# Foreign bodies that don’t belong in children

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# Epidemiology of aerodigestive tract aspirations & ingestions

- More than 17,000 ED visits for children younger than 14 years
- More than 3500 deaths per year
- 5th most common cause of unintentional-injury mortality in the U.S.
  - Can be a cause of unintentional-injury mortality in children less than 1 year

# Who Is At Risk?

- Majority of aspirations in children younger than 3 years
  - Love to put things in their mouth
  - Lack of efficient molars
  - Activity while eating
- Boys outnumber girls 2:1
- Other risks
  - Anatomically abnormal airway
  - Neuromuscular disease
  - Poorly protected airway (e.g., alcohol or sedative overdose)

# What Gets Aspirated?

## Food

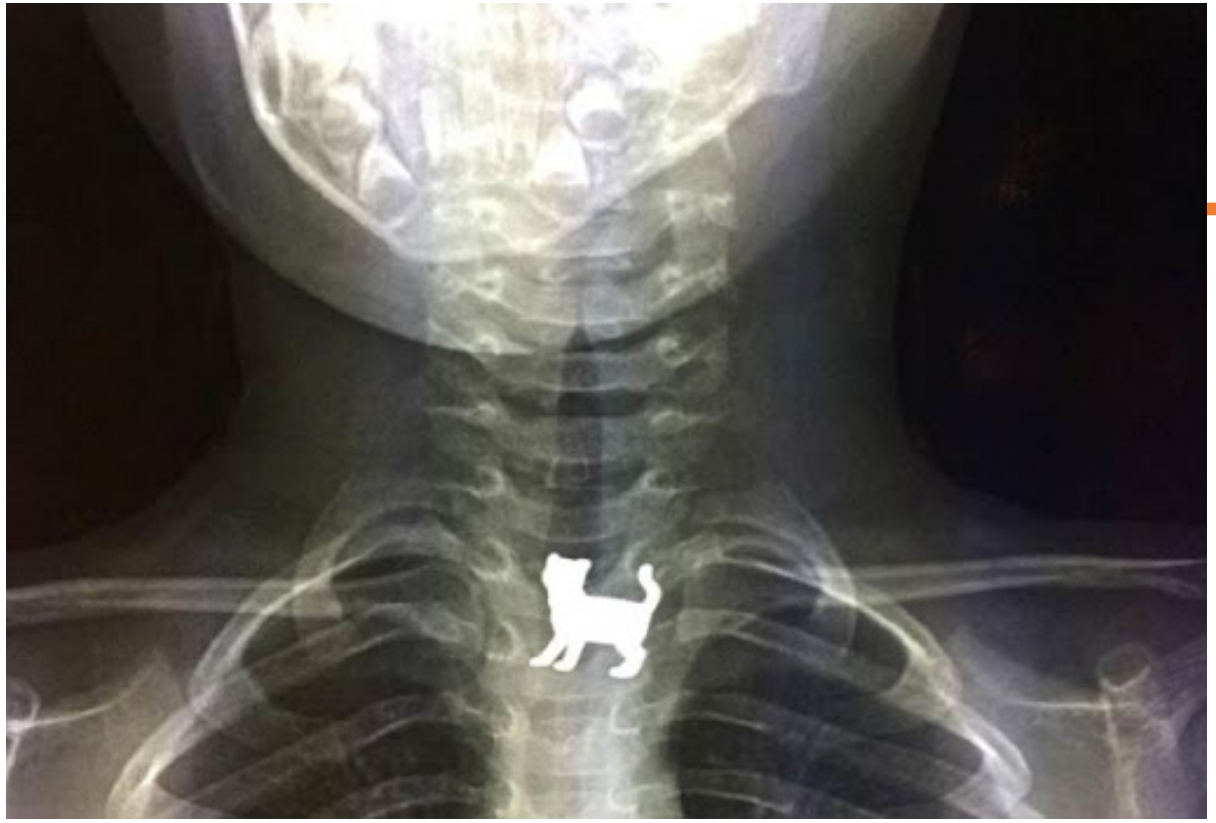
- Peanuts (36-55%) and other nuts
- Seeds
- Popcorn
- Hot dogs

## Non-food items

- Older children
- Coins, paper clips, pins, pen caps
- Bones, jacks, buttons, toys
- Pins, hair clips, marbles
- Beverage tops
- Screws, nails, tacks

# Dangerous Objects

- Round
  - Balls, marbles, rare earth magnets, watch or disc batteries
  - More likely to cause complete obstruction
- Break apart easily
- Compressibility
- Smooth, slippery surface
- Food (hygroscopic)



# More Interesting Aspirations

Metered dose inhaler

Super ball

Nails/tacks

Bugs

Pencil eraser

Toys

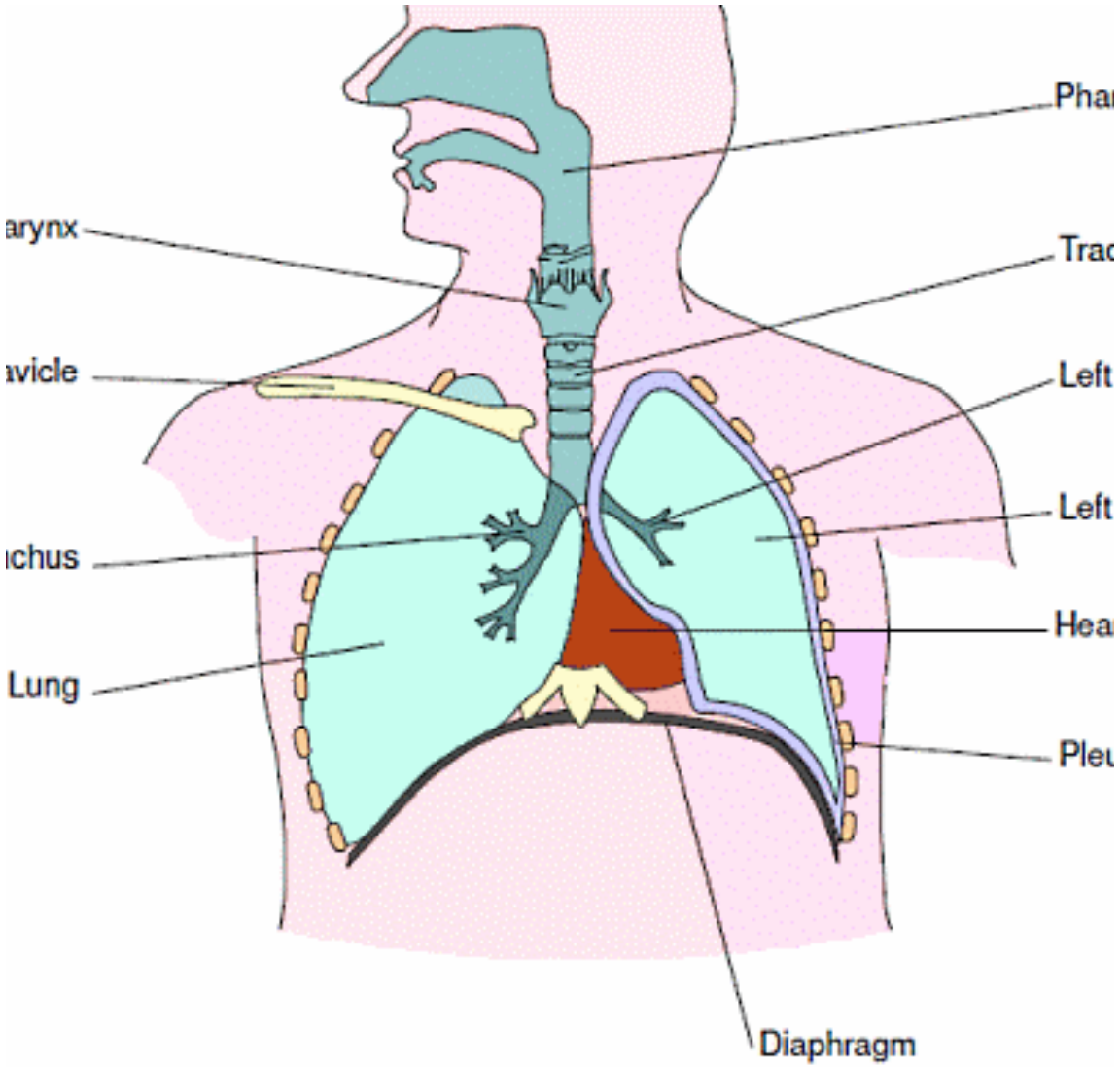
# Where Does It Go?

Majority lodge in bronchi or distal trachea

60% in right lung, mostly mainstem

Laryngeal and tracheal foreign objects less common but higher morbidity and mortality

Usually larger or irregular objects



# Site Of Aspiration: Caveats

| | |
|---|---|
| Fragment | Objects can fragment and lodge in multiple sites (e.g., sunflower seeds) |
| Multiple objects | Children can aspirate several different objects concurrently (or sequentially) |
| Erode through | Foreign bodies can erode through the esophagus and cause respiratory symptoms; more often cause compression |

# What Happens When A Child Aspirates?

## Stage 1

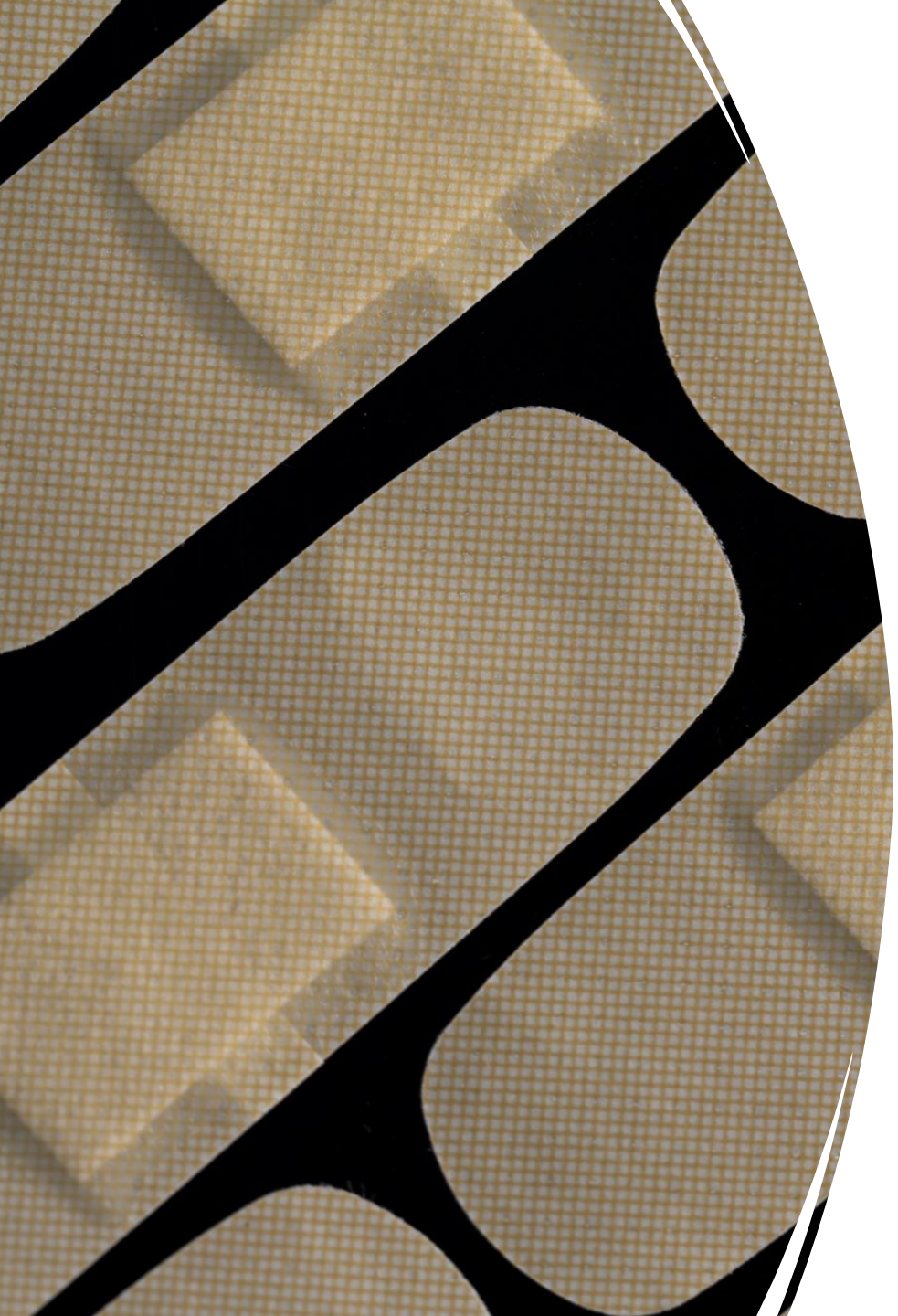
- Choking episode → paroxysms of coughing and gagging
- Occasionally, complete airway obstruction

## Stage 2

- Accommodation of airway receptors → decreased symptoms

## Stage 3

- Chronic complications (obstruction, erosion, infection)



# General Signs And Symptoms

Site of aspiration often determines symptoms

May have generalized wheezing or localized findings

- Monophonic wheezing, decreased air entry

Regional variation in air entry an important clue

- Often detected only if careful and thorough exam when child is quiet and minimal ambient noise

Classic triad in only 57%

- Wheeze, cough and shortness of air with decreased breath sounds

25-40% with normal exam

# Emergency Treatment for Aspirated Foreign Bodies

**Heimlich maneuver**

**Back blows**

**Chest thrusts**

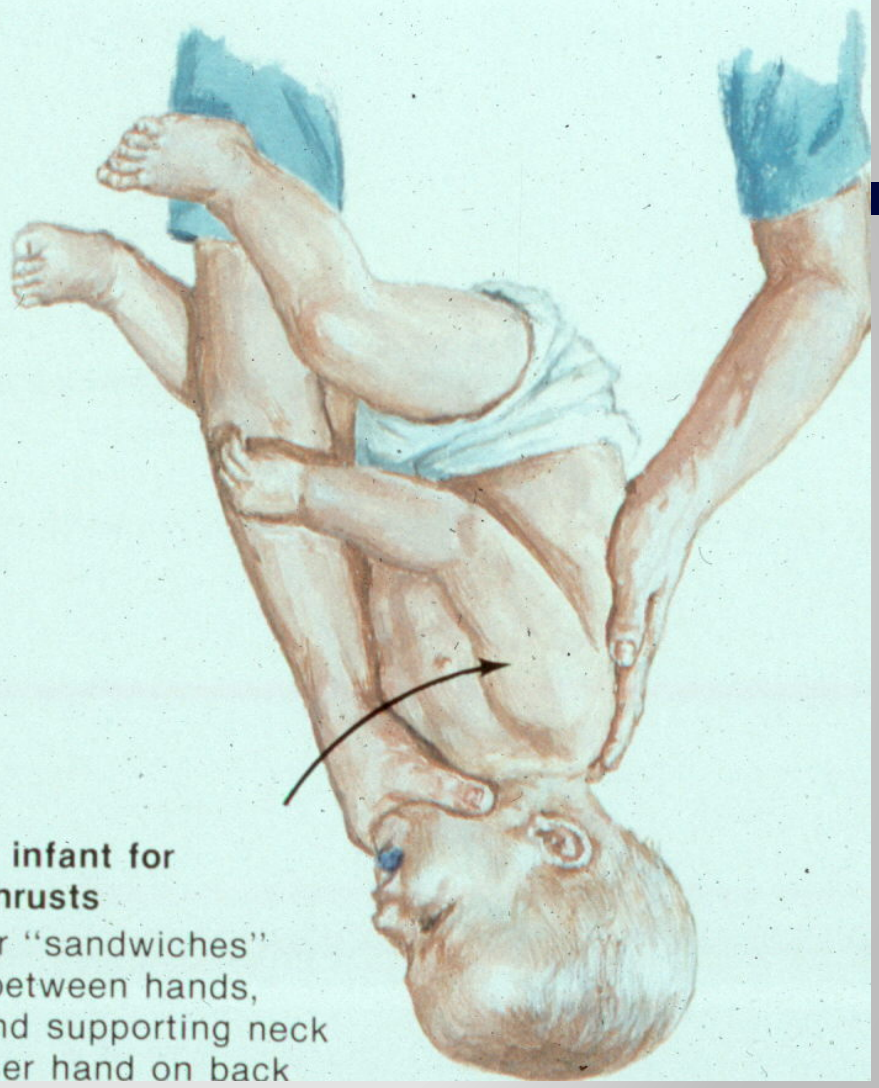
***none of these should be applied if patient is able to speak or cough***

**Finger sweep / grasp**

***should be done only if object is visible and will not be wedged deeper***

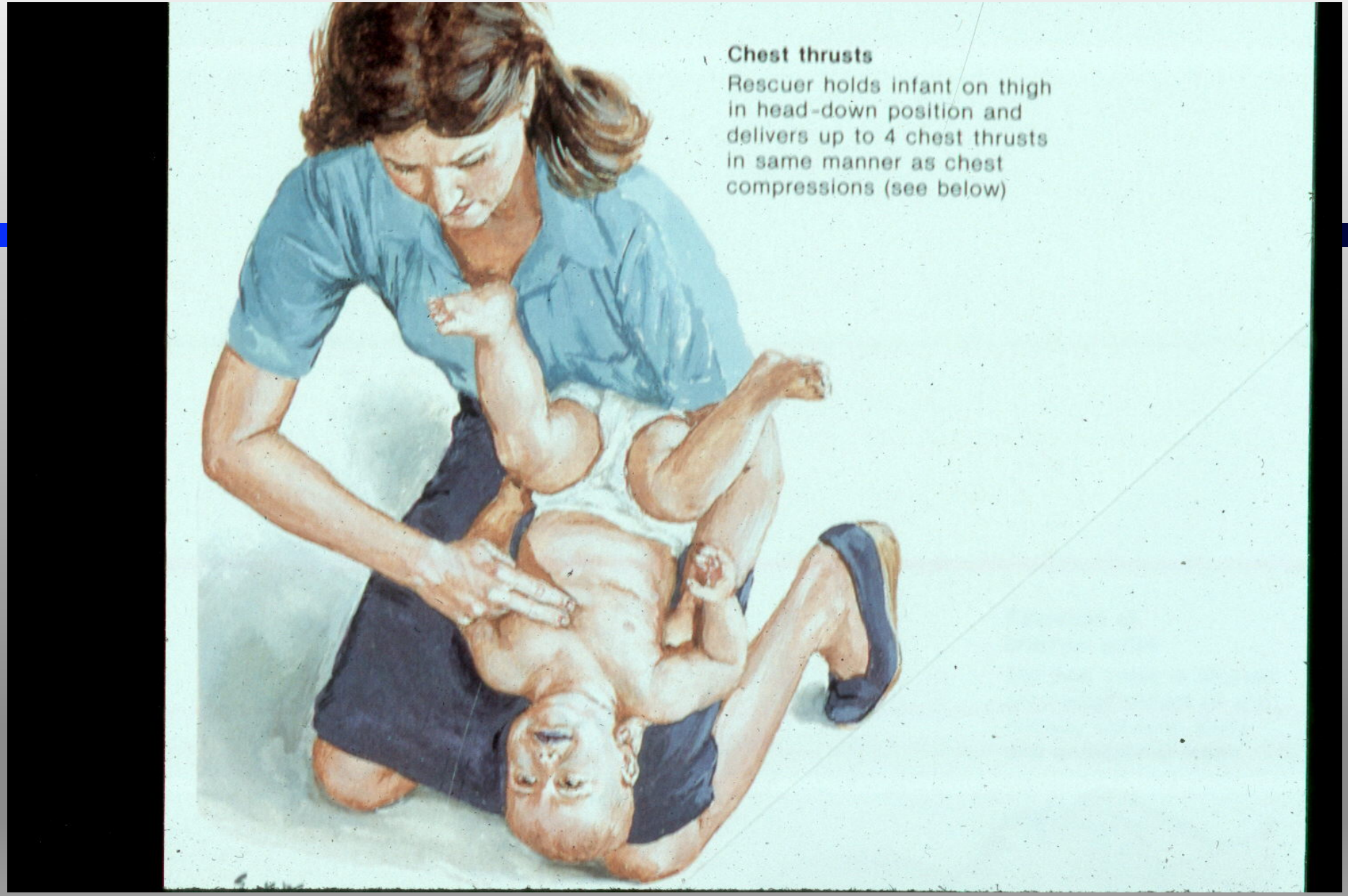
**Back blows**

Rescuer holds infant in head-down position while delivering back blows



**Turning infant for chest thrusts**

Rescuer "sandwiches" infant between hands, one hand supporting neck and other hand on back


