



The Vomiting Child

A crash course in Pediatric Abdominal Pain



Objectives

Develop age appropriate differential diagnosis for abdominal pain and vomiting

Identify red flags on history and physical exam that prompt further evaluation.

Review guidelines for the management of common conditions including gastroenteritis, GERD and constipation



Case # 1

A 1 month old female presents to your office with a 3 day history of vomiting. The vomit appears to be milk. The infant feeds vigorously at the breast, requires frequent burping, spits up multiple times with each feed since the first week of life and sometimes arches and cries during feeding. She is afebrile. She has 2 -3 yellow seedy stools each day.

PMHx: 37 and 2 days, SVD, birth weight 3.9 kg

P/E: Well appearing infant. Exam is limited by crying but patient consoles in parent arms. Soft abdomen. No masses palpable.

HR 154, RR 34, T 36.8 rectal, BP 80/58

Weight = 3.72 kg

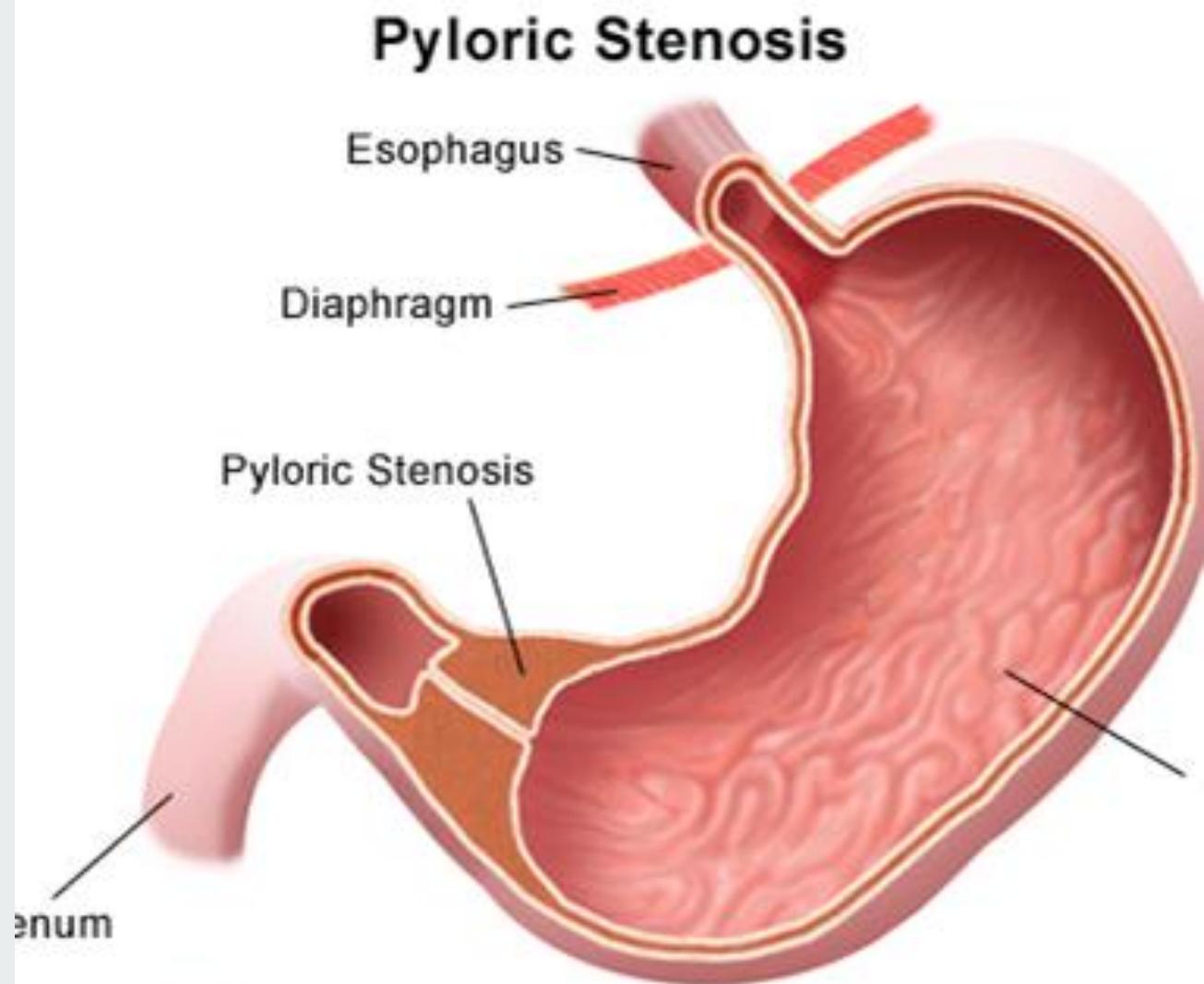


Which of the following features from history and physical make you more worried about this infant?

- a) Non bilious vomits**
- b) Frequent burping/ spit ups**
- c) 150 g weight loss**
- d) She is a full term infant**

Hypertrophic Pyloric Stenosis

- Most common surgical cause of vomiting in infants
- Gastric outlet obstruction caused by hypertrophic pylorus muscle
- 1.5 - 4/ 1000 births





Presentation of HPS

- 2 -4 weeks of life → typically full term infants
- Forceful, nonbilious emesis 10 - 30 mins after feeding
 - Can be coffee grounds if gastritis or esophagitis is present
- Vigorous feeders
- Spectrum from very well appearing to severely dehydrated and in shock
- “Olive mass”



Investivations

Labs: CBC, lytes, VBG,

- hypoCa, HypoK+ metabolic acidosis

U/S = gold standard

- Muscle thickness > 4 mm or channel length > 15 mm



Management

Replace fluids with 20/ kg NS bolus then 5% dextrose at 1.5 x maintenance

Electrolyte correction

NG decompression

Surgical pylorotomy → longitudinal through hypertrophied muscle (but sparing mucosa)

