

26<sup>th</sup> Annual General Pediatric Review & Self-Assessment

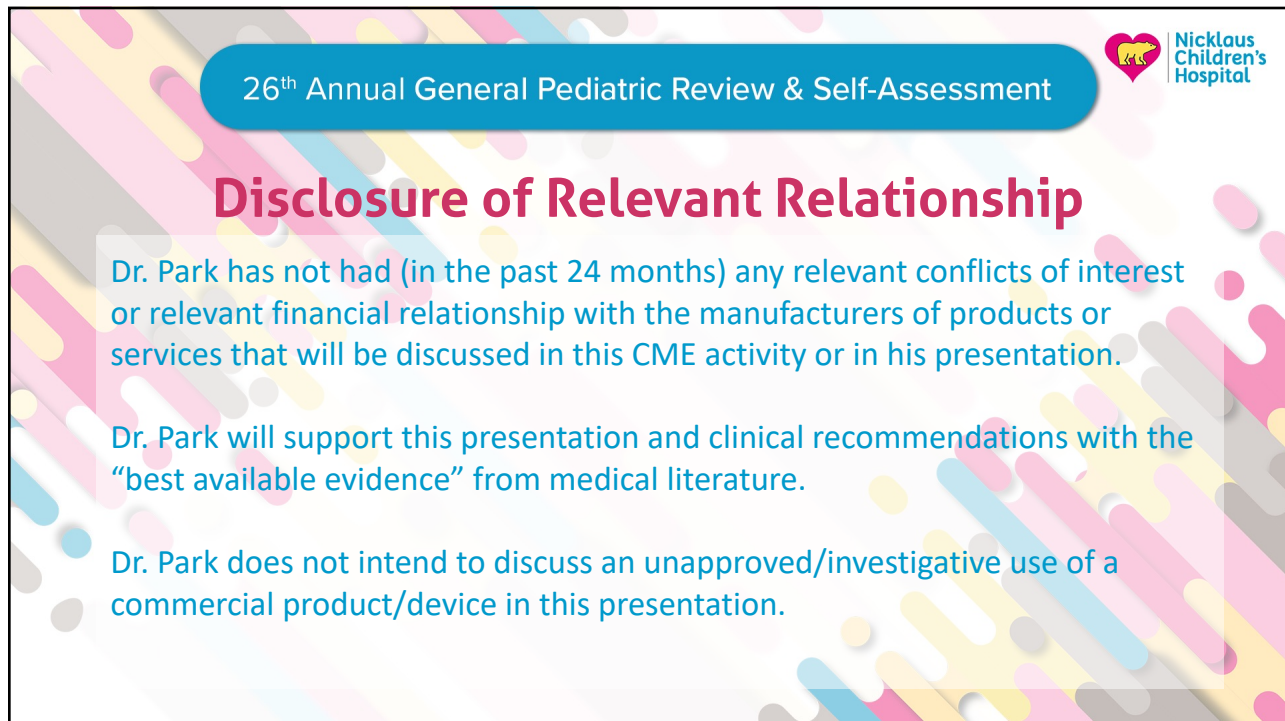
**RADIOLOGY**

**Halley Park, MD**

Attending, Pediatric Radiology  
Nicklaus Children's Pediatric Specialists  
Nicklaus Children's Hospital  
Miami, Florida

Nicklaus Children's Hospital logo

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26<sup>th</sup> Annual General Pediatric Review & Self-Assessment

**Disclosure of Relevant Relationship**

Dr. Park has not had (in the past 24 months) any relevant conflicts of interest or relevant financial relationship with the manufacturers of products or services that will be discussed in this CME activity or in his presentation.

Dr. Park will support this presentation and clinical recommendations with the "best available evidence" from medical literature.

Dr. Park does not intend to discuss an unapproved/investigative use of a commercial product/device in this presentation.

Nicklaus Children's Hospital logo

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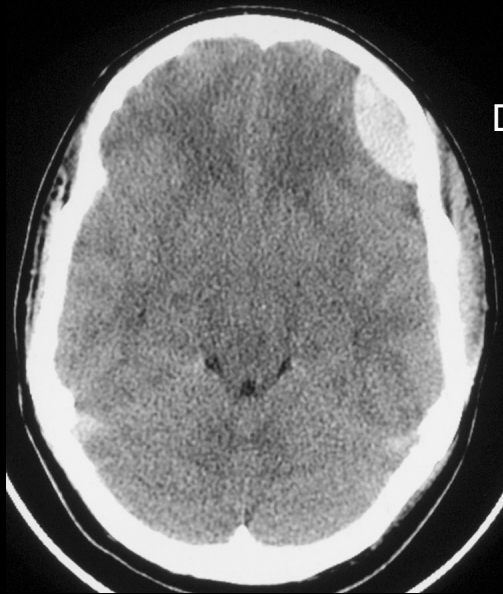
## Diagnostic Imaging for the Pediatrician

Halley Park, MD  
Pediatric Radiologist  
Nicklaus Children's Hospital  
Miami, Florida  
May 2023

Many thanks to Dr. Rachel Pevsner and Ricardo Restrepo

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### Case 1: 14y M lethargic 2 days, fall off bicycle




Diagnosis?

