Interpretation of the Pediatric Abdominal Radiograph – a basic skill or a “lost art”?

Richard I. Markowitz, MD, FACR
Children’s Hospital of Philadelphia
Perelman School of Medicine
University of Pennsylvania
Agenda

• Why do we do abdominal radiography?
• When is it most useful?
• What can we see?
• What does it mean?
• Which views are necessary?
Why do we still perform abdominal radiography?

• Advantages
  – Inexpensive
  – Ubiquitous
  – Portable
  – Overview
  – Relatively low radiation (with appropriate equipment and technique)
Why do we still perform abdominal radiography?

• Disadvantages
  – Often non-specific or insensitive
  – Wide range of variability
  – Harder to interpret
  – Limited tissue differentiation
  – More radiation exposure than US or MRI
Common Clinical Indications

- Distention +
- Vomiting +
- Ingestion of foreign body +++
- Possibility of intestinal obstruction +++
- Possibility of bowel perforation ++
- Placement of lines or tubes +++
- Organomegaly?? +/-
- Mass???
- Bleeding???
Approach to Radiographic Interpretation

- Be organized and methodical
- Look at lungs, bones, body habitus first
- Organomegaly, mass, large bladder
- Tubes and lines
- Calcification, contrast, or foreign material
- Bowel gas
  - Dilatation
  - Distribution
  - Wall pattern
- Free air
Does patient age matter? What changes with age?

<table>
<thead>
<tr>
<th>Age</th>
<th>Organ/Body Size</th>
<th>Gas Pattern</th>
<th>Disease</th>
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<tbody>
<tr>
<td>Neonate</td>
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<td>Infant</td>
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<td>Child</td>
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<td>Adolescent</td>
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Based on Loomis, A
Which one is abnormal?

Infant  Child  Young teen
Full term newborns – lines and leads

- Endotracheal tube
- Umbilical venous
- Umbilical artery
- External temperature lead
What is wrong here?

Giant omphalocele
Gastroschisis
Neonate with abdominal distention

Ascites
Newborn with bilious emesis and failure to pass meconium

Water soluble contrast enema

Ileal atresia
6 y.o. male with abdominal pain and vomiting
Abrupt transition mid small bowel

Small bowel obstruction related to Persistent omphalomesenteric duct remnant
Premature newborn with abdominal distension and bloody stools

24 hours later
Necrotizing enterocolitis with bowel perforation (free air)
Premature newborn with distended abdomen

Free intraperitoneal air secondary to bowel perforation (necrotizing enterocolitis)
Continuous diaphragm sign
Recent placement of gastrostomy tube

Free intraperitoneal air secondary to leakage from gastrostomy tube site
Pseudo pneumoperitoneum

6 month old female on chronic high dose steroids

Increased retroperitoneal fat deposition outlining organs
Two infants with necrotizing enterocolitis

courtesy M. Epelman, MD

Pneumotosis intestinalis

Portal venous air
Premature infant; NEC

Small bowel obstruction secondary to necrotizing enterocolitis
Infant with abdominal distension

Gastro-enteritis
18 y.o. female with Rett’s syndrome and abdominal distension

“coffee bean“ sign of sigmoid volvulus
Newborn with heart problem

Heterotaxy syndrome

- asplenia/polysplenia
- abnormal situs
  - discordant aortic arch, cardiac apex, stomach
  - transverse liver
- "interrupted " IVC with azygous continuation
- congenital heart disease
- malrotation
Newborn with distended abdomen

Meconium peritonitis
Are these “calcifications”?
“Wet diaper” artifact

- Water absorbed by sodium polyacrylate granules in disposable diapers
- Small “water balloons” surrounded by air
- Seen only when diaper is wet

- Not a problem on CT or MRI (cross sectional)
- Can obscure findings on radiograph
6 month old female with irritability

Neuroblastoma
2 year old male with abdominal pain and “constipation”

Ileocolic intussusception
1 month old with bilious vomiting
Malrotation with midgut volvulus
11 year old male with abdominal pain

Appendicolith

Retrocecal appendicitis
6 year old male with abdominal pain

Right lower quadrant Color Doppler US

Acute appendicitis - uncomplicated
14 year old male with abdominal pain and vomiting

Ruptured appendicitis Abscess
Sitz Mark test for constipation (colonic transit time)

Capsule with 24 rings is ingested

Abdominal radiograph obtained 3 - 5 days later

Normal: No markers present after 5 days
15 y.o. female swallowed something

AAA battery in stomach
Swallowed coin - where is it?

Erect radiograph
Swallowed screw 2 days ago
Where is it now?
18 month old with unexpected finding…

One martini too many?

courtesy M. Moore
Chronically ill 12 year old

Splenomegaly secondary to
Chronic portal hypertension
Chronic liver failure
4 year old male with fever, abdominal pain and elevated white blood cell count

Findings?
Diagnosis?
Next step?

Right lower quadrant ultrasound
Normal appendix
Let’s go back and look again…

Left lower lobe pneumonia
Summary

• Interpretation of the pediatric abdominal radiograph can be difficult.
• Wide range of normal which changes with patient age.
• Worthwhile for many indications, but not always specific or sensitive enough.
• Good start in many situations, but not needed to diagnose pyloric stenosis, intussusception, midgut volvulus, etc.
• Use orderly approach - don’t forget the lungs or the bones.
• When in doubt – work it out!