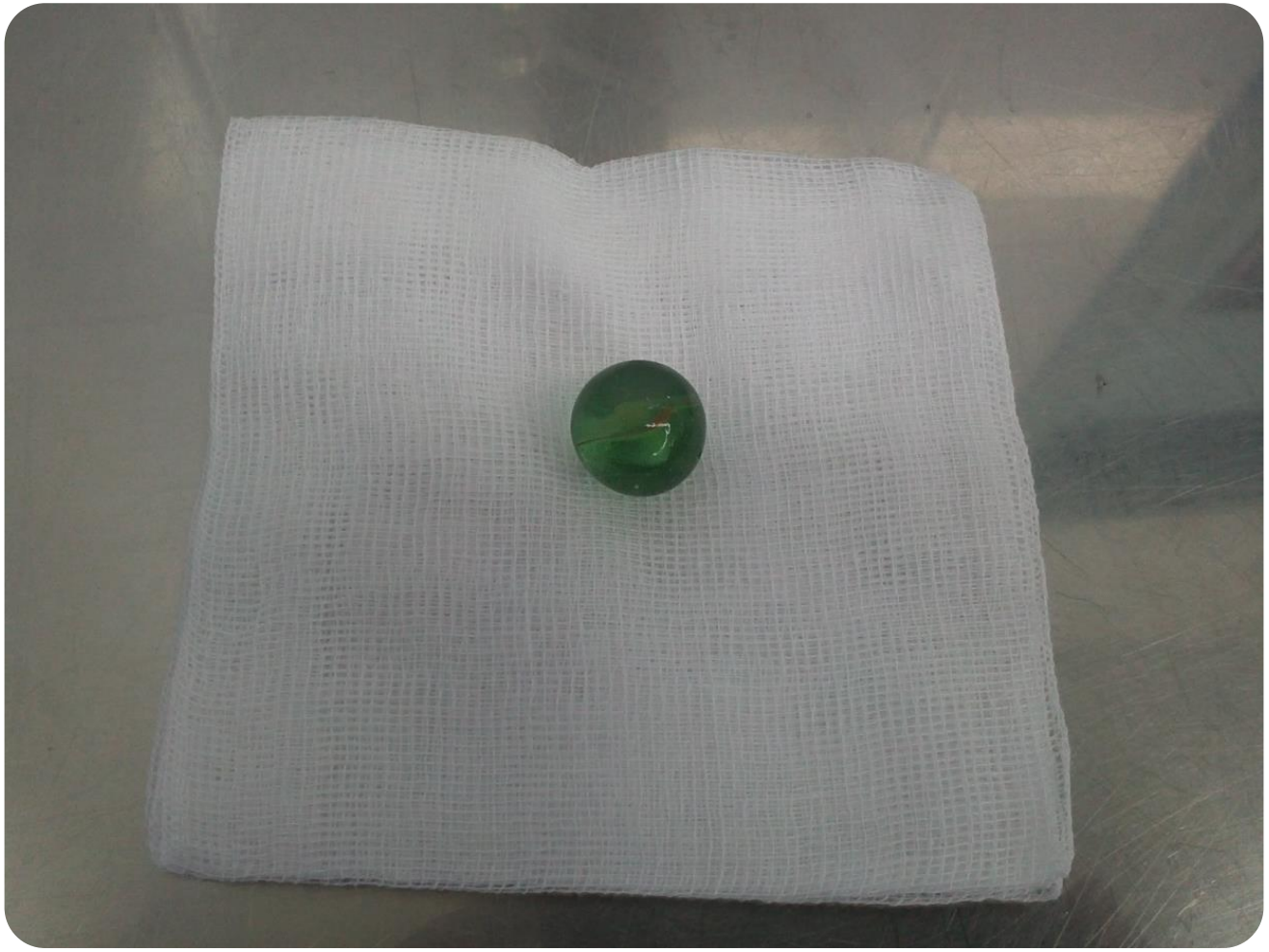
removed using foley catheter

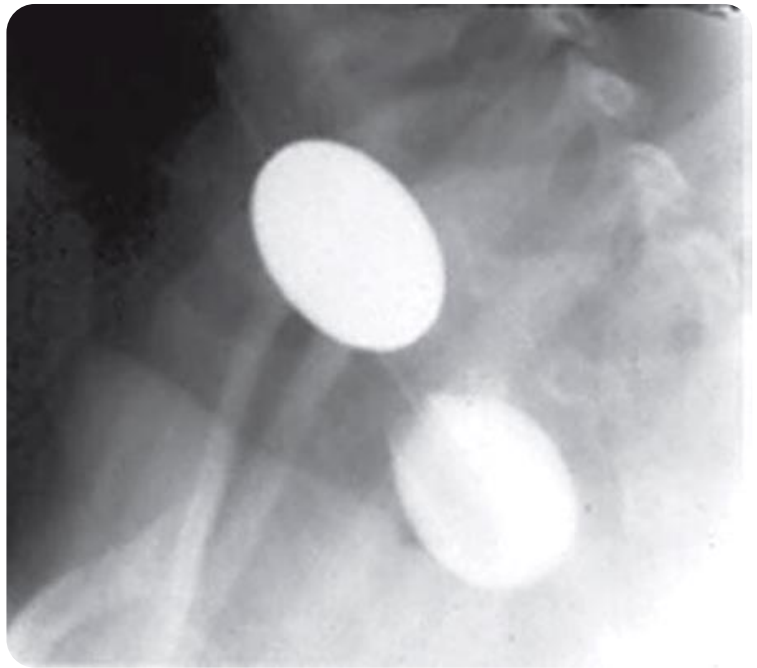


→ can easily move toward the trachea but he was secured with an endotracheal tube

Esophageal Foreign Bodies

Foley catheter technique

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



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Gastrointestinal Foreign Bodies

Gastrointestinal Foreign Bodies

- FB ingestions distal to the esophagus are usually asymptomatic

→ most of them pass smoothly through GI tract out through anus

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

Gastrointestinal Foreign Bodies

FBs that pass into the stomach..

