Pediatric Surgical Emergencies

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Pediatric General Surgery

Evaluation of the pediatric acute abdomen

- One of the more common ED visits
- Appendicitis accounts for about 90,000 cases per year
- Others to consider at any age:
  - Malrotation
  - Mechanical bowel obstruction
  - Meckel's diverticulum

Breakdown of common diagnoses by age

Baby	• Neonatal bowel obstruction • Necrotizing enterocolitis • Nonaccidental trauma • Hirschsprung's associated enterocolitis • Nonaccidental trauma • Abdominal/retroperitoneal mass
Toddler	• Intussusception • Appendicitis (complicated) • Nonaccidental trauma • Hirschsprung's associated enterocolitis • Abdominal/retroperitoneal mass • Pneumonia

Age breakdown, con’t

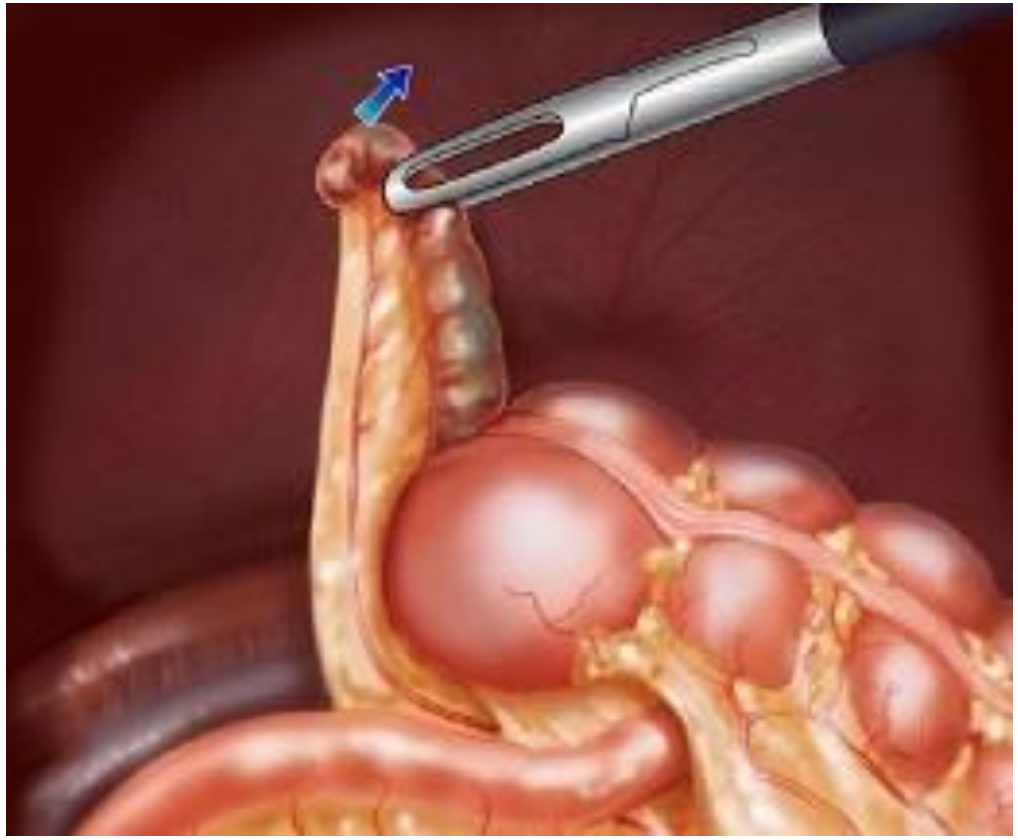
Pre-teens	• Appendicitis • Biliary (cholecystitis, dyskinesias, choledocho) • Ovarian torsion • Viral gastroenteritis • Mesenteric adenitis
Teenagers	• Appendicitis • Biliary (cholecystitis, dyskinesias, choledocho) • Ovarian torsion • Pelvic inflammatory disease • Inflammatory bowel disease • UTIs • Kidney Stones • Gastric and duodenal ulcers

- 6 year old boy presents to the ED with abdominal pain. Started periumbilical, migrated to the RLQ.

- He is nauseated but not vomiting. He has not eaten since yesterday. He has a low grade fever of 99-100.

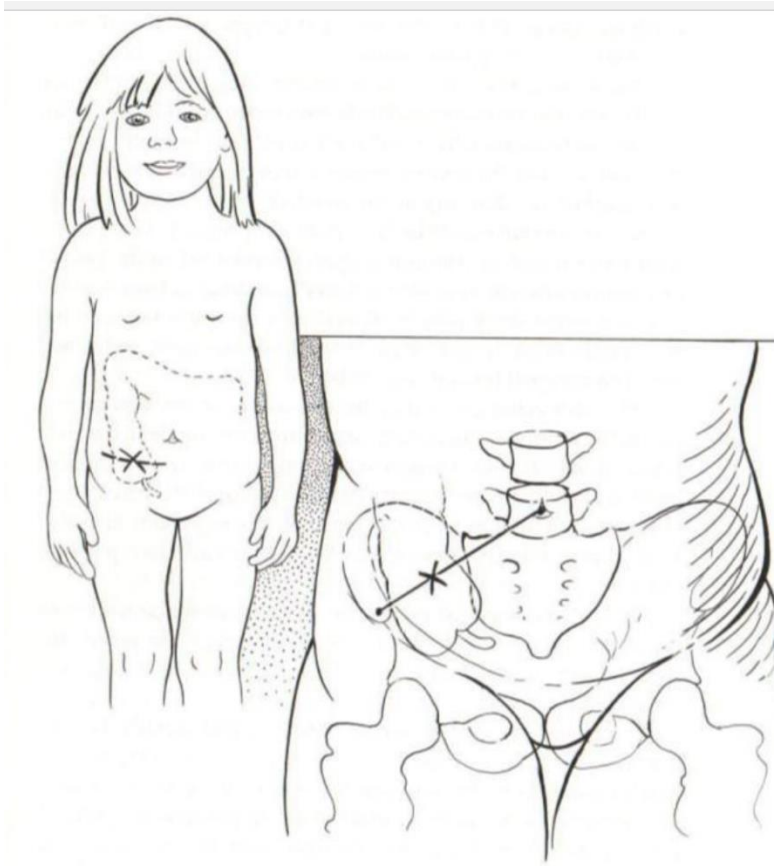
Appendicitis

- Most common pediatric surgical emergency
- Highest incidence occurs between 10-19 years old
- Caused by luminal obstruction from lymphoid hyperplasia, fecolith or intestinal parasites



Appendicitis, con't

- Typical presentation
- Simple or complicated
  - A continuum...
    - Eventual perforation
    - Increased risk of intra abdominal abscess formation, longer operative time, more difficult operation, prolonged hospital course
- Very difficult to diagnose in toddlers and preschoolers
  - Almost always perforated



Appendicitis: workup

- Labs
  - CBC, CRP
- Imaging
  - US versus CT
  - Role of rapid MRI
- Management
  - IV fluids
  - Abx
  - Medical vs surgical management?

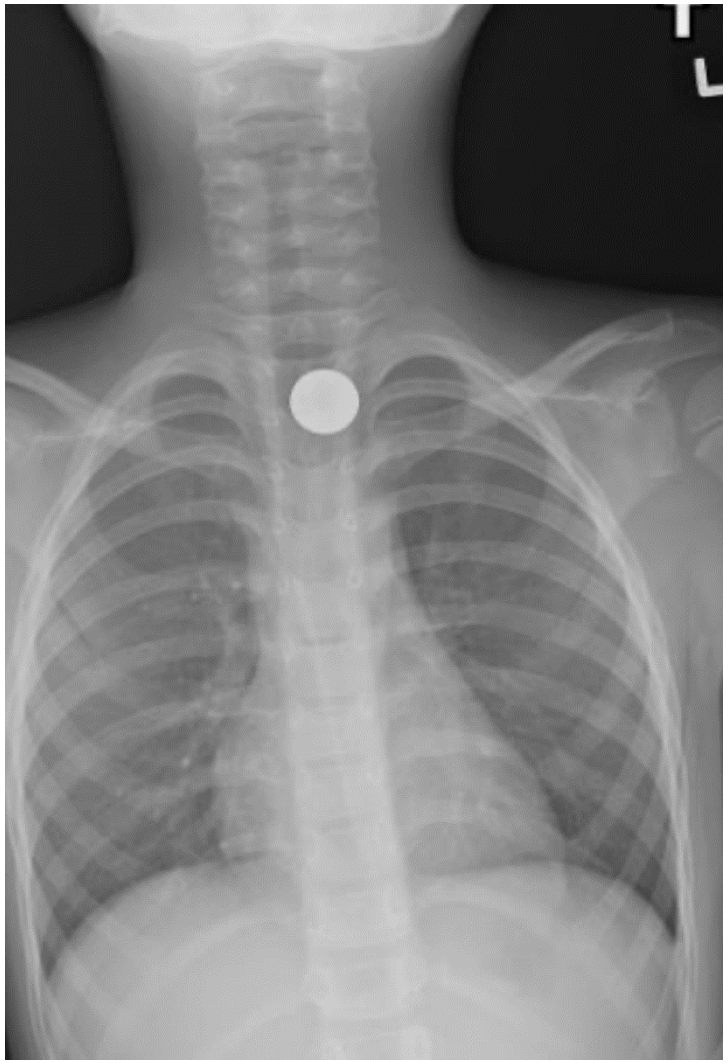
Appendicitis, cont

- Timing of surgery
  - Urgent not emergency surgery
  - Following morning is safe in many studies
- What about complicated appendicitis?
  - Many days of pain and large abscess
  - Consideration for IR placed drain and medical management
  - Do they need an interval appendectomy?

- A 2 year old male comes to the ED with parents. They state that they found him playing with a bowl of coins at grandma’s house. Since then, he has been drooling and won’t eat or drink.

