Pelvic Pain in the Pediatric Patient

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Objectives

• After attending this presentation, participants will be able to:
  – Understand the common congenital and acquired conditions that may cause acute pelvic pain in children
  – Recognize unusual or confusing findings in these conditions on US, CT, or MRI
  – Design imaging protocols for children with pelvic pain that minimizes radiation exposure and provides prompt and accurate diagnoses

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What percentage of your practice involves children < 16 years of age?

1. 0-25%
2. 26-50%
3. 51-75%
4. Greater than 75%
Pelvic Pain in Children

Challenges

- Common pathologies differ from causes of pelvic pain in adults
- Localization of pain is less reliable in younger children
- CT is less desirable in children
  - Little abdominal fat
  - Radiation exposure
- Bladder filling for transabdominal US can be problematic
Pelvic Pain in Children

• But it’s not all bad….
  – Transabdominal ultrasound is easier in children (small body size)
  – Certain conditions cluster in specific age groups
Imaging Approach

• Ultrasound can be used as a screening tool for the majority of causes of abdomen or pelvis pain

• Recommendation
  – Use the highest frequency transducer that penetrates to the necessary depth
    • Infants – linear or curved 7-12 mHz
    • Children – 5-10 mHz
    • Adolescents – lower if needed
CT – Great if Dose is Managed

• Image Gently
  – Child size the kVp and mA (use body diameter)
  – Single phase is often enough
  – Scan only the indicated area

• IV contrast often needed
  – Oral, rectal contrast only in select cases
MRI

• Excellent study for children who can hold still (usually over 6-7 years)
  – GI applications are increasing
• Better than CT if spine, bones potentially involved
Pathology Groups

- Congenital/developmental abnormalities
- Inflammatory conditions
- Cysts
- Masses
Congenital Vaginal Obstruction

- Isolated anomaly
  - Imperforate hymen
  - Transverse septum
- Complex anomalies
  - Uterine duplication
  - Cloacal malformations
- Presents in infancy or near puberty
Hydrocolpos in the Newborn

- May have palpable mass, may go undetected
- Imperforate hymen most common
- Vagina filled with mucus or serous fluid
Hematocolpos in Adolescents

- Pelvic or back pain
- Primary amenorrhea

13 yo with pelvic pain
Hematometrocolpos

- May present with urinary retention or constipation

13 year old with pain and difficulty urinating
11 year old with hematometrocolpos

MRI allows accurate determination of level of obstruction
Unilateral obstruction of uterine duplications can be accompanied by what other anomaly?

1. Meckel’s diverticulum
2. Ovarian agenesis
3. Renal agenesis
4. Ectopic pancreas
Unilateral obstruction of uterine duplications can be accompanied by what other anomaly?

1. Meckel’s diverticulum
2. Ovarian agenesis
3. Renal agenesis (ipsilateral)
4. Ectopic pancreas
12 year old with pelvic pain for 1 week
Abscess – Perforated Appendicitis
Ovarian Cysts

- Follicles seen at all ages
  - Seen on prenatal US as early as 28 wks
  - Fewer after 1 year age

- Cysts
  - > 2.5 cm
  - > 5 cm – may be treated surgically
Simple Ovarian Cyst

- Most are functional cysts (follicular, corpus luteum)
- Resolve in 4 – 12 wks
Hemorrhagic Cysts

- Hemorrhage
  - Fine fibrinous strands to diffuse heterogeneous echogenicity

[Images of ultrasound scans showing hemorrhagic cysts]
Ovarian cysts can extend to the liver in young infants.
Ruptured Hemorrhagic Cyst

- Surgical emergency, if hemorrhage large
- Cyst may be difficult to see
- Crenated appearance
Ovarian Cyst with Torsion

- More likely with cysts > 5 cm
- May show internal hemorrhage
- Look for enlargement of ovary
Torsion of the Normal Ovary

- More common in adolescents
  - Right ovary more common
- Abrupt sharp pain with vomiting, fever
- Enlarged ovary is most consistent finding (> 4 cm)
- Small cysts lining periphery
  - Central edema
Ovarian Torsion

- Incomplete torsion can lead to massive edema
- Exquisite tenderness with compression
Follow-up after Detorsion

- Ovary may be fully or partially salvageable with laparoscopic detorsion
What is the earliest Doppler ultrasound finding of ovarian torsion?

1. Decreased arterial blood flow
2. Decreased venous blood flow
3. Complete absence of Doppler flow
4. Normal-appearing flow
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Doppler US of Ovarian Torsion

- Venous and lymphatic flow initially compromised
  - Arterial walls muscular
- Arterial flow compromise variable
  - Normal arterial flow has been reported in 27-60% of cases.
- Twisted vascular pedicle
Torsion with Normal Doppler

- 47 cases of torsion
  - 13% normal flow
  - 13% no enlargement
  - 60% no cyst or mass
- Overall accuracy 76.8%

Maschiach, JUIM 2011

Multiple features are best predictor
Sonographer finds a large urinary bladder – What should you do next?