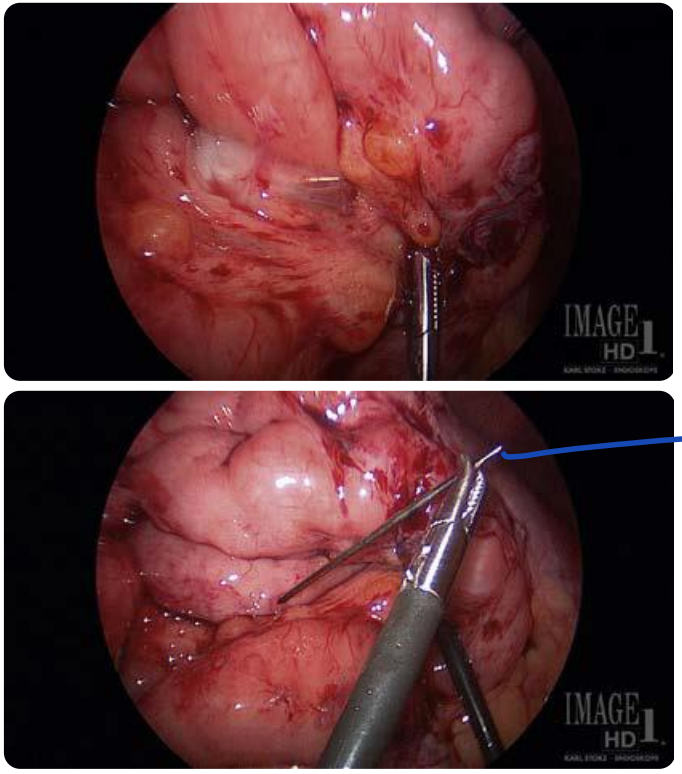
➔ usually pass through the remainder of GI tract uneventfully

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.

For exploration and direct extraction

* From jejunum to terminal ileum → non-reachable part neither by endoscopy nor colonoscopy



long enough that stopped moving → surgical intervention 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**

حفظية على الدايم

*Major problem of button battery is longer contact time between the battery and esophagus
↓
↑ injury
↑ fistula development risk
↑ perforation risk

*إذا ضلت أكثر
من ساعة
حتى لو شلناها
صار في risk
منها إنه تعمل
perforation

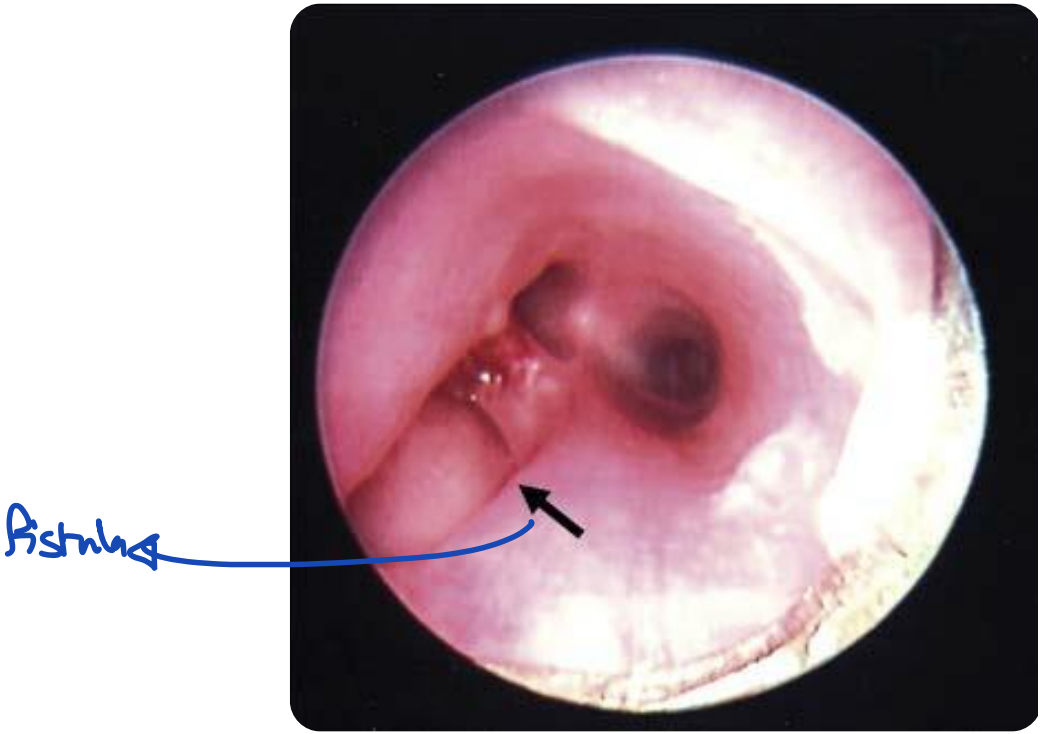
double contour rim (button battery)