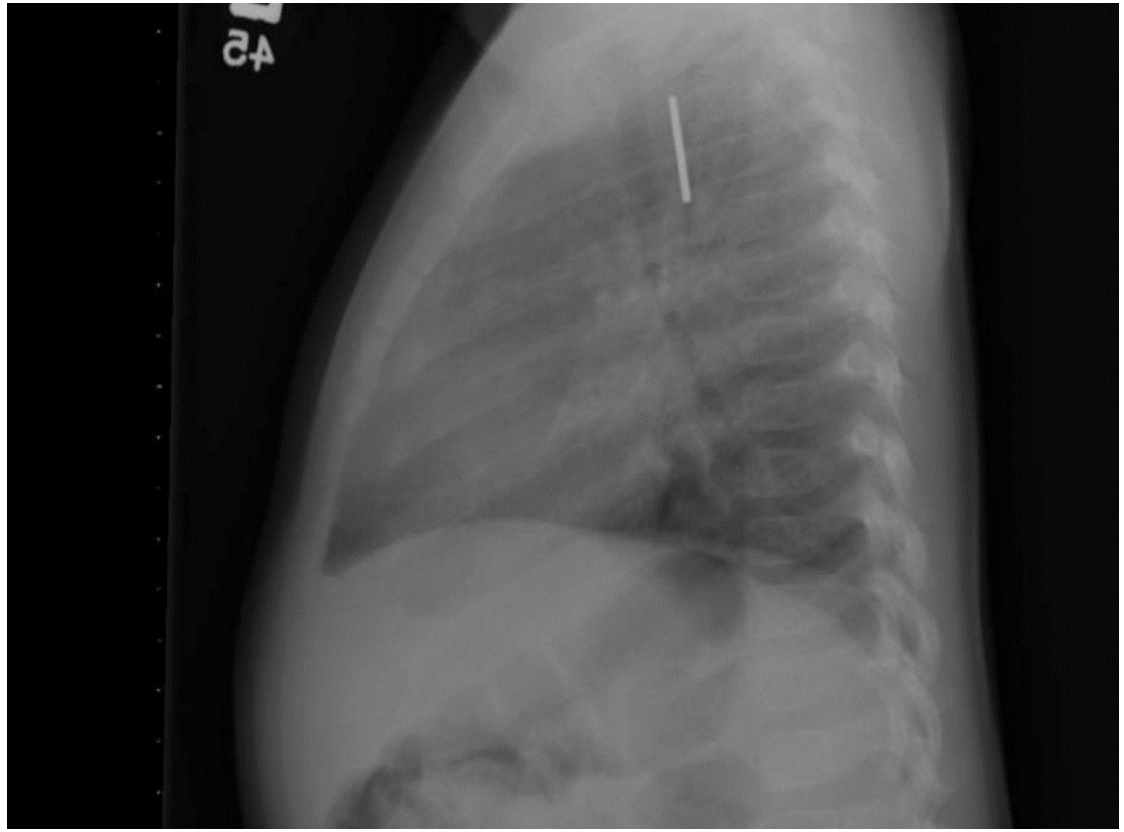
Esophageal foreign bodies

- Account for about 50%-75% of GI foreign bodies
  - Carries with it the highest risk of complications
- Presentations vary...
  - Vomiting, drooling, dysphagia, globus sensation
  - Onset can vary, but usually acute



Esophageal foreign body: workup

- Labs:
  - None necessary, but do need an iv before surgery
- Imaging
  - Multiple X-rays: FB nose to rectum
- Management
  - Surgery:
    - Rigid esophagoscopy
    - Coin bougienage
    - Foley catheter extraction



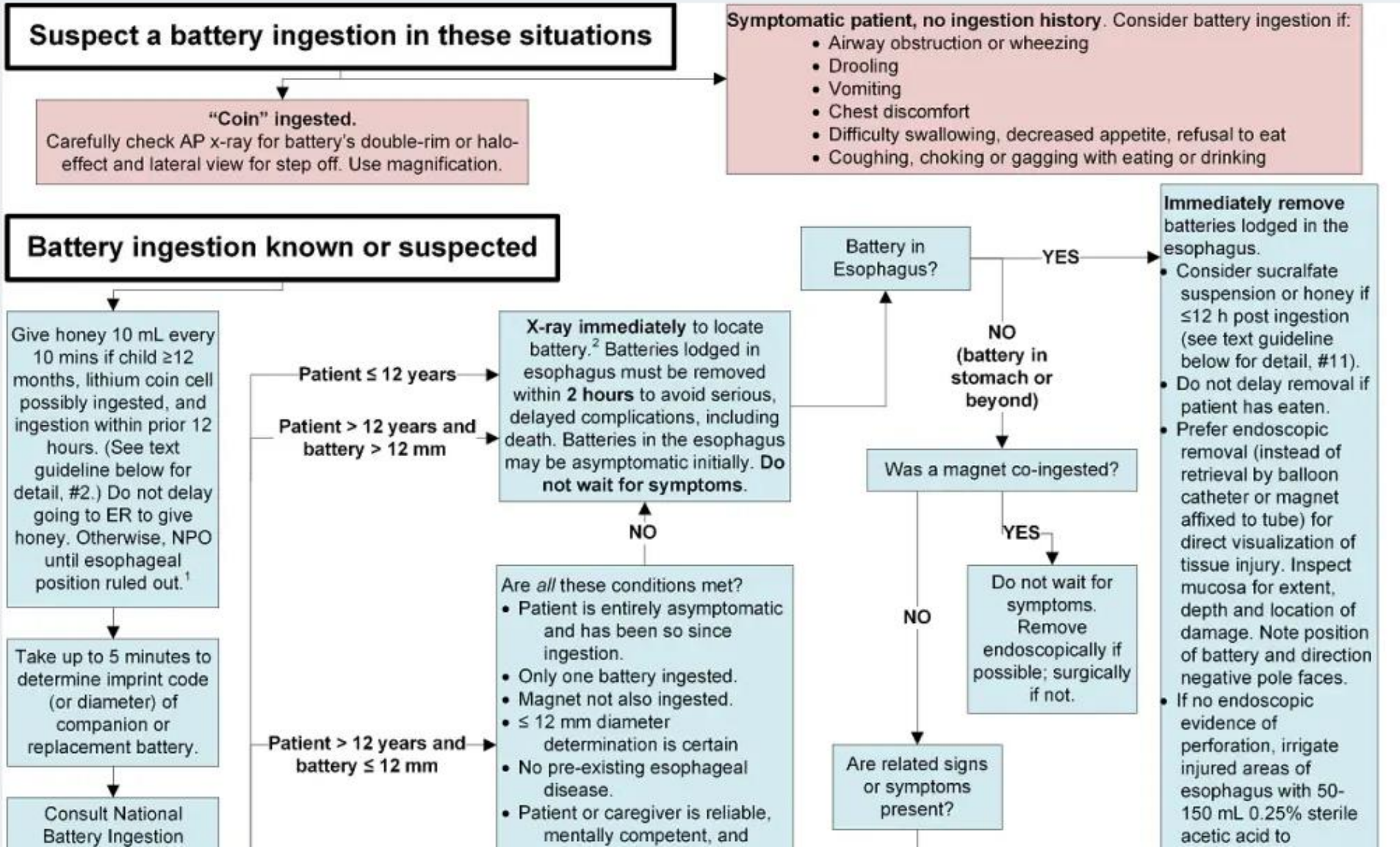
Specifically button batteries

- A true surgical emergency
- Injury to the esophagus from discharge of electrical current
- Learn to differentiate this from coins on xray

It’s a button battery, now what?

- Battery should be removed as quickly as possible.
- Complications are many and are severe:
  - Esophageal perforation
  - Tracheoesophageal fistula
  - Aortoenteric fistula with hemorrhage
- Can occur in as little as 2 hours

Poison Control Button Battery Ingestion Triage and Treatment Guideline



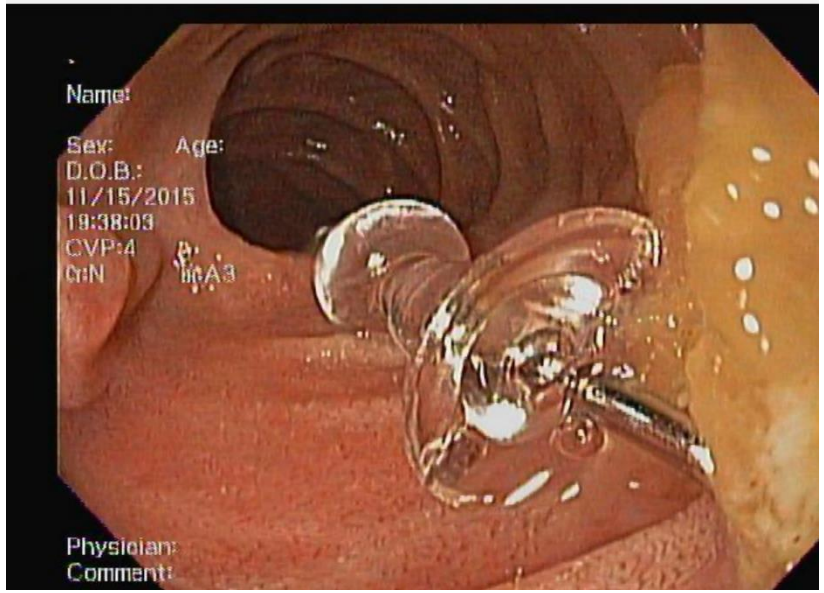
Honey dosing

- For children >12 months old
- 2 tsp of honey every 10 mins up to 6 doses
- No need to worry about exact dosing or timing
- Is not a substitute for prompt removal

- For children less than 12 months or in an inpatient setting, sucralfate is a great substitute and has also been studied.

Other foreign bodies…

- Gastroduodenal foreign bodies
  - Some can be small and asymptomatic => manage expectantly
  - Usually will pass if it makes it into the stomach (80-90%)
  - Long object (2-5cm in length) often have to be removed
  - Button batteries are less urgent, remove within 24h
- Intestinal and colorectal foreign bodies
  - Usually pass
  - Magnets can be a problem if not ingested at the same time


Name:
Sex: Age:
D.O.B.:
11/15/2015
19:38:03
CVP:4
Ch:N
Physician:
Comment:

A 2 month old is brought to the ED/clinic after mom noticed a swelling of his scrotum when changing a diaper.

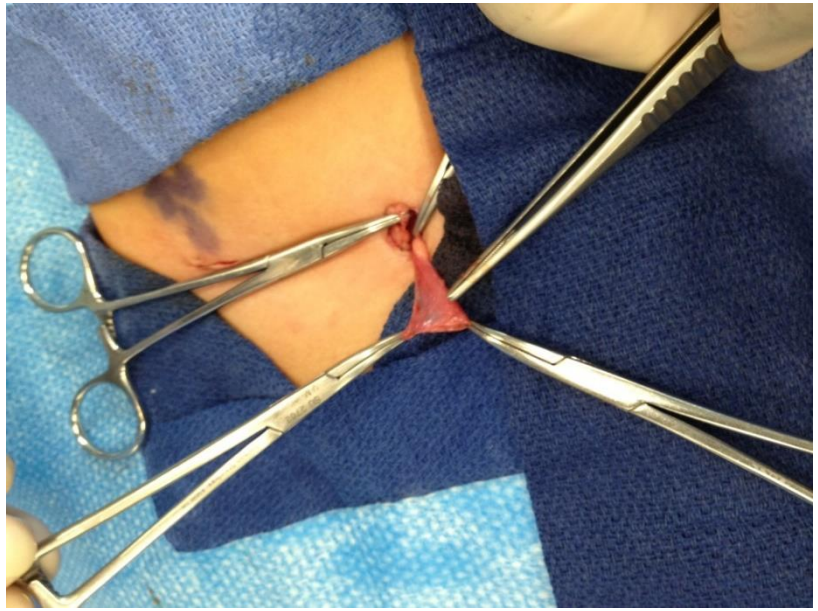
What is the diagnosis?

