

The Darn Things that Kids Put into their Mouths: Foreign Body and Caustic Ingestion



Jane A. Keng, M.D.
Pediatric Gastroenterology
Cook Children's Medical Center

Objectives

1. Identify clinical problems associated with common foreign body ingestion and caustic ingestion.
 - Coin
 - Sharps
 - Batteries
 - Magnets
2. Describe management of foreign body ingestion and caustic ingestion.



Historical Trivia

- First recorded pediatric foreign body ingestion (1692)
 - Frederick the Great
 - shoe buckle at 4 years of age



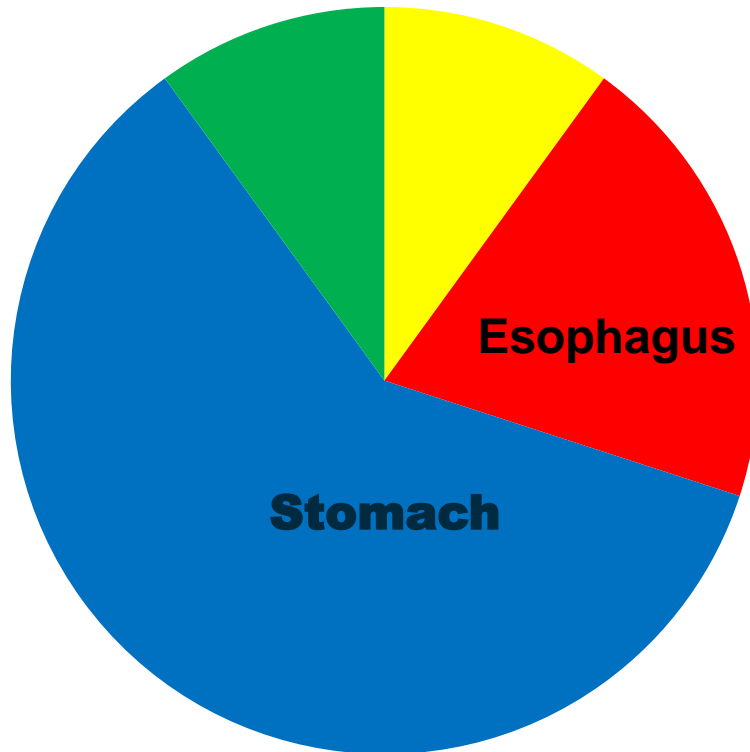
Foreign Body: Epidemiology

- Peak between 6 months to 3 years of age
- > 110,000 FB ingestion in pediatric population in US (2011) ¹
 - Underestimated
- Extremely low mortality rates
 - 1 death among 2206 children
- Coins are most common in North America & Europe compare to fish bones (Asia)
- Variation in ages
 - Children: coins (up to 70%)
 - Adults: meat/ fish bones

American Assoc of Poison Control Center' National Poison Data System (NPDS) 1

Locations of Foreign Bodies

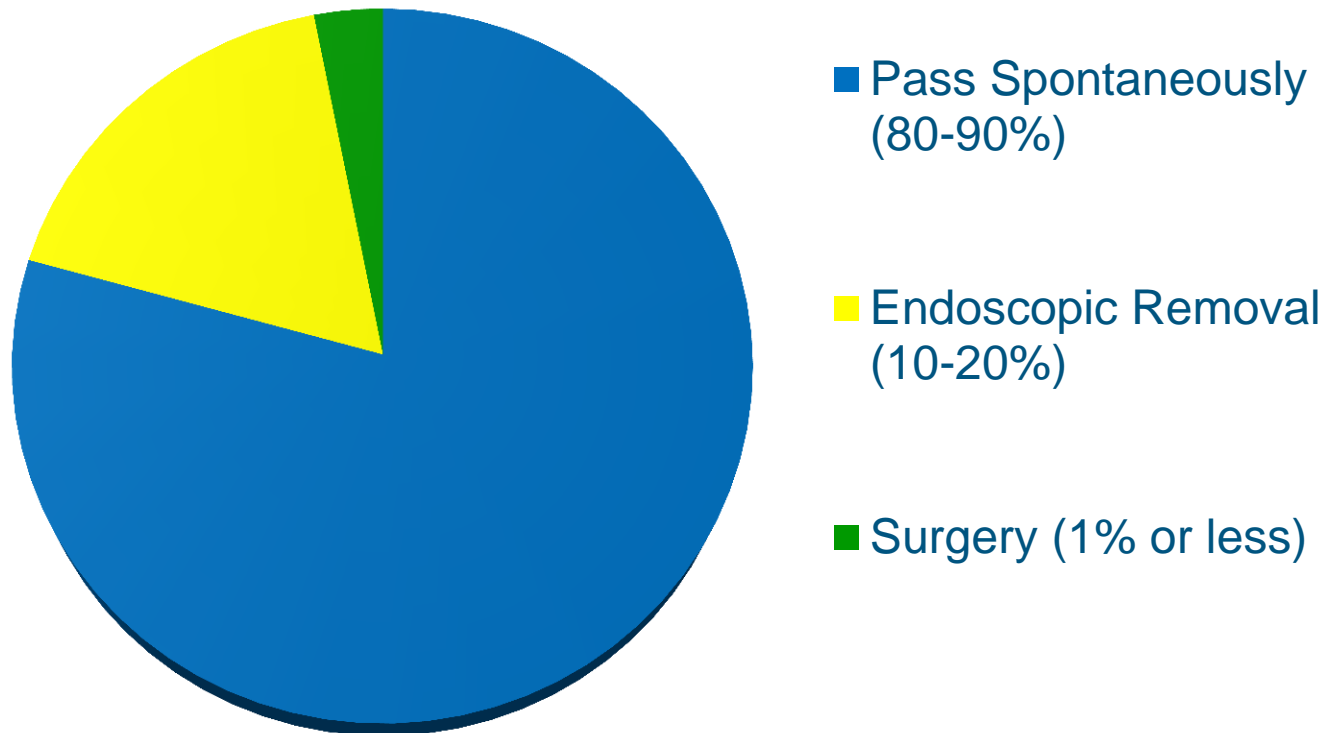
Percentage



- Oropharynx 5-10%
- Esophagus 20%
- Stomach 60%
- Beyond stomach 10%
(Duodenum, IC valve, rectum)

Do They Pass

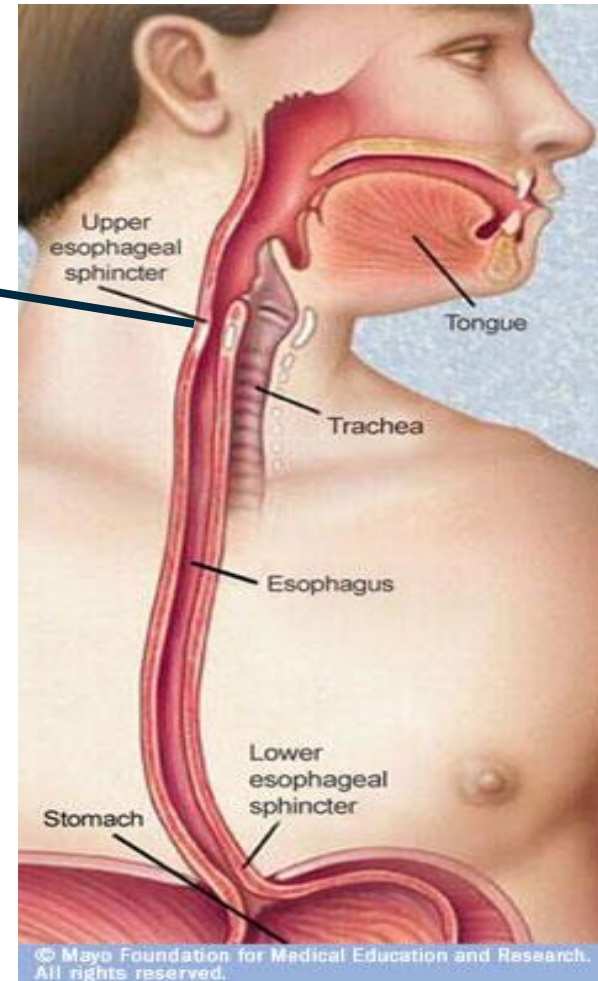
Percentage



Passage within 4-6 days

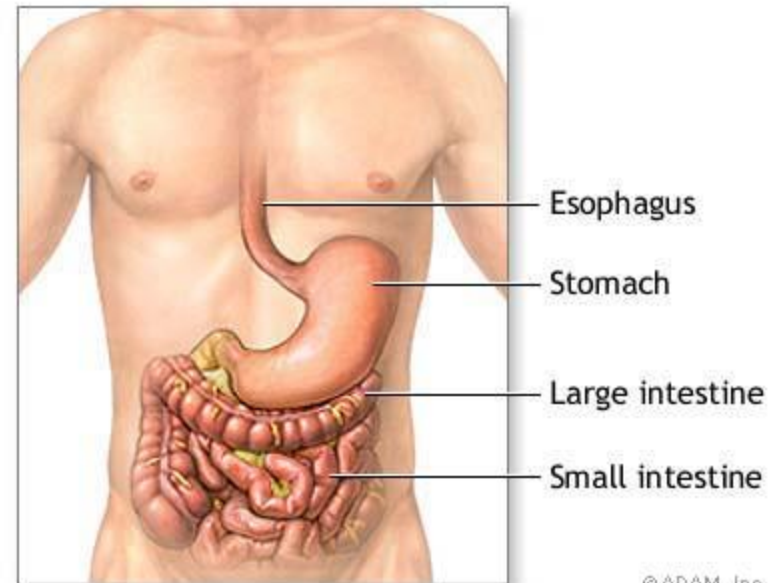
Stuck at Esophagus

- 60-70% proximal esophagus (UES or thoracic inlet)
- 10-20% midesophagus (aortic notch or left main bronchus)
- 20% distal esophagus (LES)