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

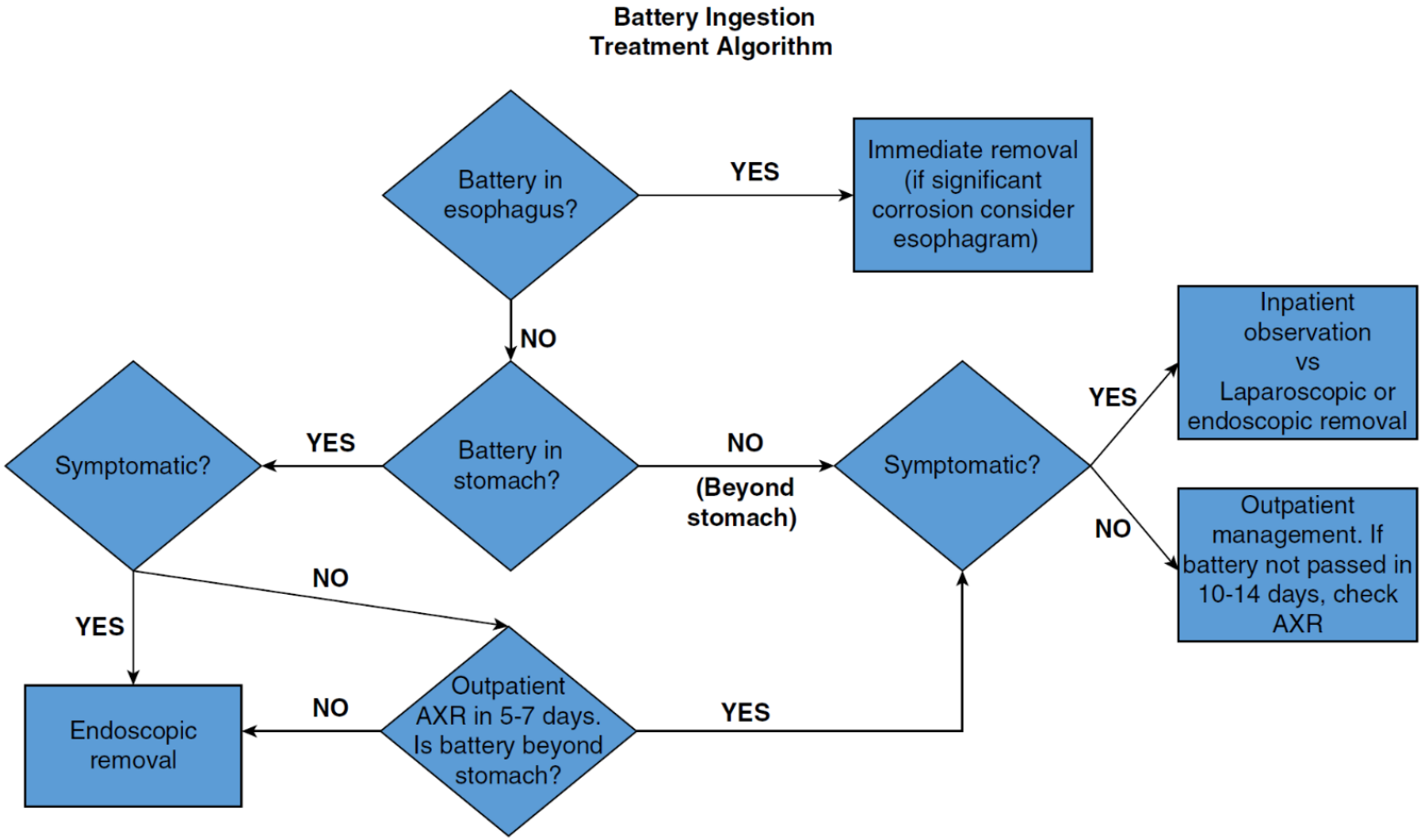
If the battery is confirmed to be distal to the esophagus

AND the patient is asymptomatic

if symptomatic you can't observe endoscopy or laparoscopy and surgery

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

because the battery will not be in a continuous contact with the same sides of the mucosa like the esophagus as the stomach is peristaltic



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MAGNETS

- Significant morbidity when:
  - multiple magnets → if two connected magnet swallowed together → not a major problem
  - **OR** single magnet + second metallic FB but if separated → two different areas in GIT → pressure necrosis → perforation, fistulas, strictures ....
    - if parents not sure go for this option
- most common symptom is abdominal pain
- <40% symptomatic
- Plain radiographs (most commonly used to confirm diagnosis)

[but.. be careful!!]

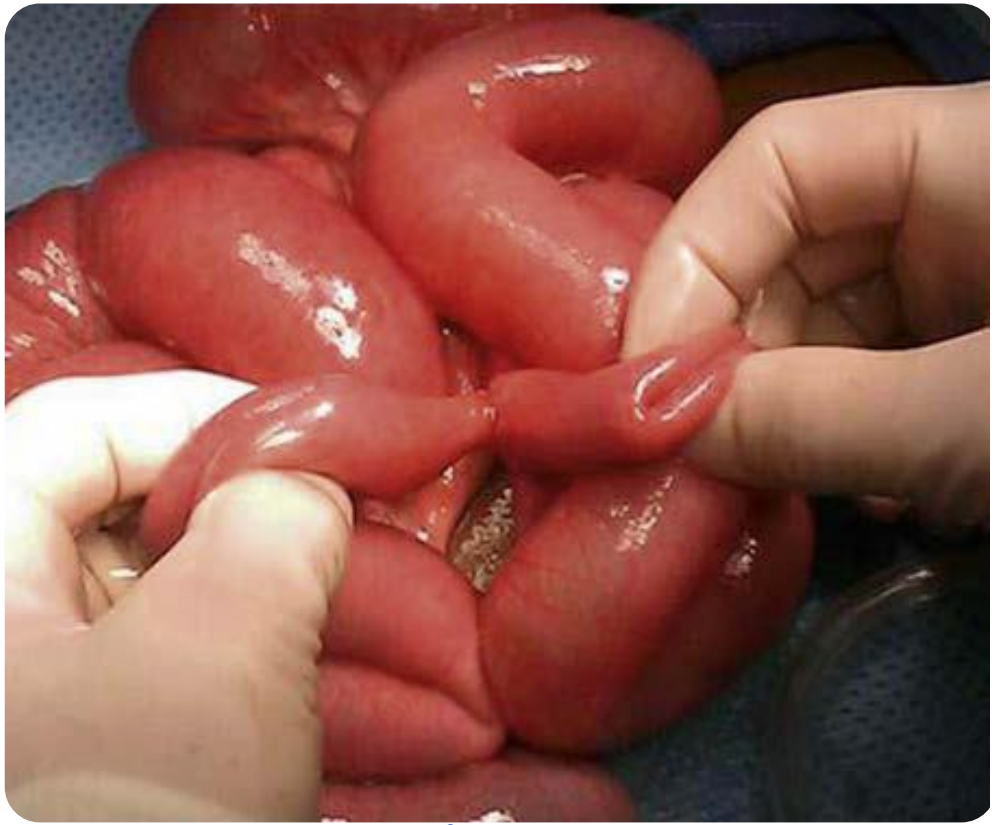
ممكن يكونوا مبينين ملزقين ببعض وهم مفصولين → different perforations