- A. Subdural Hematoma
- B. Epidural Hematoma
- C. Subarachnoid hemorrhage
- D. Hemorrhagic contusion
- E. Subdural abscess

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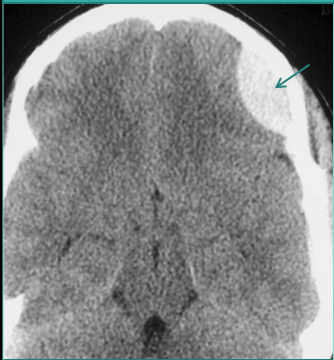
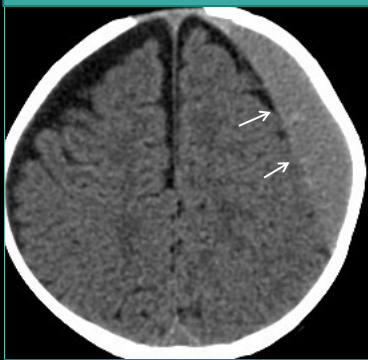
### Case 1: Diagnosis? Epidural Hematoma



- ⊗ Lentiform shape on CT
- ⊗ Arterial bleed usually middle meningeal a.
- ⊗ Associated with skull fracture
- ⊗ Acute blood is bright on CT (but < Ca<sup>++</sup>)
- ⊗ Calcium is bright on CT
- ⊗ CSF is black on CT
- ⊗ Can be venous bleed

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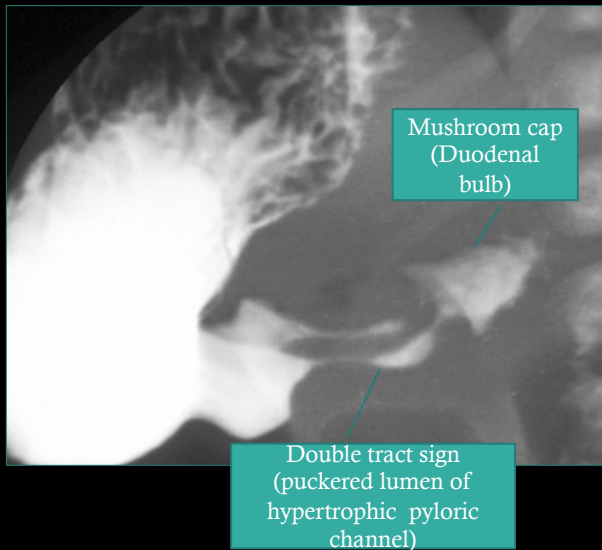
### Epidural vs Subdural Hematoma

<p>Epidural: lentiform</p>  <p>Acute: Very bright</p>	<p>Subdural: crescentic</p>  <p>Subacute: slightly bright</p>
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**CT for head trauma: NO IV contrast!!  
Can obscure small petechial bleed or contusion**

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**Case 2: 4-week M, vomiting and failure to thrive**

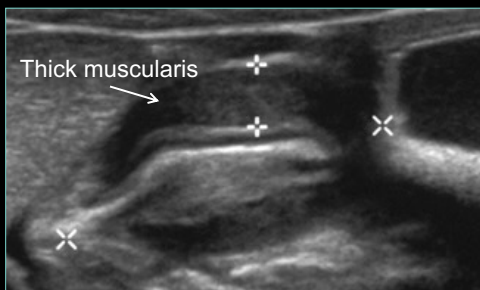


**Diagnosis?**

- A. Duodenal atresia
- B. Pyloric stenosis
- C. Midgut volvulus.
- D. Duodenal web
- E. Intussusception

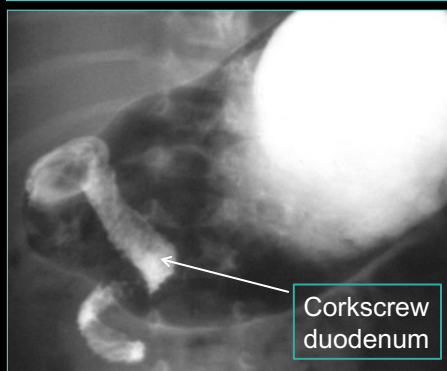
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**Pyloric stenosis: US**



- 2 wks – 3mo. M>F
- Non bilious “projectile” vomiting
- metabolic alkalosis
  - Hypokalemic, hypochloremic
- Dx: Ultrasound (study of choice)
  - Pylorus thickness > 3mm
  - Elongated channel > 15mm
  - Occasionally dx on UGI

**Midgut volvulus: UGI**



- Variable: usually < 2 years
- Bilious vomiting
- Child is toxic, acidotic
- Dx: UGI series
  - Corkscrew appearance

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Case 3: Irritable Toddler w/bloody stools  
RLQ ileo-colic intussusception.



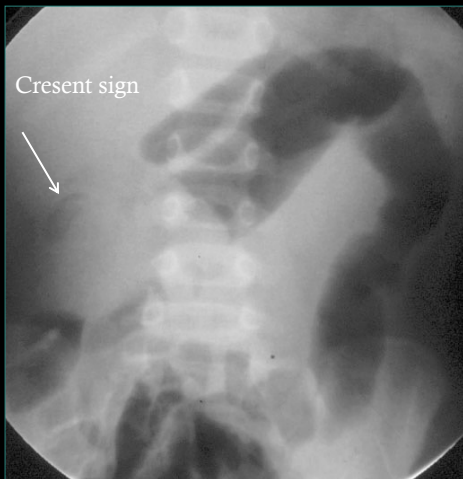
US of RLQ: Donut sign

What is next?