Chest thrusts
Rescuer holds infant on thigh in head-down position and delivers up to 4 chest thrusts in same manner as chest compressions (see below)

# Often Need High Level Of Suspicion To Diagnose

Suggestive history more likely with youngest and oldest children

- Witnessed choking episode has a sensitivity of 76-92% for diagnosing aspiration

HOWEVER, only 50% of diagnoses occur in the first 24 hours

- 80% within first week
- Will sometimes take years

# Pursuing A Diagnosis

## Plain radiographic studies

- 10% of objects are radio opaque
- Normal in about 65% of studies because no obstruction to air flow
- Often indirect evidence of obstruction
  - Various techniques to improve diagnostic likelihood

## Fluoroscopy

## CT/MRI

# Suggestive X-Ray Findings

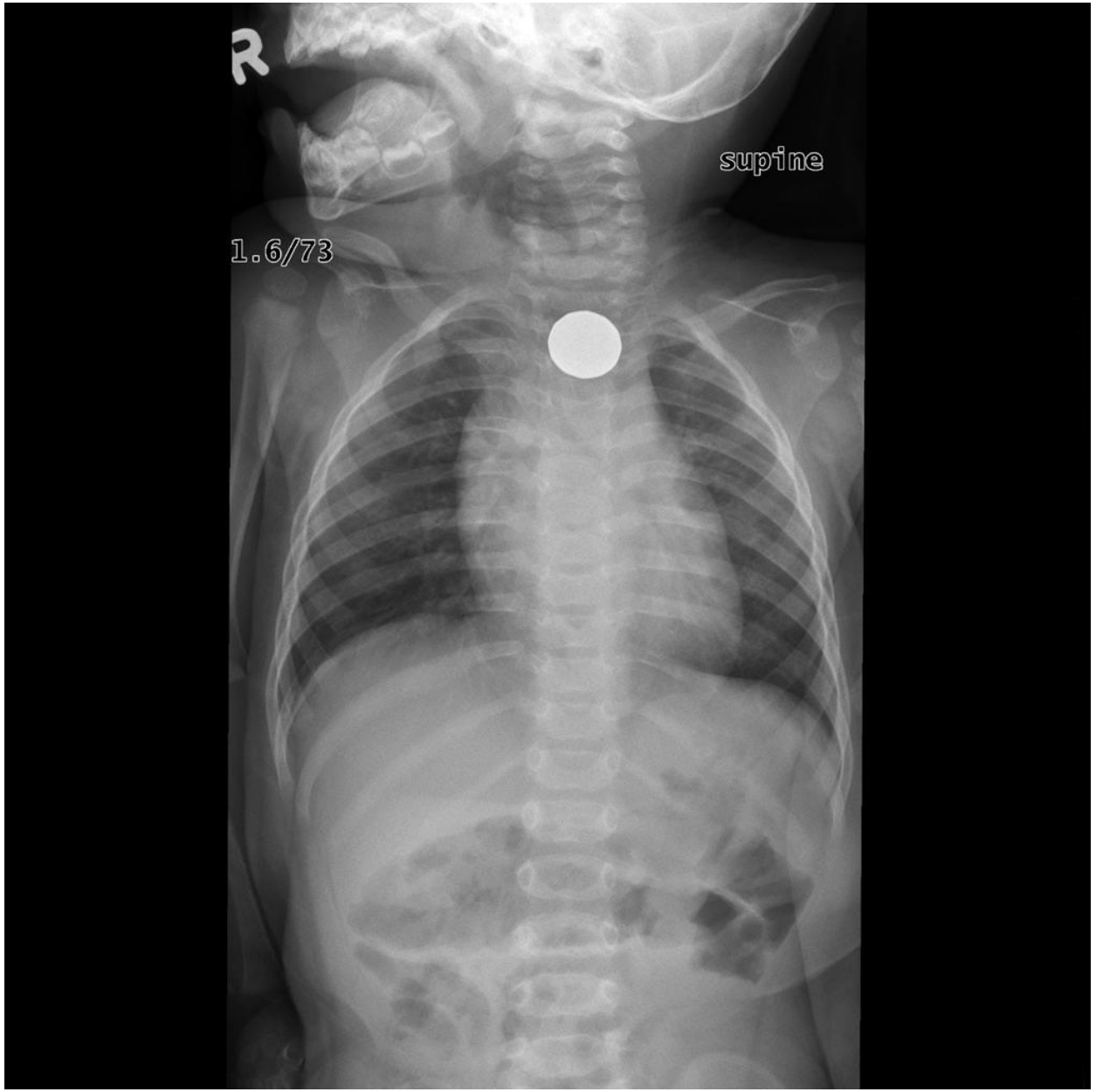
Laryngotracheal

- Subglottic density or swelling

Lower airway

- Hyperinflation on side of foreign body
- Atelectasis if complete obstruction
- Consolidation, abscesses and/or bronchectasis over time if retained

# Easy If Radio-opaque



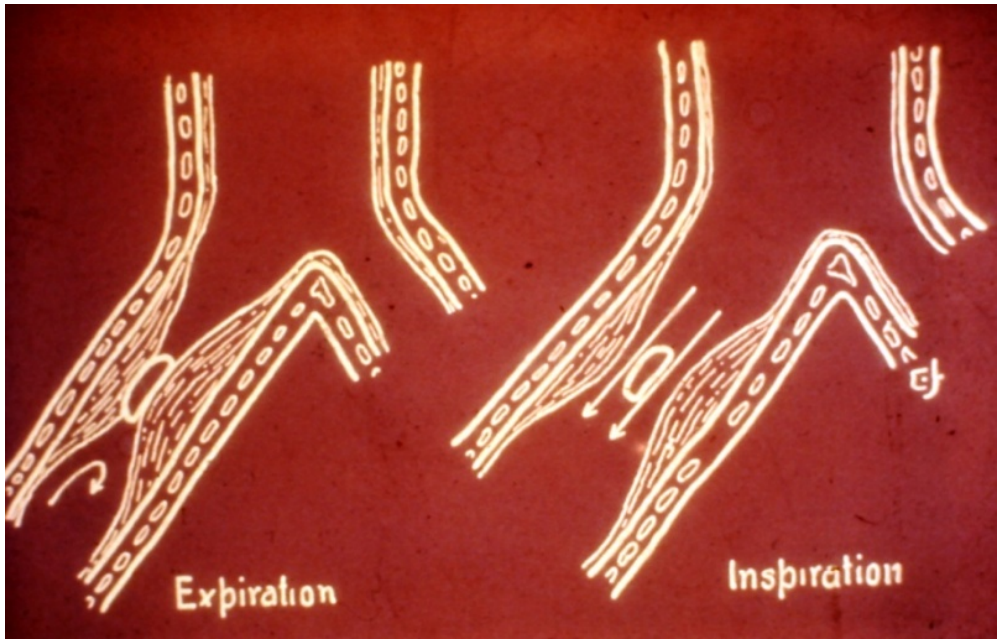
# Ball-Valve Effects

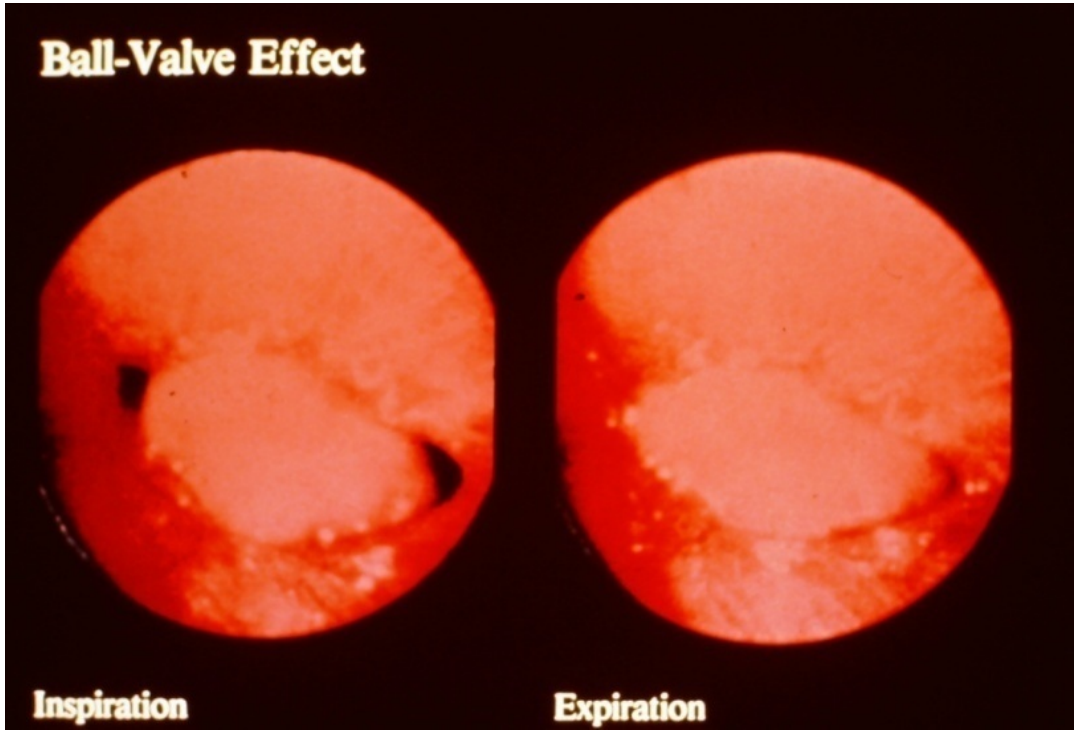
## Ball Valve

- Air enters on inspiration → blocked on expiration
- Obstructive emphysema, mediastinal shift away
- Most common

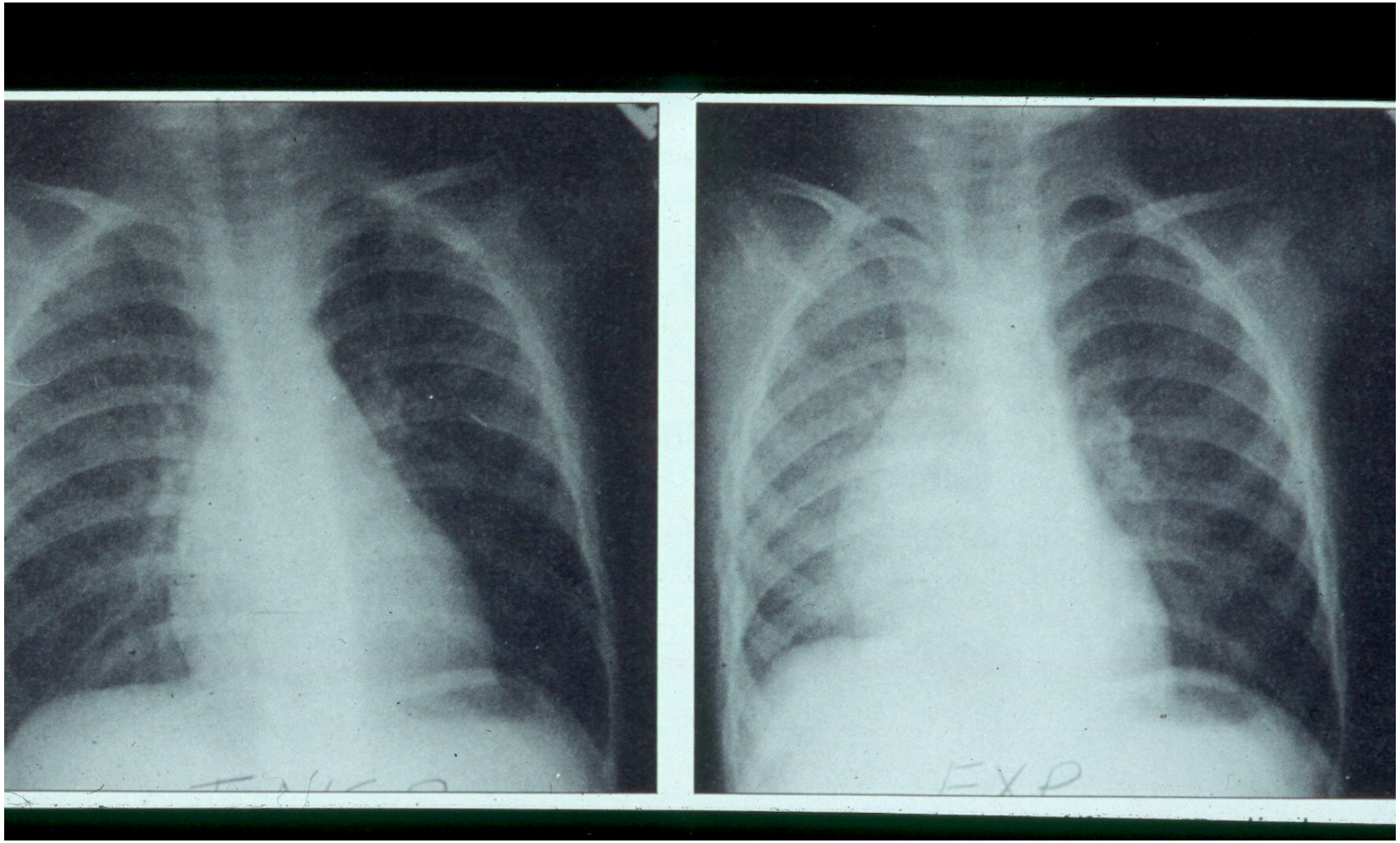
## Stop Valve

- Complete obstruction
- No air enters distally → collapsed lung (atelectasis)

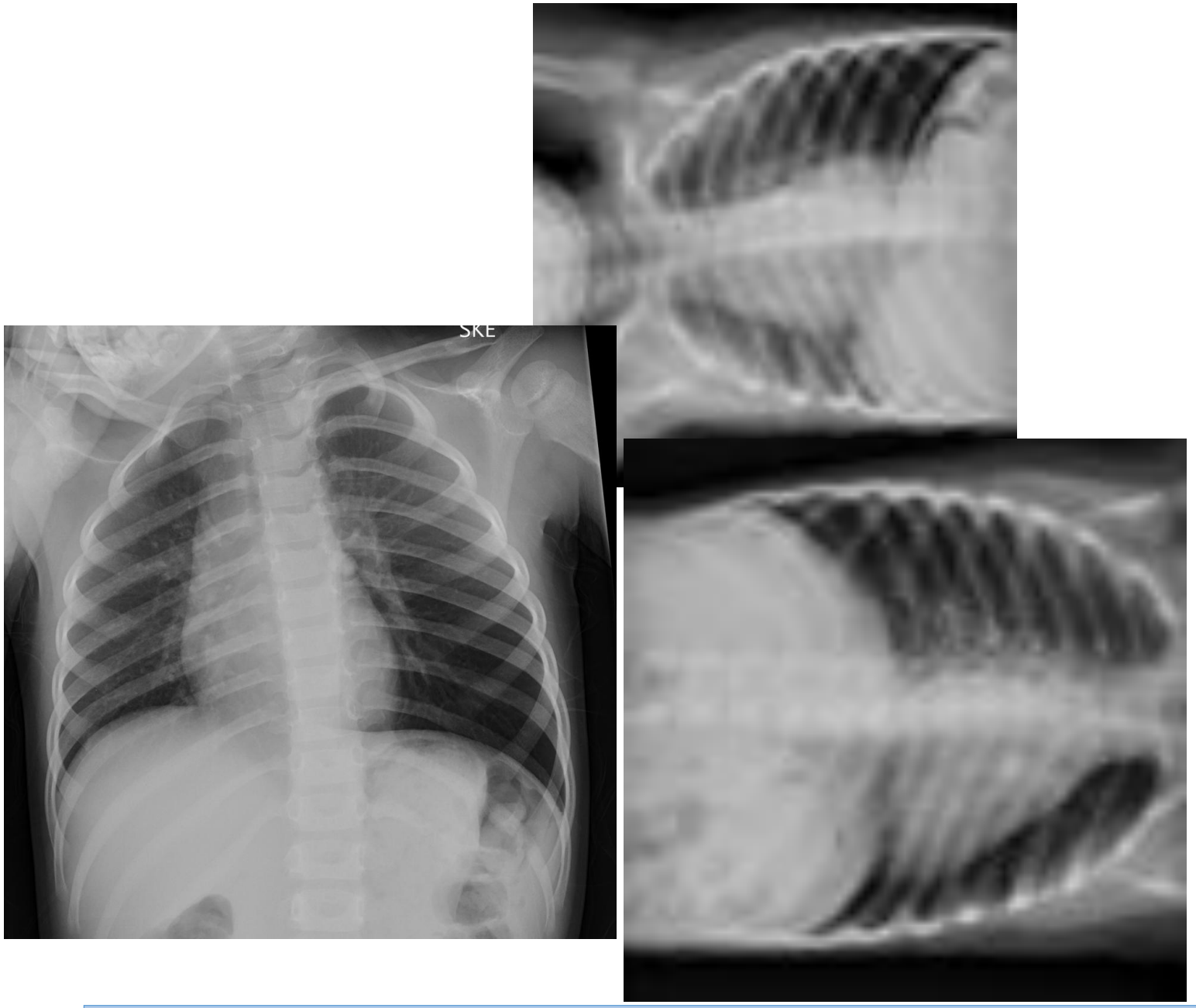


Inspiratory film on left, expiratory film on right ; Foreign body in left mainstem bronchus