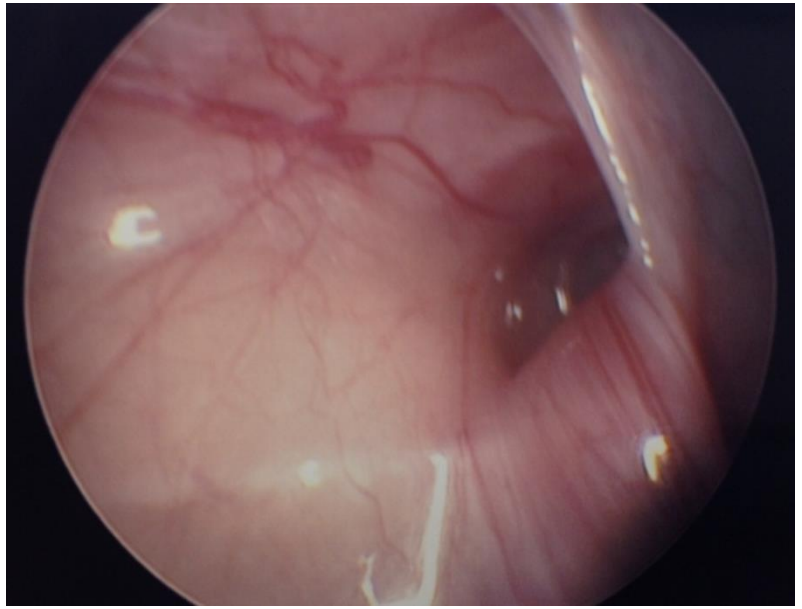
Inguinal hernia

- Up to 10% of a pediatric surgeon's practice
- Can be quite straight forward or a multi-hour endeavor

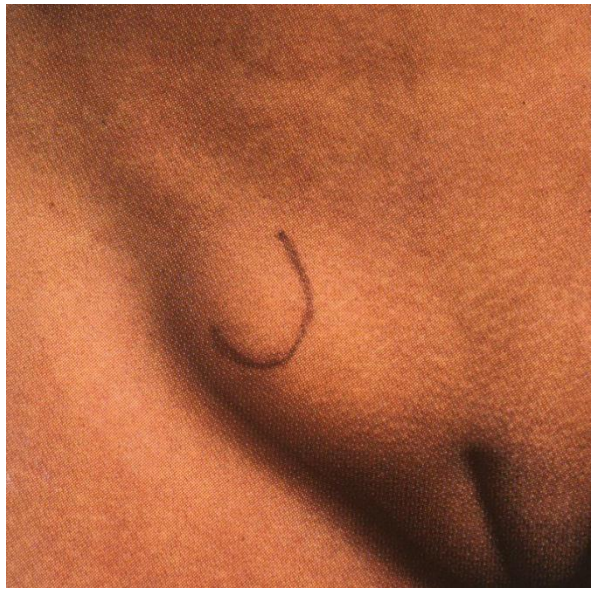
- In children, these are congenital
- Failure of obliteration of the processus vaginalis

- Pediatric hernia is **indirect**
- Repair with high ligation or laparoscopic approach

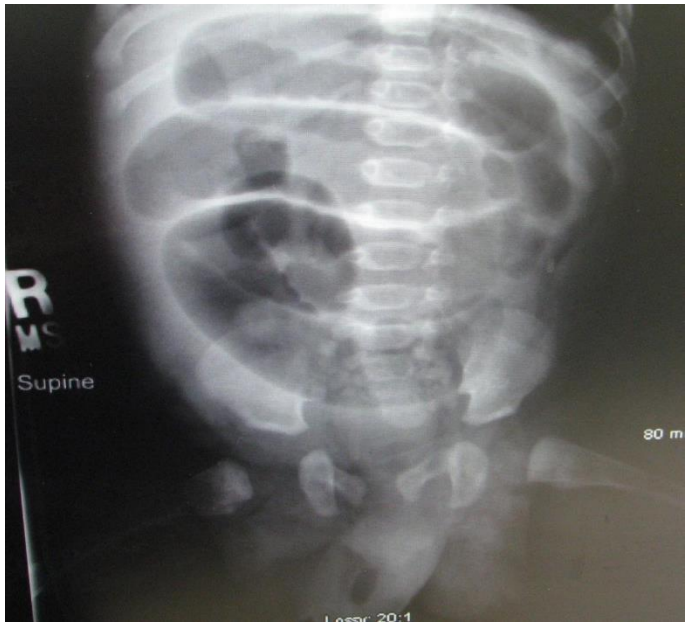




Presentation of inguinal hernia



- Variable
- Most are asymptomatic
- Can range from incarcerated to strangulated
  - Symptomatic = bowel obstruction like symptoms
  - Hydrocele is common as there is communication with peritoneal cavity



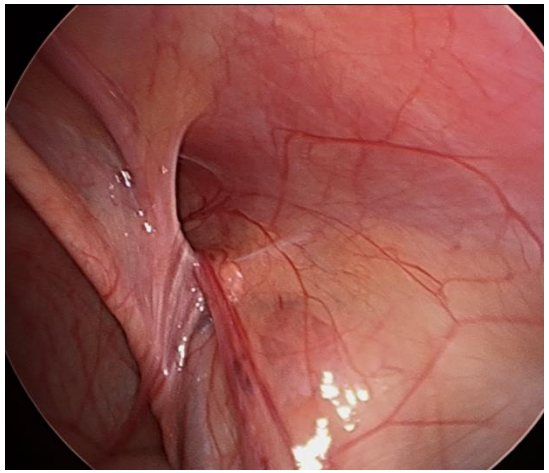
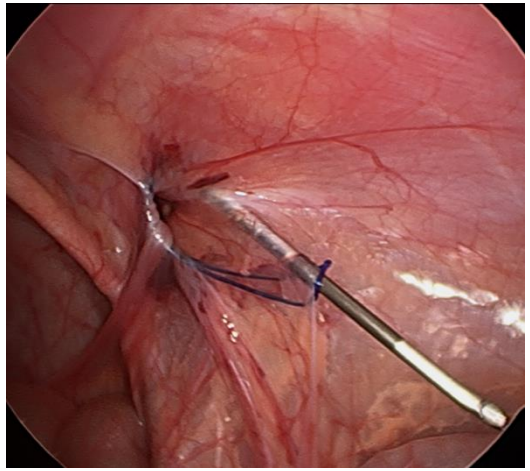
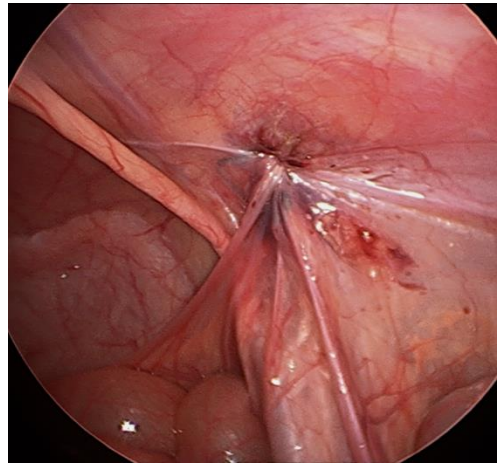
Urgency of repair

- Infants with concern for incarcerated or strangulated need an immediate ED evaluation by pediatric surgery
- Timing of repair based on assessment

- For all other inguinal hernias, they should be referred to clinic
- Elective repair offered to virtually all patients
- 17% risk of incarceration

- What to do with babies in the nicu?

Inguinal hernia

A 3 month old male is brought to the emergency room as he has been vomiting overnight. Mom reports that the emesis is bright green.

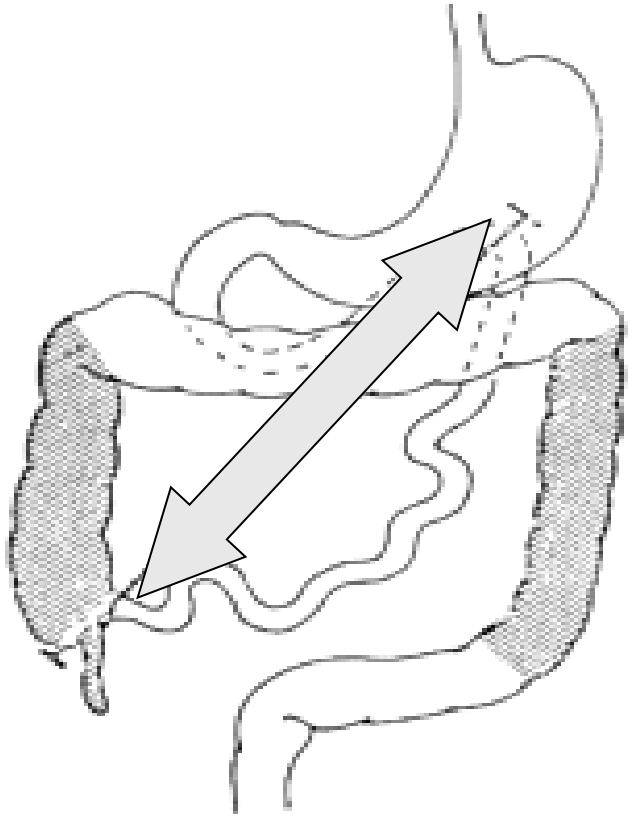
Next steps?