Nonsurgical management → generally only for nonsurgical candidates in North America



Gastroesophageal Reflux of the Newborn

GER = passage of gastric contents into esophagus +/- regurgitation or vomiting

- 75% of infants under 2 m/o → resolve in 95% by 1 year
- Very frustrating for parents

Treatment

- Lifestyle changes
- Do not use prone positioning!!
- Thickened formula
- Consider trial of hydrolysed formula for intermittent vomiting and crying (?mild protein intolerance)



Gastroesophageal Reflux Disease

GERD = when reflux causes symptoms/ complications (nutritional issues, esophagitis)

- ?Hx and P/E sufficient for diagnosis
- ? PPI trial

Treatment:

- Lifestyle changes
- Antisecretory Agents
 - H2RAs (ranitidine)
 - Issue of tolerance
 - PPIs (omeprazole)
 - Not approved/ well validated for infants
 - Delay to onset of optimal action (consider bridging older children)

So what do I do?



**Let's imagine mom
comes in and shows
you the most recent
vomit....**





Malrotation

Malrotation = abnormal peritoneal adhesive bands (Ladd bands) form between cecum and right abdominal wall which mechanically obstruct the duodenum

- 1/500 live births
- 50% present first month of life, 90% within first year

Midgut Volvulus

Volvulus = small bowel twists around this Ladd band compressing the superior mesenteric artery and causing small bowel necrosis

- Occurs in 70% of infants with malrotation



Presentation

First month of life:

- Bilious emesis (77 - 100% of cases)
- Sudden onset of inconsolable crying
- Feeding intolerance
- Abdominal exam is NORMAL in about 60% of cases

Late Findings:

- Distension
- Abdominal pain
- Infarcted bowel: erythema and edema of the abdo wall, fever, dehydration, cardiovascular collapse



Investigations

Labs - nonspecific

Plain films - can be normal, can show distension of the stomach or duodenum +/- distal intraluminal air

Limited upper GI contrast study = gold standard

Malrotation - ligament of treitz does not cross left of midline on contrast study

