Go with your Gut!
*Abdominal Emergencies in the Pediatric Population*

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Objectives

At the end of this lecture, the learner will:

- Be able to correlate GI symptomology with patient presentation to formulate a list of differential diagnoses.
- Be able to describe pathophysiology behind surgical abdominal conditions, particularly those that begin in utero.
- List 3 types of surgical abdominal emergencies and the pre and post-operative treatment and nursing care required for each.
- List 3 types of non-emergent surgical abdominal emergencies and the treatment and nursing care required for each.

A Solemn Vow
Everyone loves a Case Study

- A previously healthy 2 year old child presents to your emergency room with fever, lethargy, and acute abdominal pain accompanied by bilious vomiting and diarrhea. Pt is unable to localize pain, but does exhibit rebound tenderness when you palpate the RLQ. Mom states that symptoms began 2 days ago.

Given only the information you know right now, what condition(s) could the patient have?

<table>
<thead>
<tr>
<th>Medical Conditions</th>
<th>Birth to one y</th>
<th>Two to five y</th>
<th>Six to 11 y</th>
<th>12 to 18 y</th>
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</thead>
<tbody>
<tr>
<td>Acute appendicitis</td>
<td>Gastroenteritis</td>
<td>Gastroenteritis</td>
<td>Gastroenteritis</td>
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<td>Lower lobe pneumonia</td>
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<td>Congenital heart disease</td>
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<td>Renal disease</td>
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<td>Urinary tract infection</td>
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<td>Appendicitis</td>
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<td>Urinary tract stones</td>
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<td>Appendicitis</td>
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<tr>
<td>Intussusception</td>
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</tbody>
</table>

Table 1: Causes of abdominal pain according to age of the child

Balachandran, 2013
Box 1. Extra-abdominal causes of gastrointestinal distress

- Abdominal epilepsy
- Abdominal migraine
- Black widow spider bite
- Hemolytic uremic syndrome
- Henoch-Schönlein purpura
- Ingestions (eg, iron)
- Pharyngitis (especially induced by streptococcal infection)
- Pneumonia
- Sepsis

McCulloch, 2006

Anatomy Review

When should I be really concerned?

- Examine the child’s behavior without you nearby
Physical Examination

- Neuro/HEENT: Sunken fontanels, sunken eyes, altered mental status r/t dehydration, signs of pharyngitis
- Respiratory: Tachypnea from pain, abdominal competition
- CV: Signs of shock-tachycardia, decreased cap refill, mottling, decreased/bounding pulses

Physical Examination

- GI: Distension, masses, peristaltic waves, discoloration, presence/quality of bowel sounds (listen first), guarding, rebound tenderness, localized pain to palpation, peritoneal signs (have child jump up and down/bounce infant on knee), rectal exam.
- GU: Age appropriate-swelling/signs of testicular torsion, signs of incarcerated hernia, internal exam for post-menstrual females.
- Skin: Presence of purpura, decreased turgor

History

- Age at onset of pain***
- Any history of abdominal surgery in the past
- Recent abdominal trauma
- History of feeding difficulties, N/V/D
- Associated symptoms of abdominal pain
- Family History
### Characteristics of Emesis

<table>
<thead>
<tr>
<th>Classification</th>
<th>Emesis Type</th>
<th>Cause</th>
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</thead>
<tbody>
<tr>
<td>Billious</td>
<td>Coffee Ground/Bloody</td>
<td>Obstruction</td>
</tr>
<tr>
<td>Obstruction</td>
<td>Gastritis</td>
<td>Obstruction</td>
</tr>
<tr>
<td>Volvulus</td>
<td>Gastric Ulcer</td>
<td>Obstruction</td>
</tr>
<tr>
<td>Intussusception</td>
<td>Bleeding neoplasm</td>
<td>Obstruction</td>
</tr>
</tbody>
</table>

### Characteristics of Stool

<table>
<thead>
<tr>
<th>Classification</th>
<th>stool Type</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>Constipation</td>
<td>Melena</td>
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<tr>
<td>Gastroenteritis</td>
<td>Obstruction</td>
<td>Gastric ulcers</td>
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<td>Appendicitis</td>
<td>Pancreatitis</td>
<td>Duodenal Ulcers</td>
</tr>
<tr>
<td>IBD</td>
<td></td>
<td>Intussusception</td>
</tr>
</tbody>
</table>

Remember: The goal of treating acute abdominal pain is ensuring that life-threatening surgical causes are quickly diagnosed and treated!
Types of Surgical Abdominal Emergencies