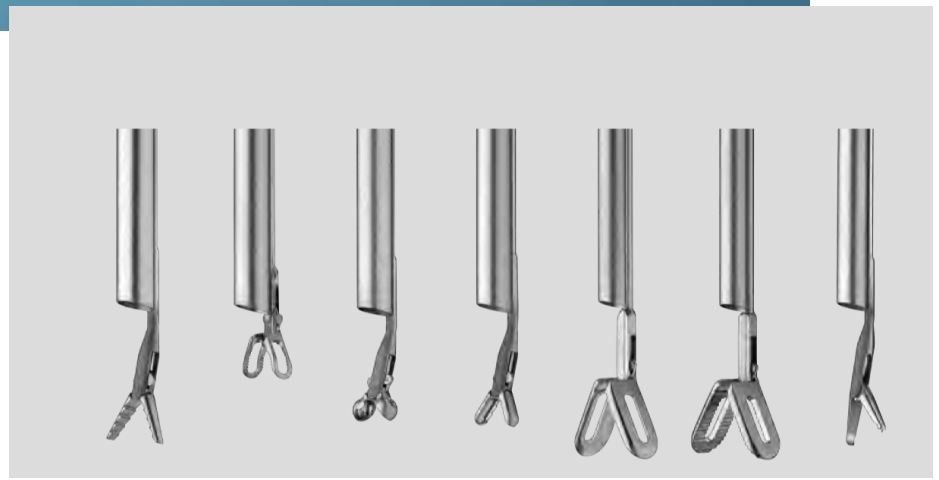


# Consider Lateral Decubitus If Child Cannot Cooperate




Case courtesy of Dr Jeremy Jones, Radiopaedia.org, rID: 26866

# The Ultimate Diagnostic Tool

# Rigid Bronchoscopy

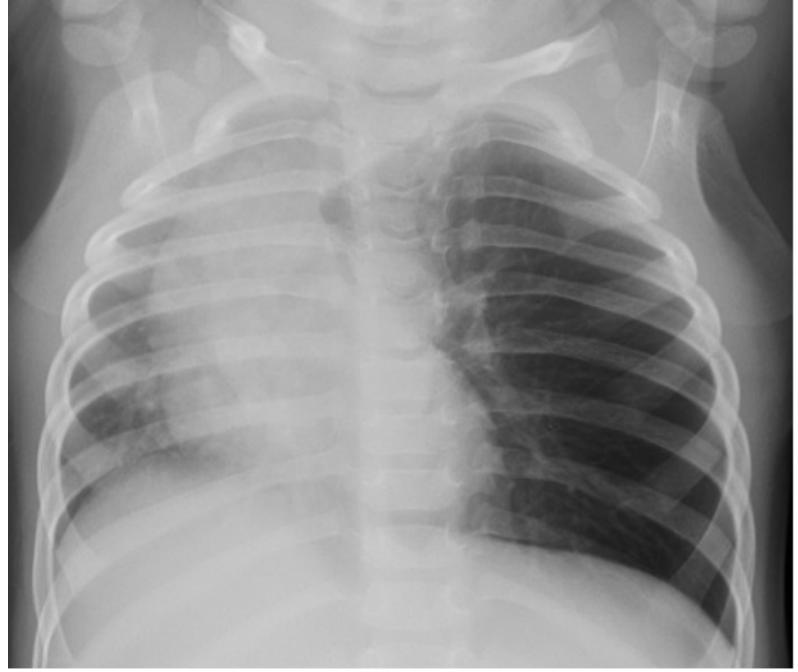
Standard of care in most centers for evaluation

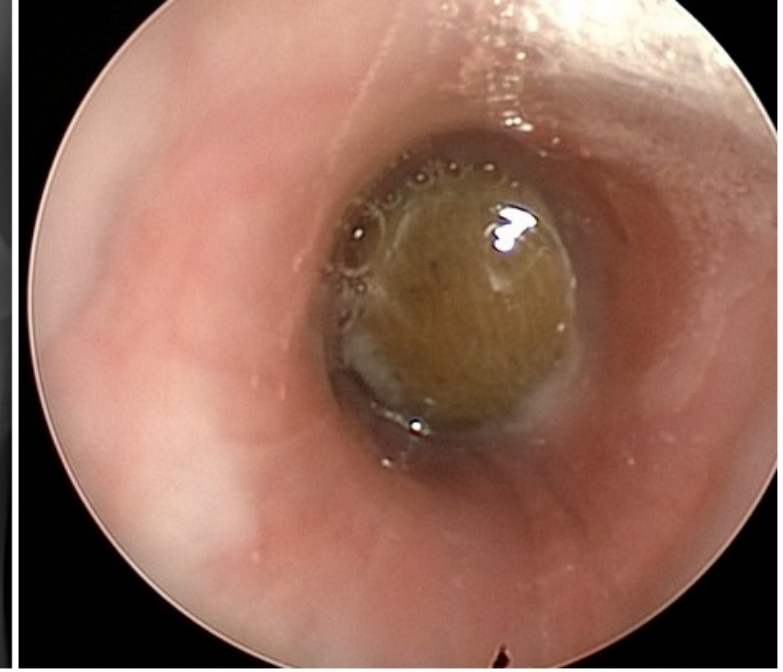
Allows visualization, ventilation, removal with multiple forceps and ready management of mucosal hemorrhage

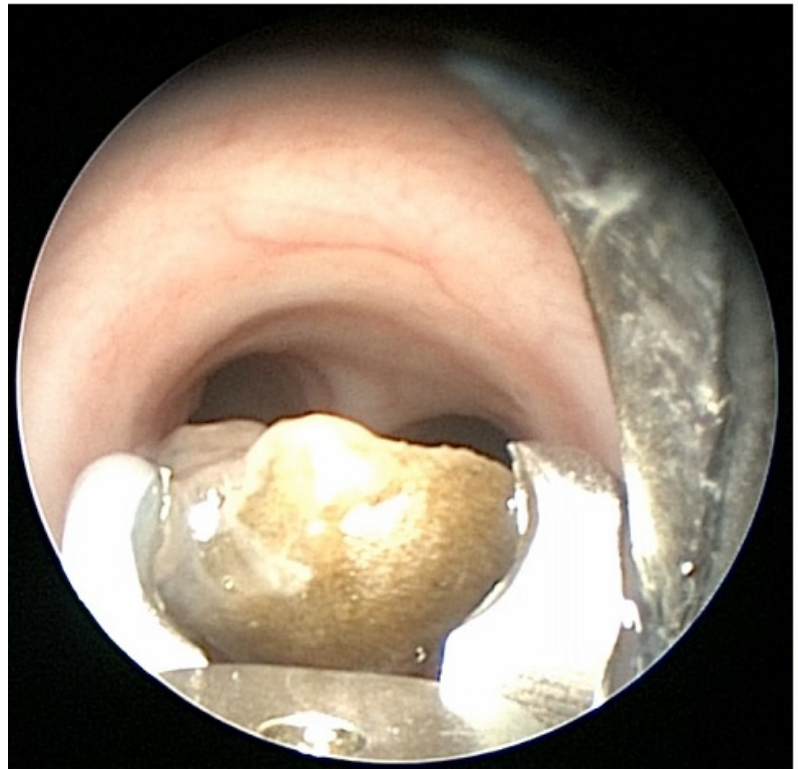
Successful in about 95% of cases

Complications are rare (about 1%)

- Laryngeal and subglottic edema, atelectasis
- Dislodgement of foreign body into more dangerous position
- Hypoxic insults





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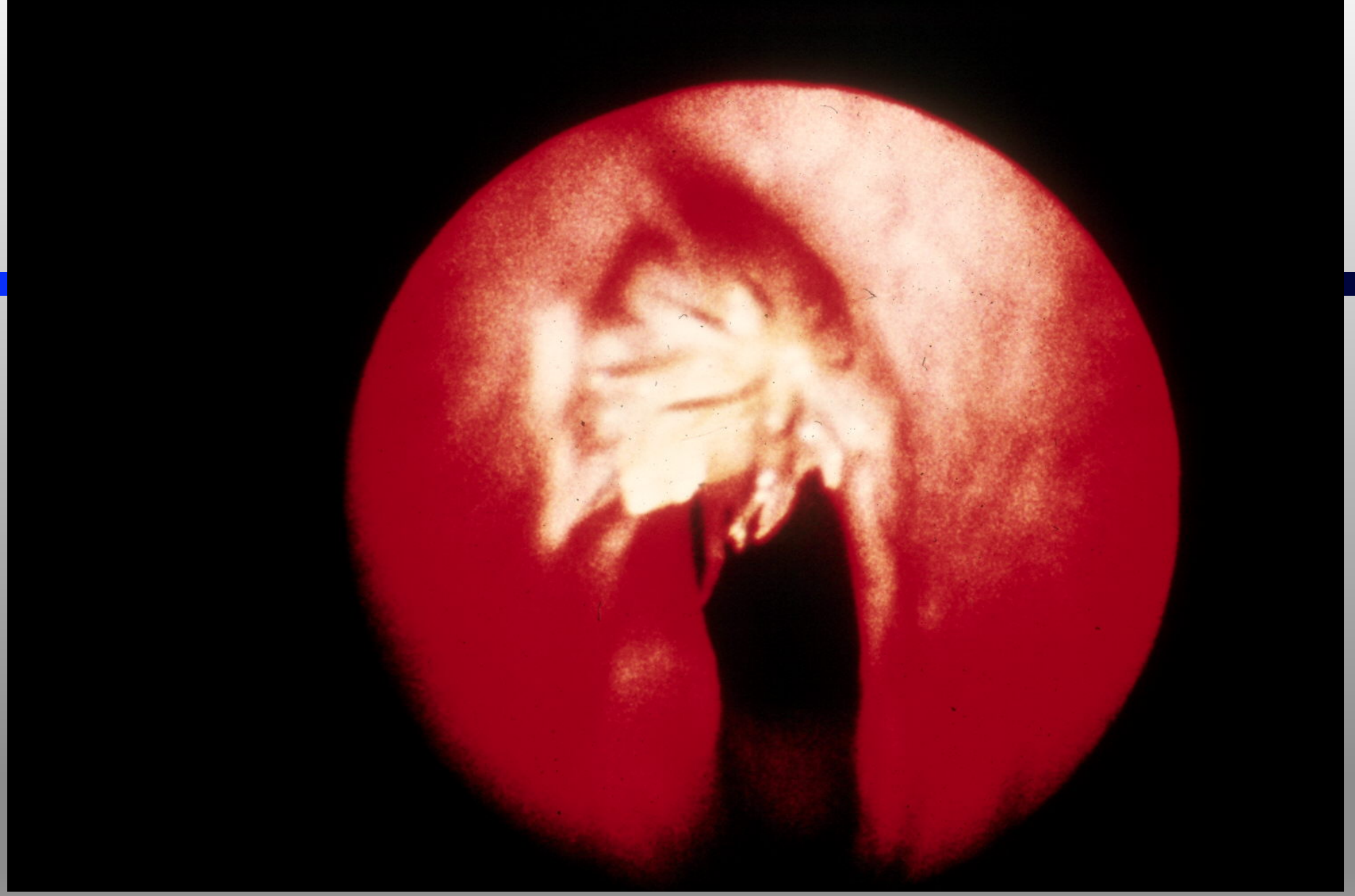
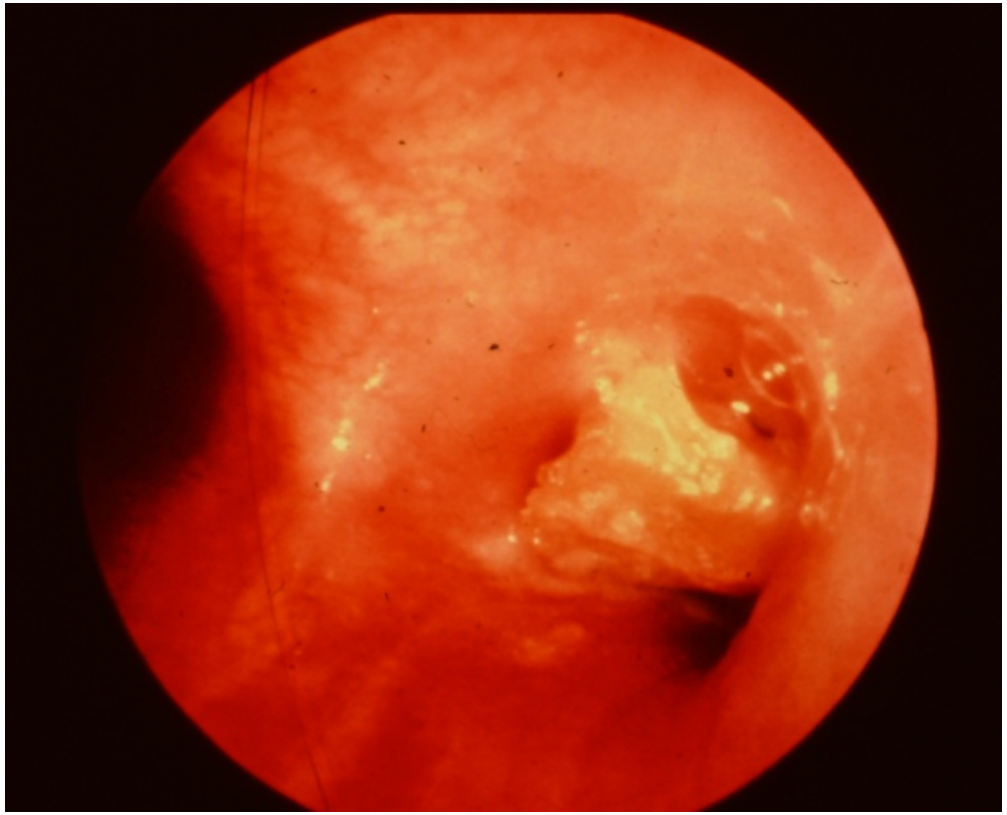


Thistle in larynx

# After Removal

- View entire tracheobronchial tree for additional objects
- If retained for significant period → gram stain and culture to guide management
- If clinical signs and symptoms persist, repeat bronchoscopy is warranted



# What If It Can’t Be Removed?

- Can have intense inflammation if retained for long period
- Antibiotics and systemic steroids often used to “cool down” the area → repeat bronchoscopy
- Open thoracotomy occasionally required

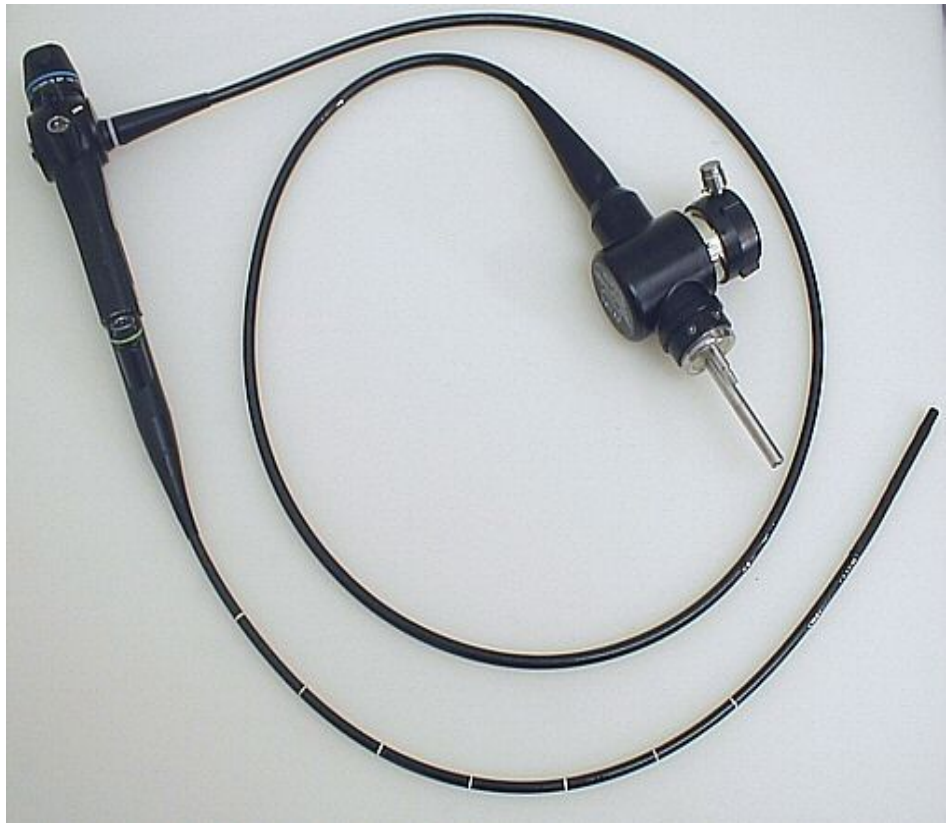
# What About Flexible Bronchoscopy?

Excellent diagnostic tool

Minimal trauma, no general anesthesia

Reports of successful removal as well

- American Thoracic Society still recommends rigid bronchoscopy for removal



# Complications Of Retained Foreign Bodies

- Hemoptysis
- Bronchiectasis
- Bronchial stenosis
- Pneumomediastinum/pneumothorax
- Persistent/recurrent pneumonias
- Acute/recurrent respiratory distress or failure
- Death

THE DIAGNOSIS MUST BE EXCLUDED!