Stuck at Stomach & Beyond

- Potential sites of no passage
 - Pylorus
 - Duodenal C loop with its fixed retroperitoneal location
 - Ileocecal valve



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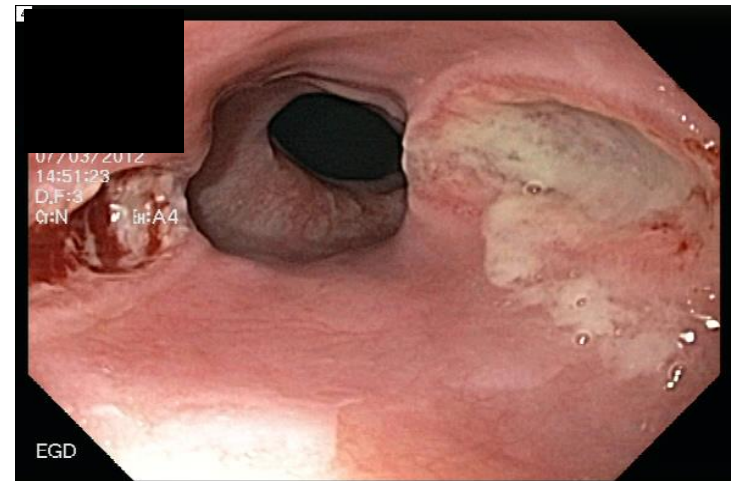
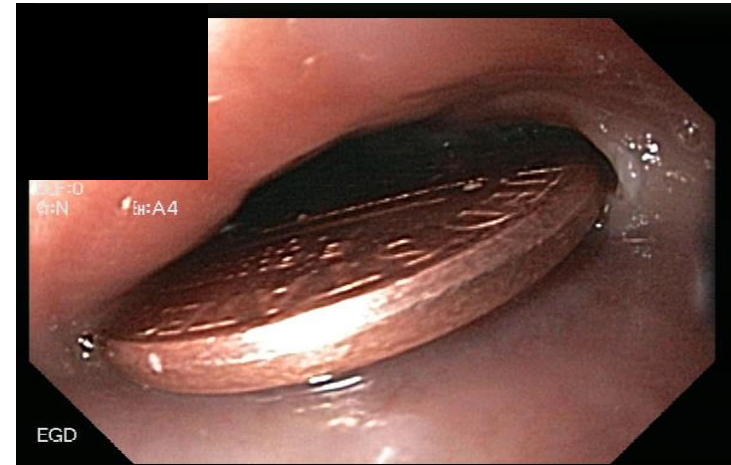
CASE #1- Coin

- 2 years old female
 - Swallowed coin 5 days
 - No symptoms
 - Mom advised to observe
 - Started to complain of abdominal pain
 - Outside ED
 - coin in esophagus
 - Transferred to Cook ED



CASE #1-Coin

- EGD with FBR
 - Penny at the mid-esophagus
 - Two deep ulcers
- Admitted for observation
 - Advanced diet
 - PPI + sucralfate
- Discharge
- Follow-up



Coin

- Most common FB that retained in the esophagus
- No Passage Out of Stomach Based on Size
 - Diameter >2 cm
 - Length >5 cm (children)
 - Length >3 cm (infant)
- Teen/Adults
 - Length >10 cm (duodenal C loop)

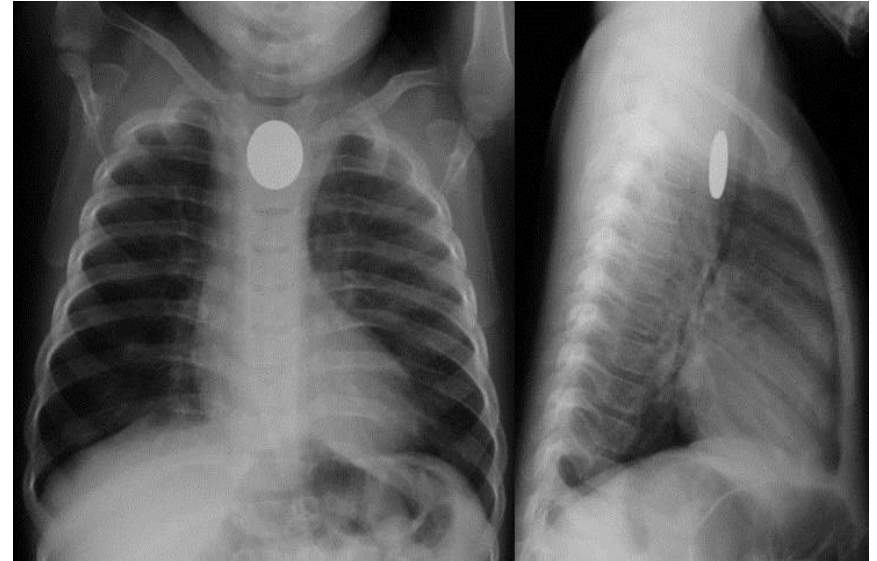


24 mm

Conditions that Prevents Passage

- Strictures and rings
- Dysmotility
- Achalasia
- Eosinophilic esophagitis
- Tight Nissen fundoplication
- Congenital defects (TEF)

Where is the coin?



60-90% are radio-opaque

Coin/ Blunt Objects

■ Asymptomatic

- Esophagus
 - observe 12-24 h for possibly spontaneous passage to stomach
- Repeat XR in 12-24 hours

■ Symptomatic

- Proximal esophagus (eg. cough, stridor, respiratory distress)
- Middle/ distal esophagus (eg. pain, drooling, dysphagia)
- **Always** remove

Removal Techniques

- Flexible endoscopy
- Rigid endoscopy
 - Surgeon
 - proximal esophagus
- Magill Forceps
 - oropharynx or UES
- Bougienage dilators
 - push coins into stomach
- Foley catheter technique



10-20% of children with foreign bodies ingestion are managed endoscopy.

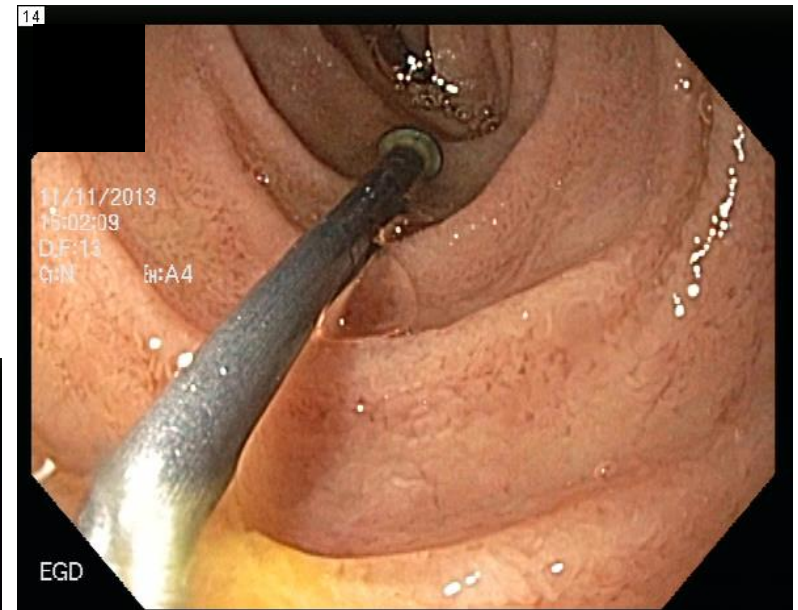
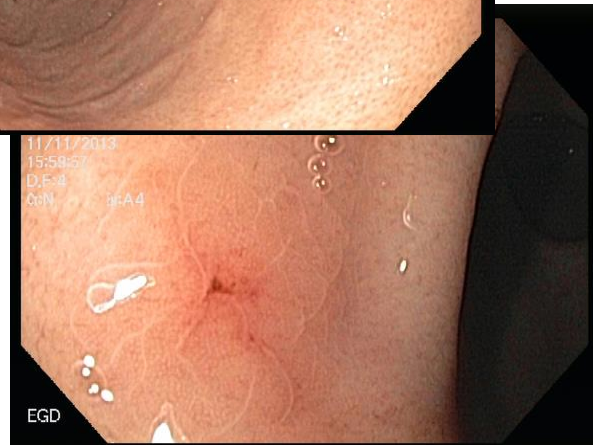
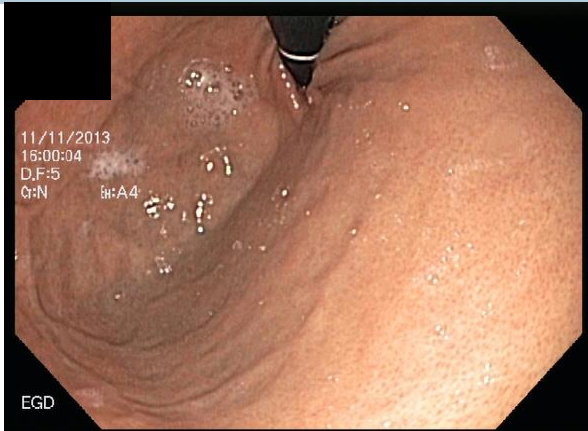
CASE #2 - Sharps