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



↳ 2 magnet in 2 different ileal loops

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

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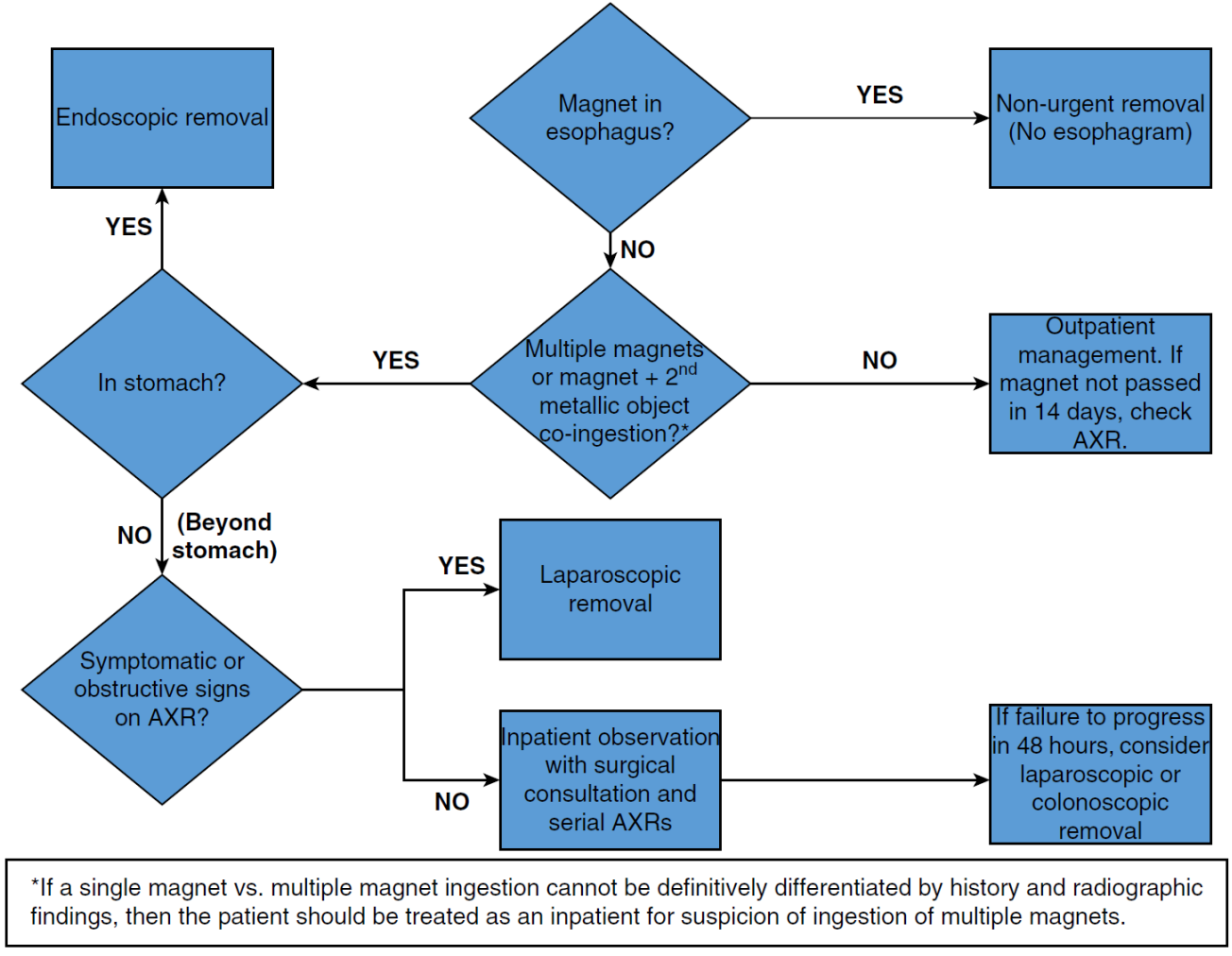

Management algorithm for ingested magnets

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SHARP FOREIGN BODIES

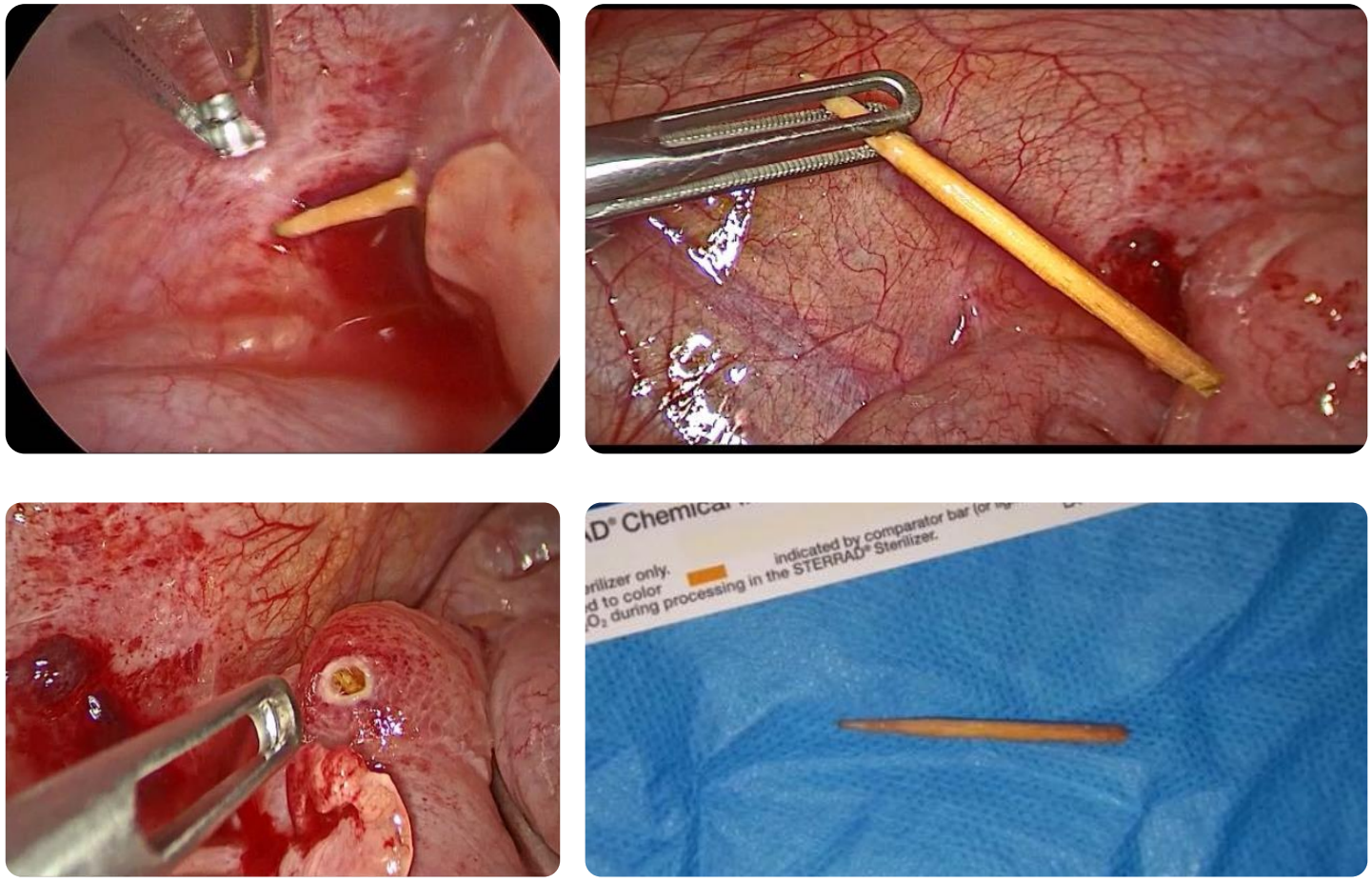
- Significant morbidity
- 15–35% risk of perforation (mostly in narrowed portions or areas of curvature)
- Mx:
  - Conservative: smaller objects and straight pins (lower rates of perforation)
  - Endoscopic retrieval
  - Close inpatient observation (for potential development of complications)