# Tying It All Together

- A history of choking is highly suggestive of a foreign body aspiration
- Often unwitnessed so absence does not rule out
- If the patient is in extremis, AHA guidelines and PALS apply
- If patient stable, radiographic studies may aid in the diagnosis but clinical suspicion most important
- Rigid bronchoscopy is the gold standard for both diagnosis and removal, if necessary

# Esophageal Foreign Bodies : Symptoms

- Stridor
- Choking
- Gagging
- Coughing
- Drooling / spitting
- Refusal to eat
- Vomiting
- Chest or neck pain
  - The person can often point to the level of the obstruction
- Dysphagia
- Odynophagia

# Most Likely Sites of Esophageal Foreign Body Impaction

**Sites of esophageal narrowing :**

- **Cricopharyngeus (15 to 17 cm. from incisors)**
- **Aortic arch (22 to 24 cm. from the incisors)**
- **Left mainstem bronchus (28 to 30 cm. from incisors)**
- **Gastroesophageal sphincter (40 cm. from incisors)**

**Pathologic narrowing of esophagus**

- **Intrinsic : tumors, strictures**
- **Extrinsic : tumors, vascular lesions**

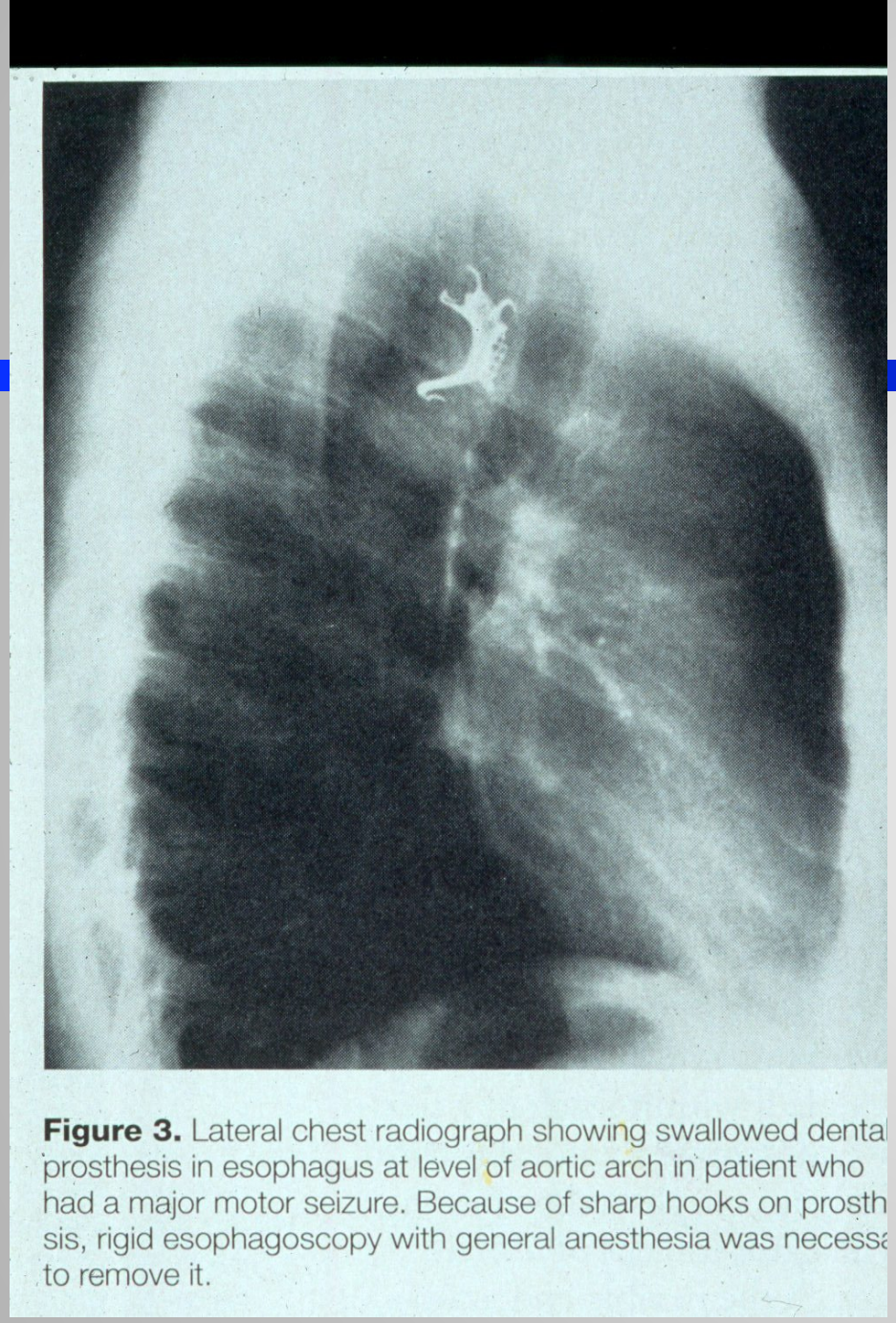
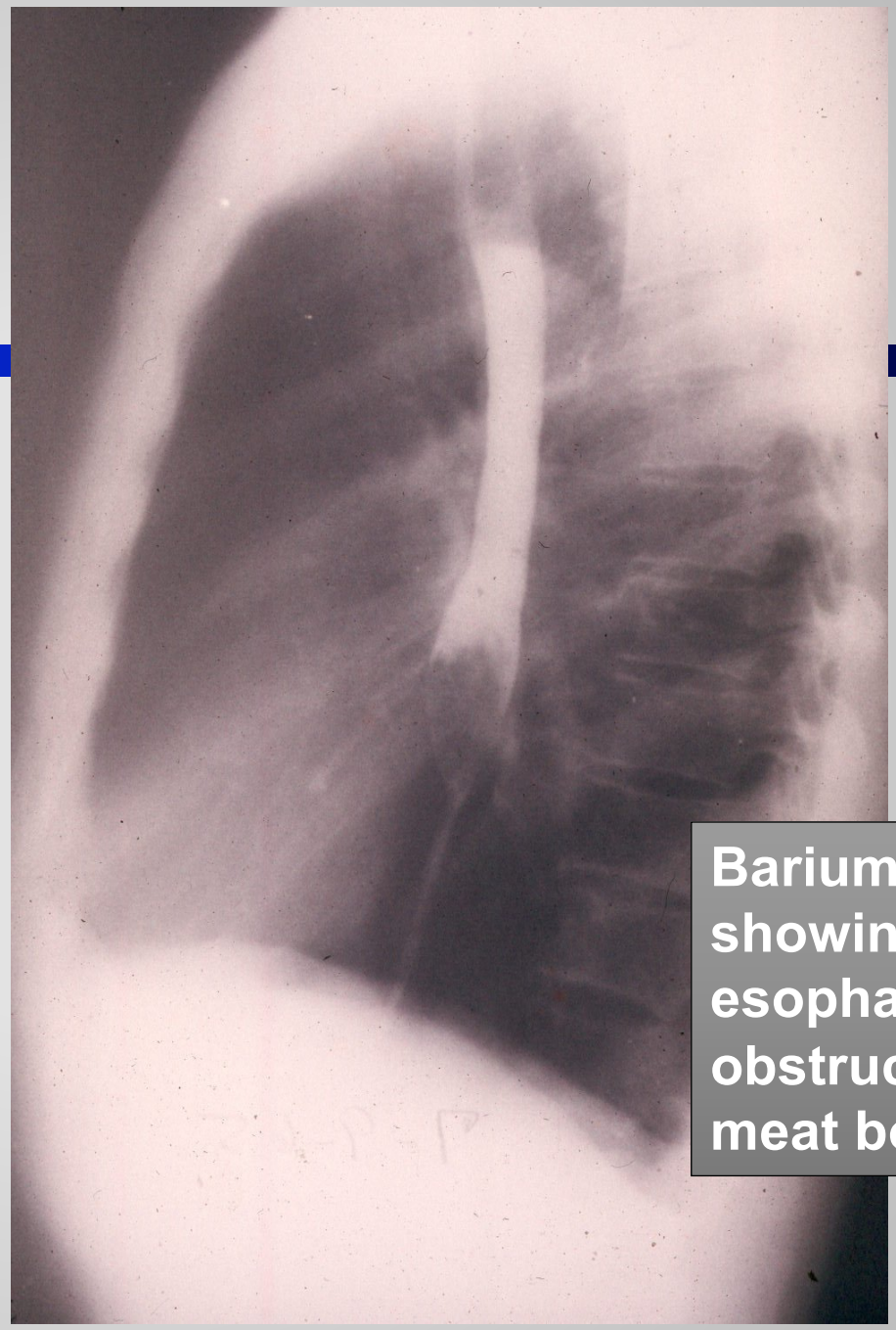
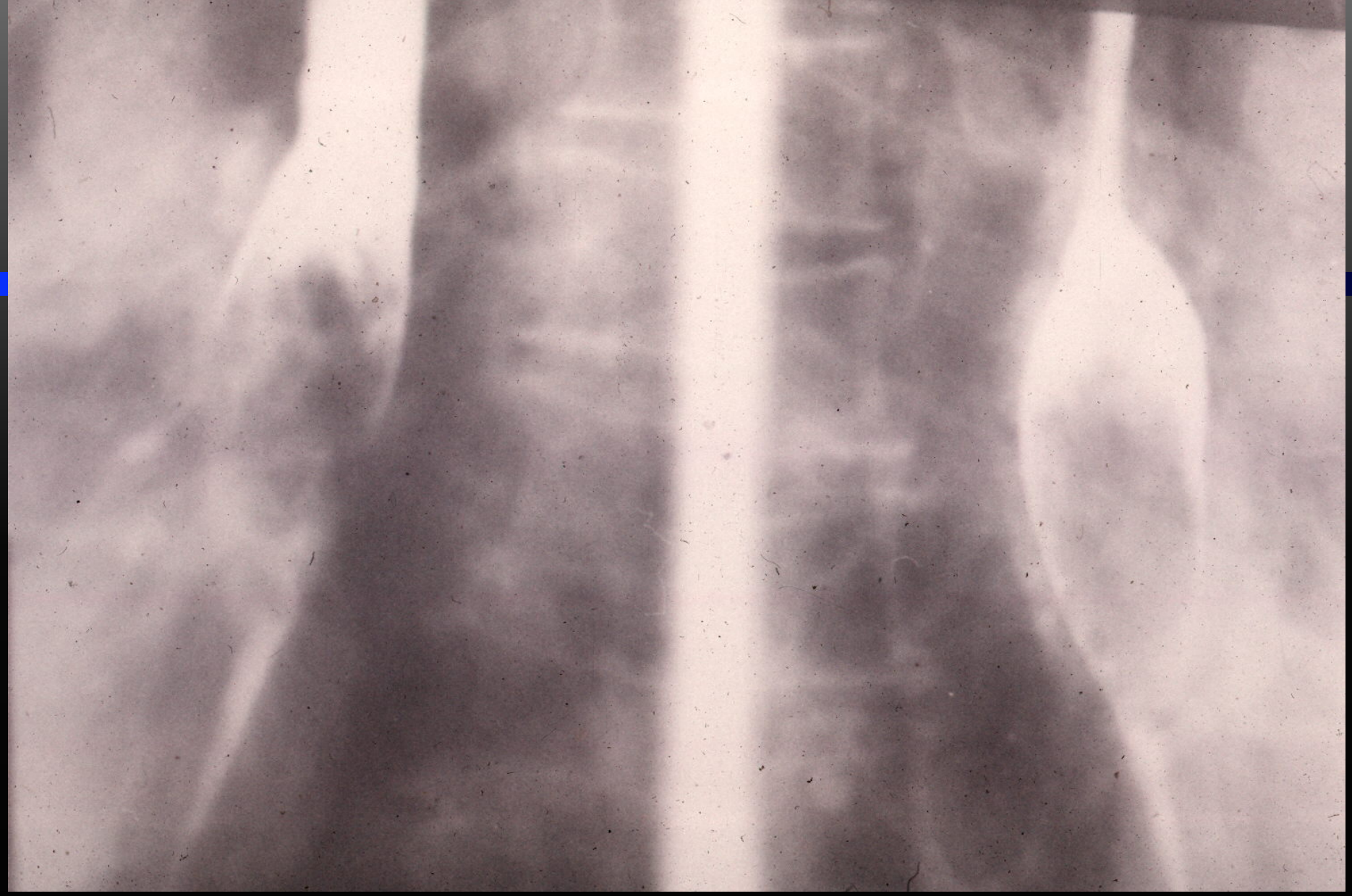


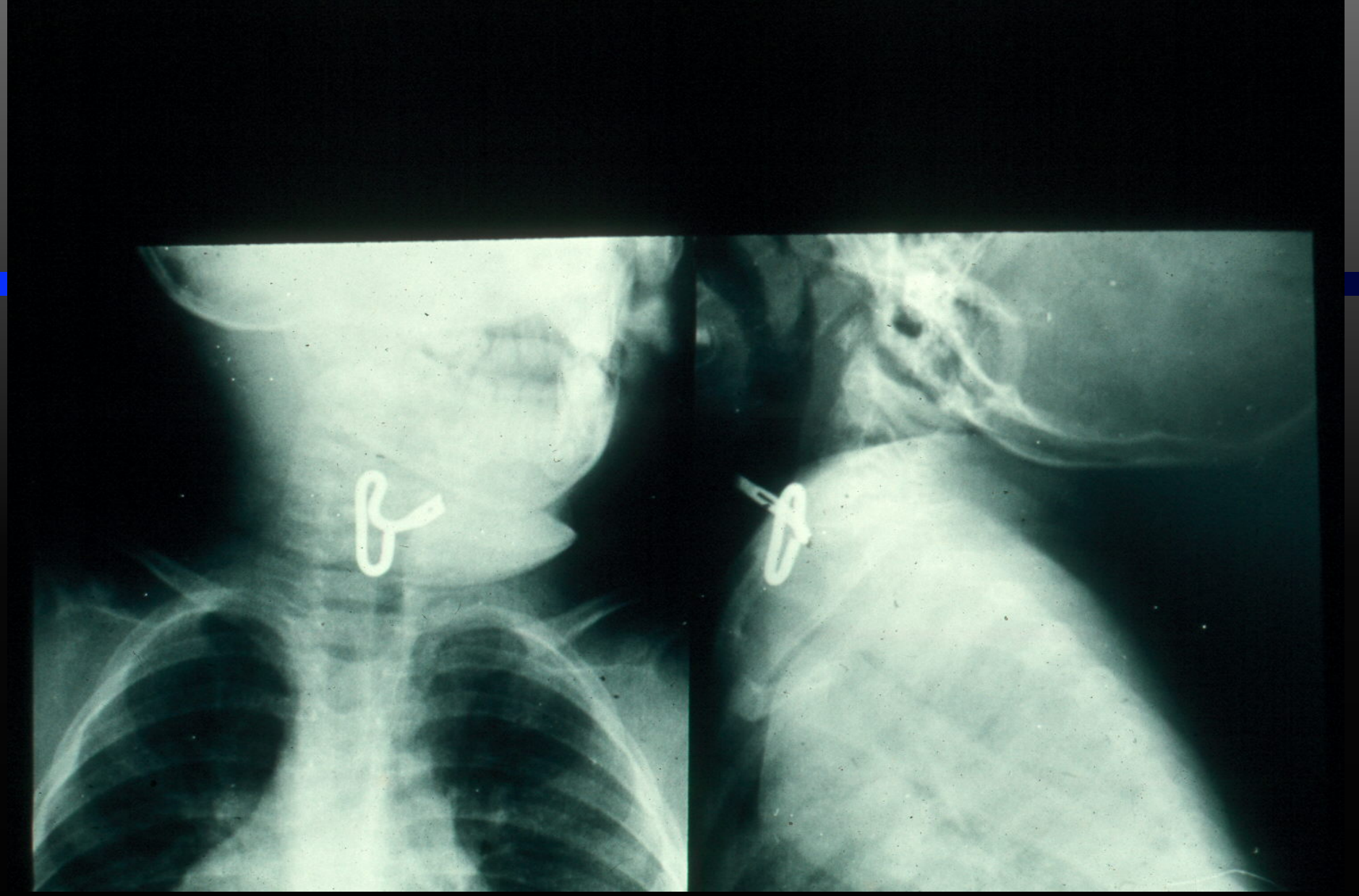
**Figure 3.** Lateral chest radiograph showing swallowed dental prosthesis in esophagus at level of aortic arch in patient who had a major motor seizure. Because of sharp hooks on prosthesis, rigid esophagoscopy with general anesthesia was necessary to remove it.



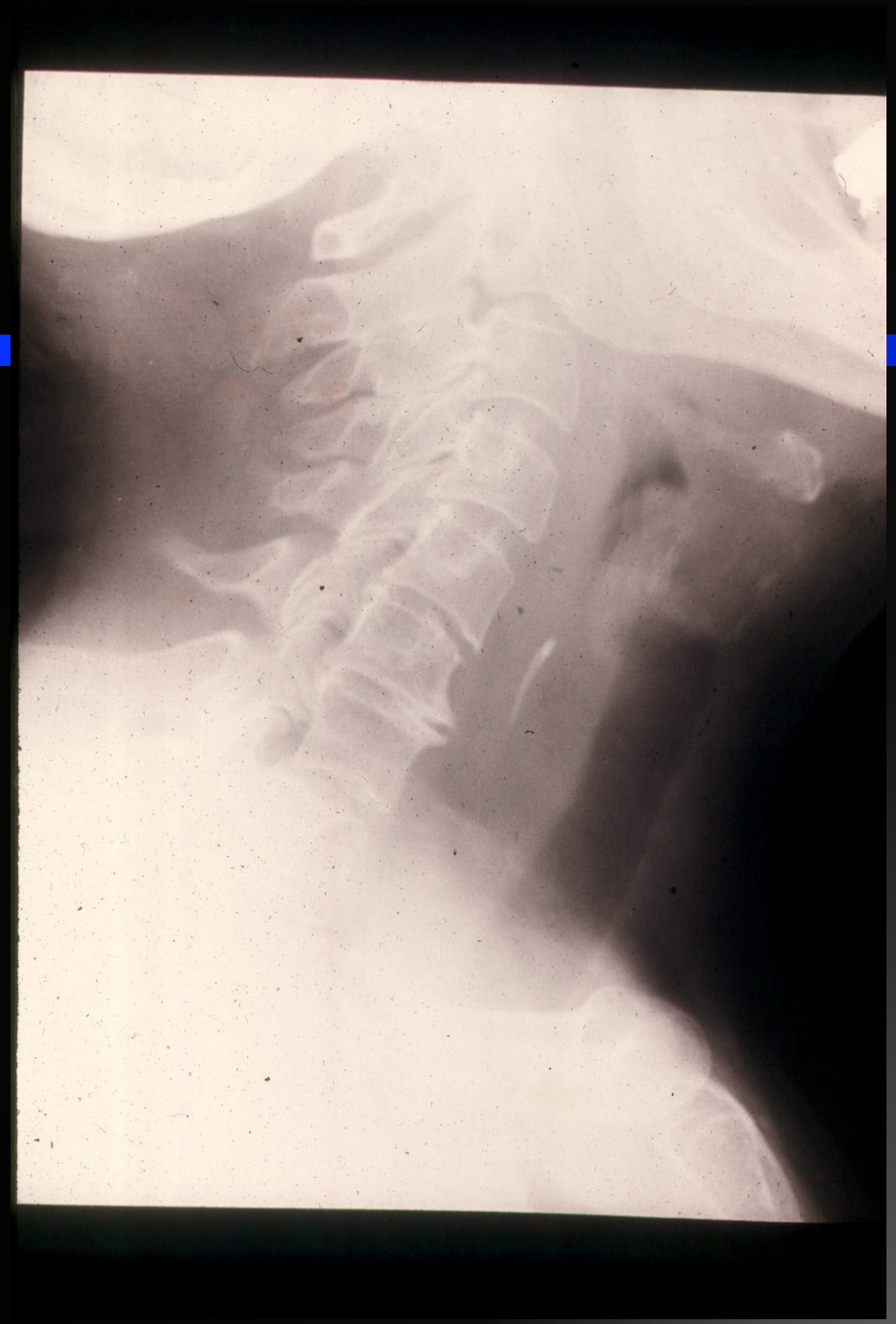
Barium swallow showing complete esophageal obstruction from a meat bolus



