Pediatric Bowel Obstruction

Matt Zerden, Harvard Medical School III

Gillian Lieberman, MD
Patient 1

- 16 year old presents with severe, episodic abdominal pain, nausea and vomiting.
- Questionable abdominal mass in RLQ
- Previous images from his record include the following CXR. What is his underlying condition?
Patient 1: Chest X-ray

- Markedly abnormal
- Coarse, reticular interstitial diffuse infiltrates
- Significant scarring, most notably along the minor fissure of the right lung
- Consistent with bronchiectasis from long-standing respiratory infections in the setting of cystic fibrosis
Patient 1: Initial KUB

- Plain abdominal film shows mildly dilated loops of SB with multiple air fluid levels.
- The transverse and descending color are relatively decompressed.
- Concerning for an early obstructive process, but more imaging is required to narrow the differential diagnosis.

Image courtesy of Dr. Andrew Hines-Peralta
Patient 1: Differential Dx

• Given his age, symptoms of severe pain, and KUB, concerned about:
  – Appendectomy
  – Severe gastroenteritis
• In the setting of CF, the differential is expanded to include the following:
  – Distal intestinal obstruction syndrome (previously known as “Meconium Ileus Equivalent”)
  – Intussusception
  – Adhesions (from prior abdominal surgeries)
• Obtain a CT
Patient 1: Intussusception on Coronal CT

- Coronal CT slice with IV contrast showing a classic image of bowel within bowel, diagnosing an intussusception.
- Other coronal CT slices confirmed that the intussusception occurred at the ileocelecal junction, the most common site of intussusception.

Images courtesy of Dr. Andrew Hines-Peralta
Patient 1: Intussusception on US

- This slide is not from this patient, but demonstrates the classic “target” lesion of intussusception on ultrasound.
- You can see the outer echoic layer of bowel surrounding an anechoic layer of fat surrounding the inner echoic layer of bowel.

Image from Timothy J. Carroll, MD, PhD and Janice M. Gallant, MD
Patient 1: Intussusception on Contrast Enema

- Enemas can be used both to diagnose and treat intussusception, with successful reduction occurring in 75-90% of cases.

- Here gastrograffin was used to opacify the large bowel. The terminal ileum is no longer telescoping into the cecum, demonstrating effective treatment of the intussusception.

Image courtesy of Dr. Andrew Hines-Peralta
Patient 1 Discussion: Intussusception

• Occurs in 1% of patients with CF
• Typical presentation: Non-CF, previously healthy infant with sudden onset colicky abdominal pain, vomiting and red currant jelly stool
• Mean age at presentation is 6-8 months
• Can be fatal if untreated for 2-5 days
• Males > females. This difference increases as children become older
• Conditions that predispose children:
  – Recent URI or GI illness; Henoch-Schönlein purpura; CF; Chronic GI tubes; Meckel diverticulum; GI polyp; blunt trauma leading to intestinal hematoma; foreign body; or any other process creating a “lead point”
• Radiological work-up: begin with plain film to look for obstruction; proceed with US, CT or barium enema depending on clinical suspicion
Patient 1: returns 1 year later with severe abdominal pain

- Dilated loops of air filled small bowel.
- Distal large bowel is fairly decompressed.
- Bubbly, stool filled lower right quadrant
- These findings consistent with a mechanical obstruction of the small bowel
- Differential is the same as in previous presentation of this patient, proceed to CT.

Image courtesy of Dr. Andrew Hines-Peralta
Patient 1: Coronal CT with IV contrast

- Dilated, fecalized SB loops filled with semi-solid fecal matter.
- Note that this is abnormal - the SB should be filled with only fluid and gas.
- This image is diagnostic for Distal Intestinal Obstruction Syndrome (DIOS)
- DIOS is complete or partial obstruction of the bowel lumen by intestinal contents
Patient 1: Contrast Enema

Gastrograffin enema showing fecalization of the ileum, with a filling defect shown as a faint lucency.

Abdominal X-ray s/p gastrograffin enema, with residual contrast lining the colonal haustra. SB loops are no longer distended.

Images courtesy of Dr. Andrew Hines-Peralta
Patient 1 Discussion: DIOS

- Formerly known as “Meconium ileus equivalent”, DIOS is a condition that occurs almost exclusively in CF patients, mostly adolescents and adults.
- Prevalence is 5% - 40% of older CF patients
- Viscid bowel contents become impacted in the distal small bowel
- Radiograph: Distal SBO with bubbly stool filled lower right quadrant
- Contrast enema can be therapeutic and avoid surgery
Patient 1 Discussion: Meconium Ileus

- Meconium ileus: A condition that typically occurs in newborns with CF where abnormal meconium is thickened and obstructs the distal ileum.
- 10% of CF patients present with meconium ileus, but it can also occur with congenital pancreatic diseases.
- Typical clinical presentation in the newborn: bilious vomiting, abdominal distention and failure to pass meconium.
- Radiographs will show a mechanical obstruction, most commonly at the ileo-cecal junction, with an absence of air fluid levels.
Can’t Miss Cases of Pediatric Bowel Obstruction

- There are a few pediatric conditions with characteristic radiological findings
- Most are present at birth or in the first few months of life
- Many of these conditions are known to be associated with other specific congenital abnormalities or occur as part of syndromes
Patient 2: Abdominal X-ray

- Previously healthy 27 day old, first-born male presents with “projectile”, non-bilious vomiting
- Palpable mass in RUQ
- Abdominal film shows large, distended stomach
- Gas pattern in small and large bowel are non-specific.