Intestinal malrotation

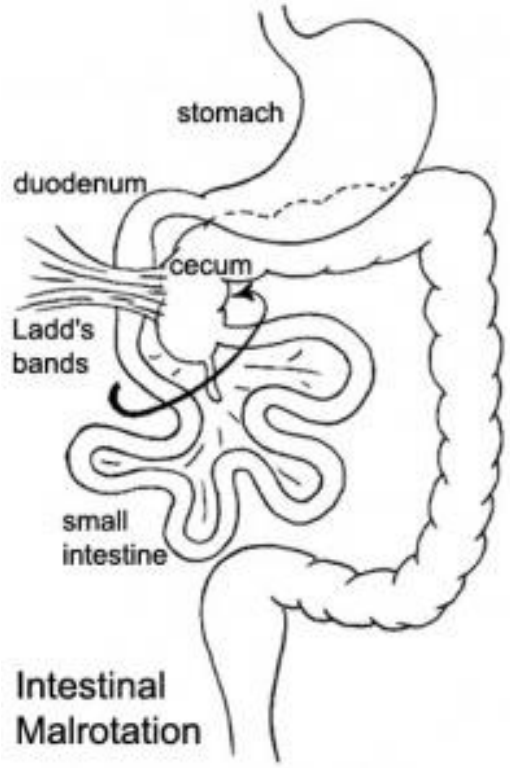
- Bilious emesis is a surgical emergency
- In patients without a clear explanation, this is malrotation with midgut volvulus
- Gold standard is an upper GI

- Incidentally found malrotation can prompt a clinic follow up in otherwise reassuring exam/presentation

Normal intestinal rotation

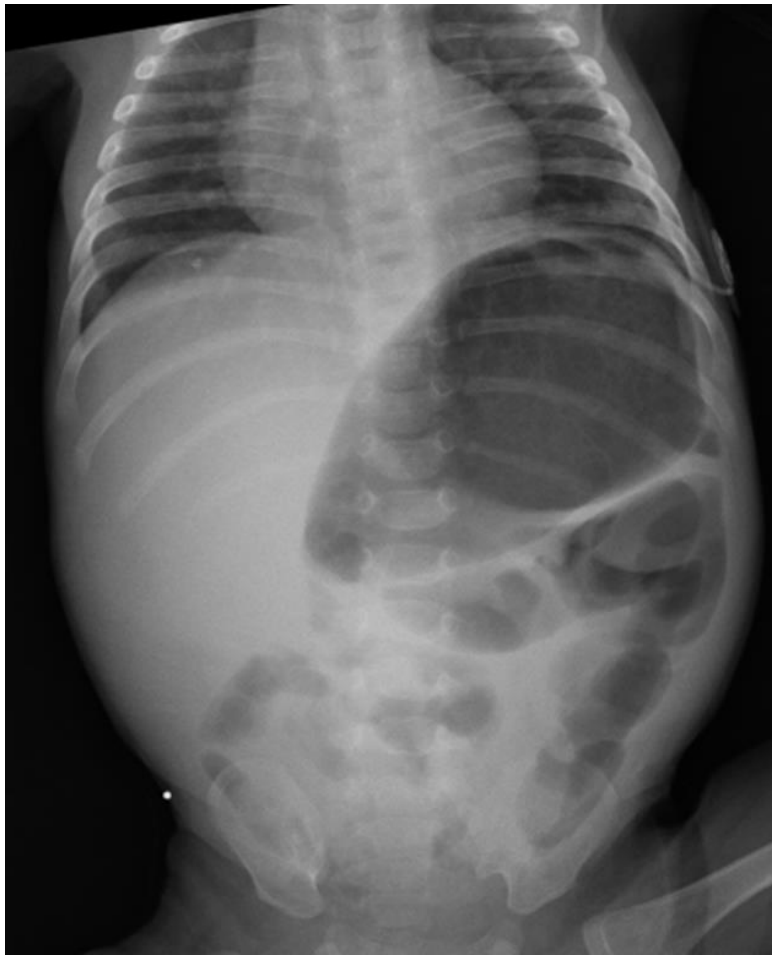


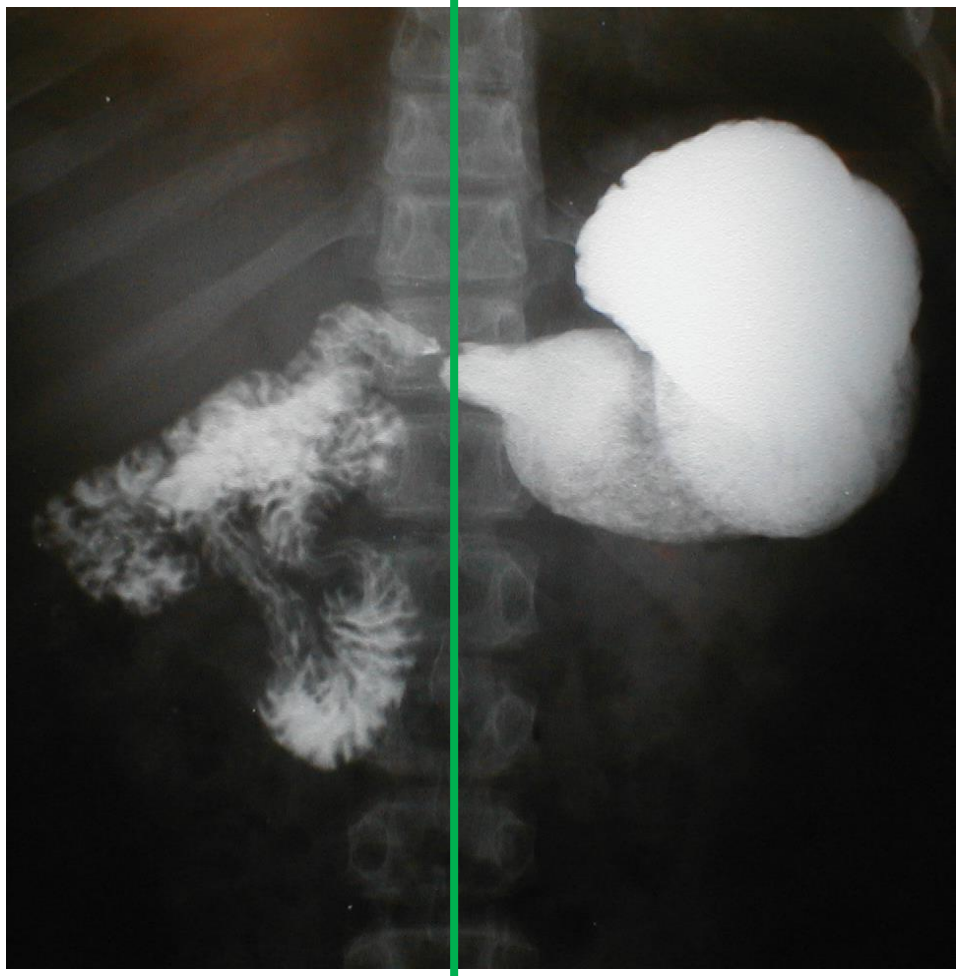
- Cecum right lower quadrant
- Duodenum left upper quadrant
- Broad based mesentery
- Fixation at duodenum, right colon and left colon


stomach
duodenum
cecum
Ladd's bands
small intestine
Intestinal Malrotation

Intestinal malrotation

- **Malrotation**: 1/200 to 1/500 live births
- **Symptomatic Malrotation**: 1/6000 live births
- 2/3 of those requiring surgery <1 month of age. 1/4 between 1 month and 1 year.





4 week old baby boy presents to the ER with a 2 week history of projectile vomiting. This has progressively gotten worse.

He is now lethargic and has not had wet diapers today.

What’s the diagnosis?

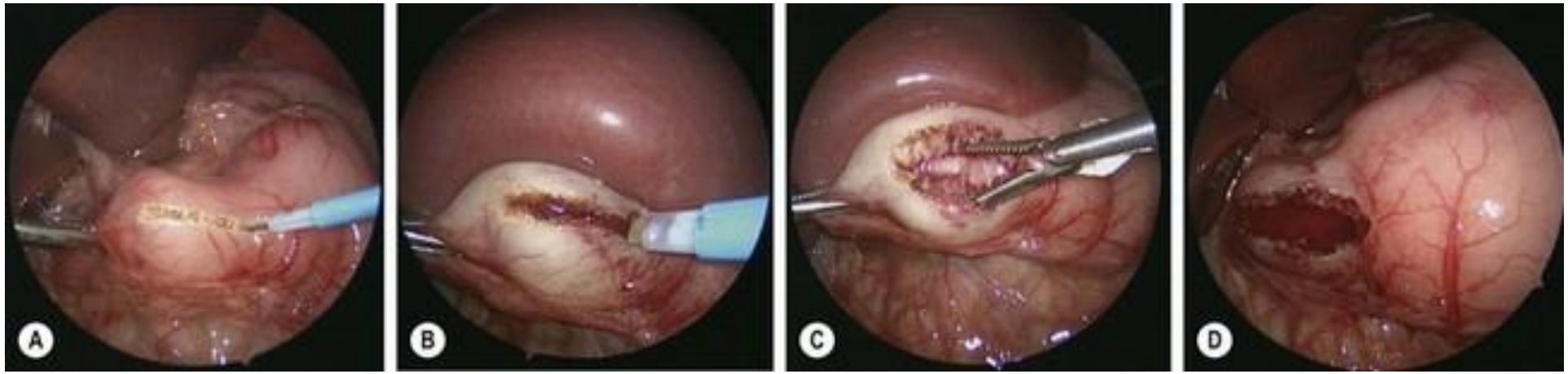
Pyloric stenosis

- 2-10 week old infant with nonbilious emesis
- Emesis progresses and worsens over time
- Commonly presents with electrolyte abnormalities

Pyloric stenosis workup

- U/S
  - Very specialized study
  - Thickness: 4mm or greater
  - Length: 15mm or greater
  - Most predictive: lack of passage of gastric contents
- Labs
  - Degree of dehydration will determine timing of surgery
  - Sometimes this can be several days