1. Report as bladder outlet obstruction
2. Call pediatrician and suggest catheterization
3. Try to get patient to void and look again
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Ovarian Teratoma

- Germ cell tumors most common ovarian neoplasms in children
- Classic mature teratoma
  - Derived from at least two germ cell layers
  - Primarily cystic (unilocular)
  - Rokitansky nodule (dermoid plug)
    - Hair follicles, fragments of bone, teeth
  - Dermoid mesh
    - Hair strands (linear interfaces)
CT or MRI appearance virtually pathognomonic

- Adipose tissue within cyst wall or dermoid plug
- Calcifications, amorphous or formed
Variable Appearance at US
Teratomas – Bilateral in 10%
Mesenteric Cyst

- Lymphatic malformation
- May be unilocular or multiseptated
- Prone to hemorrhage or infection
  - Increased complexity
Infected Lymphangioma
Enteric Duplication Cysts

- Can arise from any part of GI tract; ileum common.
- Bowel wall signature
  - Echogenic mucosa
  - Hypoechoic muscularis
  - Echogenic serosa
Hemorrhage lining cyst can mimic double layer wall of enteric duplication cyst
Urinary Tract Abnormalities

- Urinary tract infections most common
  - Imaging used to identify VUR, renal abnormalities
  - Bladder wall thickening may be seen, but of limited utility
Urachal Anomalies

- Incomplete obliteration of tract between allantois and bladder
  - Patent urachus
  - Sinus tract/fistula
  - Cyst
  - Diverticulum
Urachal Anomalies

- Asymptomatic unless infected
  - Hemorrhage, rupture uncommon
  - Carcinoma rare in children
Infected urachal cyst
16 year old male with pelvic pain and hematuria
Most likely cause of these findings is:

1. Bladder wall tumor
2. Hirschprung disease
3. Prostatic hypertrophy
4. Prostate/seminal vesicle anomaly
Seminal vesicle dilatation/cysts

- Congenital obstruction of ejaculatory duct
- Associated with ipsilateral renal agenesis in 66%
- Treated if symptomatic
Lower GU Tract Tumors

- Pelvic pain related to bladder outlet obstruction or constipation
- **Rhabdomyosarcoma** most common GU tumor
  - Best prognosis (77% 5-yr survival) of all sites
  - Majority with bladder or prostate involvement are <5 yrs of age
- **Ddx:** hemangioma, polyps, *cystitis cystica*
Presacral Lesions

- May be visible with US in young children, but MRI is best for evaluation.
Neuroblastoma

- 2-3% occur in pelvis
- Detection of intraspinal extension valuable
- I-123 MIBG scans
Calcifications are common in both neuroblastoma and germ cell tumors.
Other Presacral Masses/Cysts in Children

- Lymphoma
- Anterior meningocele
- Neurofibroma
- Tumors/lesions of sacrum
- Rectal duplication cyst
- Abscess
Question # 6

Where is this foreign body located?

1. Cecal lumen
2. Wall of cecum
3. Appendix
4. Patient’s pocket
5. Can’t tell
Nail in Appendix
Acute Appendicitis
US for Appendicitis

• Still accepted as best first screening exam
• Staged approach using CT for equivocal cases highly accurate

Krishnamoorthi, Radiol Jan. 2011
Appendix Size in Appendicitis

• 6 mm or > in diameter
  – PPV – 63%
  – NPV – 100%
  – More useful for excluding appendicitis
  Rettenbacher, Radiology 2011; 218: 757.

• 7 mm or >
  – Similar accuracy
Lymphoid Hyperplasia of the Appendix

- Enlarged lymphoid tissue in the wall of appendix
  - Response to viral infection
- Can mimic a fluid-filled appendix
  - Look for central mucosal stripe
- May result in increased size
Compressibility – difficult to demonstrate
Signs of Active or Impending Perforation

- Loss of mucosal lining
- Edematous fat
- Adjacent fluid collections

Secondary findings can be strong indicators of appendicitis

CT less desirable in young children, but useful in equivocal cases or suspected perforation
Crohn’s Disease with Abscess
Take Home Points

• Ultrasound best first imaging study for most causes of pelvic pain in children
  – Consider scanning beyond the pelvis
• CT for delineation of abscesses or troubleshooting
• MRI for presacral masses, congenital anomalies
  – Use for inflammatory lesions is growing

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