Appendicitis

Appendicitis

- Inflammation of the vermiform appendix caused by an obstruction attributable to infection, structure, fecal mass (fecolith), foreign body, or tumor.
- Appendix becomes distended → ischemia and necrosis may ensue.
Statistics

- Affects 4 out of every 1000 children
- Typically age 5-15 years, adolescents
- Of all children admitted to the ED with abdominal pain, 82% are diagnosed with appendicitis
- 70,000 pediatric appendectomies performed in the US each year
- Higher perforation rates than adults (30-65%)

Presentation

- Starts with dull periumbilical pain, then migrates to RLQ pain
- Abdominal tenderness
- Guarding
- Low-grade fever, anorexia
- Vomiting after onset of abdominal pain
- Diarrhea (in very young children)
- **Abdominal pain BEFORE vomiting is a very sensitive indicator!**

McBurney’s Point and Rovsing’s Sign
Obturator/Ilio-Psoas Sign

Psoas

Obturator

Evaluation

- Quick diagnosis ➔ perforation occurs within 24-36 hours of onset of first symptom
- If the pain suddenly stops; this has likely occurred
- CBC, CRP, ESR, UA
- Abdominal Ultrasound
  - Appendix is graded
  - Inflamed appendix is aperistaltic, difficult to compress, and ≥ 6 mm in diameter.
  - Gives 95-100% specificity
- Abdominal CT as second choice if not visualized on U/S
- Several scoring systems also available

Management

- Appendectomy
  - Laparoscopic versus Open
- If perforated:
  - IVF
  - NPO/NGT to suction
  - Zosyn/Flagyl/3rd generation cephalosporin
- Abx treatment up to 14 days
  - Common offenders: E. Coli, strep milleri, pseudomonas.
  - Usual triple cocktail: Ampicillin, gentamicin, and clindamycin
Post-Operative Complications

- Wound infection
- Deep space infection/abscess
- Bowel obstruction

Nursing Considerations

- Ensure adequate gastric decompression/drainage if NGT in place
- Manage drains if in place
- Monitor closely for S&S of infection/abcsess
  - Fever, increase in WBC count
- Progress diet slowly
- Manage pain
  - But prevent ileus!
- Wound management

Transumbilical Appendectomy
Intussusception

- Prolapse or “telescoping” of one part of the intestine into the lumen of the immediately distal adjoining part.
- Most commonly ileocecal
- Three causes
  - Idiopathic
  - Lead point
  - Post-surgical

Pathophysiology

- Mesentery dragged into distal lumen
- Venous return is obstructed → edema, bleeding, increased pressure → arterial obstruction
- Ischemia → gangrene and perforation

“I swear we didn’t give him red jell-o!!!”
Epidemiology

- Presents most frequently 3 months-5 years; peak incidence at 5-10 months
- Predominantly males
- < 5 years = Idiopathic
- > 5 years = has “lead point”
  - Polyps, lymphoma, meckel’s diverticulum, Henoch-Schoenlein purpura

Presentation

- Intermittent, colicky abdominal pain
  - Lasts 1-5 minutes at a time, then abates
- Vomiting (may not be bilious)
- Bloody mucous stools
- Late signs
  - Currant jelly stools
  - Lethargy, pallor, unresponsiveness
  - Acidosis ➔ EMERGENCY SURGERY

Abdominal Exam

- Intermittent periods of fussiness/crying
- Sausage-like mass palpated in the RUQ with absence of bowel in LLQ
Imaging

- Plain film
  - "Target sign"
  - "Crescent sign"
- Ultrasound
  - Target sign
- Doppler for bowel ischemia
- May have to treat before imaging can occur

Imaging

Management

- Air enema (or barium) to reduce the intussusception
  - If you have high suspicion of intussusception don’t wait!
  - NPO, IVP, NGT if obstructed
- If you suspect perforation...
  - Do NOT give the enema
  - Emergency laparotomy, fluid resuscitation, sepsis treatment.
- Recurrence rate is still 2-5% if bowel is reduced by laparotomy
Nursing Considerations

- Maintain NPO status
- Administer enema if ordered
- Educate parents regarding S & S of intussusception
  - Intermittent abdominal pain
  - Current jelly stools
- Closely monitor for S&S of perforation
  - Q12 or more abdominal girths

Barium Enema

Malrotation and Volvulus
Back to Embryology

Rotation of the gut

Maltrotation

- Occurs during 5th-8th weeks in utero
  - Typically intestine projects out, rotates 270 degrees, and returns in
- If this rotation is not correct, intestine does not attach correctly in the mesentery
  - Small bowel bunches together to the right of the spine
    - Has narrow base at risk for volvulus
  - Colon and cecum displaced to the left
  - Peritoneal Ladd's bands form off the duodenum causing bowel obstruction
**Volvulus**

- Twisting of a loop of bowel about its vascular mesenteric base stalk attachment
- Typically the superior mesenteric artery
- Occurs at the level of the duodenum and at increased risk with Ladd's Bands
- Causes ischemia → necrosis
- Surgical EMERGENCY!
- Complete volvulus can lead to bowel necrosis in 1-2 hours!