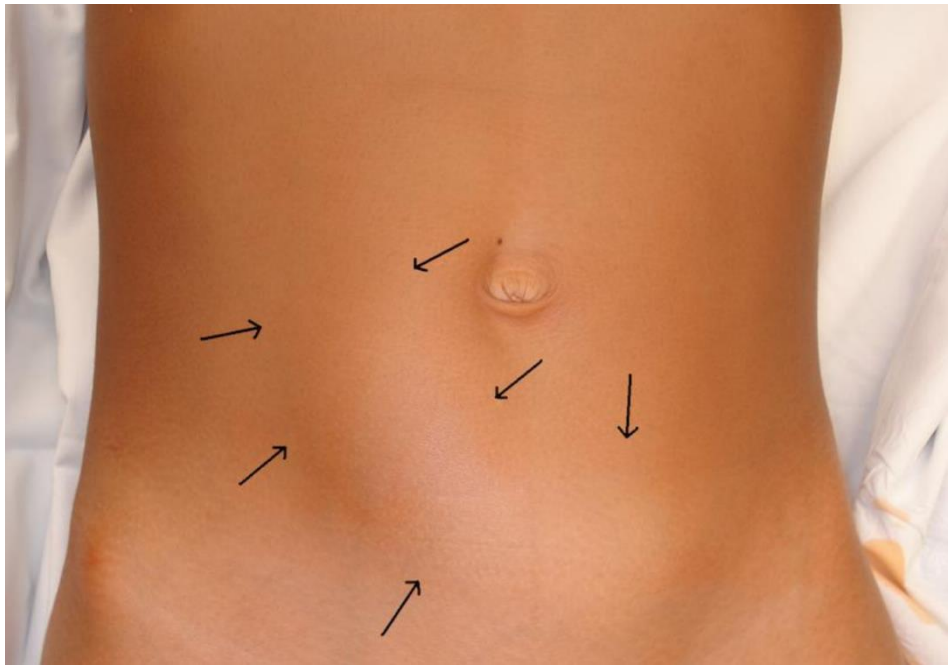
Operative treatment



- 20 month old girl with a history of rhinovirus now in the ED with crampy abdominal pain.
- Parents tell you she has had diarrhea and vomiting for 3 days.
- Pain is colicky and now she is passing stools that look like dark currant jelly.
- She is tender on the right side of her abdomen

Intussusception

- Common in children around 5 months-2 years
- Commonly caused by a lead point
  - Enlarged Peyer's patches
    - Explains the viral illness preceeding intussusception
  - Pathologic lead points in about 10% of patients
    - Meckel's diverticulum, intestinal polyp, lymphoma
- Classic triad of colicky abdominal pain, vomiting and current jelly stool



Intussusception workup

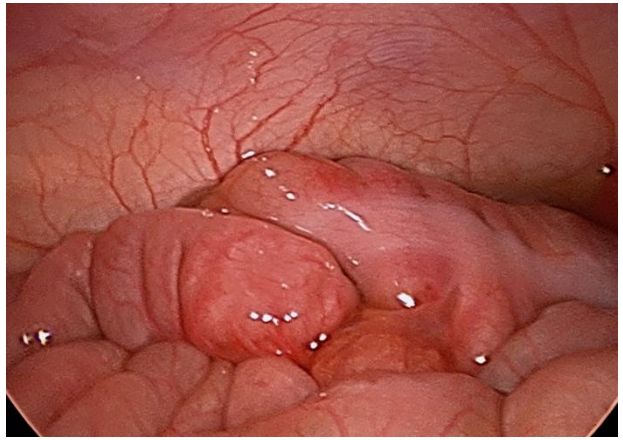
- Abdominal u/s
  - Most sensitive test
  - Finding of invaginated bowel, aka “target sign”
- What about incidental intussusception found for another reason?
  - Transient intussusception, often small bowel-small bowel
  - Low clinical significance

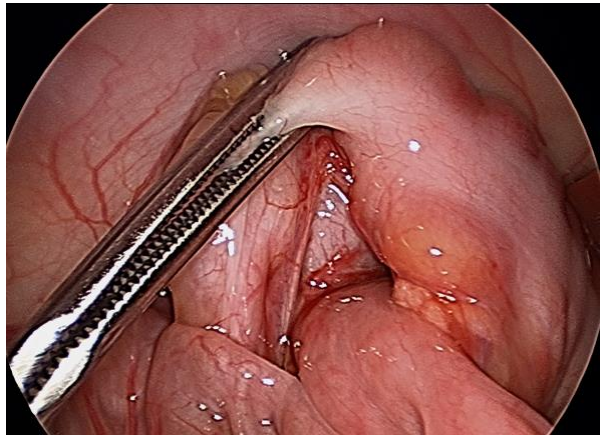
Intussusception mgmt

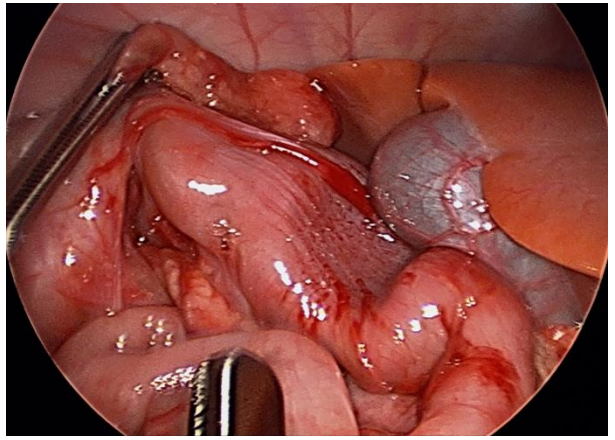
- IV and fluid resuscitation, as they are often are ill from a viral illness
- Reduction by radiology if no signs of peritonitis
  - Air or contrast enema
- Failed radiographic reduction => surgery

Operative management

Laparoscopy



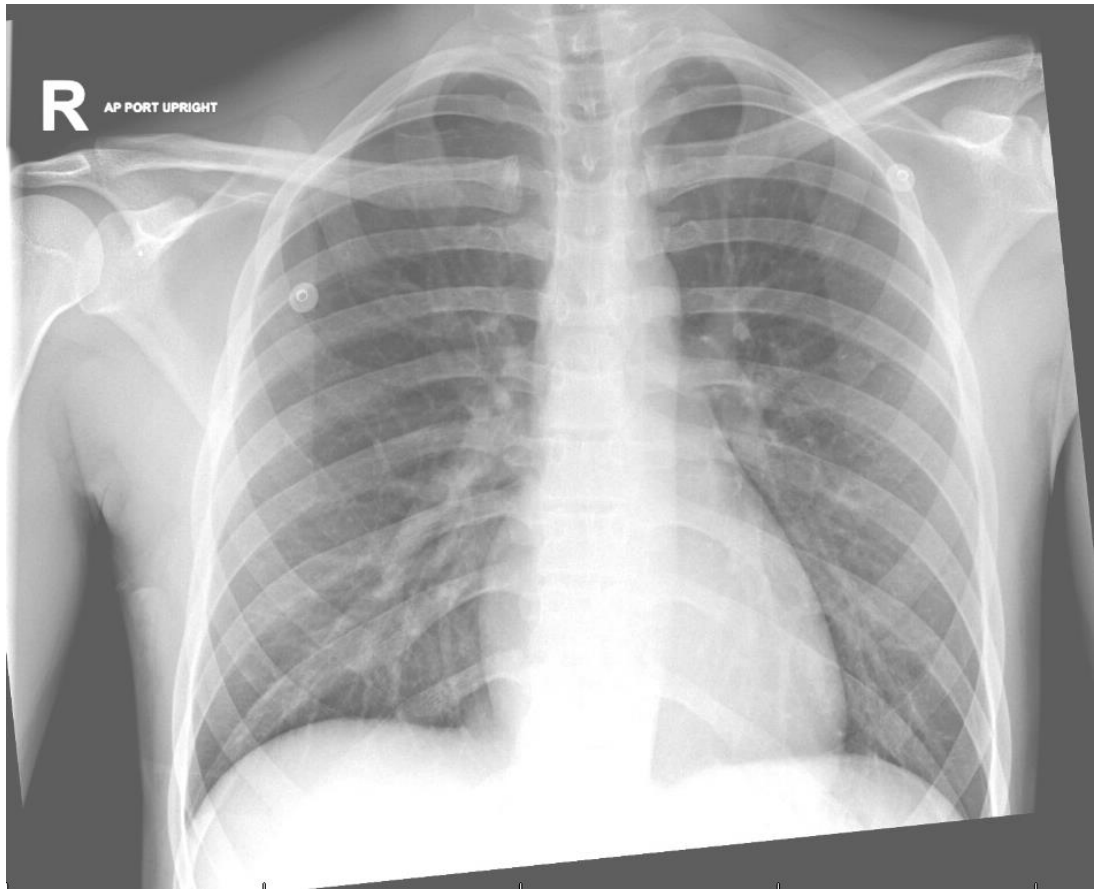




- 16 yo male comes to ED with complaints of chest pain, especially with deep breaths

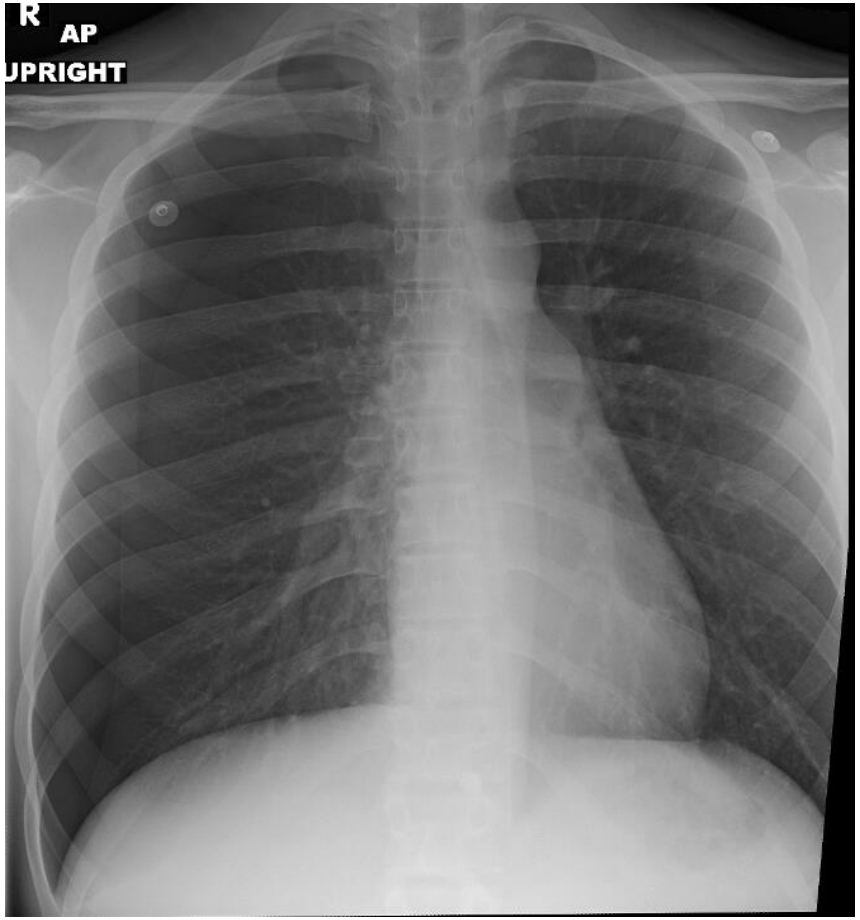
Spontaneous pneumothorax

- Unrelated to trauma or previous surgery
- Due to undiagnosed bleb disease
- Present with sharp, pleuritic chest pain
- Physical exam may be subtle
- Imaging = CXR
  - Used to categorize small or large
  - CT imaging not supported by the literature



Spontaneous PTX, con’t

- Large PTX
  - Often defined as complete dehiscence of the lung edge from the chest wall
  - About 15% of the thoracic volume
- Treatment of small symptomatic or all large PTX = chest tube
- Surgery reserved for recurrent PTX



- 4 month old male is brought to the ED for an area of induration and firmness on the buttock extending to the anus. This started as a small pimple under the diaper several days ago.