- U/S also useful for non fixed cecum or abnormal oriented SMA

Malrotation of the Midgut

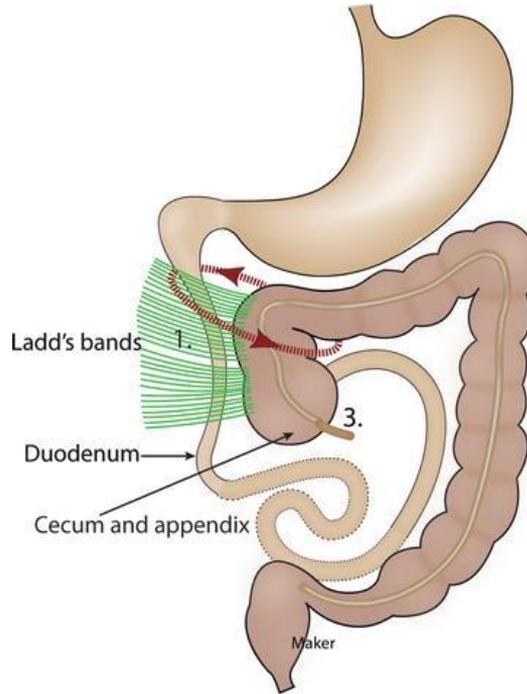
Management

Emergency

- Fluid resuscitation
- Gastric decompression via NG
- IV antibiotics (*)

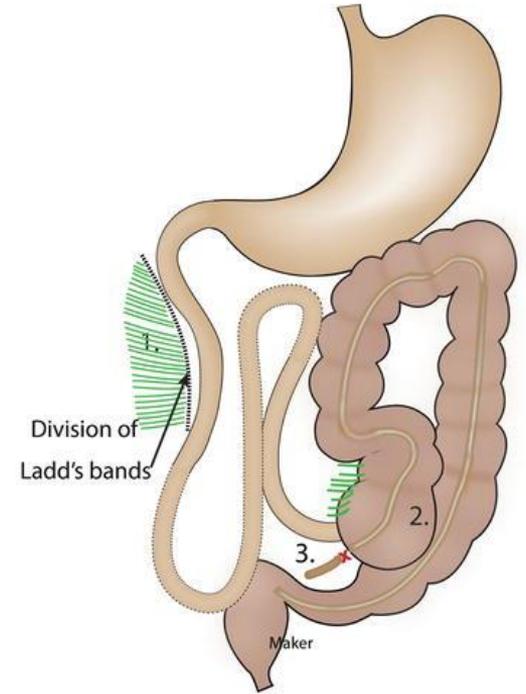
Surgical

- Ladd procedure



Preoperative

1. Ladd's Bands causing obstruction with varying degrees of volvulus



Postop after reduction of the volvulus

1. Division of the Ladd's bands and correction of the volvulus
2. Replacement of the right colon on the left side
3. Appendectomy