↳ especially in ileocecal valve

missed sometimes as appendicitis but when investigated → vague differential
So we go for imaging

if reachable (but there's a risk for injury at the site of retrieval)

*when the object is removed and we suture the perforation → perform appendectomy in case there's complications after surgery → we know they are from the operation not appendicitis



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) حليب صناعي هو مصنوع → projectile vomiting similar to PPS
  - phytobezoars (plant) → cellulose
  - trichobezoars (hair) → usually with psychological disorders

BEZOARS

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

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

↳ only diagnostic | treatment - only for lacto

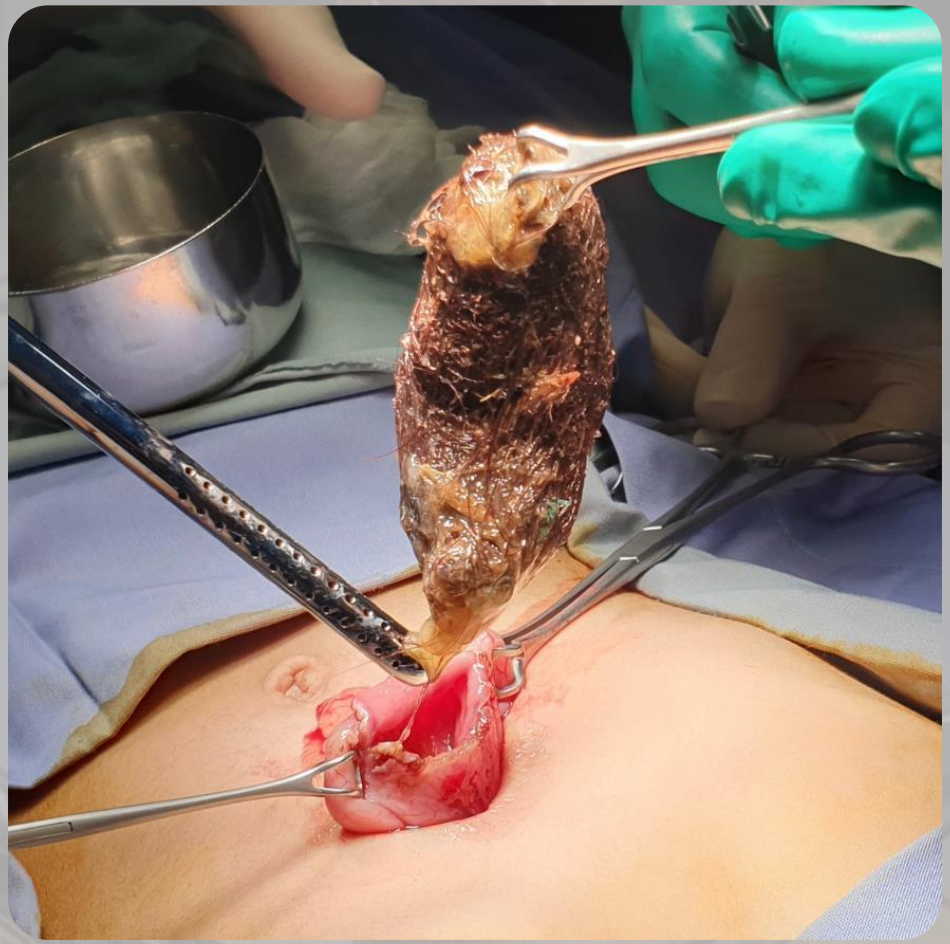
- **Mx**:
  - Operation is necessary (phyto- & tricho-) except for lacto bezoars
  - Often medical management and endoscopic removal are unsuccessful

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)
    ↳ should be referral to a psychologist
  - 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

↳ deviated to the right but remains almost straight (minimal angulation)

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. (immature swallow reflex)

Airway Foreign Bodies

A high index of suspicion is required

(sudden cough, cyanosis, change of voice)

Present later as chronic respiratory infection caused by a foreign body in the bronchial tree

Airway Foreign Bodies

- **Boys**:girls → **2**:1
- Suffocation following FB aspiration → leading cause of mortality from unintentional injury in infants. if obstructing upper airway at the level of vocal cords
- Victims of **child abuse** → at **higher risk**.

* غالبا إذا وصل الطفل للطوارئ
ستكون الحالة ingestion مو aspiration
بتكون بـ esophagus مو trachea
لأنه لو trachea بكون الطفل توفى قبل ما يوصل

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

(especially if radiolucent)