- 3-1/2 years old male
 - Swallowed nail 4 hrs prior to the ED
- AXR: Object at LUQ suggestive in stomach or colon
- Leave or Take-out ?

CASE #2 - Sharps

- EGD w/ FBR
 - Distal duodenum



Special Consideration: Sharps

- **Sharp Objects**
 - Bones, safety pins, paperclips, needles, toothpicks
- Risk of complications (high as 35%)
- Straight pin can pass uneventfully
(if blunt end head first)
- Sites of perforation: esophagus, C- loop of duodenum, terminal ileum, ICV, sigmoid

Sharps

- Retrieve **ALWAYS** if possible: esophagus, stomach or duodenum
- Esophagus need protection from sharp objects
 - Protector hood
- Jackson's axiom "Advancing points perforate and **trailing points** don't"



Sharps Beyond the Retrieval Site

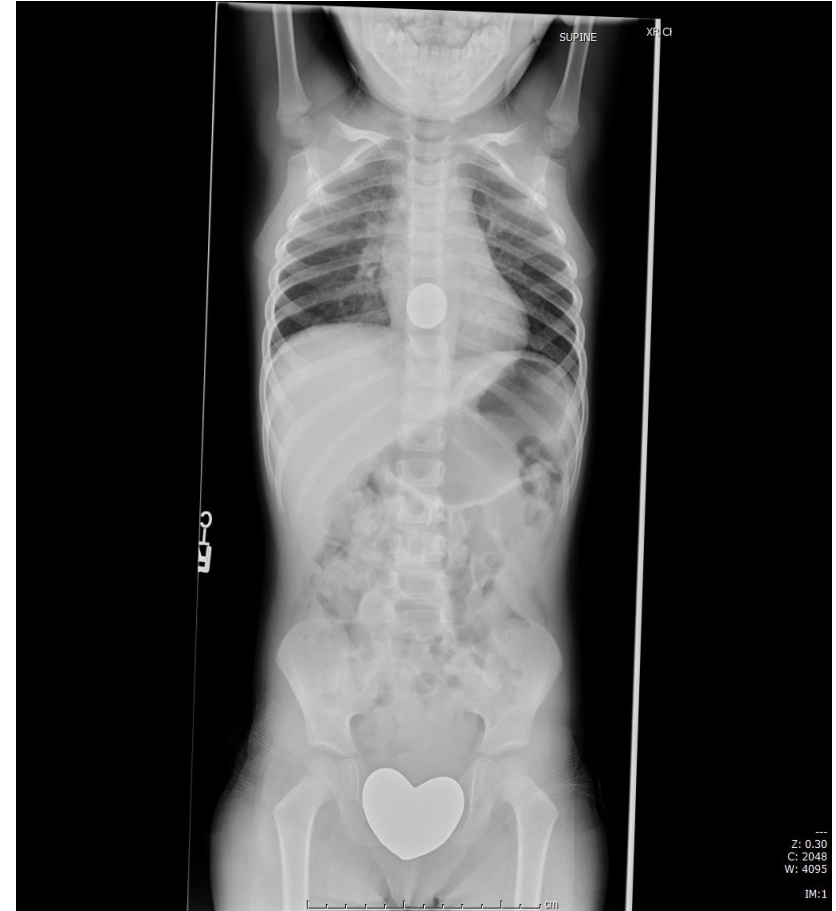
- Beyond duodenum, not symptomatic:
 - Follow radiographically every 5 days
- Surgery if object fail to progress further in intestine for > 3 days

Complications

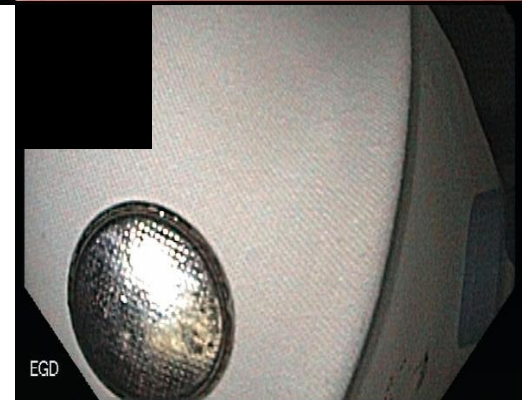
- Mediastinitis
- Strictures (esophagus)
- Fistulas
- Esophageal diverticula
- Perforations
 - 75% occurs in the ileocecal valve
- Obstructions
 - Congenital malformations (Meckel's diverticulum)
 - Prior surgery
- <1% extraluminal migration

CASE #3: Batteries

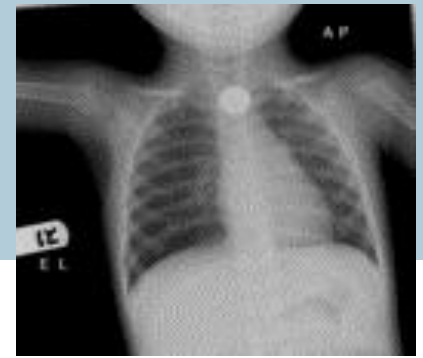
- 2 yo girl with babysitter
 - Swallowed a “coin”
 - Drooling, decreased PO, difficulty swallowing, difficulty breathing, cough, and “not acting like herself”
 - Brought to Cook ED



CASE #3: Batteries



Batteries



- Children (<6 years old): majority
- Largest registry of ingested batteries (2,382 patients)
 - 2,320 button/disk batteries
 - 62 cylindrical batteries-less common, lower injury
- Button battery (major or fatal outcomes)
 - 6.7-fold increase from 1985 to 2009 due to increase use of 20-25mm lithium button batteries

Batteries

- CDC report from 2012:
 - Period 1995-2010
 - 10% required hospitalization
 - 14 fatalities
 - 7 months to 3 years old
 - Involve button batteries
 - Nonspecific symptoms



Batteries

- Types of disk batteries
 - Mercuric oxide
 - Silver oxide
 - Manganese oxide
 - Zinc
 - Lithium
- All contain 20-45% of potassium or sodium hydroxide