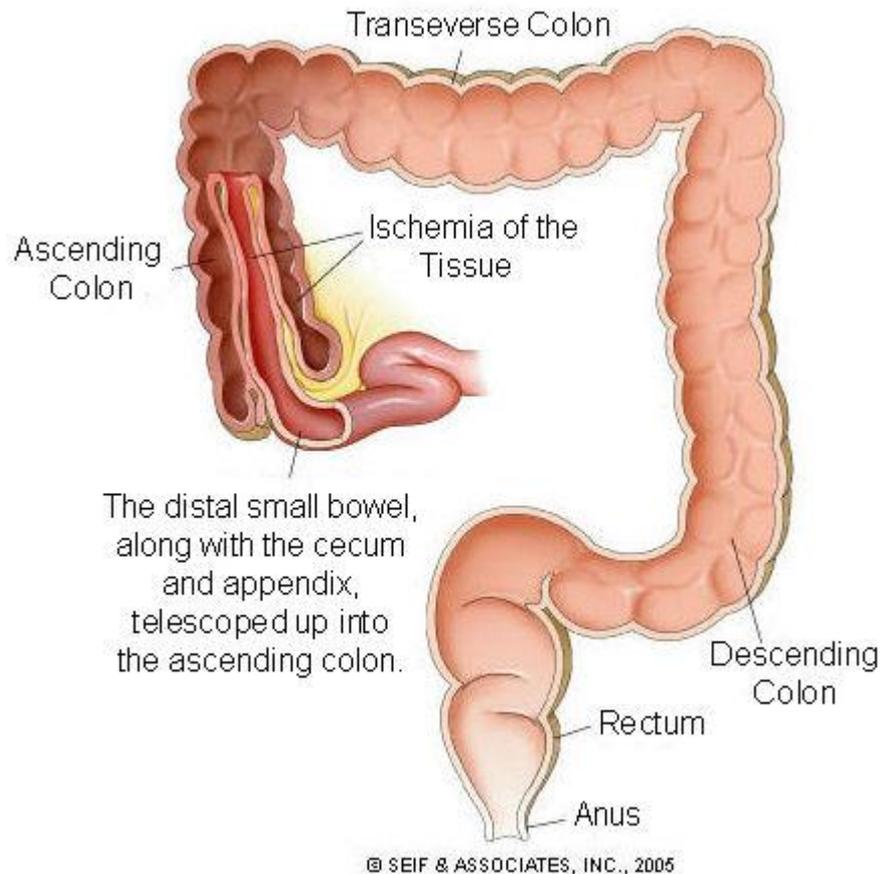
Intussusception

Classically episodic abdo pain +/- vomiting with currant jelly stools, 'sausage mass' on exam

Reality:

- intermittently inconsolable infant - toddler
- Must be on your differential for lethargy

Ultrasound for Diagnosis





Case # 2

6 y/o M with periumbilical abdominal pain starting this morning (6 hours ago). He vomited food contents 2 x after eating lunch and has had 2 loose bowel movements. There is tactile warmth but no documented fever. He presents with his mom who is concerned about dehydration as he is refusing everything but small sips of water.

P/E:

Well appearing child. HR 120, RR 24, T 37.4.



Appendicitis

- Lifetime risk of 7 - 9
- Can occur at any age but most common 10 - 17 y/o → less common under 4 y/o (2/10 000)but young (preverbal) children have the highest perforation rate (80 - 100%)
- One of the most common causes of malpractice litigation



Presentation

- Classic: periumbilical abdo pain → anorexia, nausea, vomiting → RLQ pain, +/- fever
- Reality :
 - Frequent loose stools (usually small volume)
 - Dysuria +/- hematuria (if appendix is overlaying a ureter)
 - Flank pain (retrocecal appendix)
 - Hesitant to move around (rebound tenderness) → increases likeliness of appendicitis 3x
 - Fever?
 - High grade more associated with perforation

**perforation can cloud the physical exam



Clinical Decision Tools

Table 2. Pediatric Appendicitis Score

Cough/percussion	2
Hopping tenderness in the RLQ	1
Anorexia	1
Pyrexia	1
Nausea/emesis	1
Tenderness over right iliac fossa	2
Leukocytosis	1
Polymorphonuclear neutrophilia	1
Migration of pain	1
Total score	
Appendicitis unlikely	<5
Appendicitis possible	5
Appendicitis likely	≥6

RLQ: right lower quadrant. Source: Reference 19.

But!

Systematic Review by Benabbas et al 2017 of sensitivity of Hx, P/E, investigations and POCUS

“Presence of AA is more likely in patients with undifferentiated abdominal pain migrating to the RLQ or when cough/hop pain is present in the physical examination. Once AA is suspected, no single history, physical examination, laboratory finding, or score attained on PAS can eliminate the need for imaging studies”



Investigations

Ultrasound is gold standard

Plain Film?

- Evidence in about 10% of cases of visible fecalith
- Only to r/o other indications

Bloodwork?