- What’s going on?

Perianal abscess and fistula

- One area especially where children are not “just little adults”
- Typically a much more benign disease in children
- Patients are usually healthy, with no signs of systemic disease
- Usually a healthy male infant less than 1 year old
- Begins as a pimple near the anus

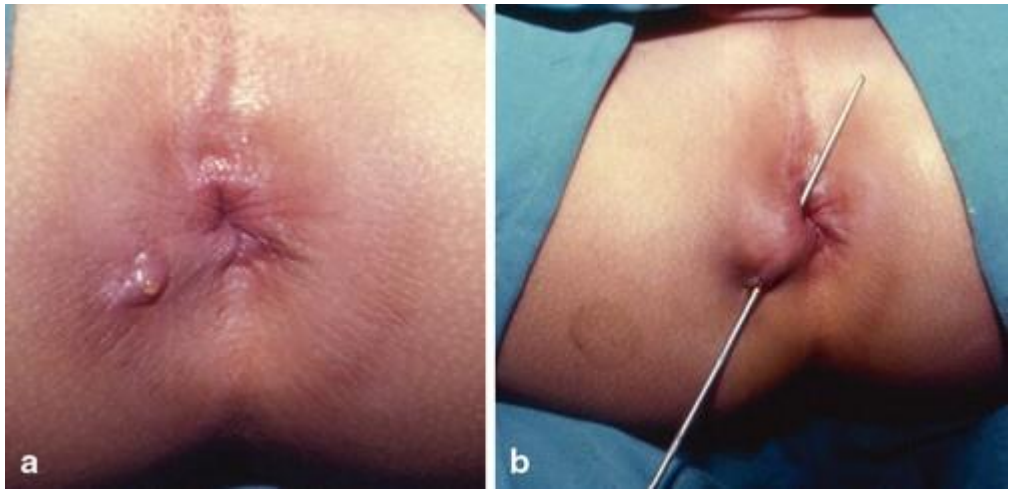
Perineal abscess workup

- No need for labs or imaging

Perianal abscess treatment

- Warm compresses, sitz baths, antibiotics
- Incision and drainage for large abscess or significant erythema

- About half will go on to develop a fistula in ano as they heal
  - Managed outpatient with clinic follow up
  - Elective anal fistulotomy

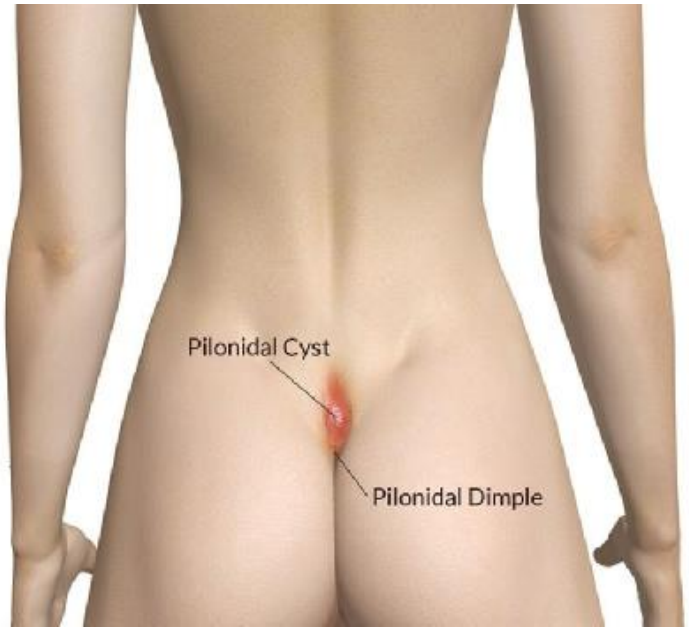


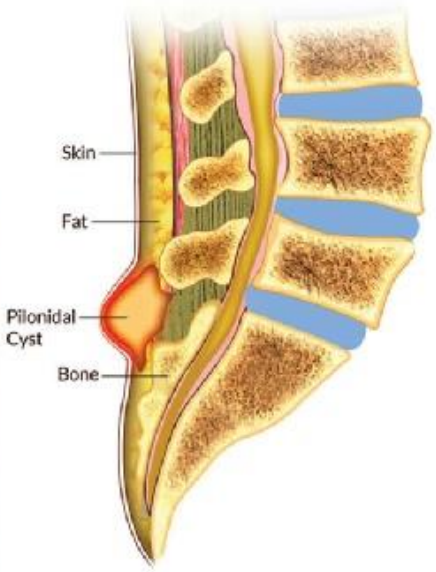
- A 15 yo M comes to the ED with pain on his tailbone.

- What do you think the problem is?

Pilonidal disease

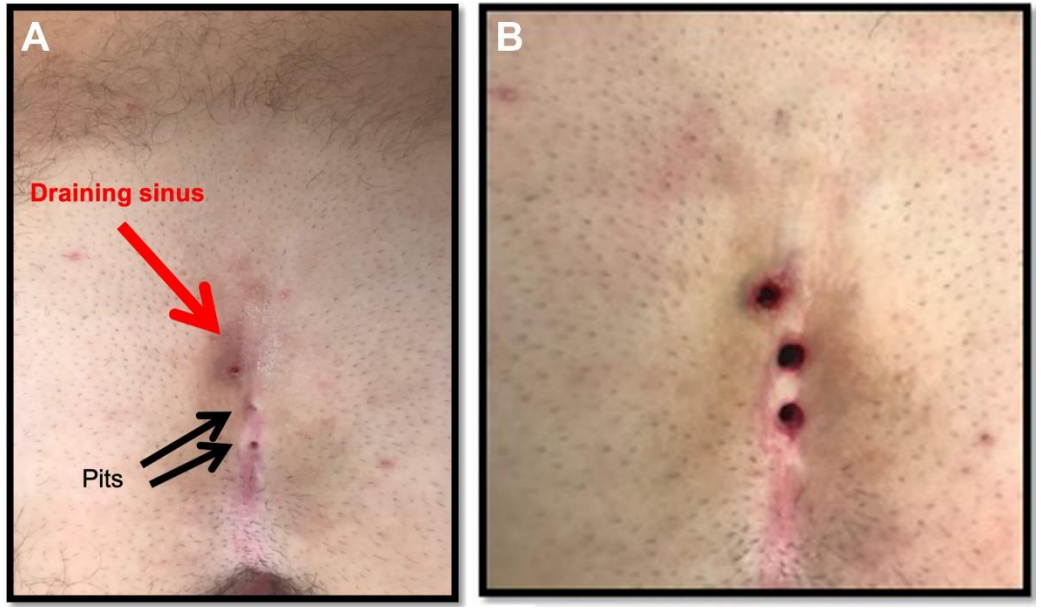
- Relatively common, acquired problem
- Hair is the inciting factor
- 50% will present with an acute infection
- Acute infections require incision and drainage





Pilonidal disease, con’t

- Treatment
  - Hair removal and hygiene are paramount
- Gips procedure
  - Pilonidal picking and coring



- A 2 year old female is brought to the emergency room because mom noticed a hard bulge on her abdomen when getting her out of the bath.

- What next?

New abdominal mass in a young child

- Often found by parents
- Usually liver or renal in origin
- Wilms, neuroblastoma, hepatoblastoma
- Start with ultrasound if there is a question
- Reserve CT scan imaging for the high volume center that will offer them surgery
  - There are some intricacies of timing, what studies to get, etc

Trauma

Trauma Resuscitation and Initial Evaluation

- Principles of Advanced Trauma Life Support
- Most common cause of morbidity and mortality in children
  - Almost 10 million ED visits per year
- The trauma “pan-scan”
  - Acceptable for adults, terrible for children
  - Limited radiation, decreased dosing
  - Minimize to the greatest extent possible
  - CONSIDER TRANSFER BEFOREHAND!

Initial priorities ---- ABC

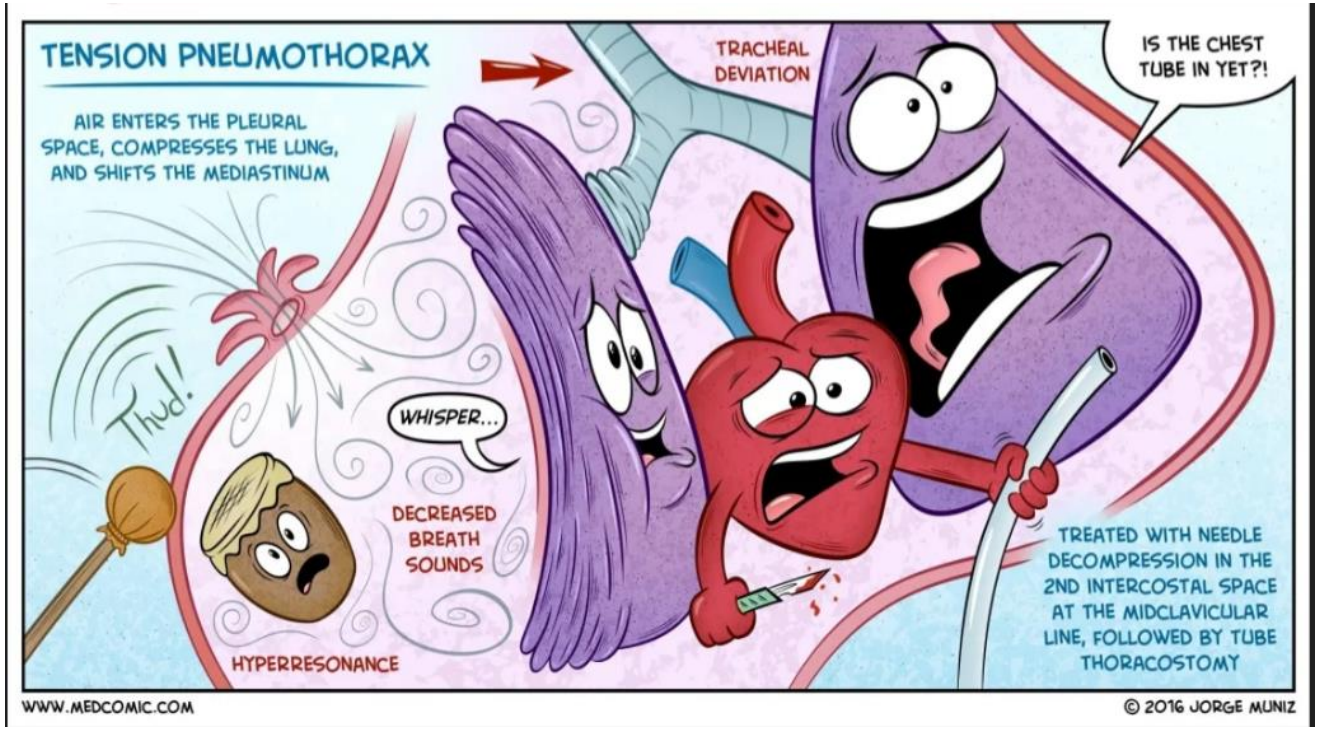
- Initial assessment according to ATLS:
  - Airway
  - Breathing
  - Circulation
  - Disability
  - Exposure