- ⊗ A. CT scan
- ⊗ B. Air enema & surgical consult
- ⊗ C. Barium enema
- ⊗ D. Send the patient to the OR
- ⊗ E. Chest radiograph

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Case 3: Ileo-colic intussusception.  
What is next? **Air enema and surgical consult**



**AIR ENEMA  
REDUCTION**

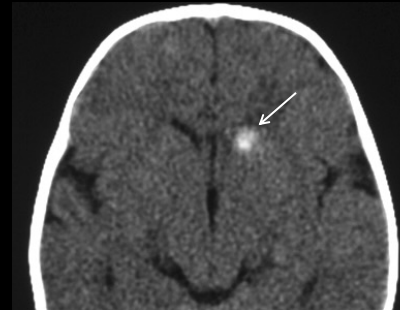
- ⊗ Imaging of choice: ultrasound
- ⊗ Air enema therapy: small risk of perforation
- ⊗ Around 10% recurrence rate
- ⊗ Small % are not reducible
- ⊗ IV and fluid bolus before Tx
- ⊗ Surgery should be on stand by

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**Case 4: 8-yr w/seizures, mental retardation,  
adenoma sebaceum**

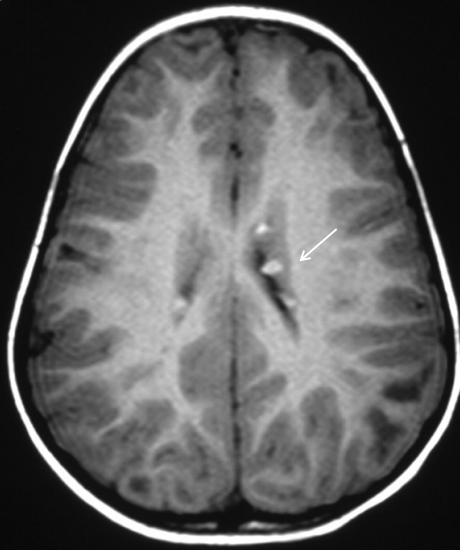


- A. CMV
- B. Hyperparathyroidism
- C. Tuberous Sclerosis
- D. Oligodendrogliomas
- E. Von Hippel Lindau

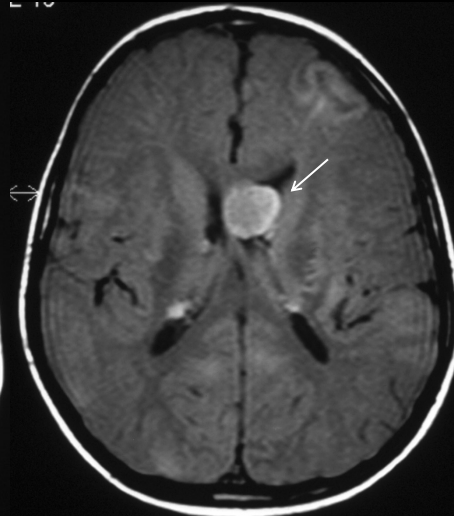


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**Tuberous Sclerosis**



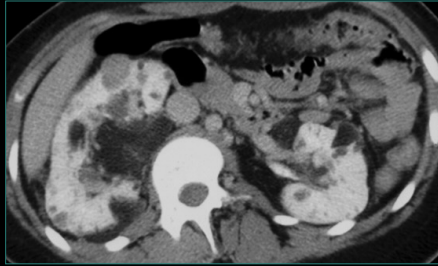
Subependymal tubers



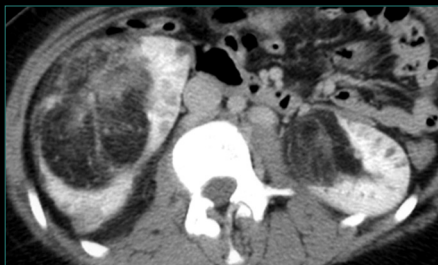
Giant cell astrocytoma:  
Foramen of Monroe

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## Tuberous sclerosis



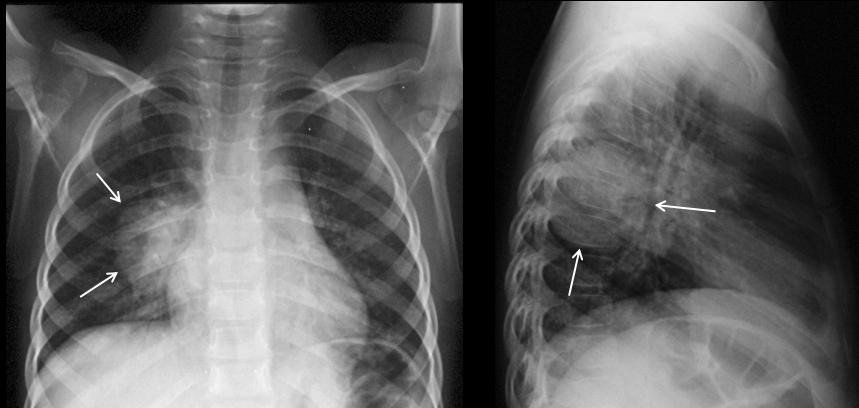
angiomyolipomas > 4 cm at risk bleed



- ⊗ Seizures, mental retardation, adenoma sebaceum
- ⊗ Hamartomas (tubers) are seen in different organs particularly brain and kidneys (angiomyolipomas)
- ⊗ Giant cell astrocytomas, renal cysts, renal cell carcinoma, bone islands

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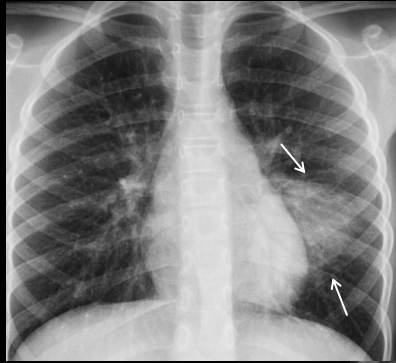
## Case 5: 5-yr F w/chest pain and cough for a week