- Varies a lot by practise setting
- When I do it?
 - Order if high pretest probability to avoid treatment delays but not so much to guide diagnosis



Management

Pain Control

- acetaminophen +/- ibuprofen in the office (does not mask diagnosis)
- NPO
- Fluid resuscitation
- Surgical consultation
- Broad spectrum Abx
 - Simple - setting variation
 - Perforated - triple therapy (amp, gent, flagyl)

Gastroenteritis

- Most common cause of physician visits (about 20% of all presentations for children < 10)
- Can present as vomiting, diarrhea or both +/- fever and +/- abdominal pain
- Usually self limited





Gastroenteritis

Investigations

- When to stool Cx?
- Urine
- Blood pressure

Management:

Oral ondansetron if available decreases need for IV and hospital admission (as per CPS guideline)

- 8 kg to 15 kg: 2 mg
- 15 kg to 30 kg: 4 mg
- Greater than 30 kg: 6 mg to 8 mg



Empiric Treatment for Bacterial Gastroenteritis



Case # 3

14 y/o M presents to your office with a 2 day history of vomiting and diarrhea with epigastric and right upper quadrant abdominal pain. He has an 8 month history of intermittent epigastric abdominal pain with vomiting last 1 -2 days usually 2 -3 episodes per month and is well in between with occasional postprandial epigastric discomfort. He is afebrile. Emesis is nonbilious. Prior to this episode his stool habits were small lumps, every second day.

P/E: uncomfortable appearing, diffusely tender, focal RUQ tenderness, -ve Murphy's and McBurney's, + stool palpable LLQ

Habitus - 78 kg

Differential Diagnosis?



Which of the following is least likely to be part of your differential diagnosis for this case?

- a) Functional constipation
- b) Cyclic vomiting syndrome
- c) Biliary Colic
- d) Gastroenteritis



Cyclic Vomiting Syndrome

All of the criteria must be met to meet this consensus definition of cyclic vomiting syndrome.

1. At least 5 attacks in any interval, or a minimum of 3 attacks during a 6 mo period
2. Episodic attacks of intense nausea and vomiting lasting 1 hr-10 days and occurring at least 1 wk apart
3. Stereotypical pattern and symptoms in the individual patient
4. Vomiting during attacks occurs at least 4 times/hr for at least 1 hr
5. Return to baseline health between episodes
6. Not attributed to another disorder

Investigations:

- BW, lytes, glucose
- U/S for SMA/ SMV relationship

Constipation

- 1100 visits to our ED / year
- Median age 5 y/o
- Presentation
 - Hard stools, big stools, straining - 21 %
 - Abdo pain - 63%
 - Vomiting - 19% (vomiting should make you pause)



This is a naughty picture



Which of the following would not be a 'red flag' for an organic cause of constipation in an infant?

- a) Passage of first meconium at 36 hours of life
- b) Explosive stool passage after rectal exam
- c) Failure to thrive
- d) Abdominal distension



Red Flags for Organic Cause

Warning signs / Symptoms	Suggested Diagnosis	Age range
Mec > 48 hours post delivery, failure to thrive, fever, bloody diarrhea, tight anal sphincter, empty rectum with palpable fecal abdominal mass, explosive stools after rectal exam	Hirschsprung's Disease	Neonatal period (most cases) > 3 y/o - adulthood (10% of cases) <ul style="list-style-type: none">Typically bc shorter segment of colon is involved
Falls, decrease LE tone/ reflexes, absent anal wink, sacral dimple/ hair tuft	Spinal cord anomalies (tethered cord, tumor)	Infants (tethered cord) Any age (tumor)
Abnormal position or appearance of anus	Congenital anorectal malformation (imperforate anus)	Infants

Hirschsprung's Disease

A portion of the colon lacks innervation causing functional obstruction

Contrast enema → may reveal transition zone from dilated 'normal bowel' to aganglionic bowel

Rectal Biopsy → gold standard for diagnosis

Surgery → resect affected area and attach innervated bowel to internal anal sphincter



Do a neuro
exam!

+/- a rectal
exam





Management of Functional Constipation

The Big 5:

- 1) Diet
- 2) Water intake
- 3) Stool habits
- 4) Exercise
- 5) Medical intervention
 - a) PEG 3350
 - b) ?Enema



We help children and families
be their healthiest

Constipation:

Caring for children over 6 months of age

What is constipation?