- 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

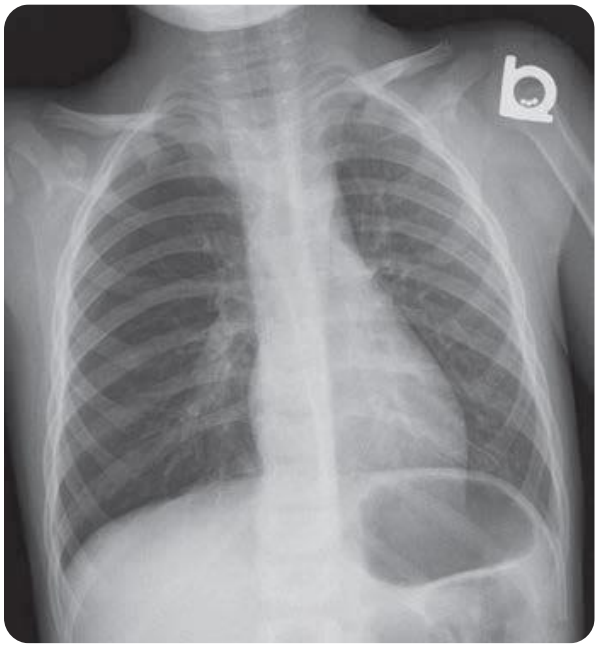
Airway Foreign Bodies

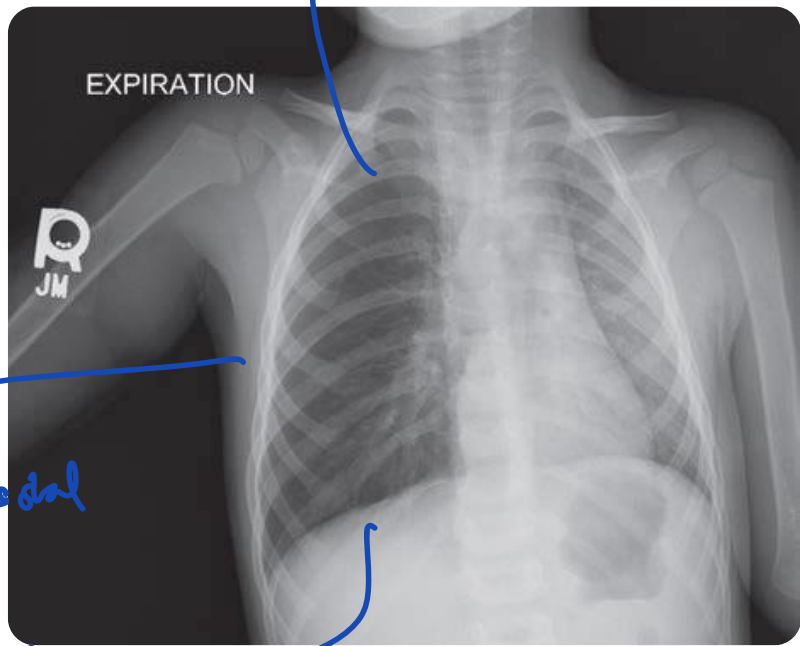
AP and lateral films of the neck and chest (inspiratory and expiratory)

→ can reveal hyperinflation or "air trapping"

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

→ +/- mediastinal shift





hyperinflated more than the other side → sign for an aspiration in the right main bronchus

horizontal + wider intercostal spaces

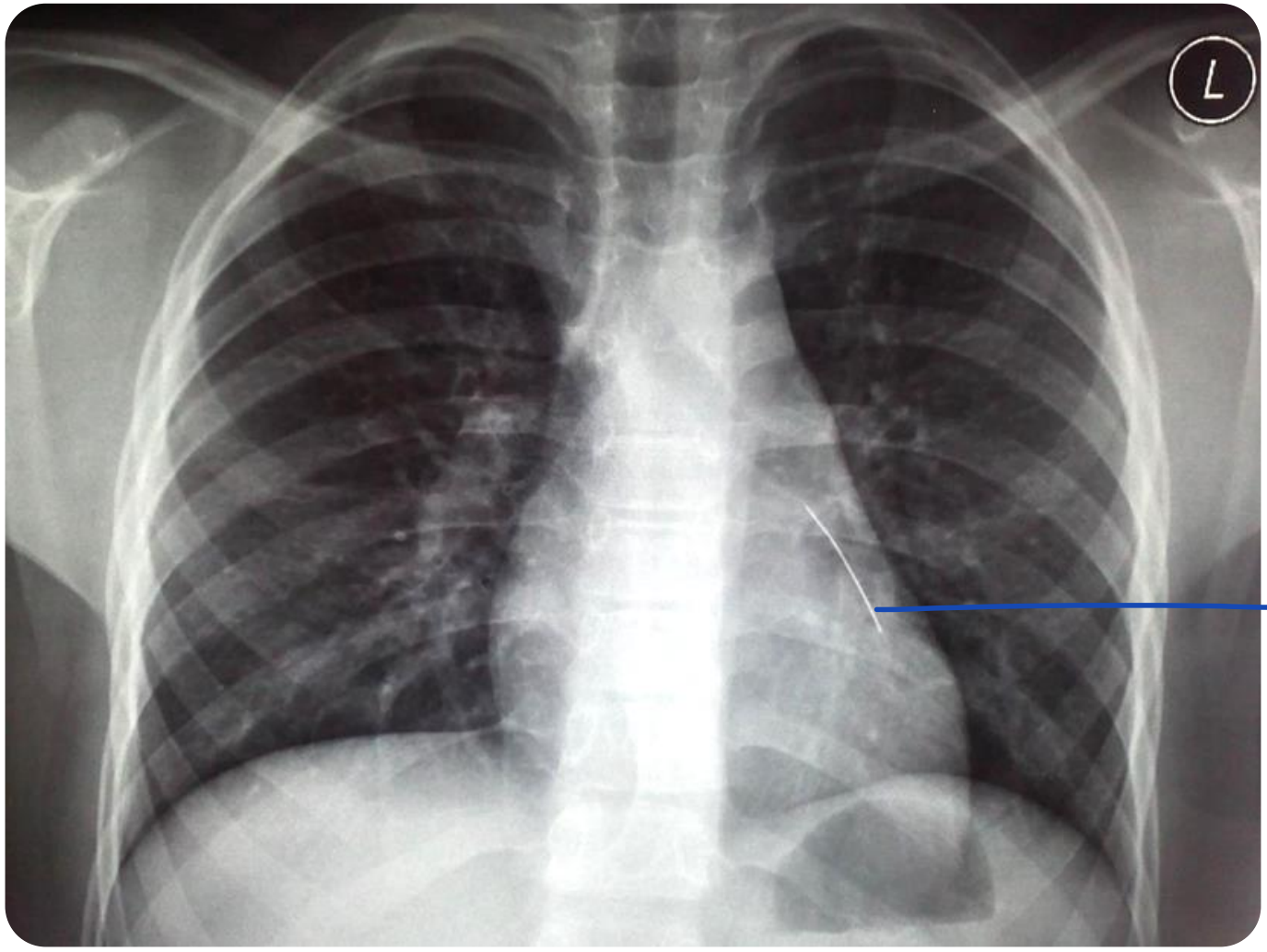
flattened diaphragm

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
radiopaque

Airway Foreign Bodies

Hx
PE
X-ray

(labs not important)