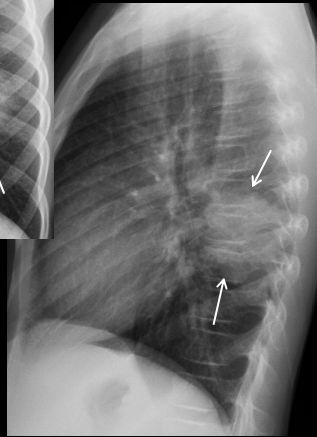
- A. Round pneumonia
- B. Mediastinal teratoma
- C. Congenital lobar emphysema
- D. Croup
- E. Neurogenic tumor

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## Round Pneumonia



Another example:  
7 yr old F w/cough & fever

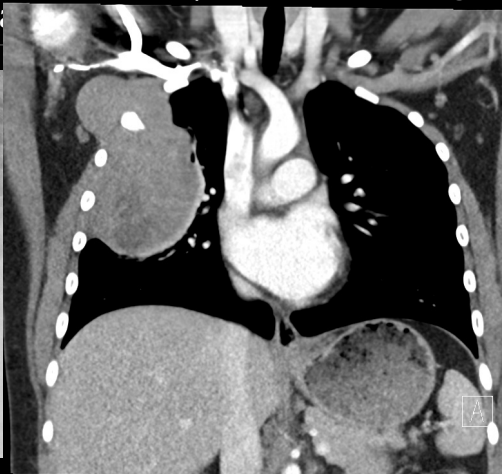


- Pneumococcus
- Usually between 2 – 8 y
- if older suspect immunodeficiency, atypical organism or neoplasm
- Lower lobes
- Touching the pleura
- **Clinical history must correlate with findings**

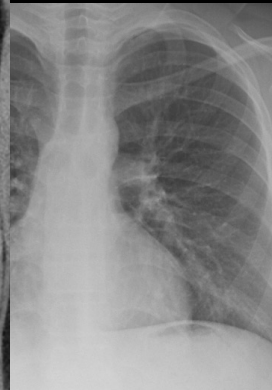
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## Pitfall case 12 yr old with chest pain and shoulder pain

Initial xray read



month later

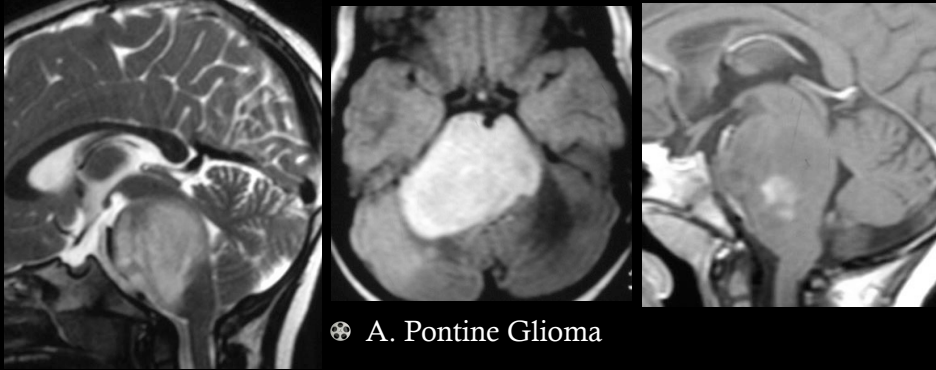


Osteosarcoma of chest wall

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### Case 6: 6yr w/headaches, vomiting, diplopia & Rt fascial weakness & Lt hemiparesis

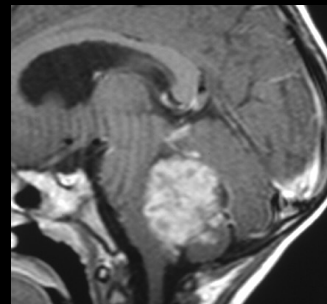
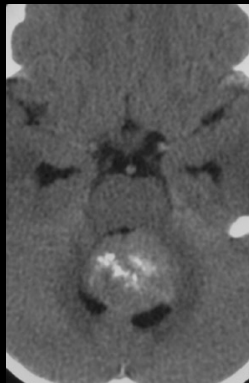


- ⊗ A. Pontine Glioma
- ⊗ B. Multiple sclerosis
- ⊗ C. Brain abscess

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## Pediatric Brain Tumors

- ⊗ Most common site for tumors is the posterior fossa
- ⊗ Most common peds brain tumors (in order):
  - ⊗ pilocytic astrocytoma
  - ⊗ medulloblastoma
  - ⊗ ependymoma



**Ependymoma:**  
•Midline  
•partially calcified  
posterior fossa mass

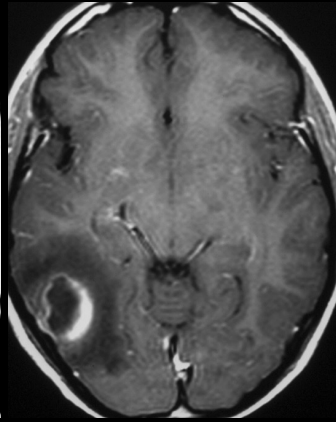
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## Contrast for tumors & infection

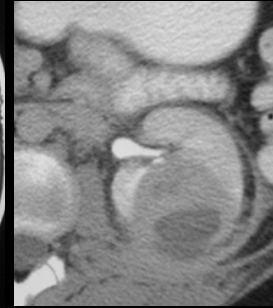
**Cerebral abscess:**  
rim enhancing lesion surrounding edema



