Case Reviews in Pediatric Radiology and Interventional Radiology

By

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Common and Uncommon Pediatric Neuro and Other Interventions
Let me know if 😊
RAPID FIRE PEDIATRIC RADIOLOGY QUIZ.  
VERY LIMITED HX, SINCE THAT IS OFTEN, REALITY 
FOR MANY OF OUR RADIOLOGY CASES.
20 MONTH OLD BOY, SWALLOWED FB
BUTTON BATTERY INGESTION

• Double contour on frontal radiograph, beveled edge on lateral view
• May lodge in esophagus, nose, stomach, large or small bowel
• Complications of nasal or esophageal batteries include tissue necrosis, tracheoesophageal fistula, esophageal stricture/perforation, or vocal cord paralysis. Most feared complication is aortic perforation.
• Must inform surgeon/pulmonologist/Gastroenterologist. If complication suspected consider CT.
What is the most likely diagnosis?

- A. Esophageal atresia with no tracheoesophageal fistula
- B. Esophageal atresia with tracheoesophageal fistula
- C. Congenital diaphragmatic hernia
- D. Normal abdomen
NEWBORN WITH POLYHYDRAMNIOS

What is the most likely diagnosis?

- A. Esophageal atresia with no tracheoesophageal fistula
- B. Esophageal atresia with tracheoesophageal fistula
- C. Congenital diaphragmatic hernia
- D. Normal abdomen
ESOPHAGEAL ATRESIA WITHOUT TEF

Scaphoid abdomen
Gasless abdomen
NG tube in cervical esophagus with dilated proximal segment
TRACHEOESOPHAGEAL FISTULA CLASSIFICATION

Type A
EA w/o TEF 10%
X-ray: gasless abdomen

Type C
N-type fistula 53-86%
EA w distal TEF X-ray: normal gas pattern

Type E
H.type fistula 6-10%
Childhood I-ray: normal gas pattern

Type D
EA w proximal and distal TEF 1%
X-ray: normal gas pattern

Type B
EA with proximal TEF 1%
X-ray: gasless abdomen

Courtesy Dr J. Davila
2 days old male baby presented with bilious vomiting since birth.
Duodenal atresia

• Most common cause of UGI obstruction in neonate
• Ddx: midgut volvulus, duodenal web, annular pancreas, prox jejunal atresia
• Associated with downs syndrome, malrotation and annular pancreas
NEONATAL BOWEL GAS PATTERNS

Normal, symmetric polygonal distribution

Distal obstruction >3 dilated loops

Proximal obstruction ≤3 dilated loops

Distal obstruction >3 dilated loops
A 2-day-old boy presented with progressive abdominal distension, bilious vomiting and no passage of meconium since birth. He was a product of full term pregnancy; delivered by 24-year-old Para 4 + 0. There was poor antenatal care at a rural hospital, without prenatal ultrasound services. The labor and delivery (though unsupervised) were uncomplicated and the baby cried immediately after birth but Apgar score could not be ascertained.
Ileal atresia

- Cutoff of contrast in distal ileum without filling defects
- Congenital occlusion of jejunum or ileum, varying in length and multiplicity
- Intrauterine ischemia; numerous bowel loops and microcolon without meconium
- Contrast enema technique: non balloon catheter, water soluble not barium. Do UGI before enema to exclude midgut volvulus if bilious vomiting
Ddx: Meconium ileus

- Microcolon with multiple filling defects from meconium corresponding to soap bubble appearance on plain film
- 90% of these pts will have cystic fibrosis; 15% CF pts present with meconium ileus
- If complicated will have atresia, segmental volvulus, or perforation with calcifications (meconium peritonitis or pseudocyst)
1 MO M WITH LIVER MASS

- What is the most likely diagnosis?
- A. Hepatoblastoma
- B. Hepatocellular carcinoma
- C. Infantile hemangioendothelioma
- D. Mesenchymal hamartoma
1 MO M WITH LIVER MASS

What is the most likely diagnosis?