Mechanisms for Injury by Batteries

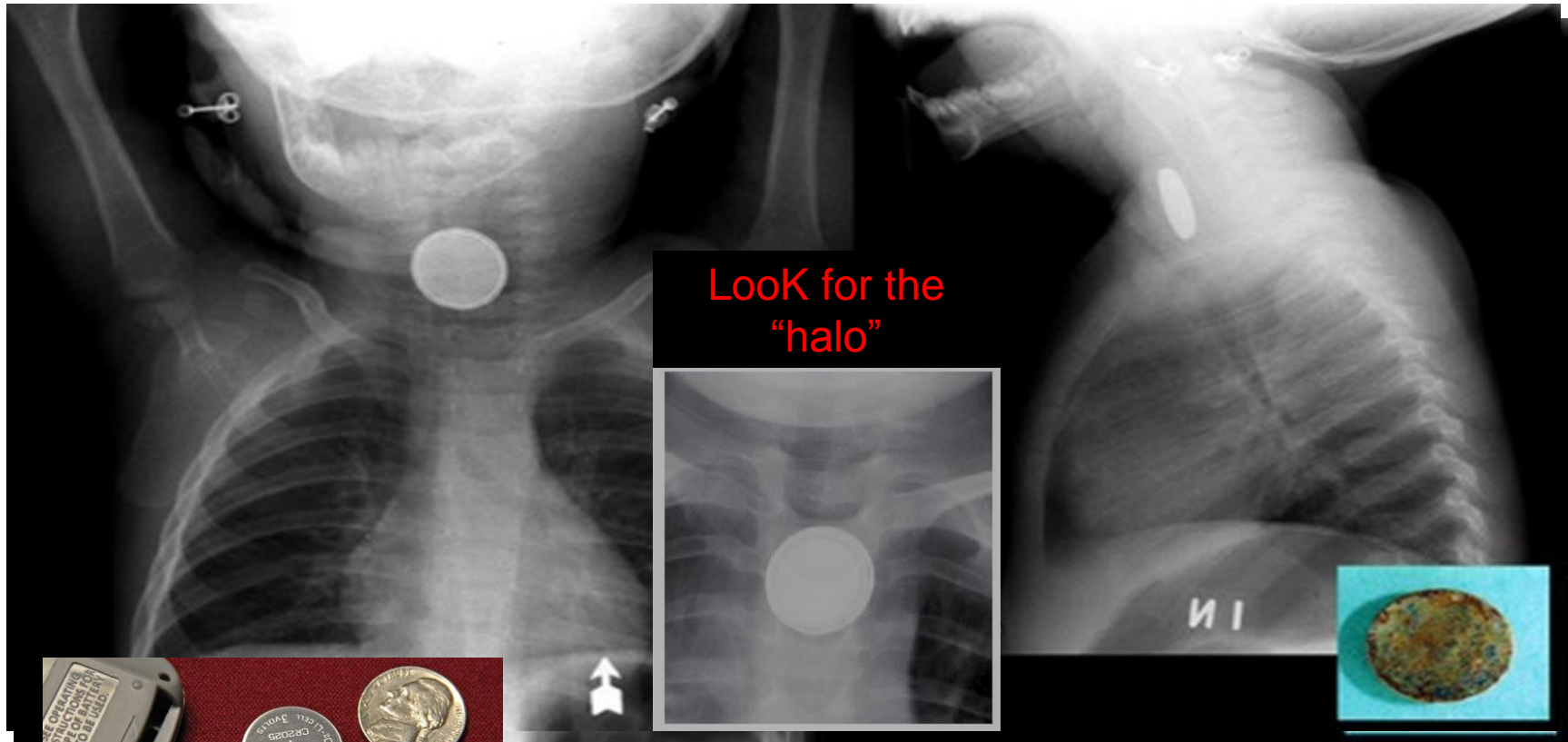


- Pressure ischemic necrosis
- Electrical Discharge
 - Current at negative pole of battery with tissue, cause local hydrolysis of tissue, hydroxide production → corrosive tissue injury.
- Leakage of battery content (especially in stomach) → alkaline solution
- Mercury poisoning (only 1 case reported)
 - Rare-mercuric oxide button battery off the market since 1995
 - No reports since 2004

Batteries

- Age: worse < 4 years old
- Size matters: worse \geq 20mm
- Ingestion of more than 1 battery
- Unwitnessed ingestion or unknown time of ingestion
- Misdiagnosis at initial presentation
- Delayed removal of the battery (esophagus)
- Lithium cells: worse clinical outcomes
 - Lightest metal, long shelf-life, cold tolerance
 - High energy density thus generate more hydroxides, more rapidly

Special Consideration



DON'T BE FOOL

20 mm batteries vs 21 mm Nickel coin

Batteries

- Disc battery in the esophagus
 - Destruction begins
 - within 1 hour (mucosa)
 - 2 to 4 hours (full-thickness)
 - 8 to 12 hours (perforation)
 - Always extract even if asymptomatic
 - Admit for at least 24 h
 - Risk of perforation, mediastinitis, exsanguination, stricture, vocal cord paralysis
 - NG placement
 - Follow-up barium study
 - at 3-6 weeks

Disk Batteries

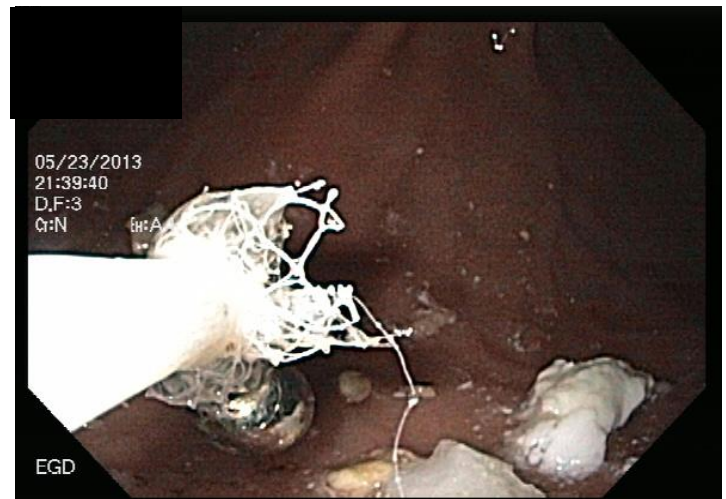
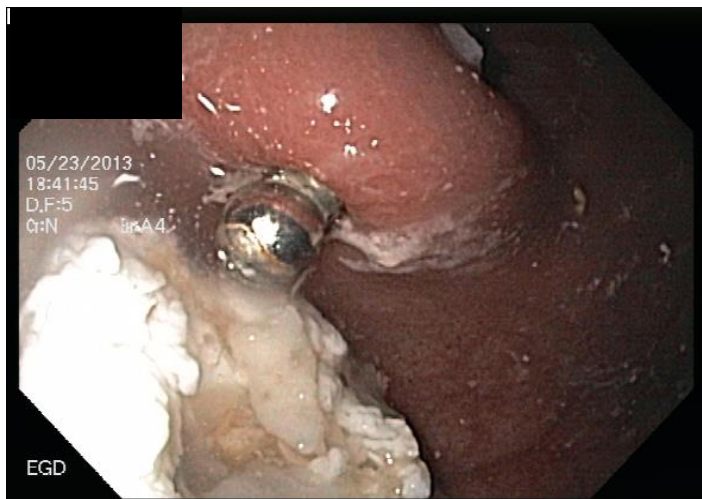
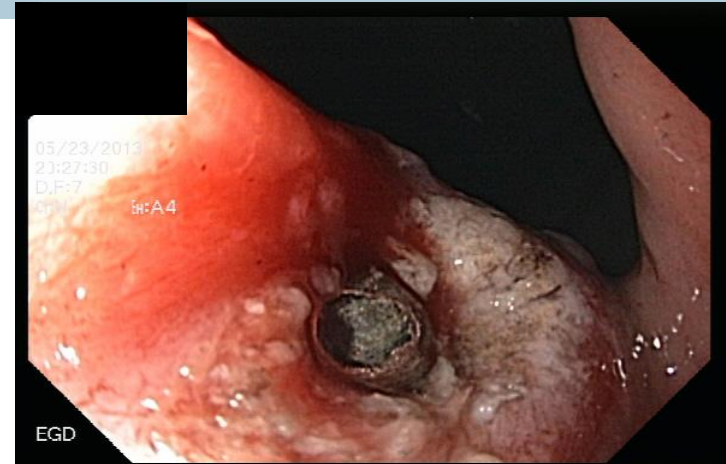
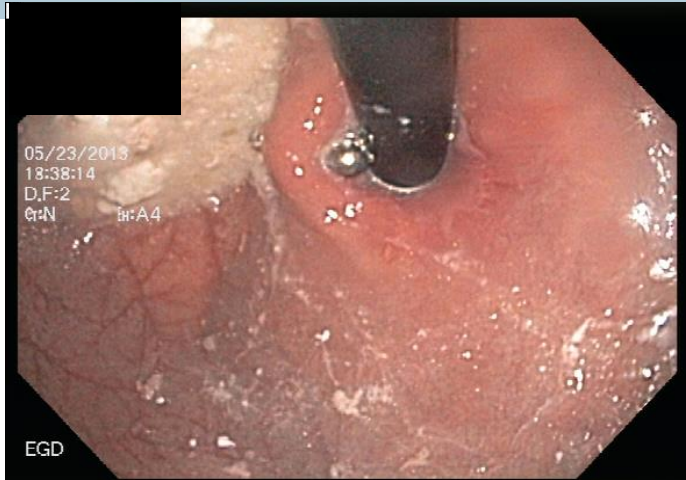
- Battery in stomach
 - Conservative approach
 - <2 cm diameter can pass spontaneously
 - Pass within 72 hours
 - Extraction if >48 hours
- Battery in intestine
 - No movement >5 days: surgery
 - Symptoms: surgery