CT



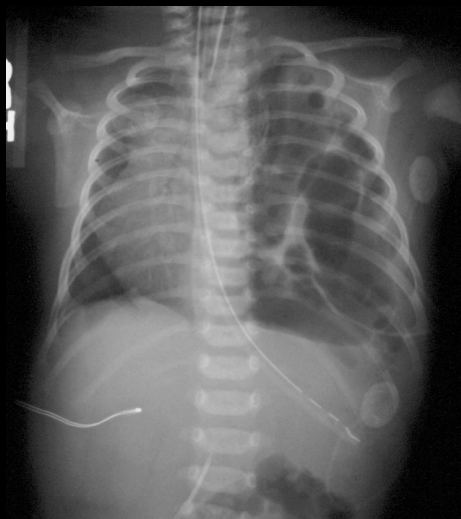
MRI



Patient also had  
Renal abscess

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Case 7: Which one is commonly observed in this term newborn with severe respiratory distress?



Congenital diaphragmatic hernia

- A. Persistent pulmonary hypertension
- B. Pyloric stenosis
- C. Tension pneumothorax
- D. Systolic murmur

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## Persistent pulmonary hypertension



Congenital diaphragmatic hernia

Associated with:

Congenital diaphragmatic hernia

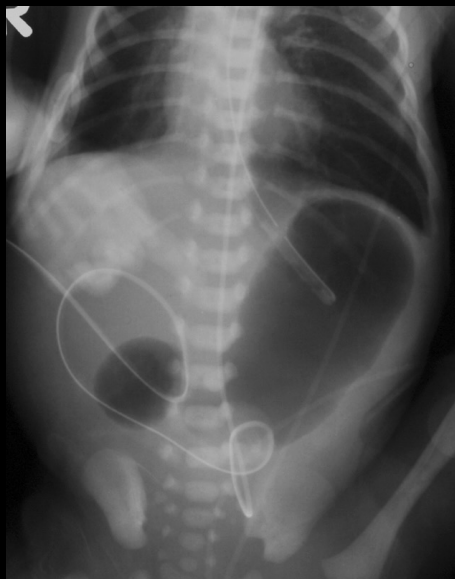
Meconium aspiration

Occasionally with severe RDS

Idiopathic

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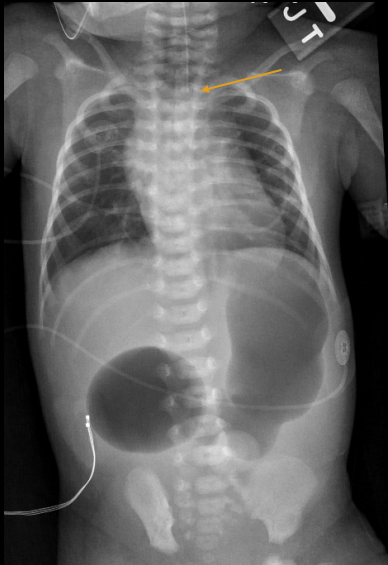
## Case 8: 1-day old baby with vomiting



- A. Pyloric stenosis
- B. Duodenal atresia
- C. Ileal atresia
- D. Duodenal hematoma
- E. T-E fistula

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## Duodenal atresia

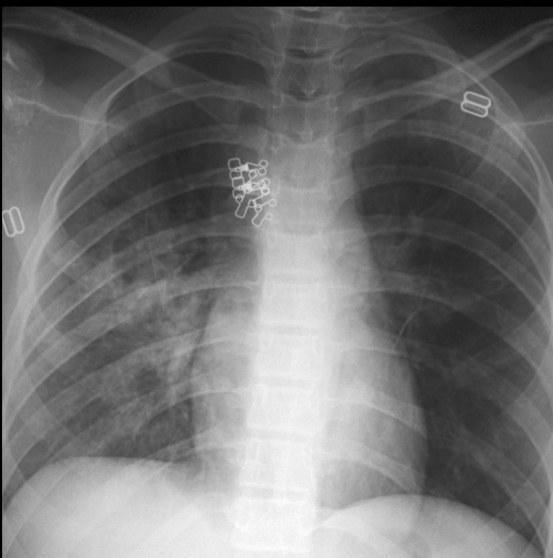


1day old trisomy & TEF

- ⊗ Double Bubble Sign
  - ⊗ No air in bowel distally
- ⊗ Bilious vomiting (obstruction distal to ampulla of vater)
- ⊗ No further imaging necessary
- ⊗ Associated with Down Syndrome (30%) and part of VACTERL
- ⊗ Due to failure canalization of duodenum

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## Case 9: Adolescent girl fell from a horse & has difficulty breathing and hemoptysis

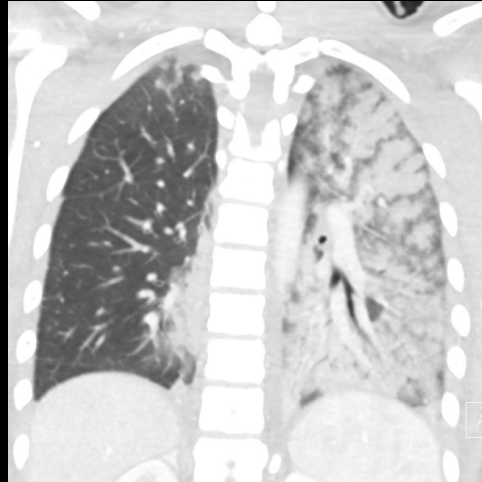


- A. Aspiration
- B. Pneumothorax
- C. Traumatic pneumatocele
- D. CPAM
- E. Necrotizing pneumonia