- A. Hepatoblastoma
- B. Hepatocellular carcinoma
- C. Infantile hemangioendothelioma
- D. Mesenchymal hamartoma
Hemangioendothelioma

- Congestive Heart failure
- Cardiomegaly, large celiac and hepatic artery
- Aorta is small below the celiac trunk due to AV shunt → heart failure
- Can Resolve spontaneously
Hepatic Mass Differential 
In Pediatrics 

• Mesenchymal hamartoma 
• Hepatoblastoma 
• Infantile Hemangioendothelioma 
• Hepatic adenoma 
• Hepatocellular carcinoma 
• Focal Nodular Hyperplasia 
• Metastases 
• Abscess(es)
### Hepatic Mass(es) by age group

<table>
<thead>
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<th>1st year</th>
<th>1-10 years</th>
<th>&gt;10 years</th>
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<tr>
<td>• Mesenchymal hamartoma</td>
<td>• Hepatoblastoma</td>
<td>• HCC</td>
</tr>
<tr>
<td>• Infantile hemangioendothelioma</td>
<td>• Hepatic adenoma</td>
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<tr>
<td>• Hepatoblastoma</td>
<td>• Hepatocellular carcinoma</td>
<td>• Focal nodular hyperplasia</td>
</tr>
<tr>
<td>• Mets from NB or Wilms</td>
<td>• Embryonal sarcoma (rare)</td>
<td>• Mets</td>
</tr>
<tr>
<td></td>
<td>• Abscess</td>
<td>• Mets</td>
</tr>
<tr>
<td></td>
<td>• Mets</td>
<td>• Abscess</td>
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15 M GIRL WITH ABDOMINAL MASS
What are the key findings?

- A. Faint calcifications
- B. Elevation of the abdominal aorta
- C. Insinuation of tumor around vessels
- D. A and B
- E. A, B, C
15 M GIRL WITH ABDOMINAL MASS

What are the key findings?

- A. Faint calcifications
- B. Elevation of the abdominal aorta
- C. Insinuation of tumor around vessels
- D. A and B
- E. A, B and C
NEUROBLASTOMA

- Age: 90% < 5 yrs, peak 1-2 yrs; rare over 10 yrs
- most common extracranial solid malignancy in children
- Surrounds and engulfs vessels (Celiac axis, SMA, Aorta)
- Elevates aorta from spine
- Calcifications: 30% radiographs, 74-85% CT

3-year-old boy with 3-month history of bilateral leg weakness, wide-based gait
Ddx Pediatric retroperitoneal masses

1. Neuroblastoma
2. Germ cell tumor
3. Other neoplasms including Ganglioneuroma and Sarcoma
4. Benign tumors eg Schwannoma/neurofibroma Retroperitoneal/psoas abscess
11 mo girl, distended abdomen

- A. Multilocular cystic nephroma
- B. Cystic renal cell carcinoma
- C. Mesoblastic Nephroma
- D. Wilms tumour

Most likely diagnosis of cystic renal mass in a child less than 1 year of age?
11 mo girl, distended abdomen

- A. Multilocular cystic nephroma
- B. Cystic renal cell carcinoma
- C. Mesoblastic nephroma
- D. Wilms tumour

Most likely diagnosis of cystic renal mass in a child less than 1 year of age?
Mesoblastic nephroma

- **Age <12 months** ddx Wilms, rhabdoid tumour

- Most common solid renal neoplasm in neonates

- Solid intrarenal mass (classic type)

- Hemorrhage, necrosis, cysts (cellular type, older children)

- Local infiltration of the perinephric tissues is common (no capsule)

- Usually cured by resection, occ invasive or metastasizing
### Differential dx: Single Renal mass in child

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| • Mesoblastic Nephroma  
  • Wilms tumor  
  • Rare: Rhabdoid tumor | • Wilms (peak 3-5 yrs)  
  • Renal Cell Carcinoma  
  • Abscess  
  • Rare: Clear Cell Sarcoma | • Wilms  
  • Renal Cell Carcinoma  
  • Abscess  
  • Rare: Renal medullary carcinoma in sickle cell trait |
2 y 6m F with abdominal pain

What is the most likely diagnosis?