CASE #4 Magnets

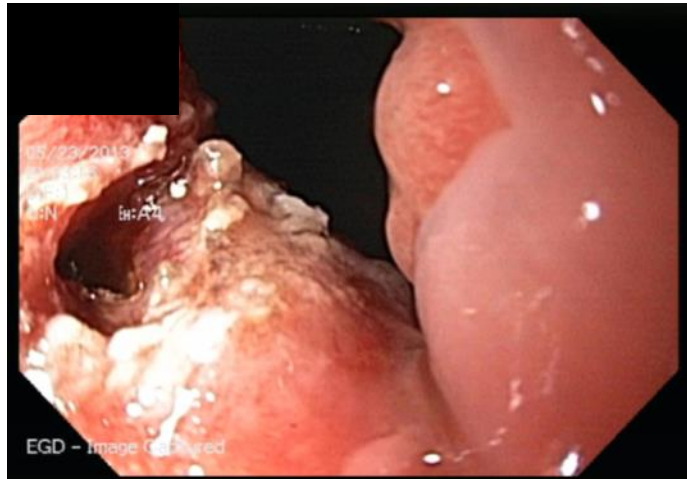
- 3 years old male
 - Swallowed tiny magnet balls
 - No symptoms
 - Went to urgent care
- Observed at home
- PCP repeated XR in 2 days
- Sent to Cook ED



CASE #4 Magnets



CASE #4 Magnets



- Contrast study
- No extravasation or signs of perforation
- Advance diet
- Discharge
 - PPI

Magnets

- First report of bowel perforation due to ingestion of multiple magnets- 1995
- High powered magnets (rare earth magnets- boron, neodymium) are 5-10x more powerful than traditional iron magnets
 - Desk toys, magnetic construction sets, jewelry

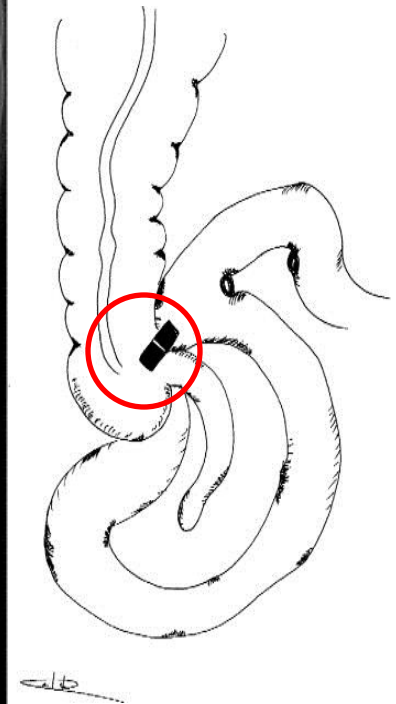
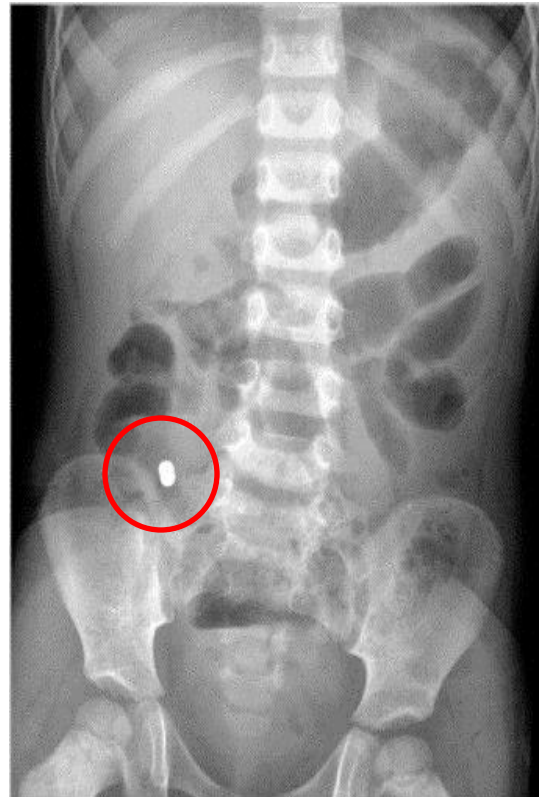


Magnets

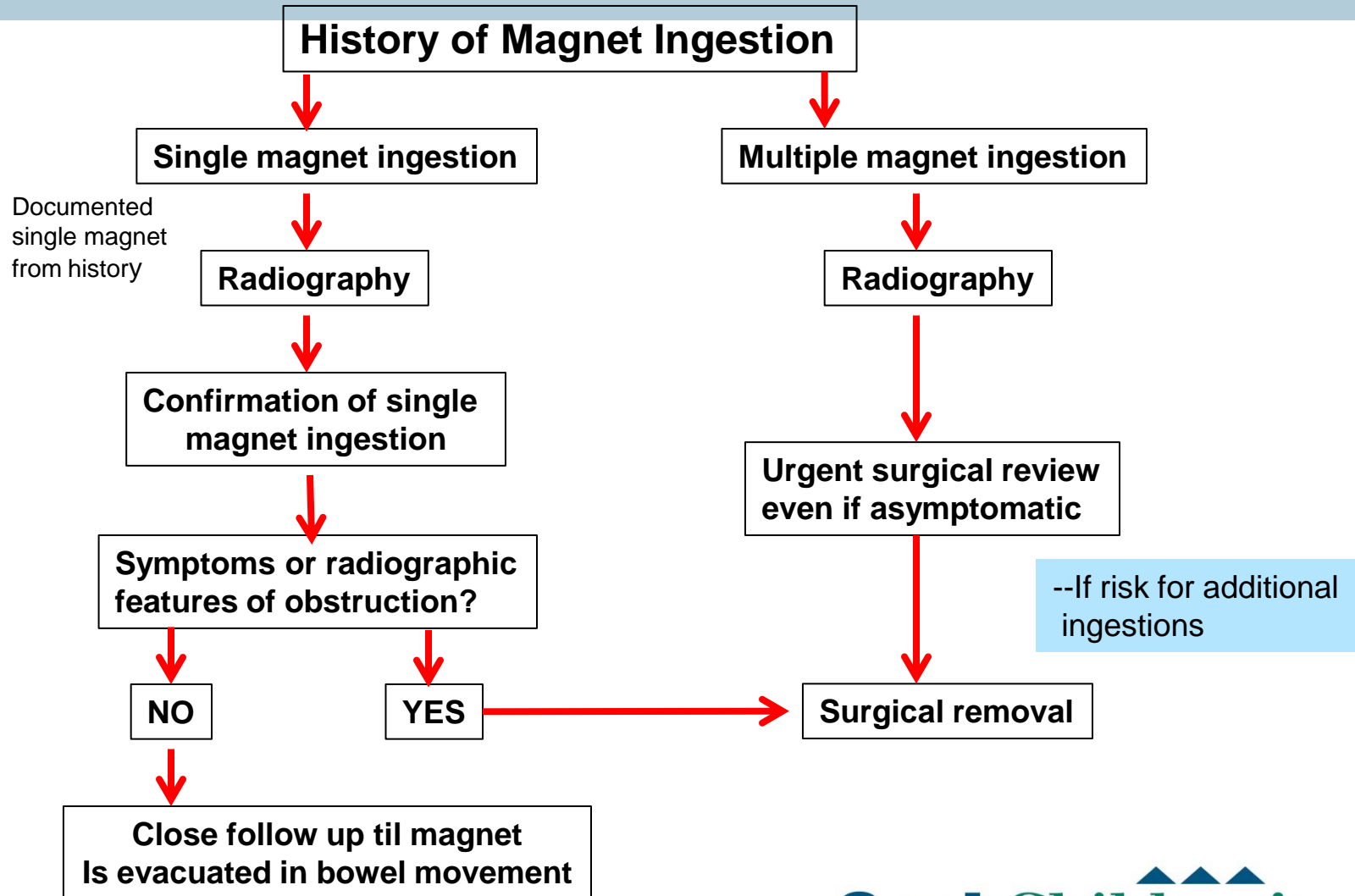
- Greater 50% of ingestion involve 2-6 magnets
- Dangerous: strong attraction across bowel walls leading to
 - Pressure necrosis
 - Ulceration
 - Bowel perforation
 - Fistula formation
 - Bowel obstruction

Magnet

- Single magnet pose no problems
- REMOVAL:
 - if in esophagus
 - 2 or more needs to remove