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## Traumatic pneumatocele/Pulmonary contusion

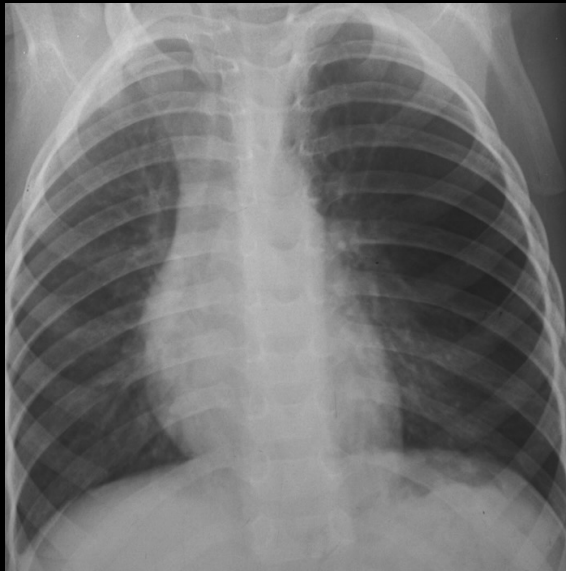
- ⊗ Ground glass opacity usually in the lung bases
- ⊗ Alveolar rent causes intraparenchymal air leak
- ⊗ Associated with rib/clavicle fracture
- ⊗ Cavity with an air fluid level classically seen (traumatic pneumatocele)
- ⊗ Hemoptysis



MVA Rollover 17yr f other occupants perished, Neg CXR, but CT showed extensive contusion & hemorrhage

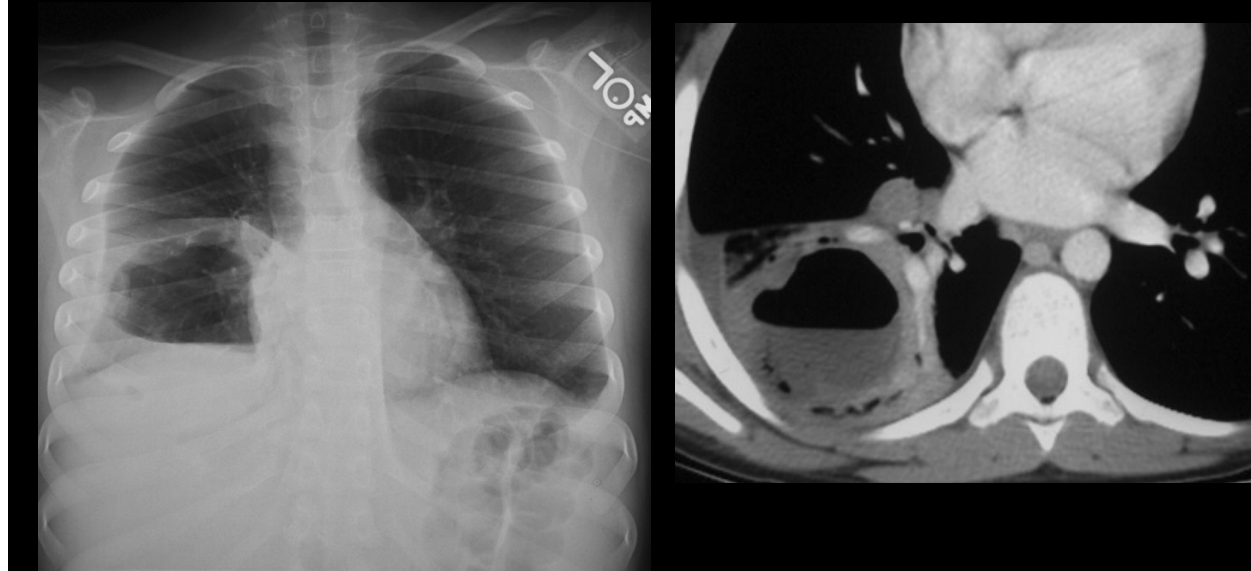
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## Cystic pulmonary masses: Congenital Cystic Pulmonary Adenomatoid Malformation: CPAM



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## Cystic Pulmonary masses: Pulmonary abscess



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## IV Contrast (CT & MRI)

In general for evaluation of

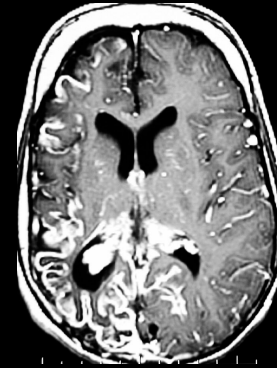
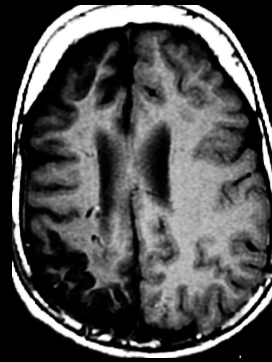
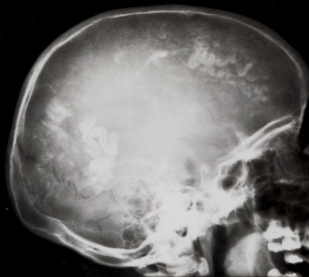
- vascular structures: vascular rings
- infection
- inflammation
- tumor
- Congenital lung malformations: CPAM, sequestration, etc