- A. Glomerulocystic renal disease
- B. Tuberous sclerosis
- C. Autosomal recessive polycystic renal disease
- D. Autosomal dominant polycystic renal disease
2 y 6m F with abdominal pain

What is the most likely diagnosis?

- A. Glomerulocystic renal disease
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- C. Autosomal recessive polycystic renal disease
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2y6m F with ARPCKD

Bilateral enlarged hyperechoic microcystic kidneys
Echogenic foci representing small cysts
Ectatic convoluted tubules and collecting ducts giving a radially striated appearance
• ARPCKD is associated with cystic liver disease including Caroli disease and congenital hepatic fibrosis
• >6 mo liver disease more severe
• <6 mo renal failure more severe
• Central dot sign
Ddx Renal cysts in children

- Bilateral
  - ARPCKD
  - ADPCKD
  - Acquired cysts
  - Syndromes:
    - Tuberous sclerosis
    - Von Hippel Lindau
    - Jouberts
    - Meckel Gruber

- Unilateral
  - MCDK (multicystic dysplastic kidney disease)
  - Multilocular cystic nephroma
  - Simple cyst
  - Calyceal diverticulum
Newborn with hydronephrosis
VCUG requested

What is the most likely diagnosis?

- A. Vesicoureteral reflux
- B. Obstructing mass in the pelvis
- C. Posterior Urethral Valves
- D. Prune belly syndrome
Newborn with hydronephrosis 
VCUG requested 

- A. Vesicoureteral reflux 
- B. Obstructing mass in the pelvis 
- C. Posterior urethral valves 
- D. Prune belly syndrome 

What is the most likely diagnosis?
Ddx Hydronephrosis

- **Unilateral**
  - Ureteropelvic junction obstruction (UPJO)
  - Vesicoureteral reflux (VUR)
  - Megaureter

- **Bilateral**
  - Vesicoureteral reflux
  - Posterior urethral valves
  - Pelvic/bladder mass
  - Neurogenic bladder
  - Rare: Anorectal malformation
  - Rare: Prune belly syndrome
VUR

- I: reflux into ureter only
- II: reflux reaching renal pelvis but no blunting of calyces
- III: mild caliceal blunting
- IV: Progressive caliceal and ureteral dilatation
- V: Very dilated and tortuous collecting system
23 month boy

Testicular Pain
23 month boy

Yolk Sac Tumor

• Most common pediatric testicular neoplasm is germ cell tumor (90%)
• Yolk sac tumor is most common malignant tumor and teratoma the most common benign tumor in children; teratoma in adults usu malignant
• **Age < 2 years old**  YST: high alpha fetoprotein
• seminoma, choriocarcinoma rare in children
• Ddx: stromal tumors (Sertoli or Leydig), lymphoma, leukemia
13y boy scrotal pain and ? mass
Most common cause of acute scrotal pain in children

Age 10 years (7-14 years)

Hypoechoic mass adjacent to testis or between testis and epidydymis

Absent doppler flow

Scrotal edema and adjacent hyperemia
### Testicular Mass
- Testicular torsion
- Germ cell tumour benign (teratoma) or malignant (yolk sac etc)
- Epidermoid
- Adrenal rest
- TB/granulomatous disease
- Leukemic infiltration

### Extratesticular mass
- Torsion of appendix epididymis or testis
- Epidydymitis
- Paratesticular rhabdomyosarcoma
- Cord hydrocele
- Hydrocele/pyocele/hematoma
- Hernia
7 yr old with chest pain

Pneumothorax
Pericardial effusion
Acute Chest Syndrome
Dislocated shoulder
Congestive heart failure
7 yr old with chest pain