Esophageal obstruction from a meat bolus



Can opener in the cervical esophagus



# Fishbones

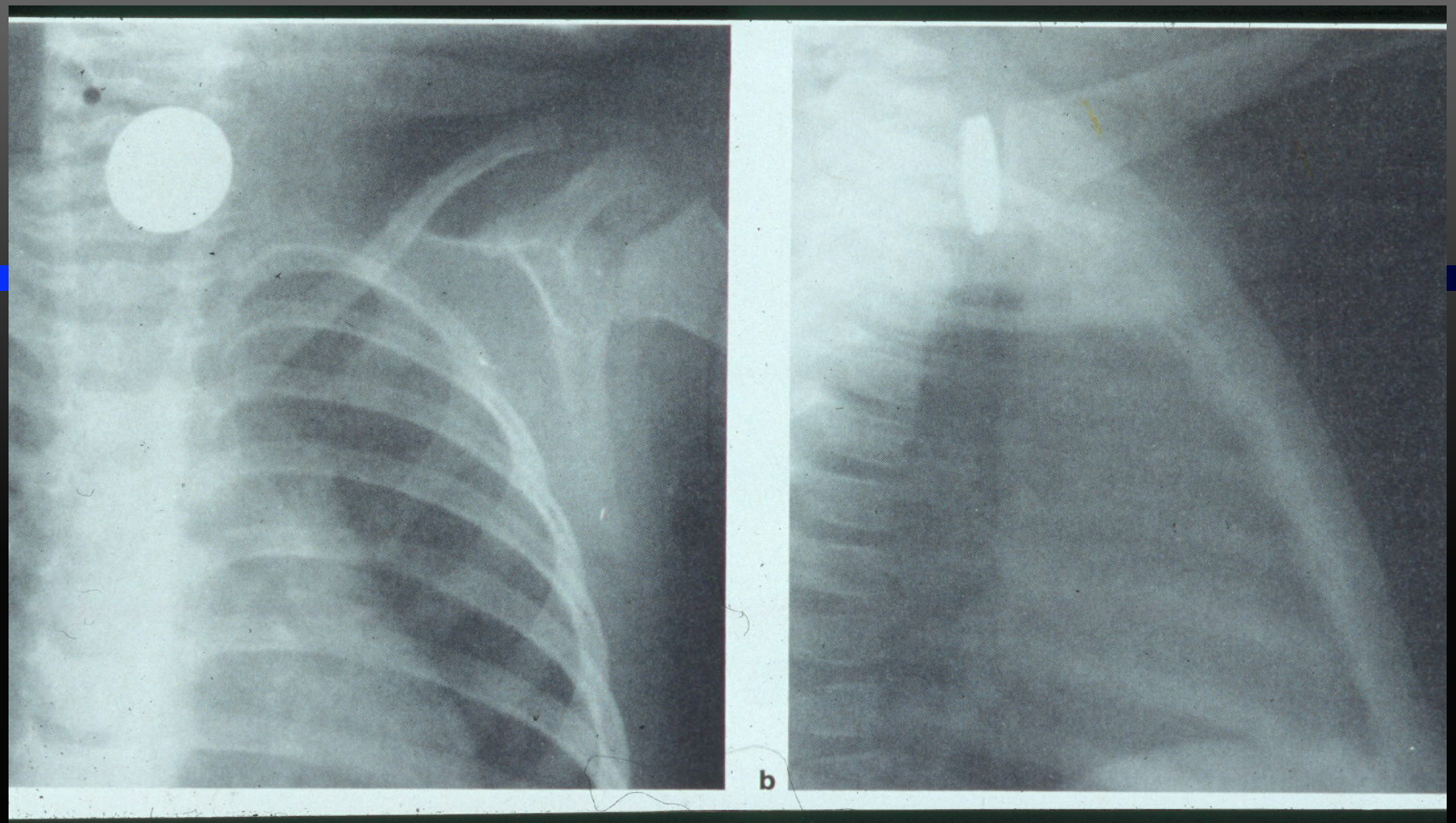
Only 20 to 35 % of patients with dysphagia after eating fish prove to have a fish bone

Most of these are in the posterior pharynx and retrievable with Magill forceps

For persistent symptoms, endoscopy is necessary since only 33 to 50 % of fishbones show on X-ray

# Coin Ingestions

- Quarters are 24 mm. in diameter
- Esophagus is 17 x 23 mm. in size
- Before 1982 pennies were 95 % copper & 5 % zinc
- Since 1982 pennies are 97.6 % zinc
- Zinc is more corrosive than copper
- Coins tend to lodge in frontal (coronal) plane in esophagus (sagitally if in trachea)
- Up to 30 % of children with coins lodged in the esophagus may be asymptomatic

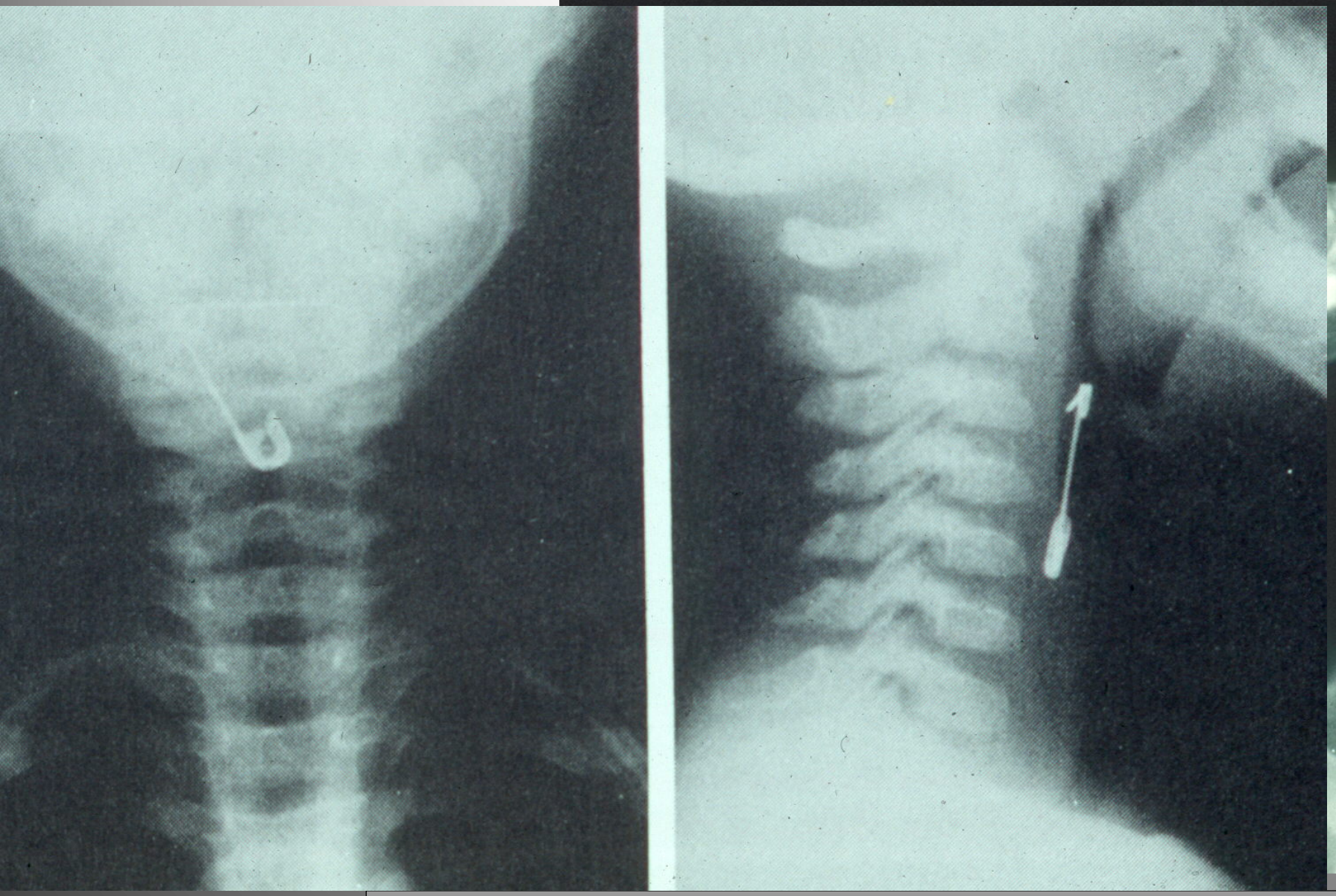



Coin in upper esophagus

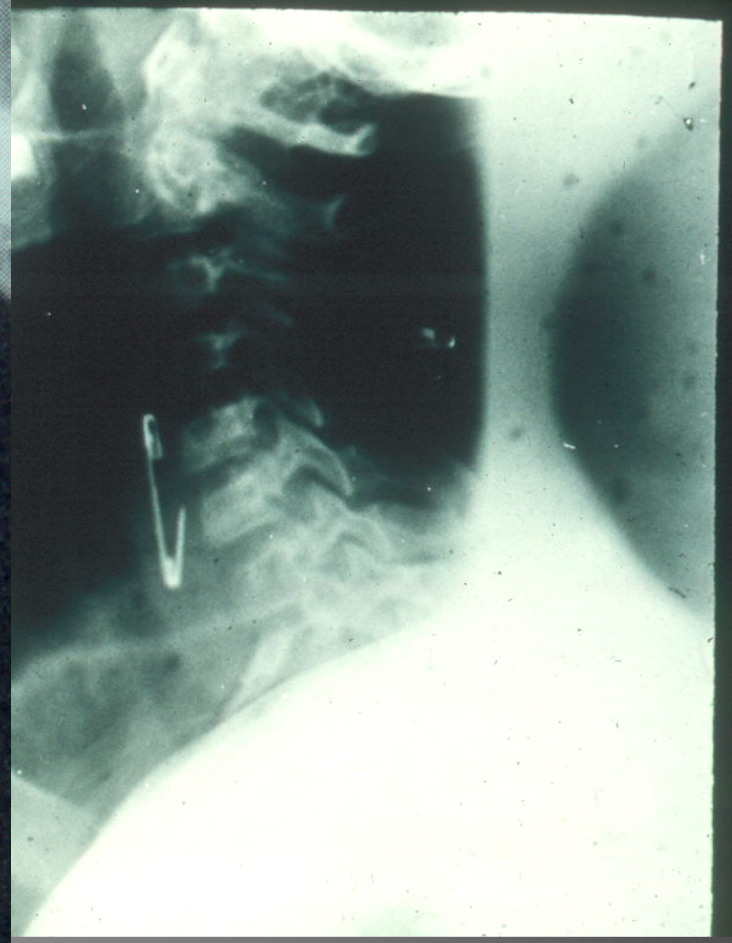
# Coin Ingestions

# Indications to Emergently Remove Objects from the Esophagus

- Sharp object (e.g. : open safety pin)
- Button battery
- Penny (younger than 1982)
- Bone fragment
- High complete obstruction (risk of aspiration)
- Any potentially corrosive agent
- Any sign of esophageal perforation







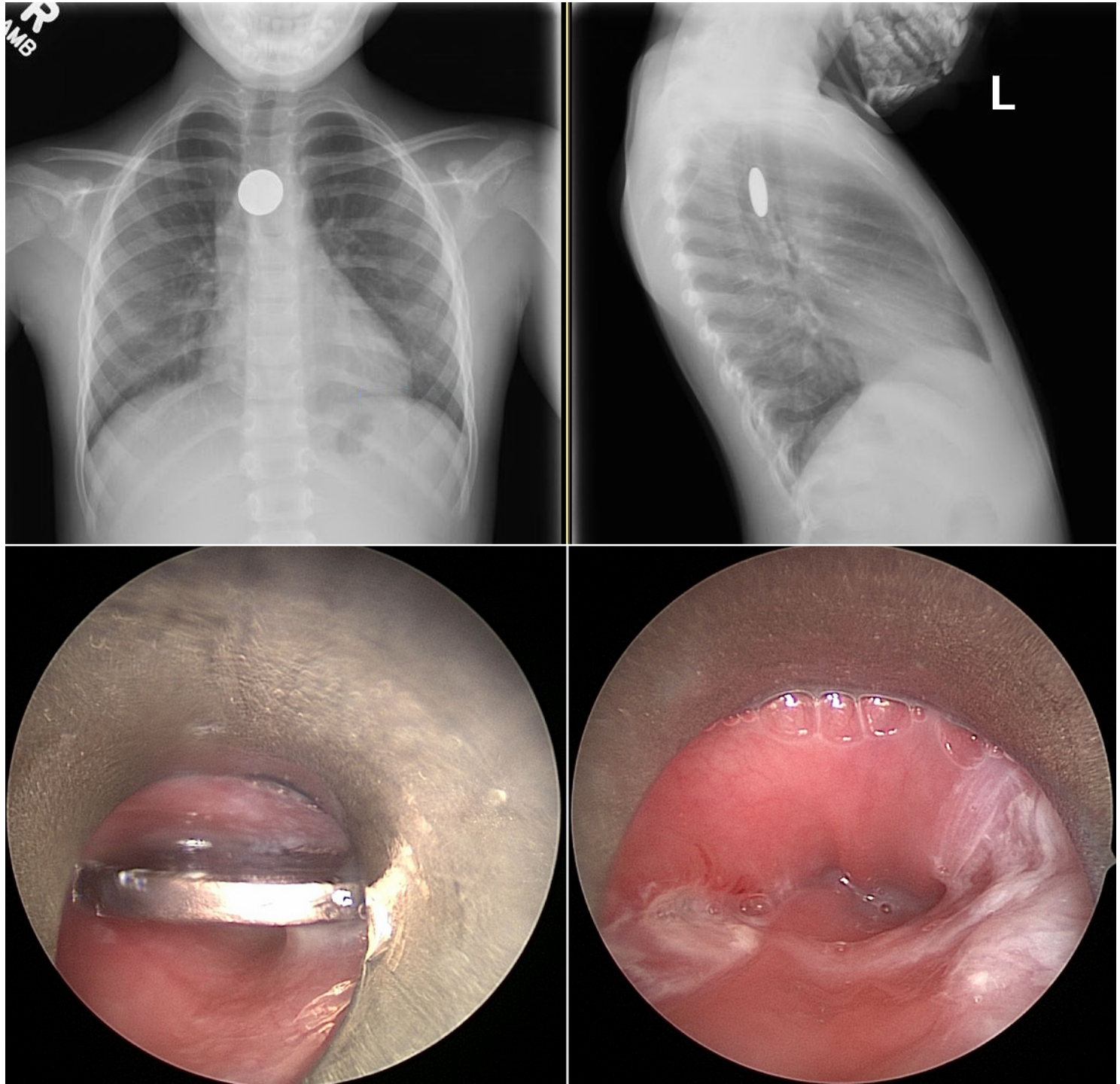
Safety pin in the cervical esophagus

# Endoscopic Techniques for Removal of Sharp Foreign Bodies

- **Alligator forceps**
- **Wire snare**
- **Magnet**
- **Suction**
- **Preplace protective tube over endoscope to protect esophagus during withdrawal of sharp object**
- **Can manipulate open safety pins to close them**

# "Invasive" Removal of Esophageal Foreign Bodies

- Flexible fiberoptic or rigid endoscopy
  - General anesthesia may be required in children
  - If food impaction, may be pushed into stomach rather than removed
- Foley catheter extraction
  - Patient must be in head - down position
  - Only suitable for upper esophageal impactions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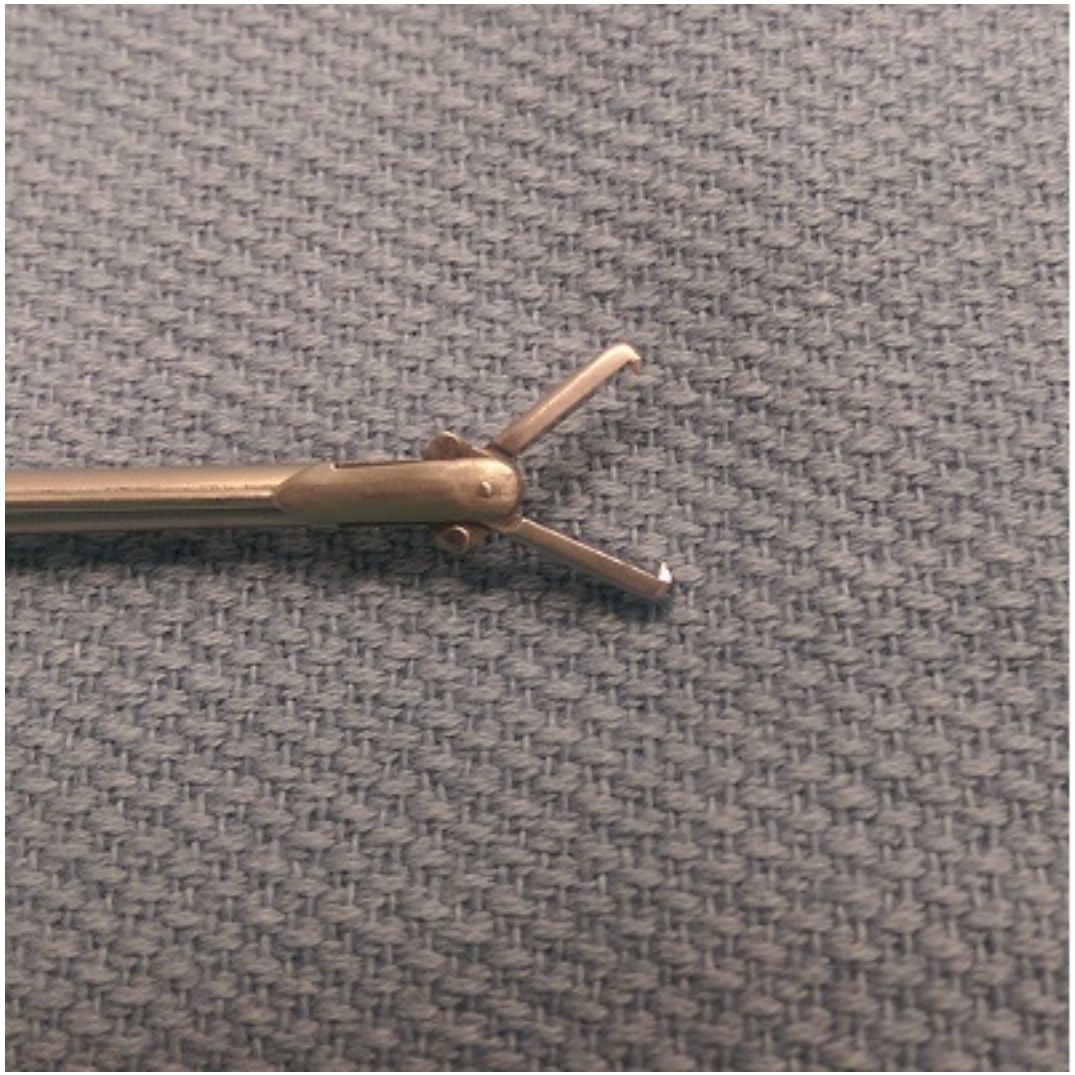


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# Unsafe Methods for Esophageal Food Impaction Removal