Exception: Sinusitis

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Case 10: Which one of the following associated findings is most likely seen in this patient with glaucoma:

calcifications



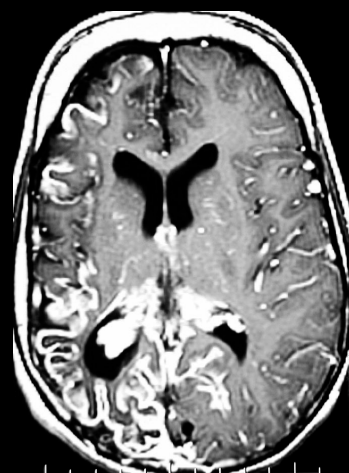
leptomeningeal angiomas

- Hypopigmented skin lesions
- Port wine stain
- Agenesis of corpus callosum
- Periostitis of the long bones

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## Sturge Weber Syndrome

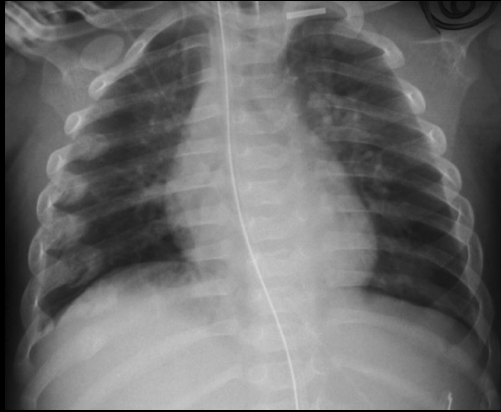
- Phakomatosis/neurocutaneous disorder
- Seizures
- Nevus(port wine stain) in the distribution of the opthalmic branch of the trigeminal nerve
- Ipsilateral leptomeningeal angiomas
- High incidence of mental retardation
- Glaucoma/buphthalmos



leptomeningeal angiomas

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**Case 11: 2 mo. Infant with hypotonia**



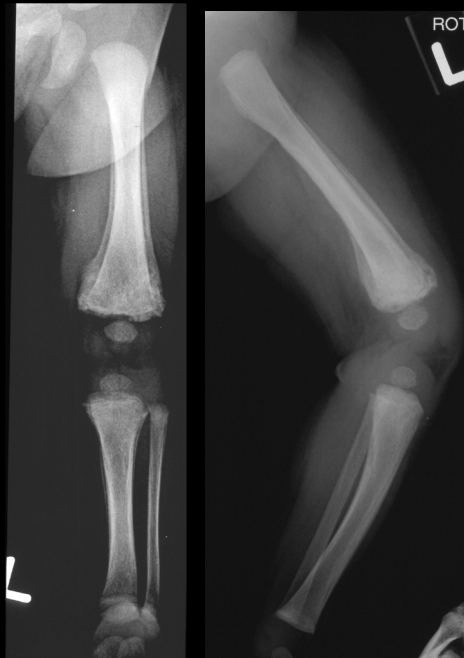
- A. Osteogenesis imperfecta
- B. Thanatophoric dysplasia
- C. Congenital syphilis
- D. Non accidental trauma
- E. Osteopetrosis

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**Child Abuse**



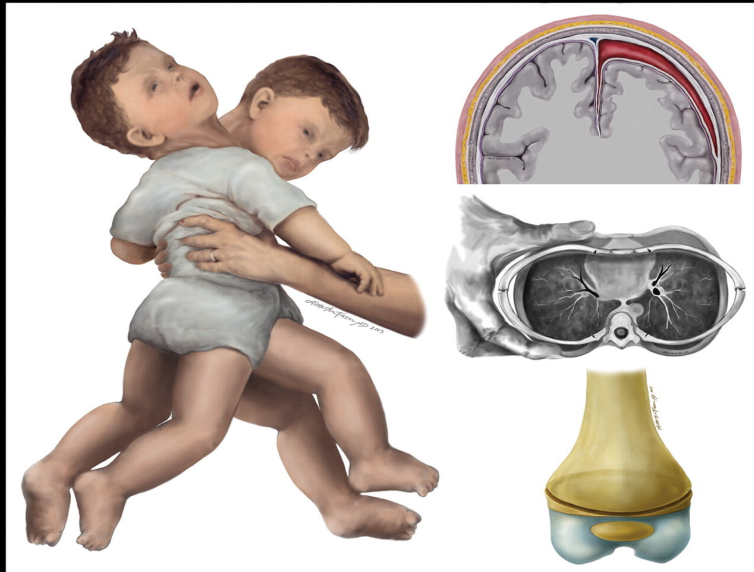
Multiple fractures in  
different stages of  
healing



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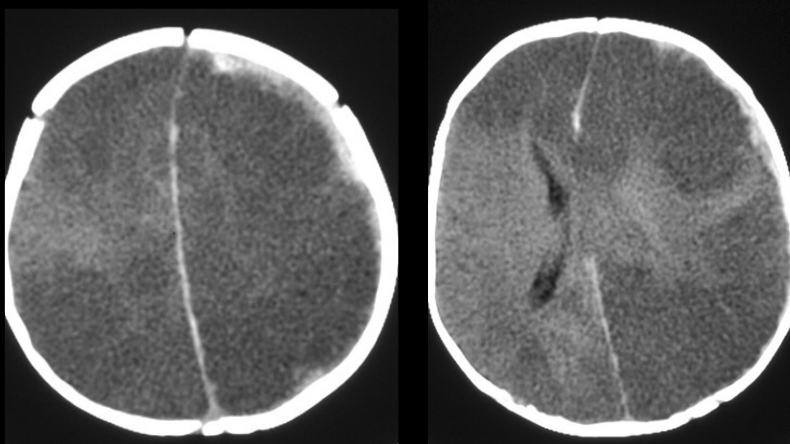
## Mechanism of Injury



Published in: Gael J. Loneragan, Andrew M. Baker, Mitchel K. Morey, Steven C. Boos, *RadioGraphics* 2003, 23, 811-845.  
DOI: 10.1148/rg.234035030

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NAHI: Acute SDH, diffuse edema & ischemia  
supposedly hit by brother with toy truck



Bone Survey: multiple rib fractures

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### Case 12: One yr old infant with abdominal distention



The best tumor marker to diagnose this tumor is?