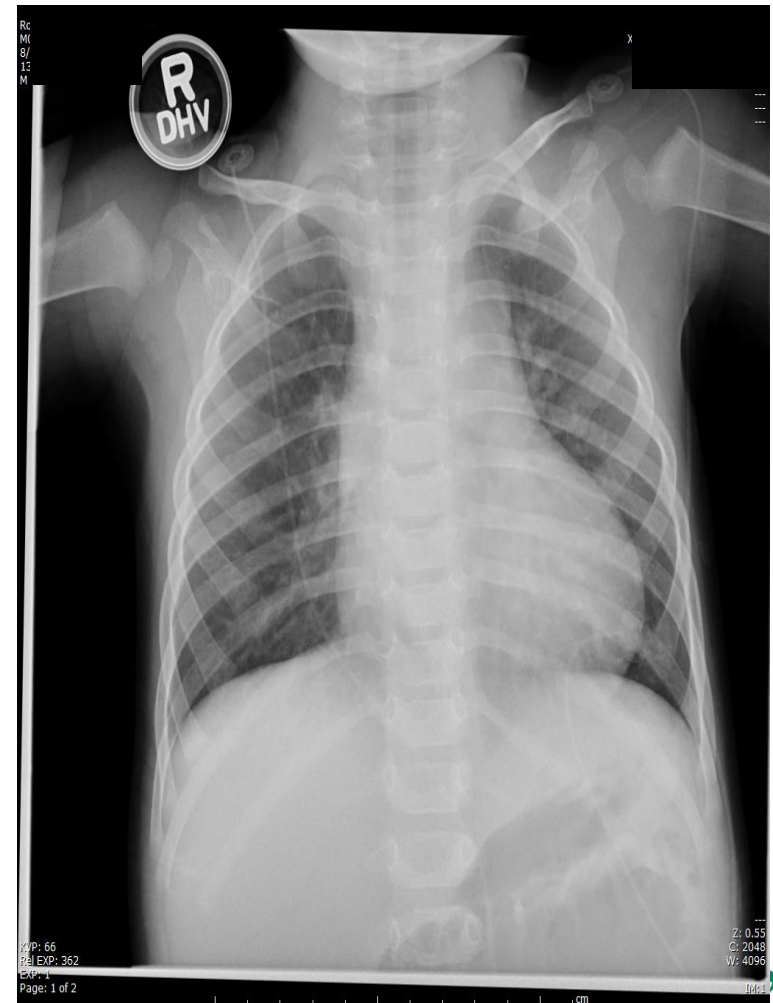


Management of Magnet

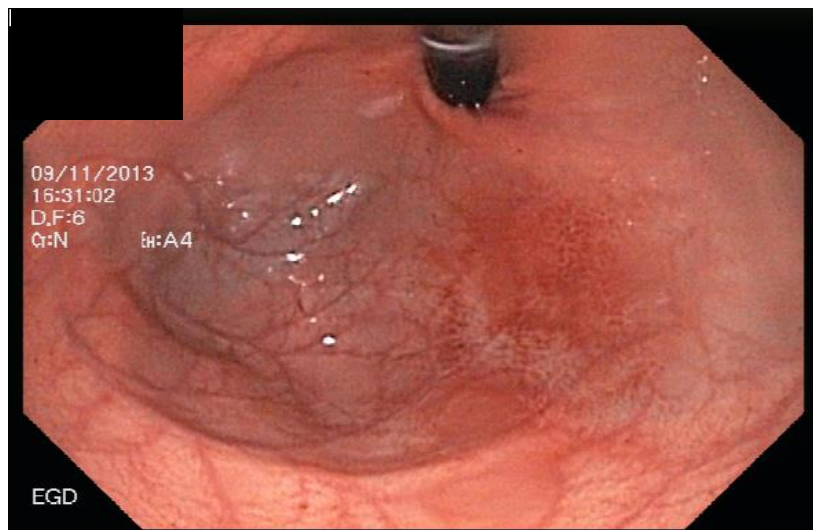
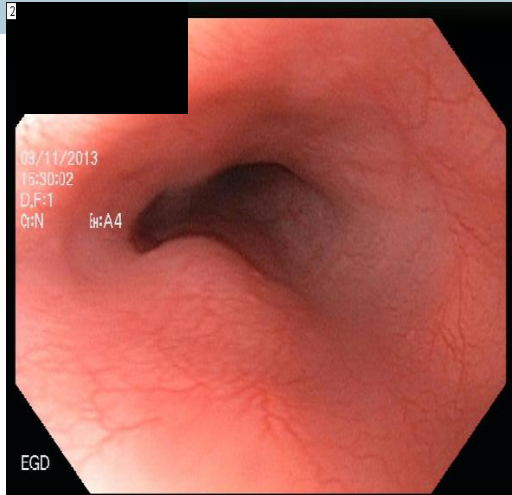


CASE #5 MILD Caustic

- 13 months old male
 - home with grandmother
 - 2 detergent pods and swallowed solution
 - Vomited x 1
 - crying, coughing
 - Poison Control
 - ED: Drooling, swollen lips, no hypoxia, sleepy



CASE #5 MILD Caustic



- Bx: Mild reactive changes in the stomach
- Admitted:
 - Acid suppression,
 - Advanced his diet
 - Discharged
- Follow-up:
 - Good condition

Caustic Ingestions

- 5,000- 18,000 accidental caustic ingestion reported per year in US (underestimated -only 10% reported)
- Alkali ingestions > acidic ingestions
- Two peaks of age distribution
 - Under 5 years old
 - 20-30 years old (intentional & larger volume)
- 1960s increased incidence due to usage of liquid alkaline cleansers
- The Poison Prevention Packaging Act (1970)
 - Limited concentration of caustic agent to 10%
 - Child-resistant containers

Laundry Detergent Pod (LDP) Ingestion

- Pods are **BAD**
 - Water-soluble membrane (polyvinyl alcohol)
 - Contains higher concentration surfactant components (Ethoxylated alcohols, propylene glycol, alkylbenzene sulfonate) → caustic injury
 - Intoxication from propylene glycol → lactate, metabolic acidosis
 - CNS effect from ethoxylated alcohols
- Small case series (Beuhler MC et al. 2013)
 - 3 of 4 patients needed intubation
(respiratory; mental status changes)
 - 1 of the 4 had airway injury



Caustic Ingestion

■ Alkaline

- Drain cleaner, oven/grill cleaner, dishwasher detergent, lye
- Most common: Developed countries (West)
- Odorless & tasteless & not immediately painful
- Liquefaction necrosis: liquefy tissue by dissolving lipid leading to deeper penetration
- Erythema, deep ulcers, perforation

■ Acid (15% of CI)