- Pneumothorax
- Pericardial effusion
- **Acute Chest Syndrome**
- Dislocated shoulder
- Congestive heart failure
Typical Pediatric Interventions at Children’s Hospital of Michigan

- Biopsy: 6%
- Arterial: 10%
- CV access: 9%
- GI: 9%
- Airway: 7%
- Vasc Malf: 16%
- Other: 43%
Peds Interventional Radiology still in its infancy, so material may not always be appropriately sized
Case 1

A 7-year-old child presented with vomiting, headache, nervousness, acute squint and papilledema.

Blood pressure was discovered to be 220/170. Ophthalmological examination revealed retinal exudates.
A 7-year-old child presented with vomiting, headache, nervousness, acute squint and papilledema.

Blood pressure was discovered to be 220/170. Ophthalmological examination revealed retinal exudates. Renal duplex revealed bilateral RAS.

Medical treatment with captopril, methyldopa, and nifedipine failed to control his blood pressure.

CTA revealed right renal artery 30% focal truncal stenotic lesion and left renal artery high-grade 99% stenosis causing near total occlusion. Renal scintigraphy showed relative function of 14% in the left kidney and 86% in the right, with marked reduction in size of the left kidney on DMSA scan.
Systemic hypertension in children is usually secondary to a specific pathology, and RAS is the most common cause in children.

Causes of RAS include neurofibromatosis type 1, Takayasu arteritis, middle aortic syndrome, Williams syndrome, Ehlers-Danlos syndrome, congenital aneurysms, Kawasaki syndrome, and polyarteritis nodosa, but fibromuscular dysplasia (FMD) is the most common cause.
Transplant Intervention
9 yr old with Pelvic Mass discovered with ultrasound.
9 yr old with 
Pelvic 
Neuroblastoma.

Fusion 
techniques for 
Biopsy 
Using of MRI 
and MIBG scan 
and 
Intraprocedural 
Cone Beam CT 
to guide biopsy.
A 16-year-old girl with new chest masses: (a) Axial CT scan image demonstrates two masses in the right thoracic cavity; (b) Sonographic-guided percutaneous needle biopsy of the posterior chest mass.
A 16-year-old girl with new chest masses: (a) Axial CT scan image demonstrates two masses in the right thoracic cavity; (b) Sonographic-guided percutaneous needle biopsy of the posterior chest mass. (Pathology confirmed eosinophilic pulmonary granulomatous disease)
14 YR BONE MARROW TRANSPLANT PT WITH HX OF MULTIPLE CENTRAL VENOUS CATHETERS, MOSTLY SUBCLAVIAN WITH SUBCLAVIAN OCCLUSION, ISSUE SOLVED WITH WIRE GUIDED PICC ACCESS TO SVC VIA SMALL VENOUS TRIBUTARY.
Neonate With sudden PAC’s and atrial arrhythmia
Foreign Body Retrieval
UAC catheter fragment in the IVC and Right Atrium causing PAC’s
Neonate with sudden increase in Alk Phos abdominal tenderness on exam
Catheter Related Complications
• Enteric access and intervention

• Percutaneous image-guided retrograde or anterograde placement of gastrostomy and gastrojejunostomy tubes is now the standard in some large pediatric institutions for enteric nutrition. (Other enteric tubes are Direct Jejununal Feeding tubes and Cecostomies for fecal incontinence)