Airway

- Especially challenging in children < 6 years old
- Indications:
  - Respiratory distress
  - GCS < 8
  - Concern, potential airway compromise/obstruction
- Performed by the most experience provider
- Remember surgical airways in children < 10 = needle cric

Breathing

- Think pulmonary contusion without rib fractures
- Majority can be managed with supportive care/chest tube
- Tension physiology can develop quickly



Circulation

- Can be challenging
  - After 3 attempts, proceed to IO
- Start with 20cc/kg crystalloid
- Failure of response?
  - Proceed to 10-20cc/kg of pRBC
- TXA appears to be safe in children

Disability and Exposure

- Baseline GCS
- Remember to account for age of the patient
- Avoid hypothermia, even in the summer
- Look for concomitant injuries

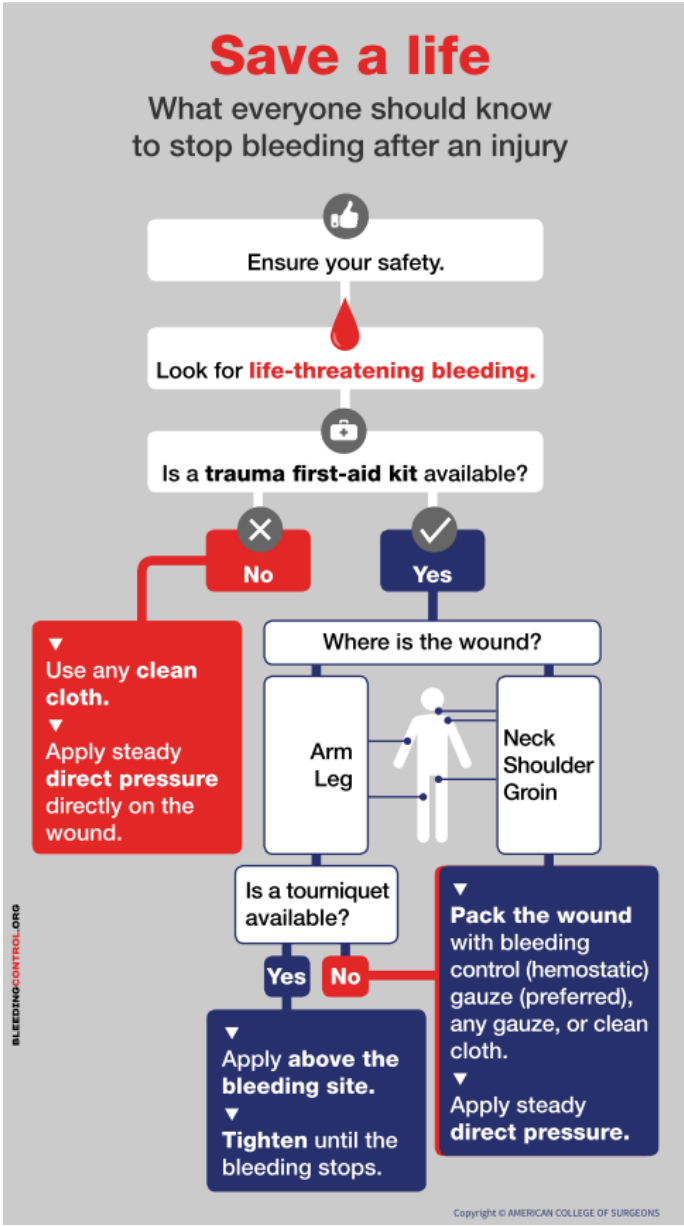
Modified Glasgow Coma Scale for Infants and Children

	Child	Infant	Score
Eye opening	Spontaneous To speech To pain only No response	Spontaneous To speech To pain only No response	4 3 2 1
Best verbal response	Oriented, appropriate Confused Inappropriate words Incomprehensible sounds No response	Coos and babbles Irritable cries Cries to pain Moans to pain No response	5 4 3 2 1
Best motor response*	Obeys commands Localizes painful stimulus Withdraws in response to pain Flexion in response to pain Extension in response to pain No response	Moves spontaneously and purposefully Withdraws to touch Withdraws to response in pain Abnormal flexion posture to pain Abnormal extension posture to pain No response	6 5 4 3 2 1

*If patient is intubated, unconscious, or preverbal, the most important part of this scale is motor response. Motor response should be carefully evaluated.

Stop the Bleed

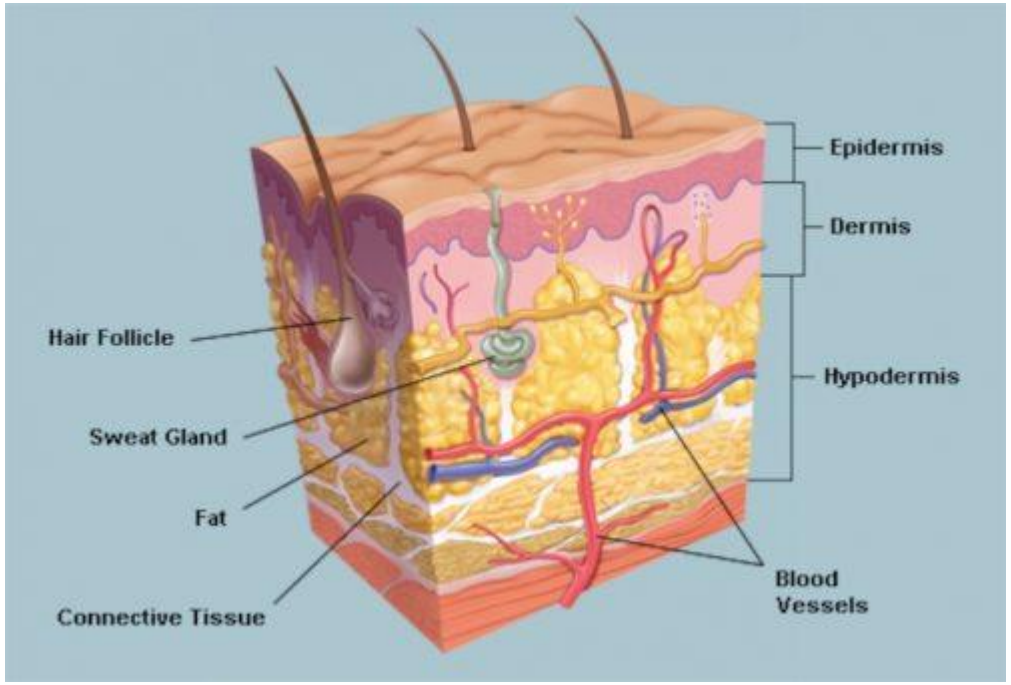
- FREE Program through the American College of Surgeons
- Developed after Sandy Hook
- Teaches the public hemorrhage control



Burns

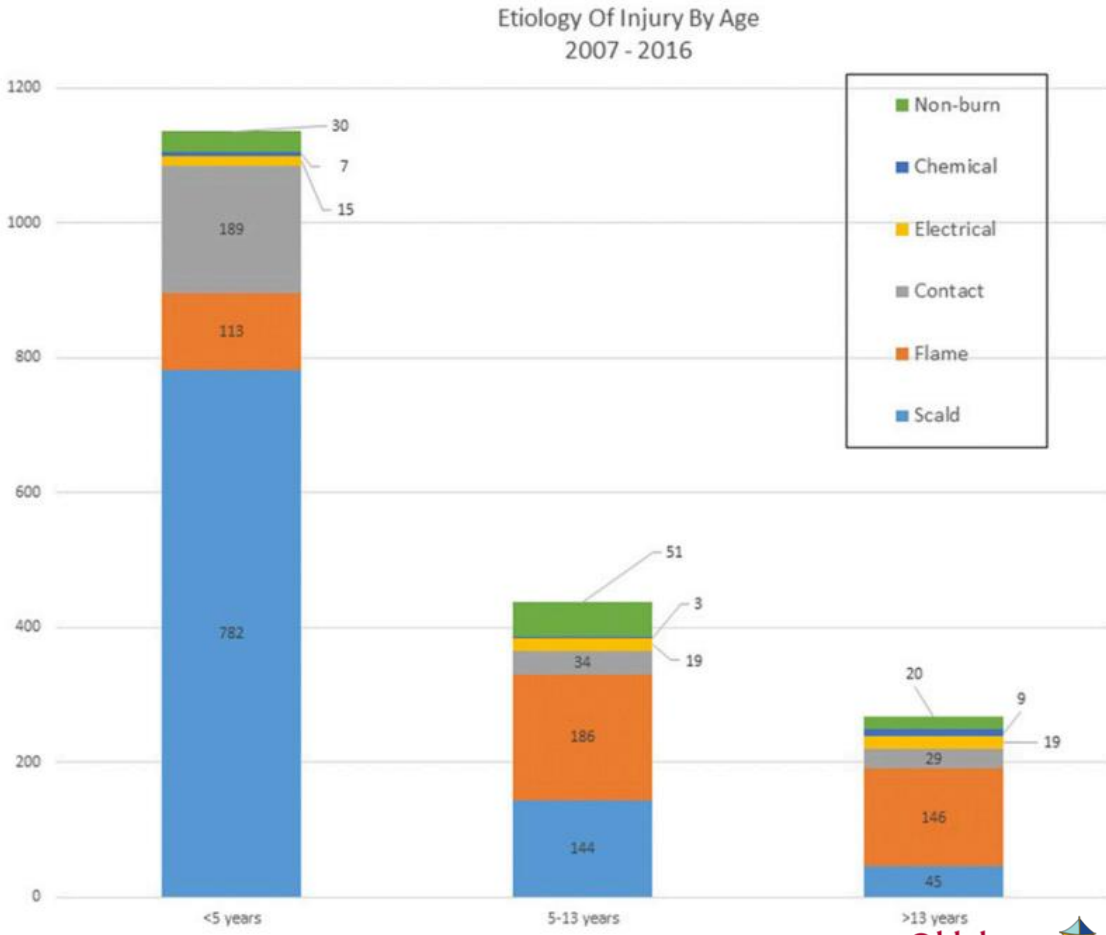
How are children getting burned?