**Incidence**

- Peaks during 1st month of life but can happen at any time in childhood.
- Males > Females
- Higher risk if patient has Ladd’s bands
**Presentation**

- Sudden onset of *bilious vomiting* with abdominal pain in an otherwise healthy neonate
- History of “feeding problems” with bilious vomiting progressing to bowel obstruction
- FTT with severe feeding intolerance

**Presentation**

- Late signs
  - Abdomen appears blue → bowel is already ischemic and necrotic
  - Jaundice
  - Hematochezia → intestinal necrosis
  - Septic-like symptoms
  - Dehydration/acidosis

**Diagnostic Imaging**

- Upper GI Contrast study is GOLD STANDARD
- Small intestine rotated to the right side of the abdomen
- Cork-screwing appearance of contrast on the way to site of obstruction
Management
• Early diagnosis
• Fluid replacement/NGT placement
• Broad spectrum abx
  • i.e. ampicillin, gentamycin, clindamycin, zosyn
• Surgical consult for immediate laparotomy
• Ladd’s procedure
  • Resect Ladd’s Bands
  • Reduce any volvulus
  • Reposition small and large bowels
  • Appendectomy if needed

Meckel’s Diverticulum

Pathophysiology
• Remnant of the omphalomesenteric (vitelline) duct that usually disappears by the seventh week of gestation.
Epidemiology

• "Rule of 2's"
• Presents in 2 % of the population with only 2 % presenting as symptomatic
• Forty five percent are < 2 years of age.
• Most common location is 2 feet from the ileocecal valve
• Generally 2 inches long

Presentation

• Painless GI bleeding
  • Heterotopic gastric tissue in the diverticulum
• Abdominal pain, vomiting, and distension are concerning for obstruction
• Perforation can occur

Imaging

• Meckel's Isotope Scan-Gold Standard
  • Technetium-pertechnetate injection
  • Heterotopic gastric tissue has affinity for radionucleotide
• 85% accuracy

[Images of Meckel's Isotope Scan]
Treatment

- Fluid resuscitation if hemorrhaging
- NPO/NGT decompression
- Abx therapy if peritonitis suspected
- Surgical intervention with diverticulectomy

Hypertrophic Pyloric Stenosis

“So, Nurse, when my baby pukes, she looks like the exorcist...”

Pathophysiology

- Narrowing of the pyloric canal caused by hypertrophy of the musculature
- Idiopathic cause OR
  - H. Pylori
  - Early erythromycin administration (< 2 weeks old) → azithromycin OK.
Presentation

- 3rd-5th week of life
- Occasional vomiting progresses to projectile vomiting
- **Nonbilious because stenosis is proximal to the duodenum**
- Infant will be hungry but will be unable to gain weight

Presentation: Electrolyte Imbalance

<table>
<thead>
<tr>
<th>Prolonged Vomiting of Gastric Secretions</th>
<th>Loss of body fluids rich in H+ and Cl- ions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydration</td>
<td>Kidney attempts to conserve Na+ by exchanging for K+</td>
</tr>
<tr>
<td>Loss of H+ and K+ ions</td>
<td>Hypokalemic, hypochloremic metabolic alkalosis</td>
</tr>
</tbody>
</table>

Exam

- Peristaltic waves in LUQ after feeding
- Palpable “olive” shaped mass in RUQ or middle quadrant at the lateral quadrant of the right rectus muscle
- Emaciated, dehydrated infant → sunken eyes, sunken fontanelles
Exam

- Abdominal U/S
  - Pyloric wall thickness ≥ 4 mm
  - Length of pyloric canal ≥ 14-16 mm
- Upper GI series
  - “string sign”
    - Contrast flowing through narrowed pyloric lumen

Management

- Correct dehydration/electrolyte abnormalities
- Surgical correction is not emergent → correct electrolyte abnormalities and dehydration first!
- Ramstedt procedure/Pylorotomy
  - Resect hypertrophic muscle fibers of the pylorus.
- Post-op
  - NGT; advance diet as tolerated