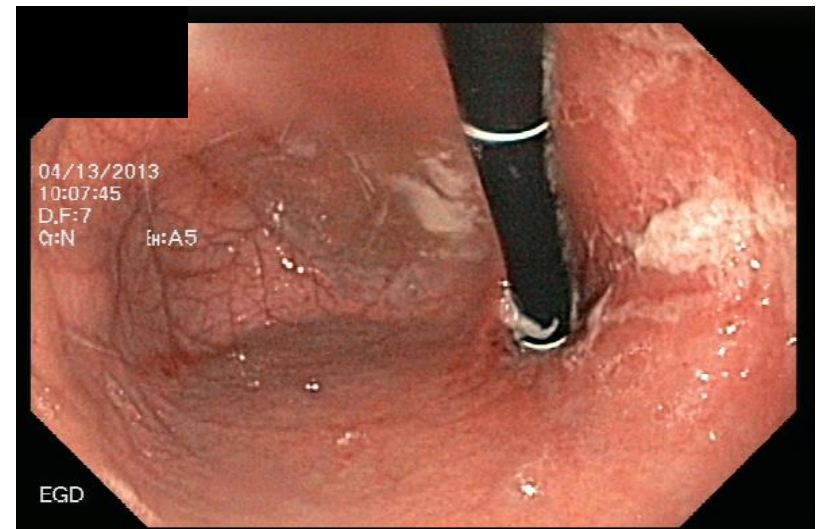
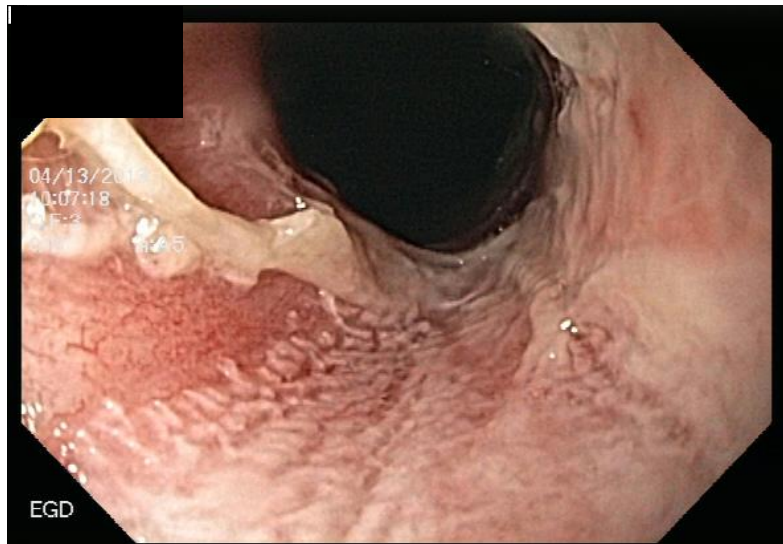
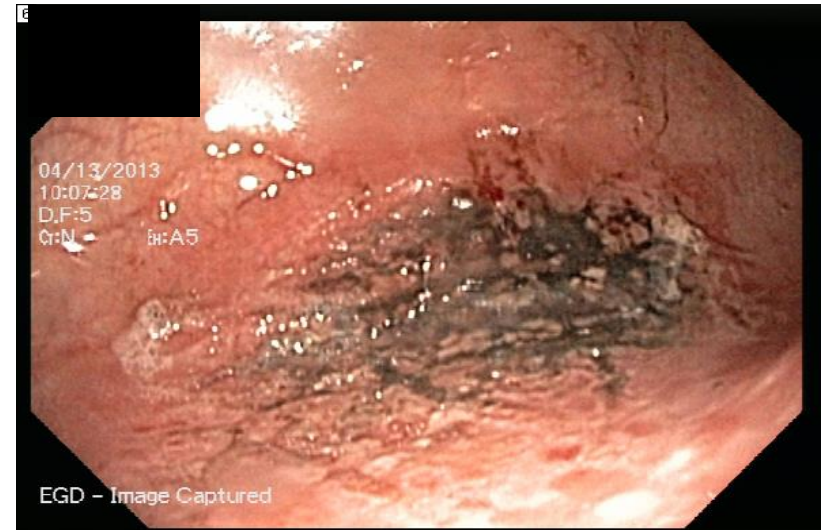
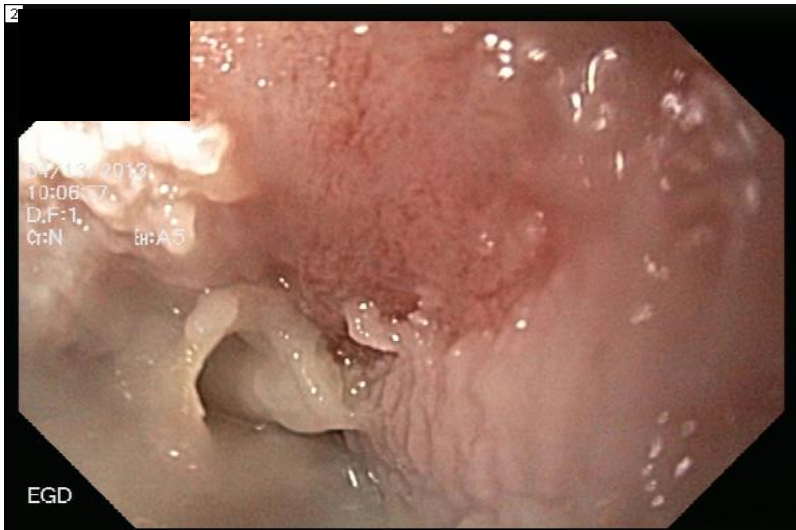
- Concentrated vinegar, swimming pool cleanser, toilet/industrial cleaners
- Most common: Developing countries
- Bitter taste & immediately painful
- Coagulate protein resulting in an eschar (partially inhibits deeper damage)
- Deep ulcer, perforation (large volume)

CASE #6 SEVERE Caustic

- 2 years old female
 - Swallowed industrial strength 12.5% bleach (obtained from work-dairy farm)
 - Cry, bleeding lips, drooling and vomiting en route to local ED
 - Transferred to Cook ED
 - Ulcers in mouth, drooling

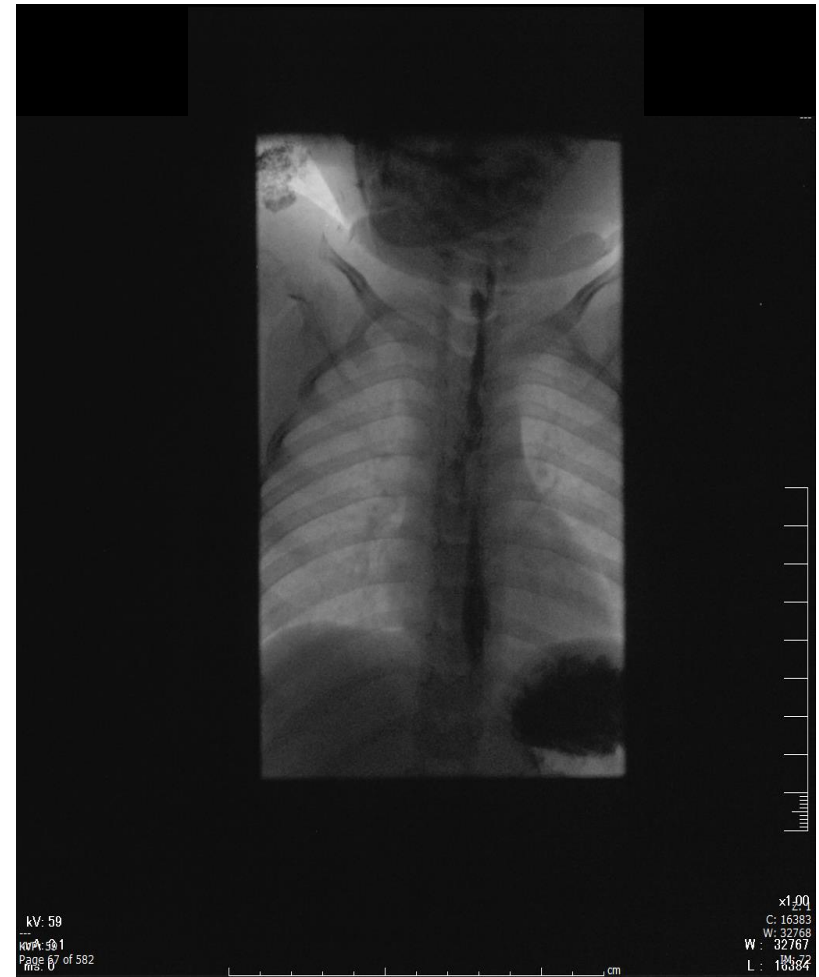


CASE #6 SEVERE Caustic

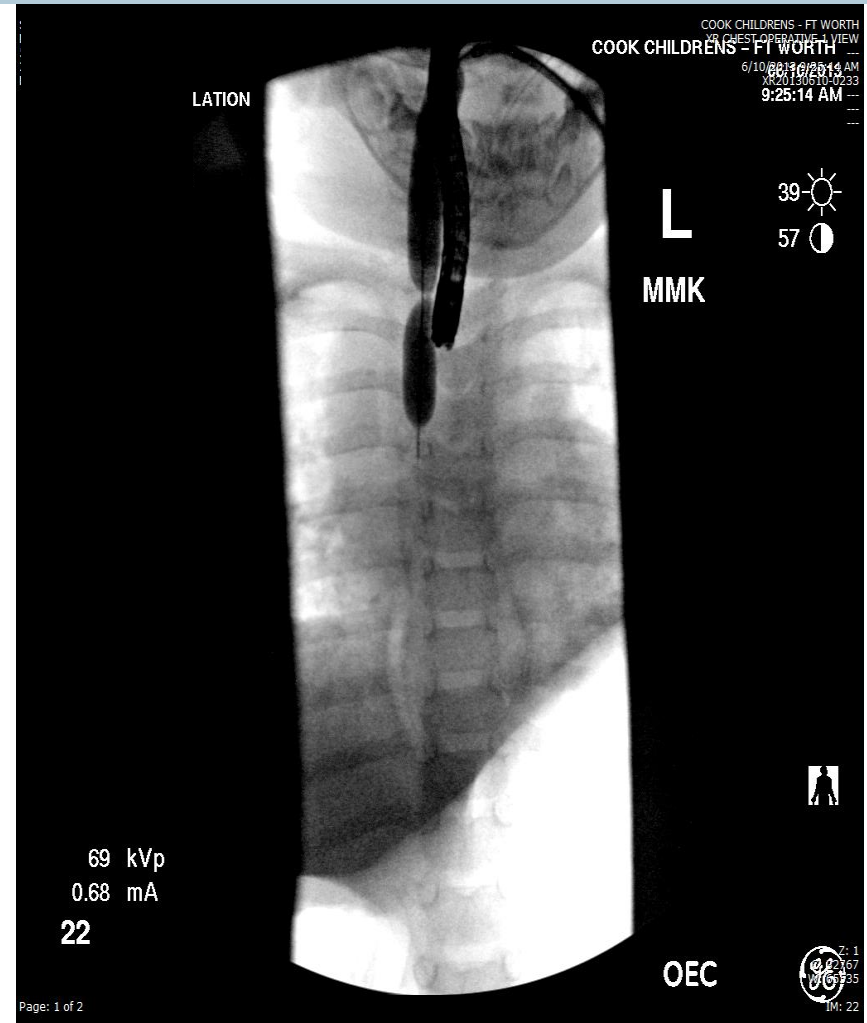
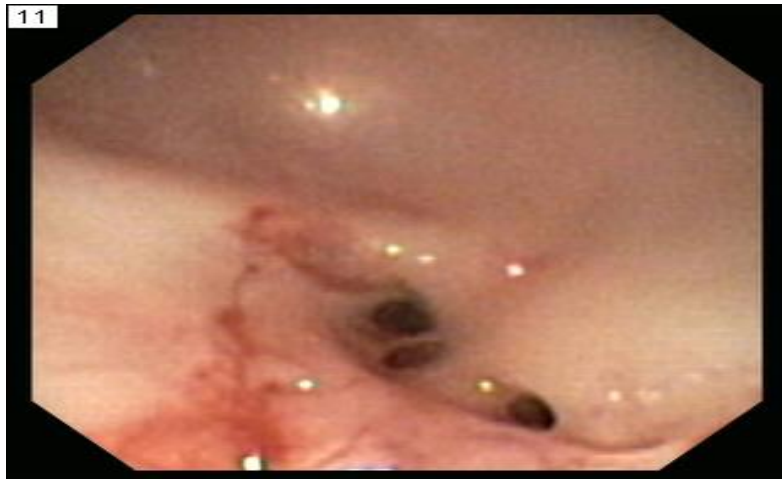