- Burns are more common in children than adults
- Thickness of skin
  - More significant burns with lower contact times
  - Increased depth of burns compared to adults



Epidemiology of burns

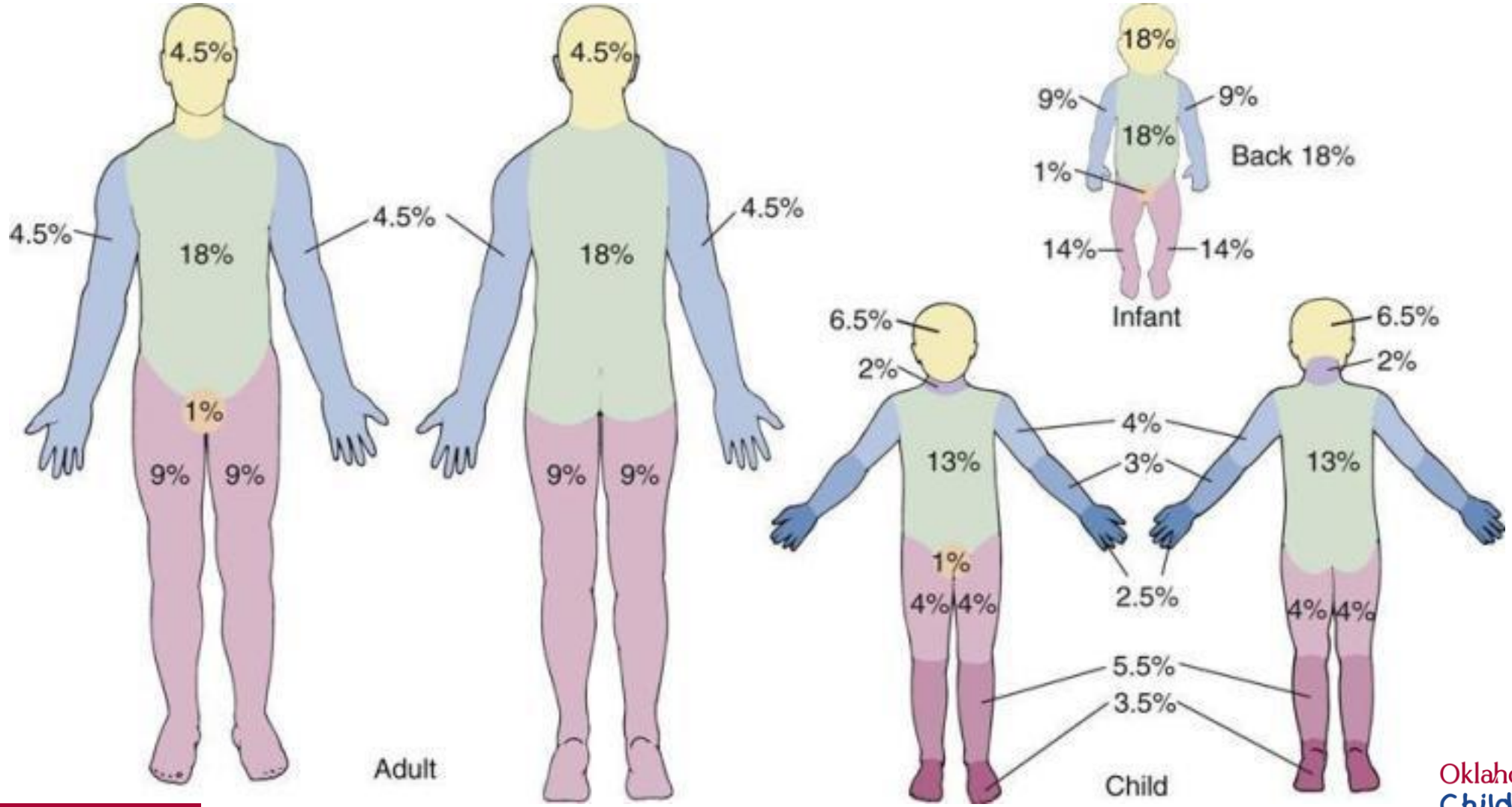
- Scalds are the most common cause of burns
  - In children 2 or younger, 68% of burns = scald burns
- Flame burns increasing in frequency with age
- 89% of patients are treated at non-burn centers
- On average, PICUs are admitting about 2 burns per year



What are the initial priorities in burn care?

- Initial assessment according to PALS or ATLS:
  - Airway --- remember the challenges in pediatric intubation/airway
    - Smaller diameter, more anterior
  - Breathing --- higher risk for inhalation injury
    - Cyanokit for closed-space fires
  - Circulation --- difficulty in obtaining iv access
    - After 2-3 attempts, move to an intraosseous line
  - Disability --- age based GCS, importance of assessing a baseline neuro exam
  - Exposure --- pediatric burn % are very different!

Lund and Browder Chart can be hugely beneficial



- Assess size and depth of burn
  - 1st degree --- dry and painful
  - 2nd degree --- moist and painful
  - 3rd degree --- dry and insensate
  - 4th degree --- include underlying muscle or bone

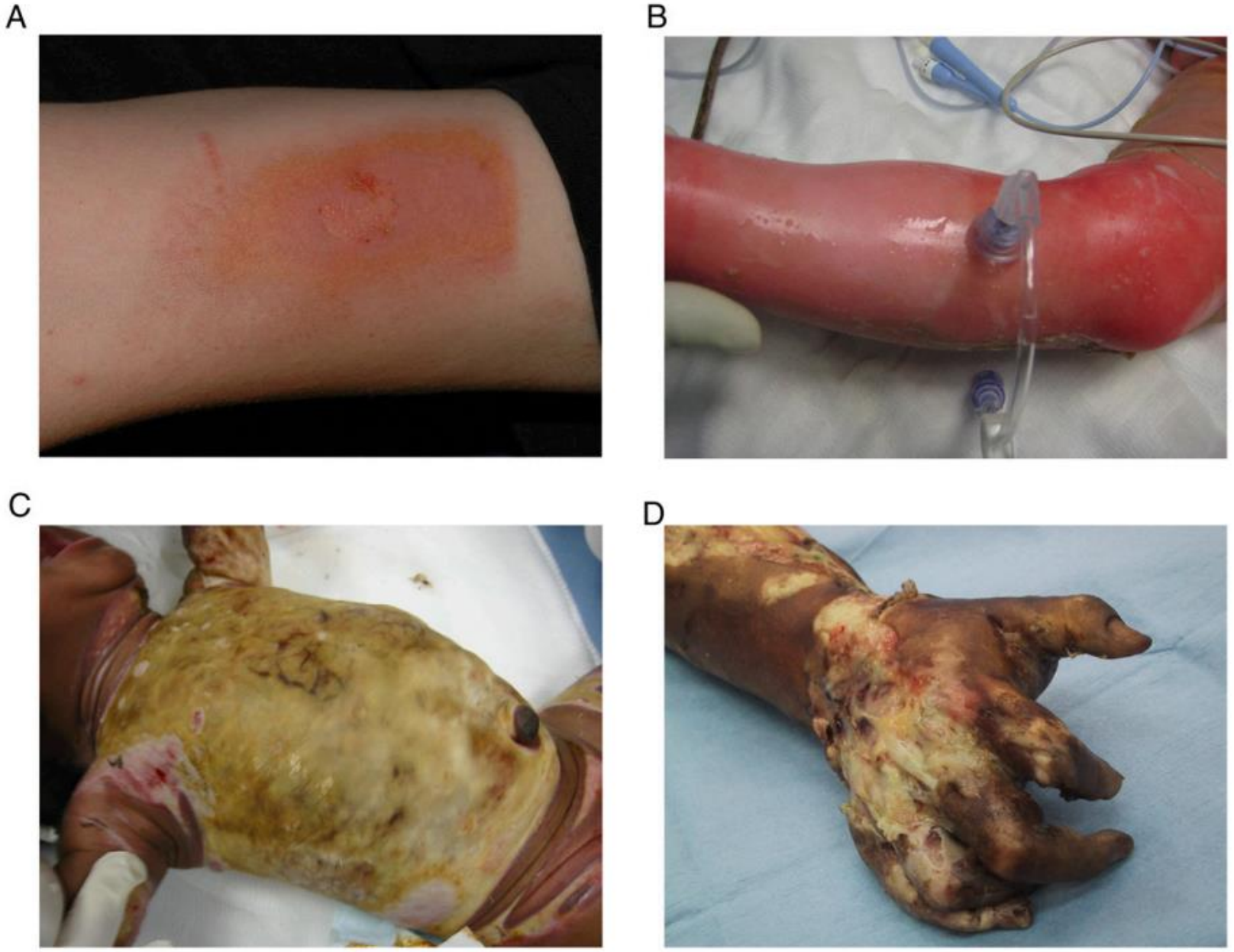


Figure 3. Burn depth can be deceiving on initial examination, but as a general rule, first-degree burns are dry and painful (A), second-degree burns are moist and painful (B), third-degree burns are charred and insensate (C), and fourth-degree burns appear to involve muscle and bone (D). Treatment planning depends in large measure on an initial estimate of burn depth.

Who needs burn resuscitation?

- Any child with more than 10% TBSA burns
- Parkland = historic benchmark
  - 4cc/kg x %TBSA
  - ½ in the first 8h, next ½ over 16h
- Brooke formula now more in favor, especially in pediatrics
  - 2cc/kg x %TBSA
  - ½ in the first 8h, next ½ over 16h

Burn care in Oklahoma

- Lacking American Burn Association Verified Burn Center
- Children's Hospital is the state designated destination for burned kids
- May need to transfer for higher level of care depending on severity

Have a clinical question? Want to send someone to my clinic?

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Oklahoma Children's Hospital
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