- Meat tenderizer (papain)
  - Has caused esophagitis & deaths from esophageal perforations
- Gas - forming agents
  - Sodium bicarbonate & tartaric acid
  - "EZ Gas" (sodium bicarbonate & citric acid & simethicone)
  - Can rupture esophagus from gas buildup
- Syrup of ipecac

# Followup of Patients After Endoscopic Removal of Esophageal Foreign Body

- Observe until child can accept some oral intake
- Follow-up esophagogram for difficult to remove objects
- Not necessary in children unless esophagitis present and risk of stricture

# X-ray Signs of Possible Perforation of the Esophagus

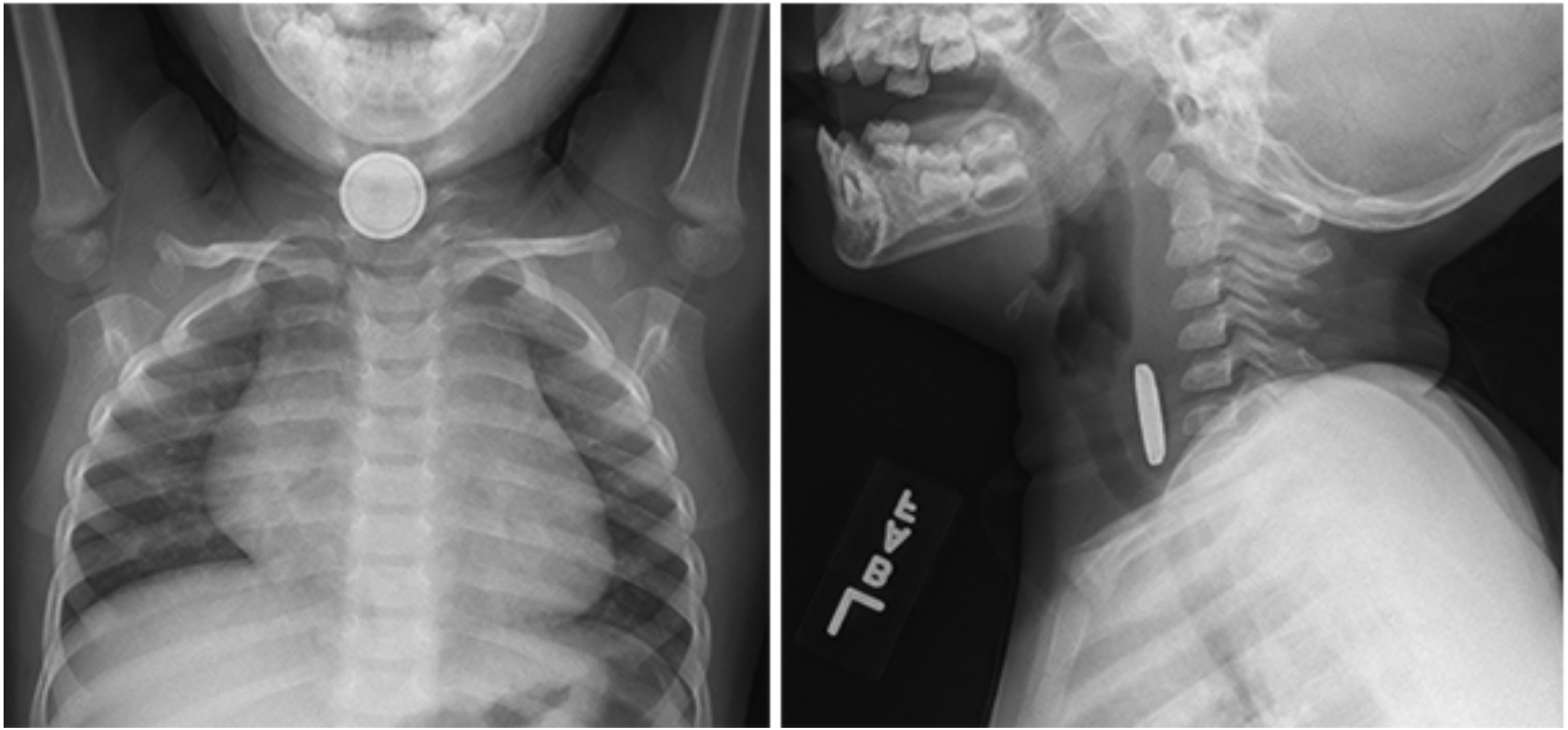
**Air in :**

- **Cervical soft tissues**
  - **Subcutaneous**
  - **Supraclavicular**
  - **Mediastinum**
- **Pneumothorax**
- **Pleural effusion**
- **Retropharyngeal swelling**

# Button Battery Ingestions

**Button batteries are 6 to 23 mm. in diameter**

**Used in calculators, cameras, electronic games, hearing aids, watches, etc.**



# Dangers of Button Battery Ingestions

**Esophageal impaction**

- **Corrosion & esophageal perforation**
- **Erosion into the trachea**
- **Some deaths reported**

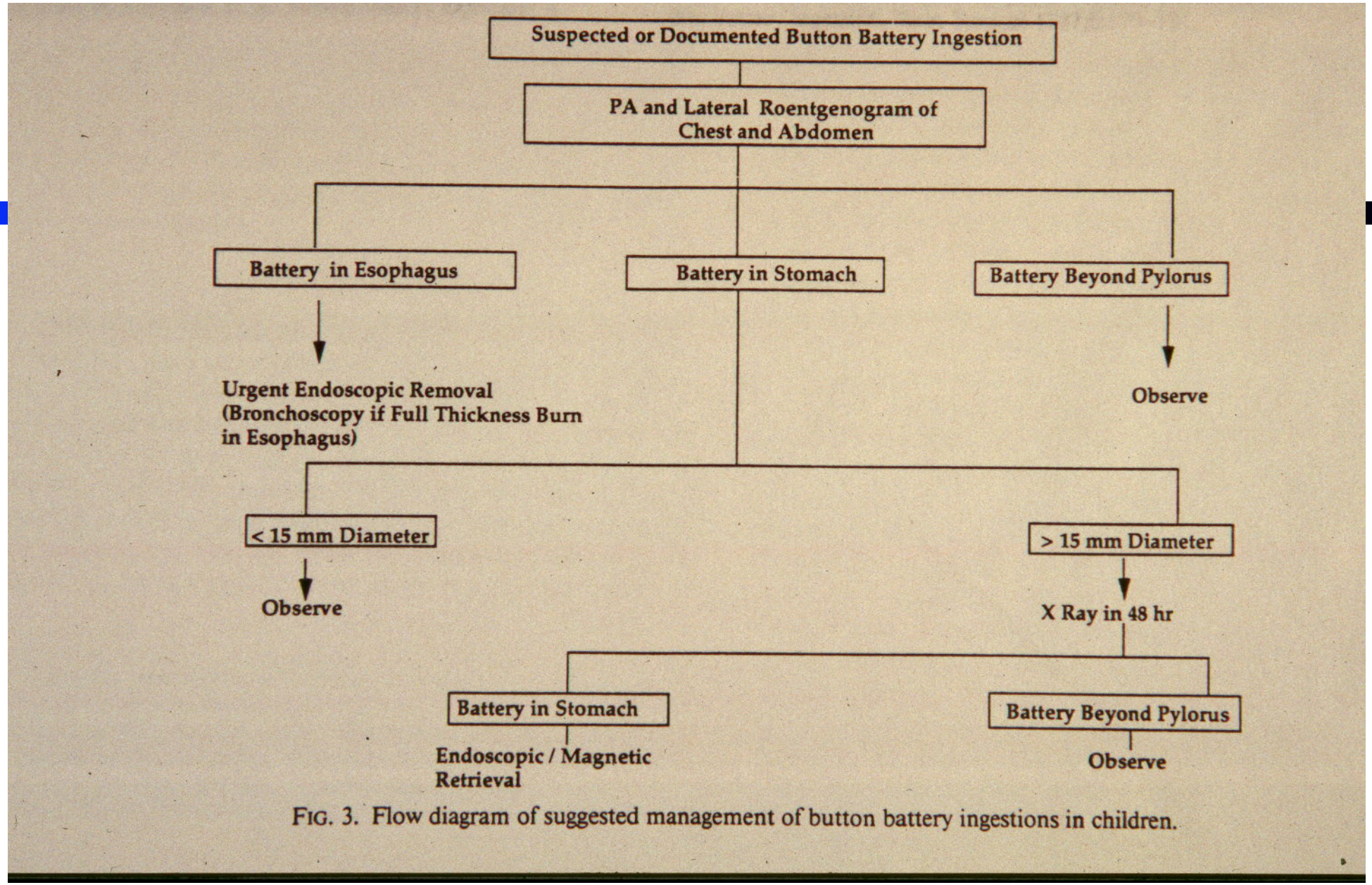
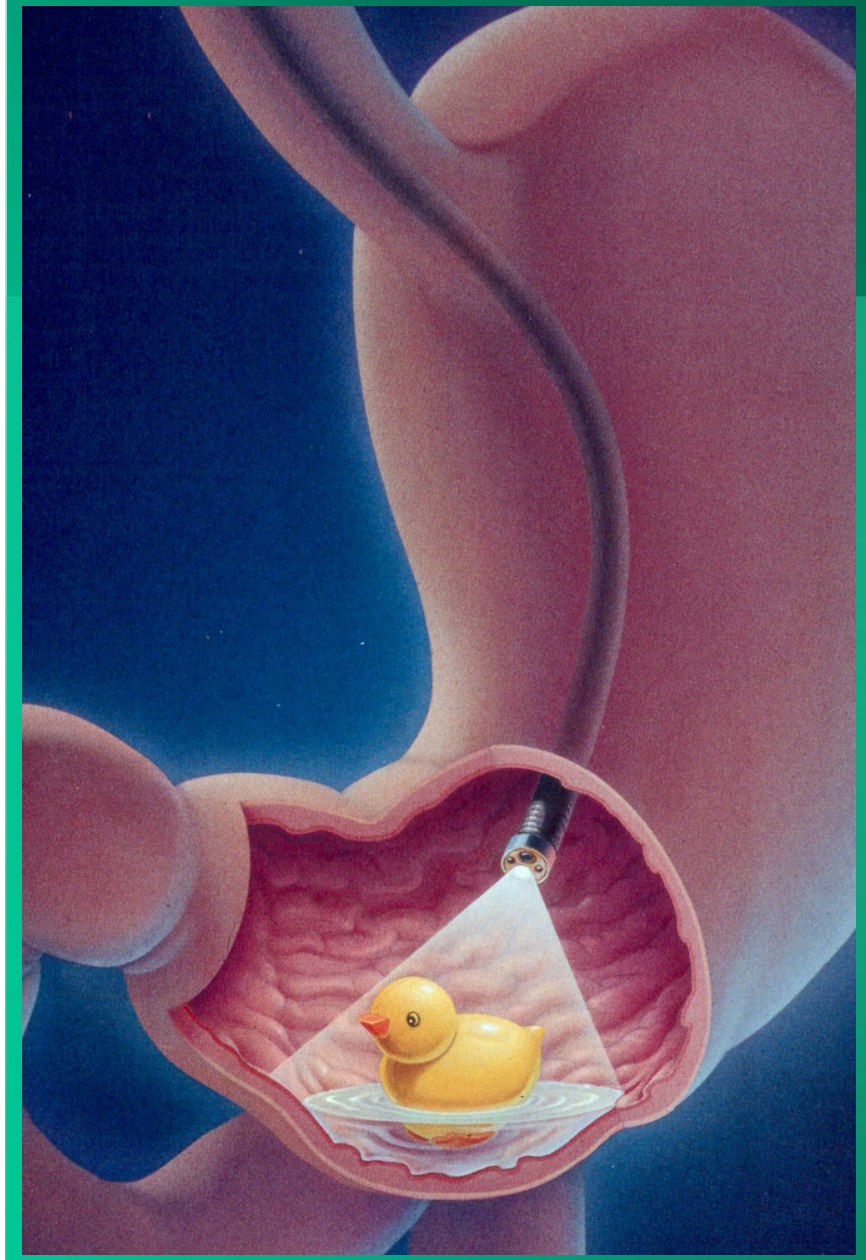
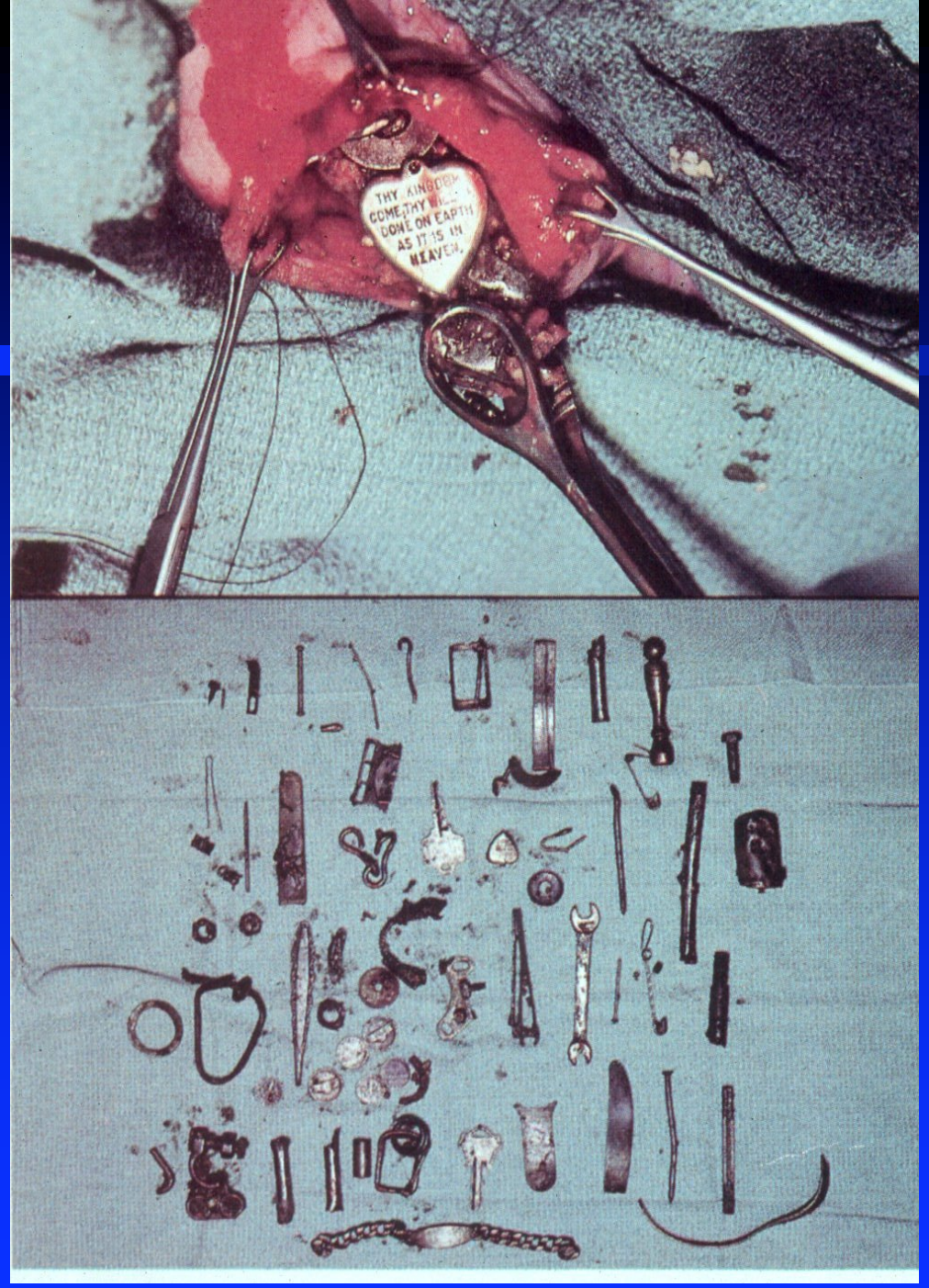



FIG. 3. Flow diagram of suggested management of button battery ingestions in children.

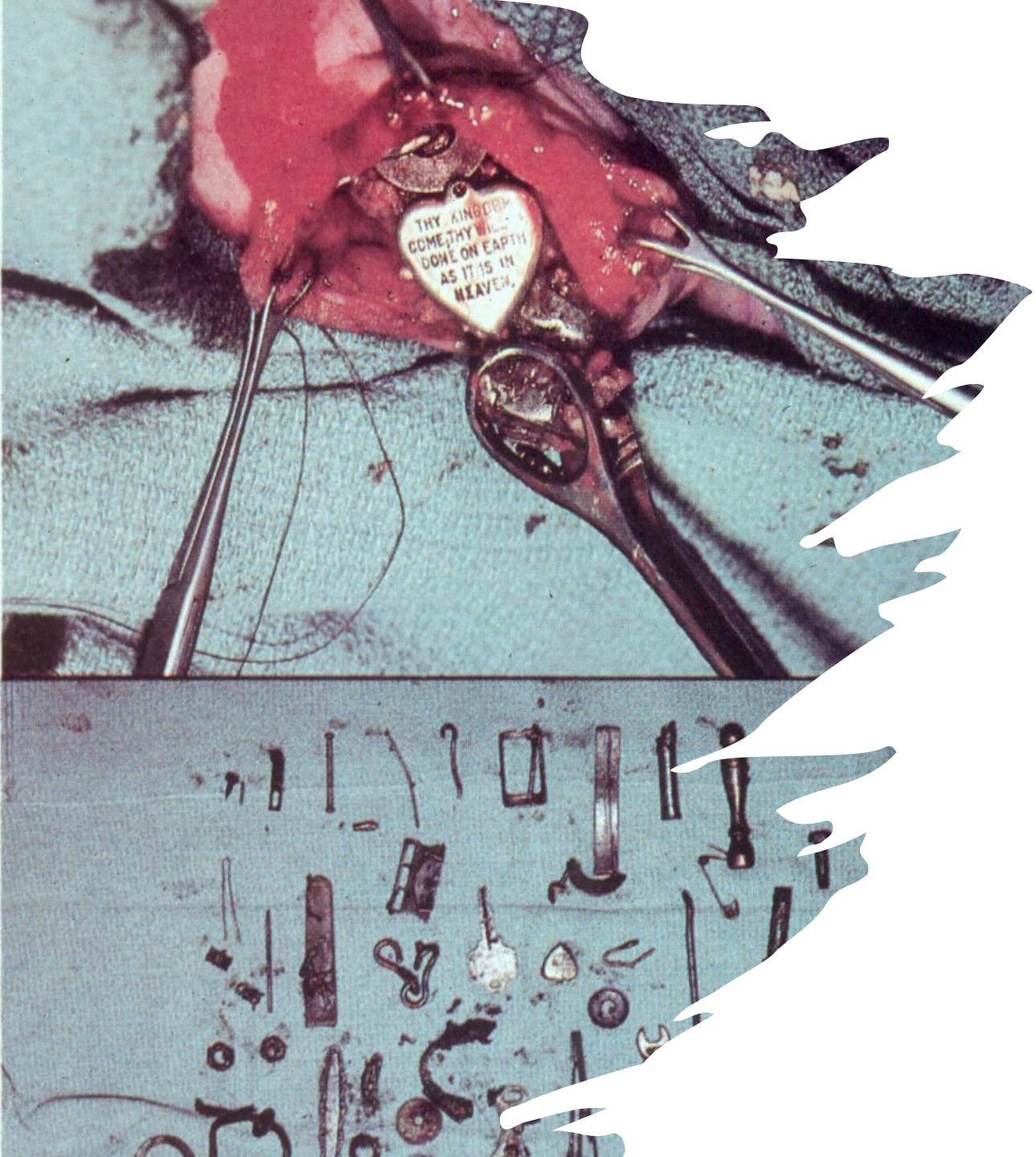
# Stomach and Intestinal Foreign Bodies

- **Only 1 % of objects that reach the stomach will require surgical removal**
- **Only 2 to 7 % of high-risk objects (pins, nails, toothpicks) will need surgery**
- **Somewhat higher risk for ingested Christmas ball ornaments (have thinner, sharper glass)**
- **90 % of foreign bodies will pass in less than 7 days**