Image courtesy of Dr. Andrew Hines-Peralta
Patient 2: Pylorus Stenosis

- This is the classic presentation of infantile hypertrophic pyloric stenosis, resulting in gastric outlet obstruction
- One of the most common forms of bowel obstruction with an incidence of 2-4 per 1000 live births
- Male-to-female predominance of 4:1, with 30% of patients being first-born males.
- The usual age of presentation is approximately 3 weeks of life, with 95% of cases diagnosed between 3-12 weeks
- Corrected by pyloromyotomy

Image courtesy of Dr. Andrew Hines-Peralta
Patient 2: Pylorus Stenosis

- Radiograph with barium contrast in the stomach
- Barium is unable to move past the pylorus, resulting in "shouldering" of the barium

Image courtesy of Dr. Andrew Hines-Peralta
Patient 2: Pylorus Stenosis on US

- US with calipers measuring the size of the pylorus.
- US is the modality of choice for imaging pylorus stenosis because it allows a quantitative measurement, with a pylorus of > 4mm being diagnostic.

Image courtesy of Dr. Andrew Hines-Peralta
Patient 3: Abdominal X-ray

- 10 month old presents with intermittent, abdominal pain.
- Abdominal distention is noted on physical exam.
- No significant past medical history.

Image courtesy of Dr. Andrew Hines-Peralta
Patient 3: Inguinal hernia

- Multiple loops of dilated small bowel
- No apparent transition point
- Upon close inspection of the scrotum, areas of lucencies are seen
- Diagnosis: Incarcerated inguinal hernia

Image courtesy of Dr. Andrew Hines-Peralta
Patient 4: Contrast Enema

- A 3 month old male child with a history of colicky abdominal pain and constipation
- The patient had delayed (greater than 24 hours) passage of meconium at birth
- One of the parents has suffered with constipation all their life

Image courtesy of Dr. Andrew Hines-Peralta
Patient 4: Hirschsprung Disease (HD)

- Supine x-ray with contrast in the large bowel.
- Markedly abnormal, narrowed segment in the sigmoid colon.
- Just proximal to the narrowed segment is enlarged colon
Patient 4 Discussion: HD

- HD is caused by failure of neural crest cell migration to both the myenteric and submucal ganglion
- This patient had short segment Hirshprung, the most common form of the condition that affects only the rectosigmoid region vs. long-segment which can affect the entire colon
- Occurs in 1/5000 live births, with an overall male:female ratio of 4:1
- Associated with other congenital abnormalities and syndromes, most notably Down’s syndrome in 10% of cases
- Diagnosis requires a biopsy even if highly suggested HD via imaging
- Presentation can be variable from complete obstruction to undiagnosed disease that produces constipation through adulthood
Patient 5: Abdominal X-ray

• Newborn with a prenatal history of polyhydramnios
• Born with Down’s Syndrome
• Within 24 hours has multiple episodes of bilious vomiting
Patient 5: Duodenal Atresia

- Characteristic “double-bubble” showing air in the stomach and duodenum
- Failure of duodenum to completely form

www.e-radiography.net/radpath/d/duodenal_atresia2.jpg
Patient 5 Discussion: Duodenal Atresia

- Atresias can occur anywhere along the GI tract, with ileum being the most common site in the intestines.
- Most atresias in the jejunum or ileum occur in isolation, while duodenal atresias co-occur with other congenital abnormalities in 50% of cases.
- Additionally, duodenal atresia is associated with Down’s Syndrome - 22-30% of patients with duodenal obstruction have trisomy 21.
- Polyhydramnios occurs in 33% to 50% of cases.
- 45% of those with duodenal atresia are born premature.
Patient 6: Abdominal X-ray

- Premature infant born weighing 1300 grams
- On the 10th day in the NICU, he begins to have decreased feedings, abdominal distention, and decreased bowel sounds
- Later he develops bloody stools, respiratory distress and lethargy

Patient 6: Necrotizing Enterocolitis (NEC)

- This supine abdominal radiograph shows dilated loops of bowel
- Pneumatosis coli appears as linear lucencies along the bowel wall
- There is distension of the stomach.
- There are several lucencies in the liver, representing portal venous gas.

Patient 6 Discussion : NEC

- Necrotizing Enterocolitis is a disorder commonly effecting low birth weight infants, with a mortality rate between 15-30%
- Approximately 5-10% of infants with a birth weight less than 1500 grams will develop NEC with the incidence increasing with decreasing gestational age
- The etiology is uncertain, but leading research suggests a combination of infection combined with ischemia and reperfusion injury which sets off an inflammatory cascade
- Patients can rapidly evolve into sepsis.
- If it is not caught early, permanent bowel necrosis can occur resulting in surgery with significant bowel resection.
- Following the acute event, the patient can have long term consequences of damaged bowel wall, such as strictures, which occur in approximately 25% of those who survive NEC.
References

Acknowledgments

- **Dr. Andrew Hines-Perlata** for his time, teaching and image contributions
- **Gillian Lieberman, MD** for her efforts in developing this course and creating the opportunity for this presentation
- **Pamela Lepkowski** for her assistance throughout the course
- **Larry Barbaras** for his efforts as webmaster