- 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)

doesn't pass distally but more helpful to grasp the fb

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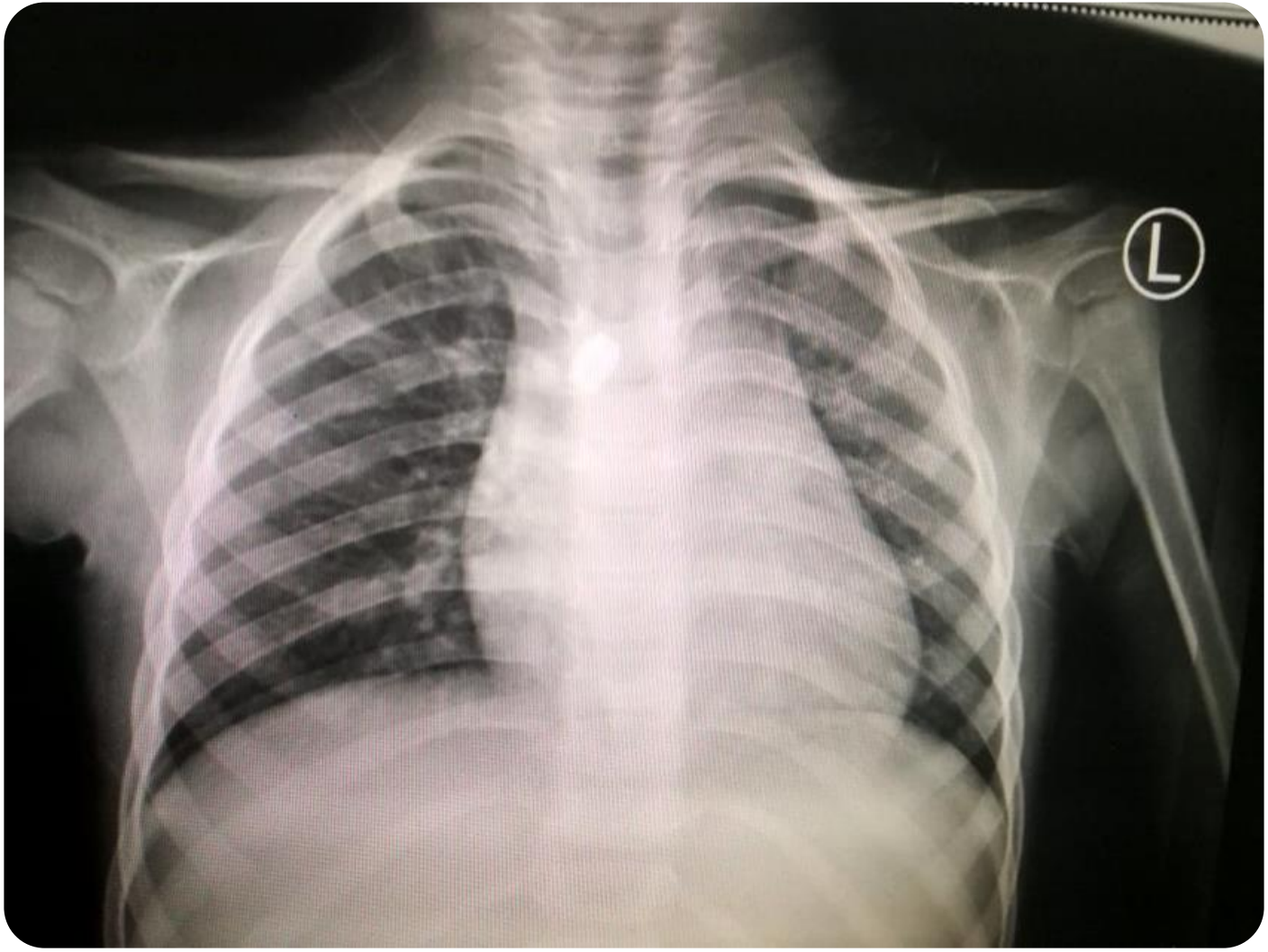
BRONCHOSCOPY

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

very thin used in adults especially in cardiovascular surgery to extract emboli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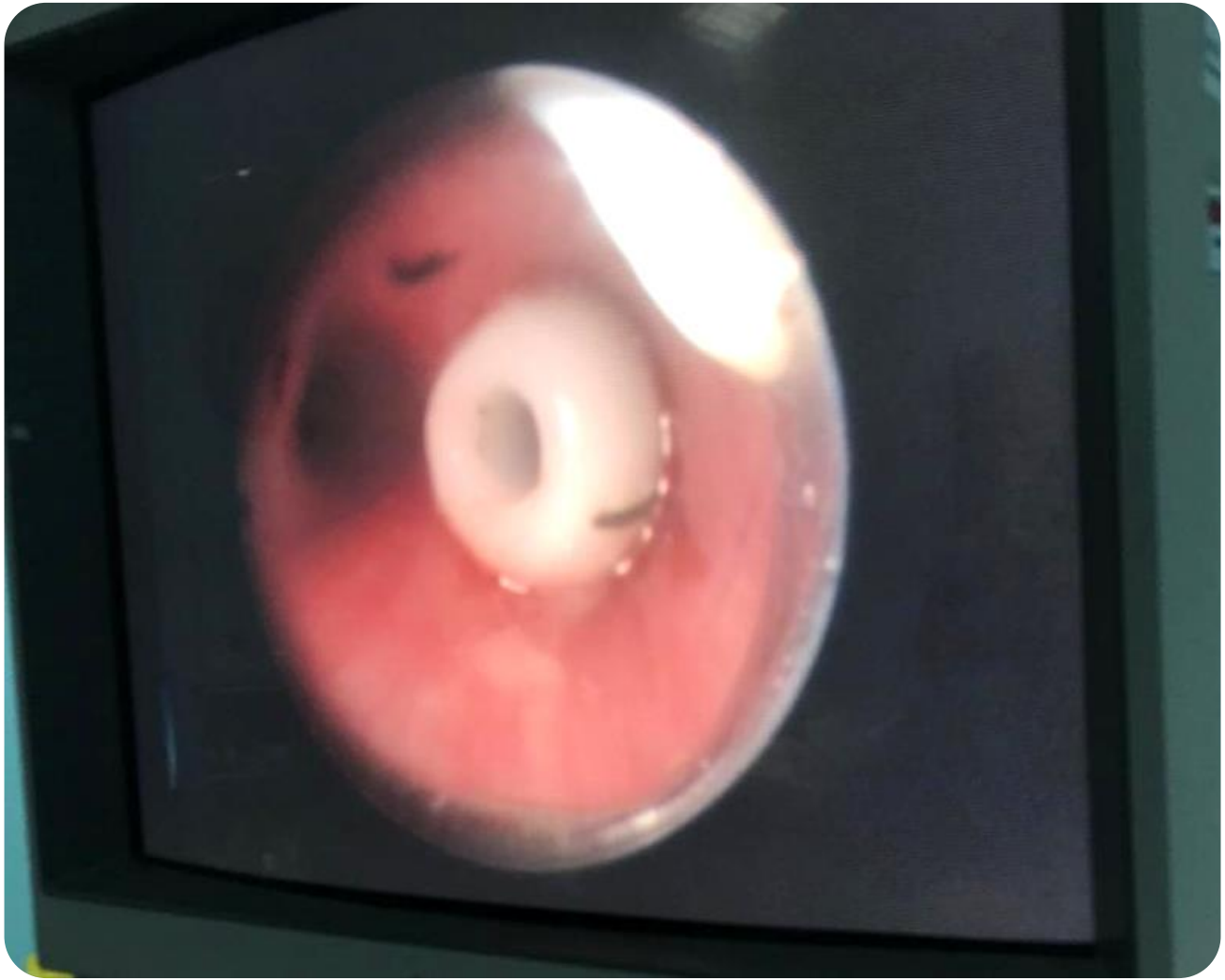