You've just learned your child or teen has a very common problem: constipation. Constipation means that stool is building up in the bowel and causing distress. Parents sometimes feel a little embarrassed about this, but constipation happens to most children at some point. The good news is that constipation is rarely caused by a serious illness.

Remember! Constipation can still happen even if a child is having a bowel movement (BM, stool or poop!) every day.

A child or teen with constipation may:

- Suffer with stomach pain or cramps (these can be severe)
- Have very large stool (sometimes needing a plunger to get it down the toilet)
- Have stool that is Type 1, 2 or 3 on the stool chart
- Have trouble passing urine (going pee)
- Need to pass urine often
- Have blood on stools
- Have problems with behaviour
- Leak stool into underwear
- Avoid going to the toilet

How does constipation happen?

Constipation is often caused by:

- Not eating enough fibre, fruits, vegetables and grains
- Not getting enough physical activity
- Stress, travel, change in diet
- Some medications (e.g. antacids, morphine, anti-depressants)
- Holding in stool ('withholding')
- Putting off going to the toilet when feeling the urge to 'poop'. Children may do this when they are feeling stressed about potty training, are too busy playing, embarrassed about using a school or public toilet or afraid of having a painful or unpleasant bowel movement.

Delaying a bowel movement causes stool to become hard, dry, and difficult to pass. This sometimes causes a large mass of stool in the rectum (the part of the bowel that holds stool). When this happens, it is called fecal impaction. Stool builds up behind the impaction and may leak, soiling a child's underwear. This is often mistaken for diarrhea.

Bristol Stool Chart

Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges (passed easily)
Type 6		Fluffy pieces with ragged edges, a muddy stool
Type 7		Watery, no solid pieces ENTIRELY LIQUID

Bristol Stool Chart developed by Dr. Ken Heaton
University of Bristol, 1997 Creative Commons license 2.5

1 Initial bowel clean-out

The first step is to clean out the bowel. The doses below should only be used for 3 days at most.

- ✓ **3 day PEG 3350 clean out (Lax-a-Day®, Restoralax®, Relaxa®, Clearlax®)**, for children over 6 months of age. The amount you give depends on your child or teen's weight.

Weight	Dose
7 - 10 kg	2 teaspoons (10mL) in 100 mL fluid 2 times a day for 3 days
11 - 13 kg	3 tsp (15 mL) in 150 mL fluid 2 times a day for 3 days
14 - 19 kg	4 tsp (20mL) in 200 mL fluid 2 times a day for 3 days
20 - 34 kg	1 capful (25mL) in 250 mL fluid 2 times a day for 3 days
35 - 50 kg	1 capful (25mL) in 250 mL fluid 3 times a day for 3 days
more than 50 kg	2 capfuls (50mL) in 500 mL fluid 3 times a day for 3 days



1 capful = 5 teaspoons (tsp) or 25 mL

After this step, move on to step 2. This is very important, even if your child has been in distress for only a few days.

2 Retrain the bowels and prevent constipation

- ✓ **PEG 3350 (Lax-a-day®, Restoralax®, Relaxa®, Clearlax®)**: Your child or teen will need to continue with these treatments once a day for 2 months or so to get back to a normal pattern of bowel movements. The amount you give depends on your child's weight.

Weight	Dose
7 - 10 kg	2 teaspoons (10mL) in 100 mL fluid once a day
11 - 13 kg	3 tsp (15 mL) in 150 mL fluid once a day
14 - 17 kg	4 tsp (20mL) in 200 mL fluid once a day
more than 17 kg	1 capful (25mL) in 250 mL fluid once a day

- Check your child's stools (use the Bristol stool chart). Decrease the dose of medicine if the stools are very loose or your child or teen gets cramps
- You can continue this medication for longer than 2 months if the constipation doesn't get better.