• Maintenance and exchange of such tubes is very common procedure of the Peds IR service.
A 2-YEAR-OLD GIRL WITH NOCTURNAL LEFT TIBIAL PAIN AND LAMENESS RELIVED WITH NSAIDS AND ASPIRIN.
A 2-YEAR-OLD GIRL WITH NOCTURNAL LEFT TIBIAL PAIN AND LAMENESS RELIVED WITH NSAIDS AND ASPIRIN. (A–C) TYPICAL FINDINGS OF OSTEOID OSTEOMA OF LEFT TIBIA ON RADIOGRAPHIC, SCINTIGRAPHIC AND CT IMAGES. (D, E) CT-GUIDED BIOPSY AND RADIOFREQUENCY ABLATION OF THE LESION. (F) NEEDLE TRACT WITHIN THE LESION ON POST-PROCEDURE CT SCAN.
A 7-YEAR-OLD BOY WITH LUMBAR PAIN. (A–C) LUMBAR SPINE OSTEOID OSTEOMA WITH SOFT TISSUES INFLAMMATORY OEDEMA ON MR, CT AND SCINTIGRAPHIC IMAGES. (D) CT-GUIDED RADIOFREQUENCY ABLATION OF THE LESION.
AN 8-YEAR-OLD GIRL WITH LEFT SUPRACLAVICULAR SWELLING.
AN 8-YEAR-OLD GIRL WITH LEFT SUPRACLAVICULAR SWELLING. (A) LARGE OSTEOLYTIC ANEURYSMAL BONE CYST OF THE LEFT CLAVICULA. (B) FLUOROSCOPIC-GUIDED SCLEROTHERAPY OF THE LESION. (C, D) PROGRESSIVE OSSIFICATION OF THE BONE IN 2-YEAR FOLLOW-UP.
A 9-YEAR-OLD GIRL WITH SOFT TISSUE SWELLING OF THE LEFT DISTAL MEDIAL VASTUS MUSCLE EXTENDED TO THE SOFT TISSUES OF THE SUPRAPATELLAR REGION.
A 9-YEAR-OLD GIRL WITH VENOUS MALFORMATION OF THE LEFT DISTAL MEDIAL VASTUS MUSCLE EXTENDED TO THE SOFT TISSUES OF THE SUPRAPATELLAR REGION. MR IMAGES (A–C) AND ULTRASOUND DOPPLER (D, E) OF THE VENOUS MALFORMATION WITH ECTATIC VENOUS VESSELS AND PHLEBOLITHS. (F) PHLEBOGRAPHY SHOWS DEEP FEMORAL VEIN DRAINAGE. SCLEROTHERAPY WAS PERFORMED AFTER TOURNIQUET POSITIONING.
Imaging Options for Vascular Malformations

- Ultrasound
  - Assess flow pattern
- **MRI**
  - Critical, often definitive
- **Radiographs**
  - Limited benefit - bony structures, calcification
  - Quick and Cheap
- **Angiography and CT angiography**
Classes of Congenital Vascular Anomalies

- **Malformations**
  - *Capillary*
    - Dermatologic
    - Superficial laser tx
  - **Lymphatic**
    - Microcystic
    - Macrocystic
  - **Venous**
  - **Arterial / Arteriovenous**
  - Combined Forms / Syndromes

- **Tumors**
  - **Hemangiomas**
    - Infantile
    - Congenital
  - **Tufted Hemangioma**
  - **Hemangioendothelioma**
  - **Acquired dermatologic**
  - **Other syndromes**
IMAGING WORKUP DECISION TREE

- Ultrasound
  - MRI (High flow)
    - Hemangioma (Mass-like)
    - AVM (No mass)
  - MRI (Low flow)
    - Venous (Diffuse enhancement with contrast)
    - Lymphatic (No/rim enhancement with contrast)
SCLEROTHERAPY OVERVIEW

- Primary IR treatment for VM/LM
- Intralesional injection of irritant/sclerosant
  - U/S & fluoroscopically guided
  - Induces fibrosis, contraction over 4-8 weeks
- Sclerosants
  - Doxycycline: sufficient for LM
  - Bleomycin: experimental for microcystic LM
    - Theoretical concern for systemic effects – pulmonary fibrosis
  - Sodium Tetrade cyl Sulfate (STS): detergent for VM/LM
  - OK-432: experimental, lyophilized S. pyogenes cells
  - EtOH: avoided in children
SCLEROTherapy Setup