Hirschsprung’s Disease

AKA congenital aganglionic megacolon
Pathophysiology

- Absence of ganglion cells of the enteric nerve plexus of the intestines.
- Results in absent peristaltic function \( \rightarrow \) intestine obstruction
- Loss of sphincter reflexes \( \rightarrow \) stool cannot evacuate
- Associated with Down’s Syndrome

Presentation

- 50-90% of patients present in neonatal period
- Classic Presentation:
  - Failure to pass meconium within the first 8-24 hours of life
  - Bilious emesis, abdominal distension, FTT
  - Rectal exam \( \rightarrow \) spastic rectum with no stool in rectal vault—“gloved finger”
    - Will cause patient to have explosive diarrhea
  - If stool does pass, it is ribbon-like
  - Varying degrees of presentation \( \rightarrow \) may have chronic constipation and diagnosed later in life.

Diagnosis

- Plain films
- Barium enema
  - Dilation of the area of normal ganglionic colon
- GOLD STANDARD is Rectal Biopsy!
Management

- Surgical correction has come a long way!
  - Removal of aganglionic portion of bowel and end-to-end anastomosis of ganglionic "good" bowel
- Post-Op/Long Term
  - Rectal dilatations and evacuation
  - Strict bowel regimen
  - Monitoring for rectal nerve damage
  - Avoiding enterocolitis if at all possible

Small Bowel Obstruction

- Can be caused by any of the above, and many other causes
- Vomiting starts with stomach contents
  \( \rightarrow \text{bilious} \rightarrow \text{feculent} \)
- Abdominal distension, tenderness, high-pitched bowel sounds with visible peristalsis
- Serial radiographs (KUB & L Lateral Decub)
- CT enterography
- Exploratory laparotomy needed

“Double Bubble”

[Image: Classic for Duodenal Atresia!]
Necrotizing Enterocolitis

- Most common abdominal emergency in pre-term infants in the ICU; also in patients with congenital heart disease
- Risk factors include birth asphyxia, polycythemia, UA/UV line placement, early and rapid feedings, and perinatal infection.
- Ischemia, infection, and intraluminal injury eventually lead to a generalized inflammatory response and mucosal injury.
- Initial treatment is medical: NPO 10-14 days, NGT/OGT decompression, MIVF, broad spectrum abx (vancomycin, zosyn, flagyl).
- Indications for surgery: pneumoperitoneum, intestinal necrosis, gangrene
  - Peritoneal drainage
  - Laparotomy
Incarcerated Inguinal Hernia

- Repair is most common surgical procedure in children
- Bulge or swelling in the groin area, increasing with crying
- If pt has lack of bowel movements, vomiting, distension, poor feeding → obstruction and surgical emergency
- Can attempt to manually reduce, followed by surgical consult.

Testicular Torsion

- Caused by twisting of the spermatic cord → obstruction to testicular blood flow and ischemia.
- 4-8 hour window before irreversible damage ensues.
- Thought to be caused by rapid growth and increasing vascularity of the testicle during puberty

Testicular Torsion

- Classic presentation of severe unilateral testicular pain with swelling of the scrotum.
- If history and physical findings are consistent with testicular torsion and pain has been present for 6 hours → surgical evaluation should begin IMMEDIATELY!
- Manual detorsion may be attempted (medial to lateral) prior to surgery.
Ovarian Torsion

- AKA adnexal torsion
- Twisting of the ovary on its pedicle when center of gravity is altered
- Acute abdominal pain not unlike an ovarian cyst
- True surgical emergency
  - Laparoscopy to save the ovary

Abdominal Compartment Syndrome

- Syndrome caused by sustained increased intra-abdominal hypertension
  - > 17 mmHg (normal in children should be 0 mmHg)
- Three causes: Surgical, Medical, and Chronic
- Caused by:
  - Complications s/p intra-abdominal surgery, abdominal trauma
  - Massive fluid resuscitation and capillary leak → fluid sequestration and ascites
  - Burns (eschar formation)
- Can lead to:
  - Abdominal compartment → increased intrathoracic pressures
  - Direct cardiac/IVC/portal vein compression → reduced venous return
  - Renal Dysfunction
  - Hepatic and splanchic ischemia
  - Increased intracranial pressure

Abdominal Compartment Syndrome

- The most important thing to remember about abdominal compartment syndrome is that it is imperative to be able to recognize who is at risk, and diagnosing and treating quickly to minimize organ damage!
- Management
  - Body positioning (< 20 degrees)
  - Prokinetic agents, NG/colonic decompression
  - Fluid resuscitation (if patient is intravascularly deplete)
  - Diuretics/CRRT
  - Percutaneous Catheter decompression
  - Surgical abdominal decompression
Questions?

Thank you!!!

References

Contact information
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