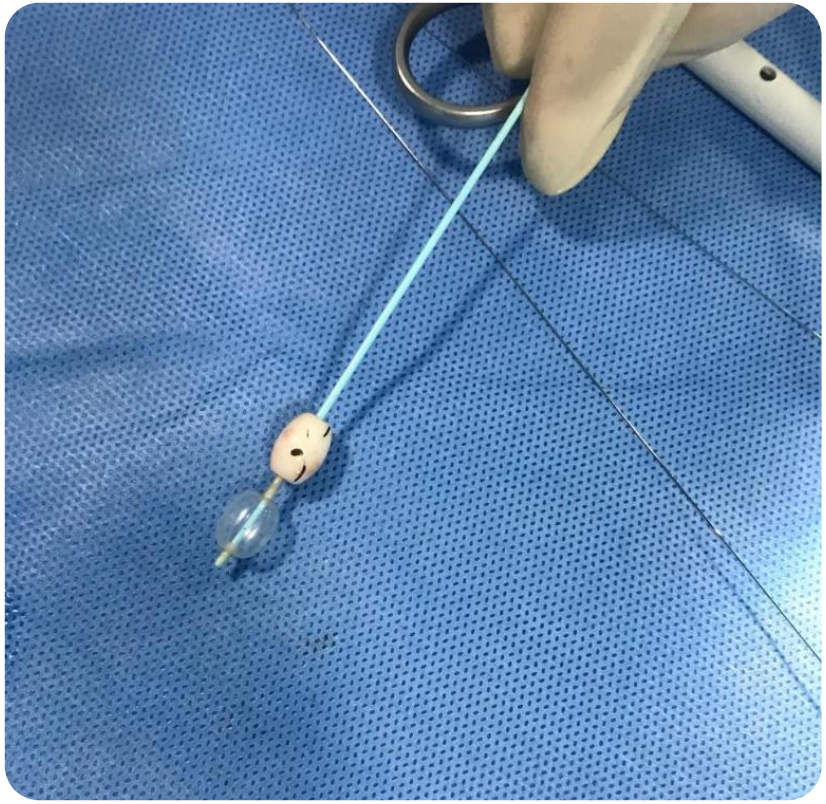

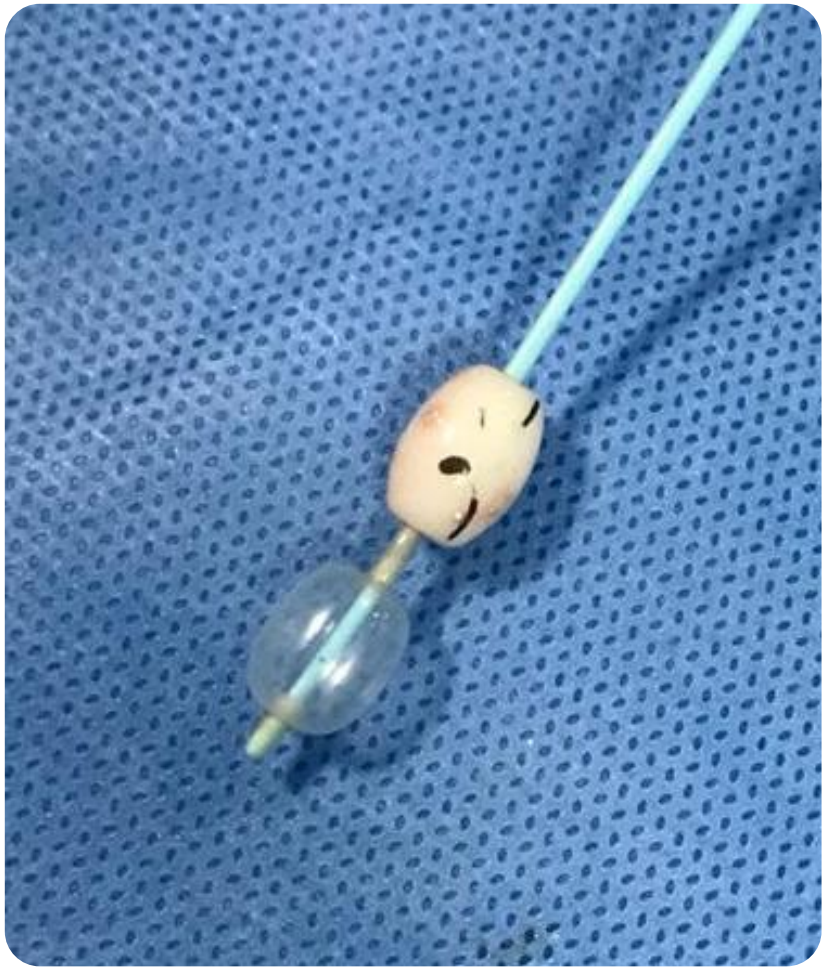

BRONCHOSCOPY

- Overall **complications** of rigid or flexible bronchoscopy:

  - Bleeding from local inflammation
  - Laryngospasm
  - Pneumothorax
  - Hypoxia

BRONCHOSCOPY

- Rarely a thoracotomy with bronchotomy or lobectomy is required. if bronchoscopy isn't beneficial

Reference

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