CASE #6 SEVERE Caustic

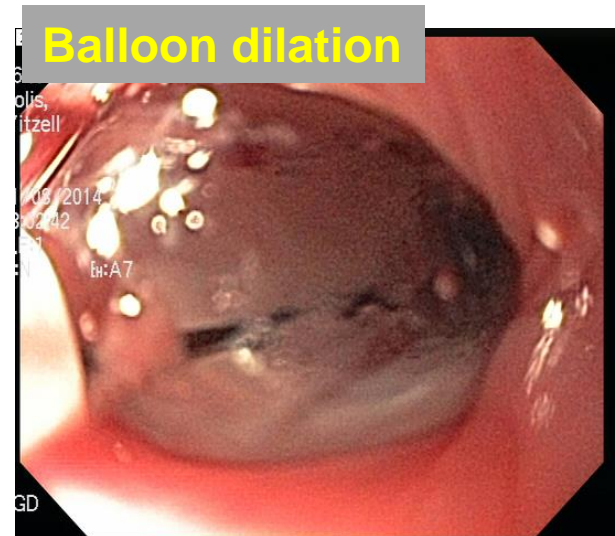
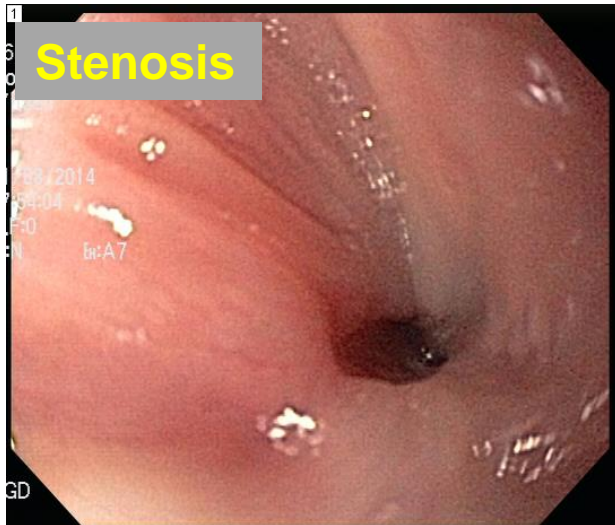
- Follow-up UGI: 4 weeks



CASE #6 SEVERE Caustic



CASE #6 SEVERE Caustic



Caustic Ingestion

- Degree of damage is related to the alkalinity
 - pH 9-11: rarely cause significant injury
 - pH >11: severe burns
 - Household bleach has concentration of 5% to 10% with pH 11-12
- Products in granules or crystal more dangerous due to better adherence to mucosa

Caustic Ingestions Presentation

- Pain, dysphagia, drooling, refusal to swallow, stridor
- Visible mouth lesions
 - Absence oral lesions does NOT correlate with degree of injury
- Gastric perforation
 - Shock, fatal
 - Hemorrhagic pancreatitis
 - SB perforations
 - Peritonitis

Caustic Ingestion

- Visible oral ulcers do not predict the extent of damage
- 378 pediatric patients over 10 year period with caustic ingestion
- **Symptoms**
 - (298 patients)
 - 82% Grade 0/1
 - 18% Grade 2
 - 2% later stricture
- **No symptoms**
 - (80 patients)
 - 88% Grade 0/1
 - 12% Grade 2
 - 1% later stricture

Classification of caustic injury

| GRADE | Visible Appearance | Clinical Significance |
|----------|--|--|
| Grade 0 | History of ingestion, no visible damage | Able to take fluids immediately |
| Grade 1 | Edema, loss of normal vascular pattern, hyperemia. No transmucosal injury | Temporary dysphagia, able to swallow within 0-2 days. No long-term sequelae |
| Grade 2a | Transmucosal injury, friability, hemorrhage, blistering, exudate, scattered superficial ulceration | Scarring. No stenosis if no circumferential damage. No long-term sequelae. |
| Grade 2b | Grade 2a +deep ulceration and/or <u>circumferential</u> ulcers | Small risk of perforation. Scarring may result in stenosis. |
| Grade 3a | Scattered deep ulceration with necrosis of tissue | Risk of perforation. High risk of stenosis. |
| Grade 3b | Extensive necrotic tissue | High risk of perforation & death. High risk of stenosis. |

Management of Caustic Ingestions:

Observation

- Asymptomatic
- Limited history of ingestion to taste or lick
- Clear fluids can be given
- Observe 4-6 hours and observe at home

Endoscopy within 12-24 hr

- Symptomatic
- Firm history of ingestion
- Intentional ingestion yet asymptomatic
- Oral burns
- Stabilized & hospitalized
 - Intubated: Respiratory tract is involved.
 - Grade 2 or 3 injury: ICU

Caustic Ingestion: Management

- NG/ Transpyloric tube
 - Grade 2b or greater
 - Stent and route for feeding (larger diameter the better)
 - NEVER place blindly
- G tube
 - Grade 3 to esophagus
- TPN
- Antibiotics
 - Fever
 - Grade 2b or greater
- Steroids (Controversial) - effect in scar prevention
- Acid reduction

Long-term Management

- Esophagus weakest at 1-3 weeks after ingestion
 - Collagen deposition not present until after second week
 - Avoid scope and dilation
- Grade 2 or greater
 - Rescope in 3 weeks
- Contrast studies for strictures
 - Scar retraction begins by 3 weeks and ongoing for several months



Caustic Ingestion: Longterm Problems

- Stricture
 - Balloon (longer stricture) or Bougies dilation
 - Triamcinolone injection
 - Perforation rate with dilation (0.4 to 32%)
- Shortening of esophagus
 - Sliding hiatal hernia
 - Worsened reflux (impaired LES sphincter pressure)
- Dysmotility
 - Alkaline injury with deeper mucosal injury

Long-term Management

- Surgery for non-responding esophageal stricture
 - Reconstruction with gastroplasty
 - Coloplasty (more functional failures compare to gastroplasty).

Caustic Ingestion: Longterm Problems

- Esophageal cancer (squamous cell and adenocarcinoma)
 - 1,000-3000 times higher than general population
 - Latency period (mean time of 41 years)
 - Periodic surveillance is necessary
 - Endoscopy preformed 15-20 years after caustic ingestion for neoplastic screening

Foreign Body: TAKE OUT

- Symptomatic
- Coins in esophagus for >24hours
- Coins in stomach \geq 4 weeks
- Sharp objects
- Disk batteries in esophagus
- Disk batteries in stomach >48 h
- Big objects
 - >5 cm long (children) or >3 cm long (infants)
 - >2 cm diameter
- Over staying >1 week in same intestinal location
- High-powered magnets



Caustic Ingestion

- Visible oral ulcers do not predict the extent of damage
- Always evaluate if history is firm
- Damage can be lifelong

National Battery Ingestion Hotline website or 202-625-3333
www.poison.org/battery/guidelines.asp



Good to EAT



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