!! 1 capful = 5 teaspoons (tsp) or 25 mL

- ✓ **Healthy diet** with plenty of fruits, vegetables and whole grains. Simple, unprocessed food is best.
- ✓ **Regular physical activity** helps keep the bowels moving. Children need at least 1 hour of moderate physical activity each day.
- ✓ **Bathroom routine.** It can take months to train the bowel back to a normal pattern. Take advantage of the body's normal urge to empty after meals. 20-30 minutes after each meal at home, have your child sit on the toilet or potty for 1 minute for each year of age (for example, 3 minutes for a 3 year old). Give your child a foot stool if needed. This will make your child more comfortable and give some support to let go of a bowel movement. Join your child to read a book together or chat and catch up! Younger children may like stickers on a chart for sitting on the toilet after each meal.





Back to Our Case

Investigations:

Labs:

- AST = 310, ALT = 455, GGT = 294
- Amylase normal

U/S:

- CBD 12 mm, dilated intra and extrahepatic ducts, multiple gallstones

ERCP removing stone from distal CBD → asymptomatic at follow up

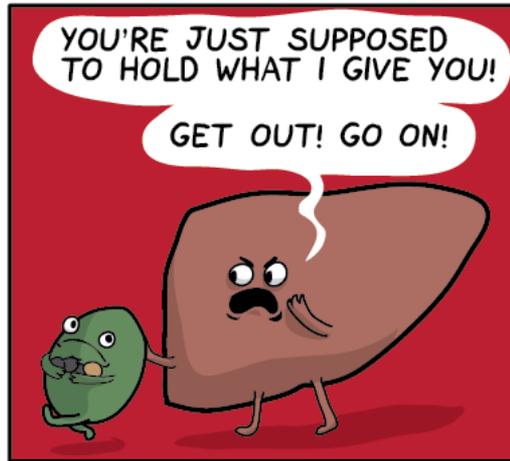
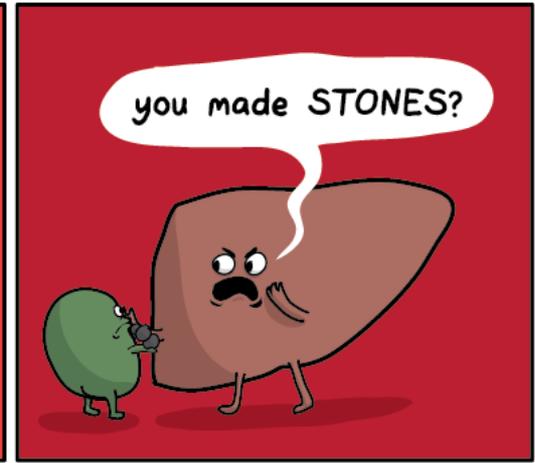
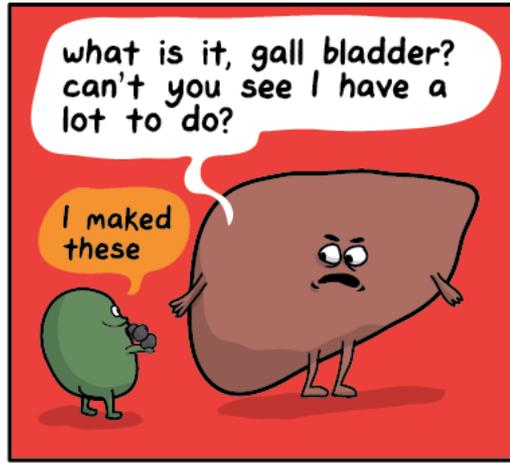
Don't forget "Adult" Diagnoses

Cholelithiasis 22/ 100 000
children under 18

4:1 females

Risk Factors:

- Habitus
- Hemolytic disease
- Hispanic lineage





So What Should I Remember?

- 1) Bilious emesis in an infant is malrotation until proven otherwise
- 2) Convince yourself the vomiting infant doesn't have pyloric stenosis, not that they do have GER (and be judicious with pharmacological treatment of GER/D)
- 3) Acute abdominal pain + RLQ tenderness or rebound = imaging
- 4) Do a neuro exam for all constipation presentations
- 5) Enema sparingly for functional constipation, X-ray even less
- 6) Any case could be your most interesting case today!



Questions?