Surgical exploration of the same patient revealed a 2 by 3 cm lesser curve gastric ulcer and an interesting variety of swallowed objects




# Indications for Surgical Removal of A Stomach or Intestinal Foreign Body

**Signs of obstruction**

**Persistent vomiting**

**Progrssive abdominal distention**

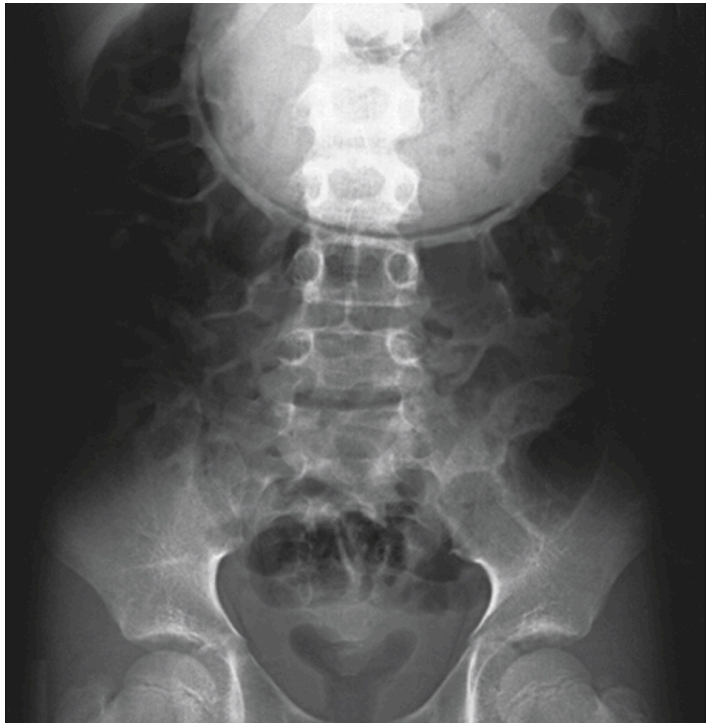
**Abdominal pain / peritonitis**

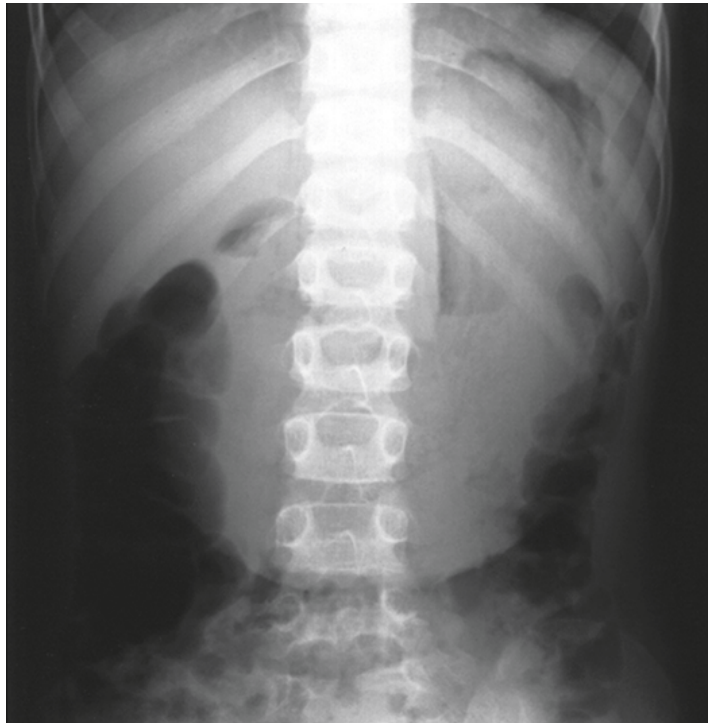
**Gastrointestinal bleeding**

**Failure to move distally for > 2 weeks (?)**

# Indications to Admit a Patient with a Foreign Body in the Stomach or Intestine

- **High risk object**
  - **Sharp point(s)**
  - **Cocaine packets**
  - **> 6.5 cm. in length**
  - **Potential toxin**
- **Multiple objects (?)**
- **Preexistent GI disease (?)**
- **Bezoar (trichotillomania)**

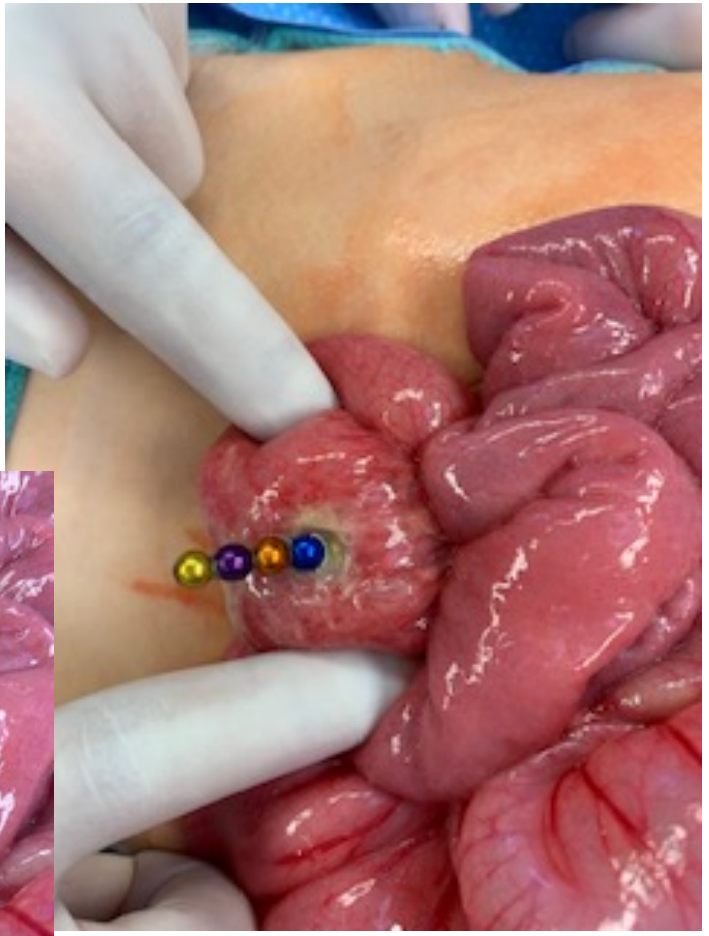


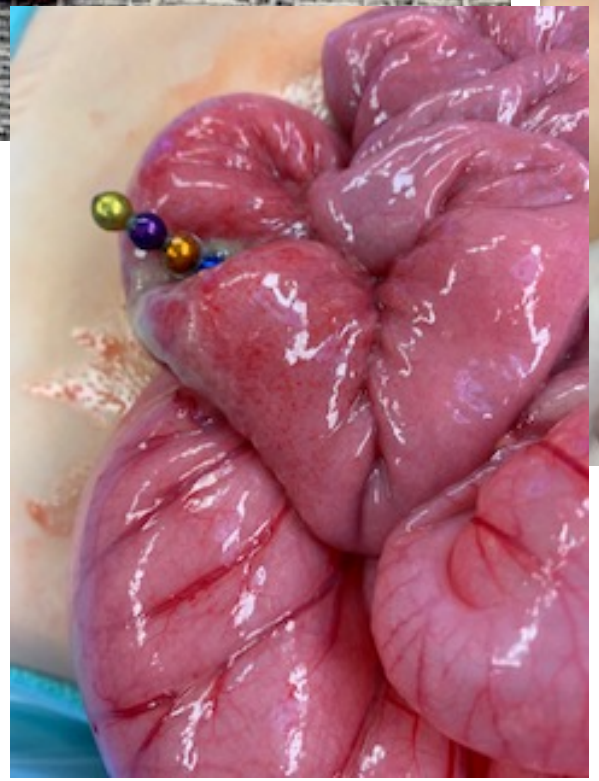



- Picture of the Month—Diagnosis. *Arch Pediatr Adolesc Med.* 2006;160(5):500. doi:10.1001/archpedi.160.5.500

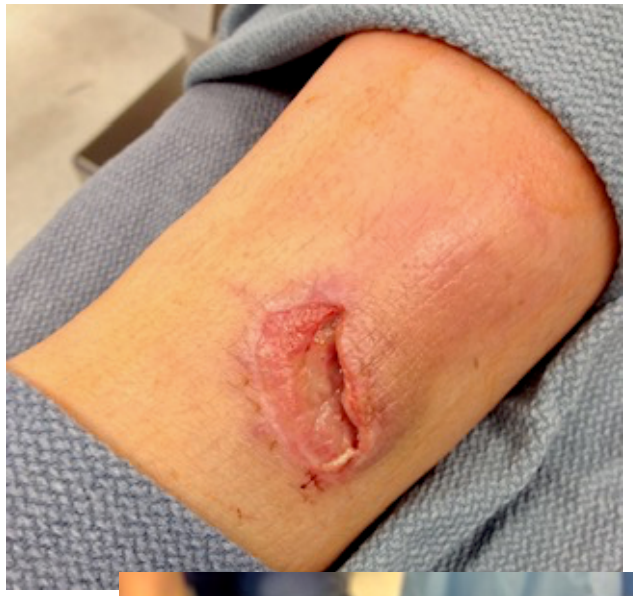
# Indications to Admit a Patient with a Foreign Body in the Intestine

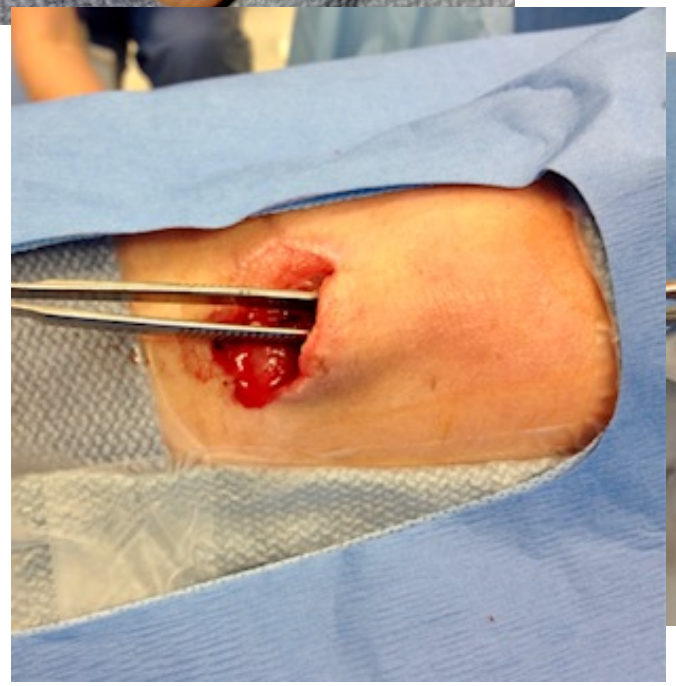
## RARE EARTH MAGNETS

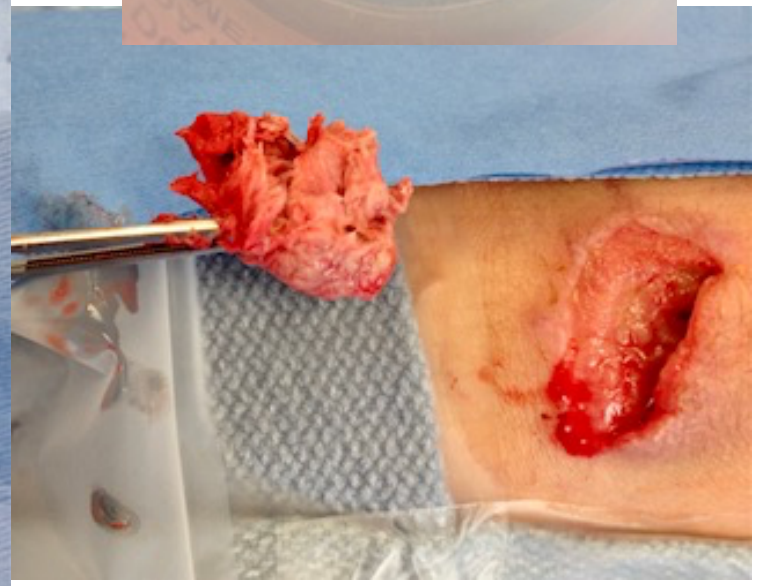




# Foreign Bodies in the skin and subcutaneous tissues





# Nasal Foreign Bodies

**May present in children as :**

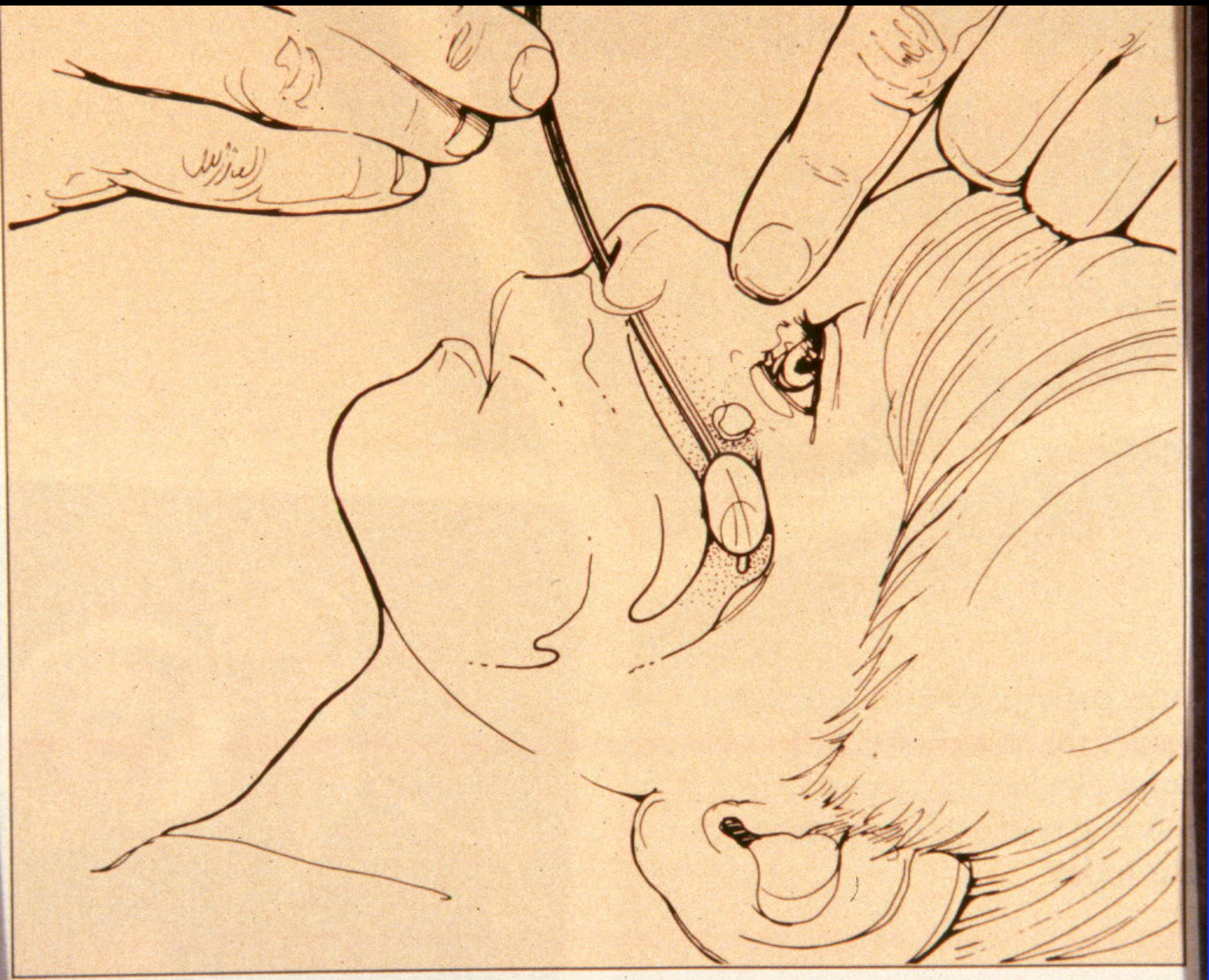
- **Extremely bad body odor**
- **Unilateral rhinorrhea**
- **Epistaxis**
- **Sinusitis**

**Use decongestant first for exam**

**May require general anesthesia for removal**

**Sometimes removable with suction, alligator forceps, or inflatable balloon catheter**

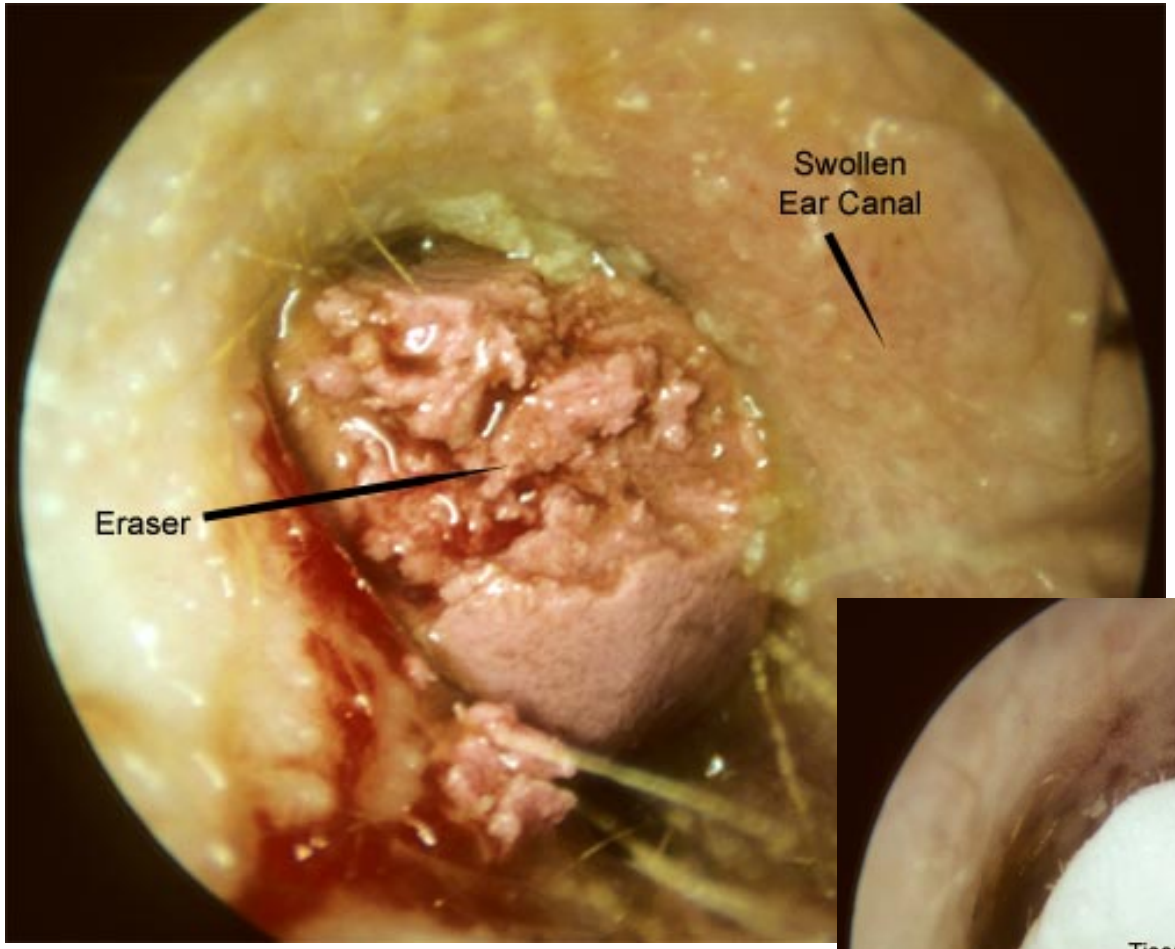
**May need antibiotics post-removal**

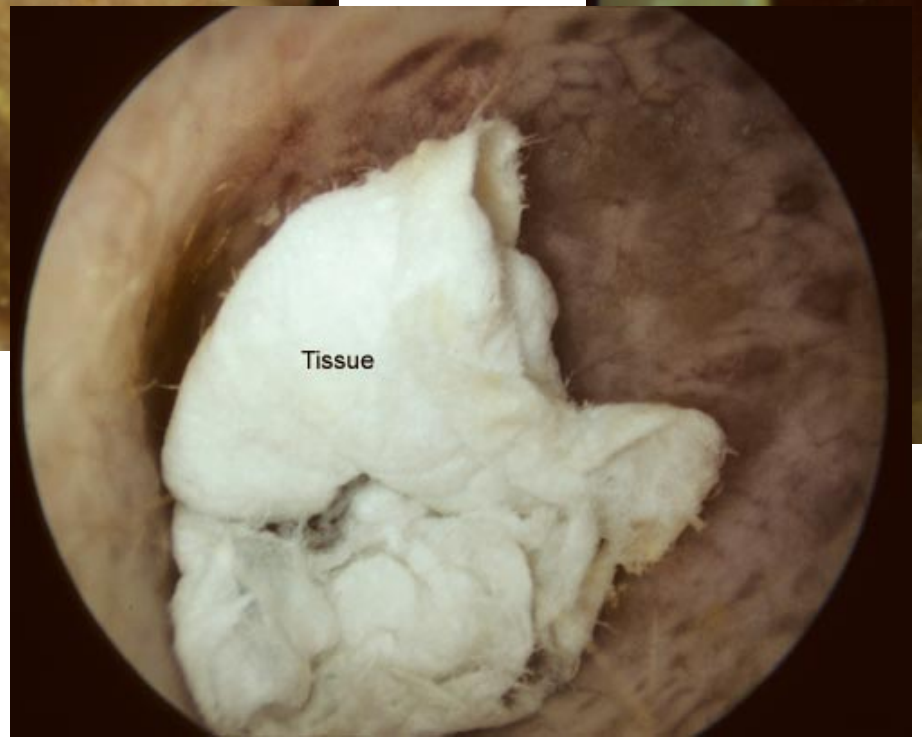


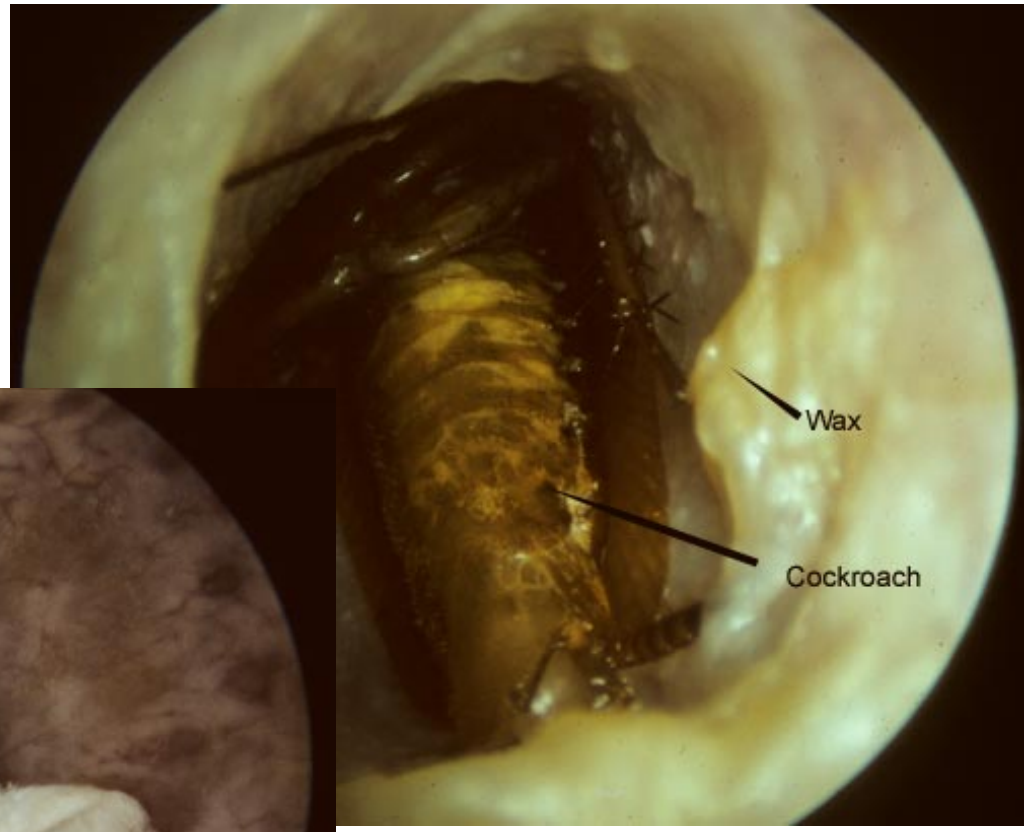
**Foolproof Removal of Foreign Body From Child's Nose**

# Ear Canal Foreign Bodies

- Insects (cockroaches) are most common
- End of a cotton tipped applicator
- Patients have been misdiagnosed as psychiatric
- Can fill ear canal with 2 % lidocaine to cause bug to seize & jump out
- May require general anesthesia for removal
- May need otic antibiotic drops afterward if canal wall injured

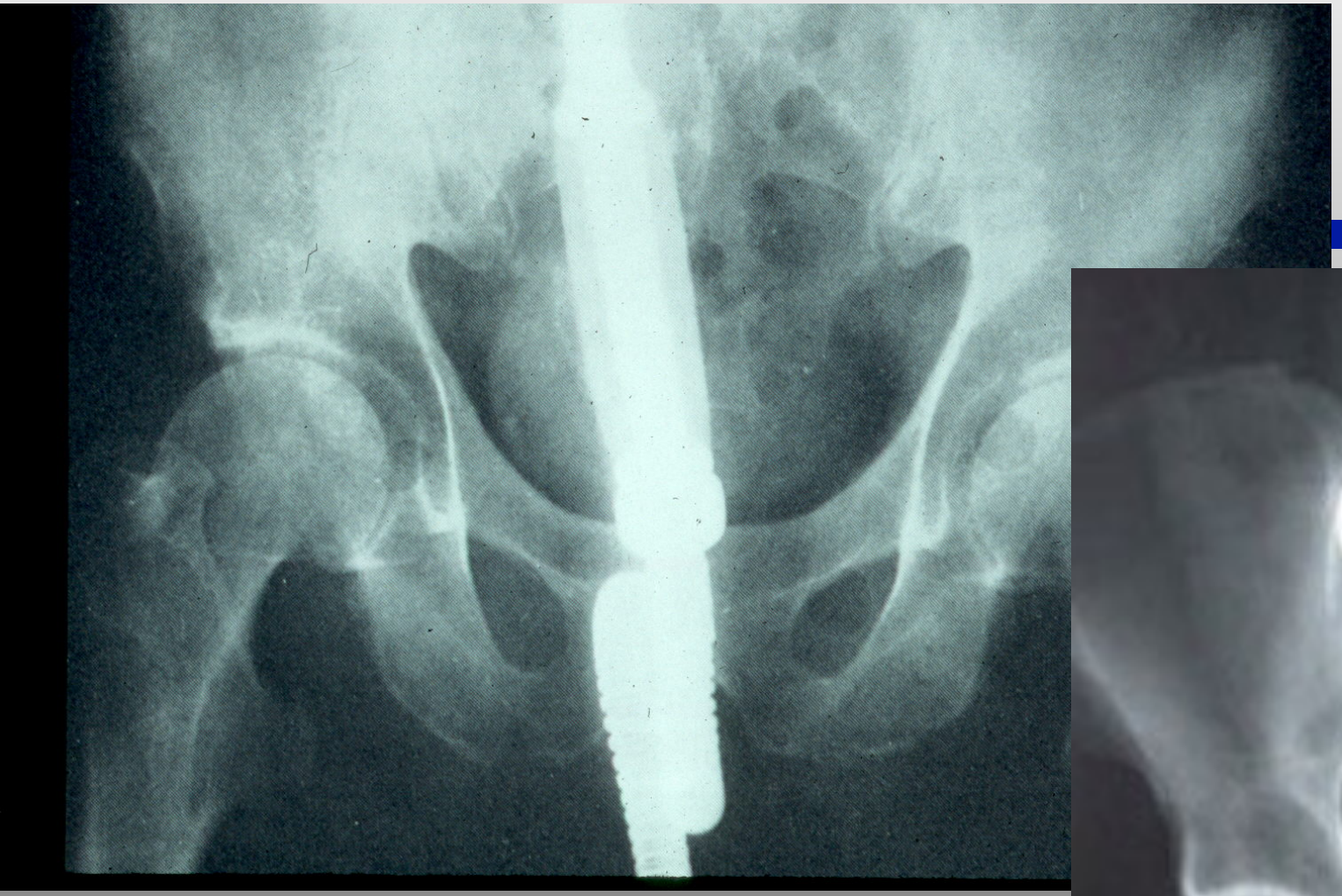

Swollen
Ear Canal
Eraser

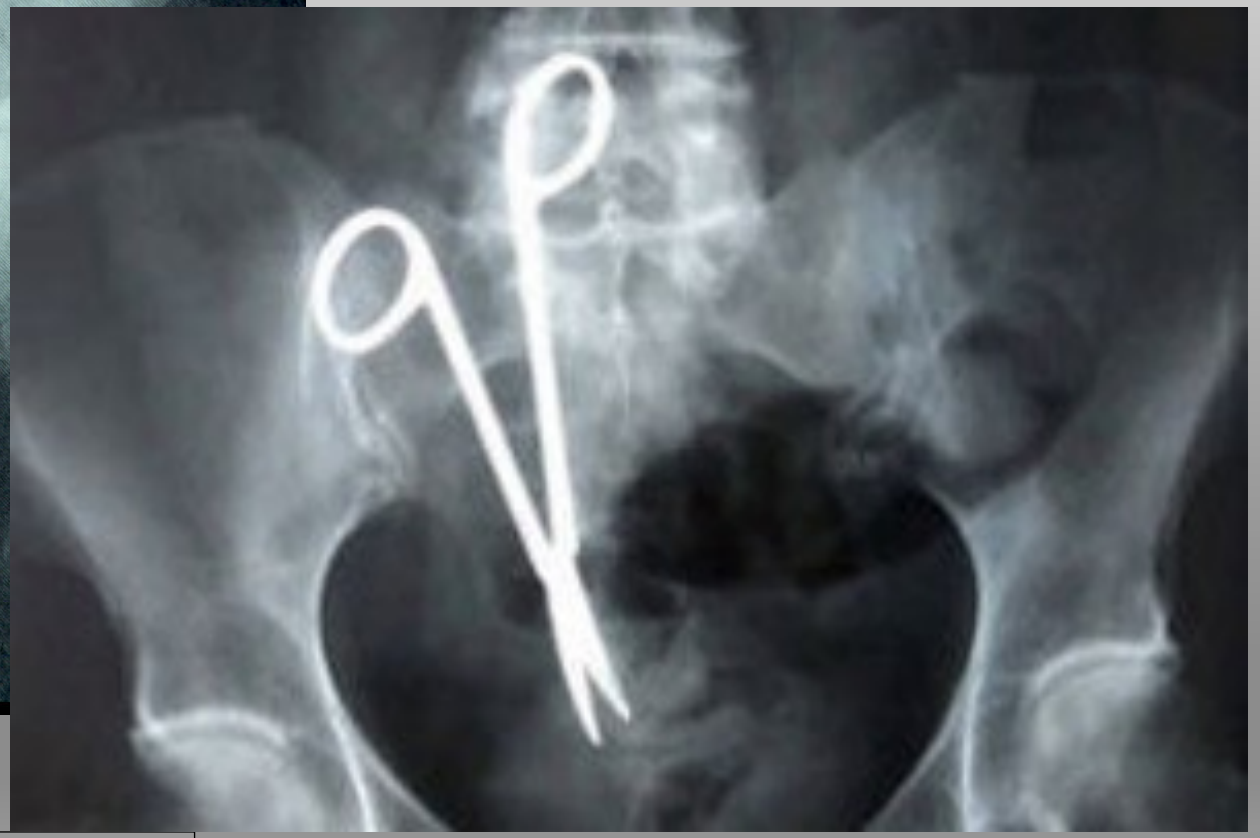

Tissue


Wax
Cockroach

# Rectal Foreign Bodies

- Should get pelvic / abdominal X-rays first
- Emergent surgery indicated if any sign of perforation
- May require perianal block or general anesthesia for removal
- Can insert foley beyond object & inflate balloon to assist removal
- After removal do sigmoidoscopy to look for mucosal injury or perforation

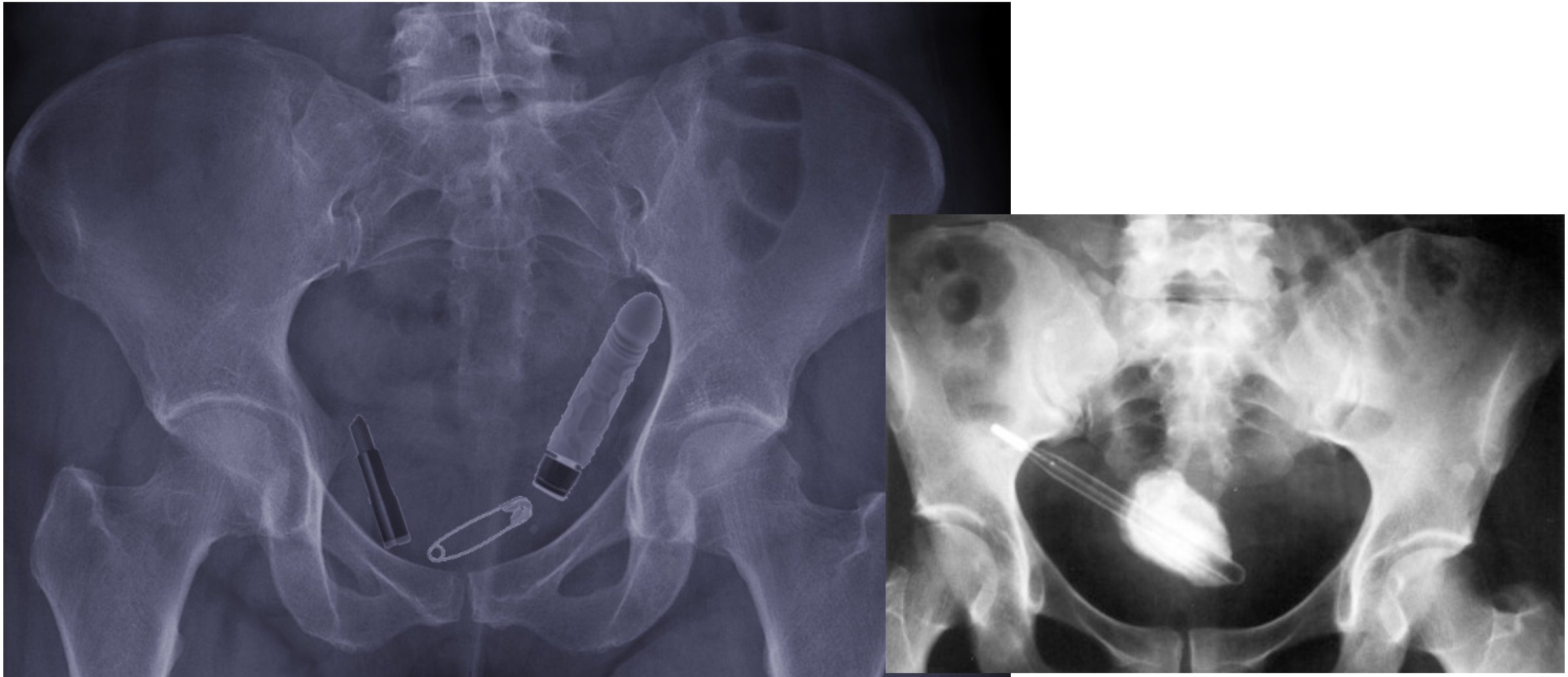




X-ray of hand shower misplaced in the rectum

# VAGINAL and URETHRAL Foreign Bodies

- Should get pelvic / abdominal X-rays first
- Emergent surgery indicated if any sign of perforation
- May require general anesthesia for removal
- May need vaginoscopy or cystoscopy or ultrasound while anesthetized
- Intra-operative ultrasound may be helpful



Anderson J, Paterek E. Vaginal Foreign Body Evaluation and Treatment. [Updated 2020 May 23]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. [Figure, Types of vaginal foreign bodies. Image courtesy S Bhimji MD] Available from: https://www.ncbi.nlm.nih.gov/books/NBK549794/figure/article-21927.image.f1/

# Foreign Bodies Satchel knowledge

1. Some are obvious and some aren’t
2. Small children may not be able to tell you they *** something and you need a high index of suspicion
3. If in doubt, call us to discuss if, how, and when to send a patient