- A. Alpha-fetoprotein
- B. Beta HCG
- C. CEA
- D. CA 125

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## Hepatoblastoma

- Most common primary liver tumor of childhood
  - 43% of total liver masses
- Usually seen in infants and children < 3 yrs
- Most common presentation is a painless mass
- Serum AFP levels elevated in > 90% of pts.
- Predisposing conditions:
  - Beckwith-Wiedmann syndrome
  - Trisomy 18
  - familial polyposis coli,
  - Gardner syndrome

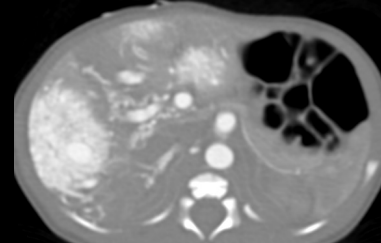
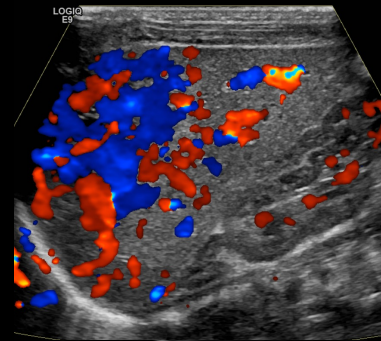


2yr m, mass incidentally found on appy US,  
Palpable & firm on clinical exam in RLQ

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## Liver neoplasms

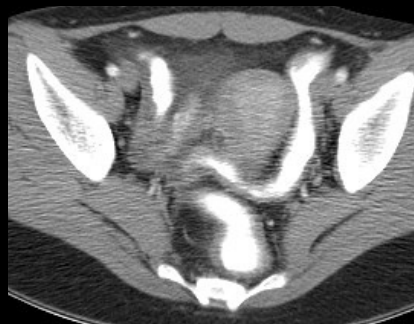
- ⊗ Liver 3<sup>rd</sup> most common site primary tumor in peds after kidney & adrenals
- ⊗ 2/3 of primary liver tumors are malignant, most common:
  - ⊗ Hepatoblastoma
  - ⊗ HCC (hepatocellular carcinoma)
  - ⊗ Undifferentiated Embryonal Sarcoma
- ⊗ 1/3 of hepatic primary tumors benign, most common:
  - ⊗ Infantile hemangioma
  - ⊗ FNH (focal nodular hyperplasia)
  - ⊗ Mesenchymal hamartoma



New born: multifocal hepatic hemangiomas & high output cardiac failure due to significant arteriovenous shunting.  
Tx: High Dose Propranol & steroids

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### Case 13: Teenager with rectal bleeding, diarrhea, and anorexia



Thickened colonic walls, no small bowel involvement

- A. Crohn's
- B. Ulcerative Colitis
- C. Irritable Bowel Syndrome
- D. Lactose Intolerance

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## Case 14: 14yr M with vomiting, fever & RLQ pain



SUP TO BLADDER SG

Complex collection appendix not seen  
extensive inflammation RLQ

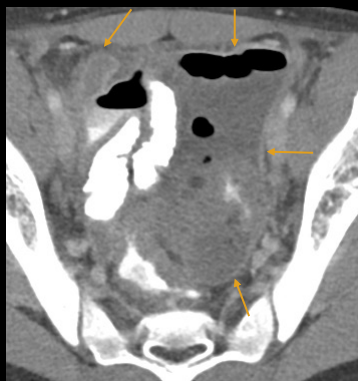
- ⊗ A. Perforated Appendicitis
- ⊗ B. Ulcerative Colitis
- ⊗ C. Crohn's Disease
- ⊗ D. Sprue

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## Case 14: Perforated Appendicitis



Deep pelvic abscess  
US guided transrectal drainage with TPA

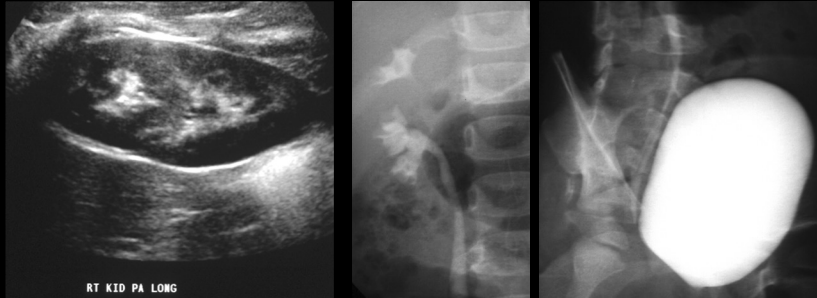


Appendicitis

- Dx is not often straight forward
- 1/3<sup>rd</sup> kids atypical presentation
- Complications: abscess, peritonitis, sepsis, bowel obstruction
- Peds higher incidence perforation

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### Case 15: 2 mo old infant w/ fever.

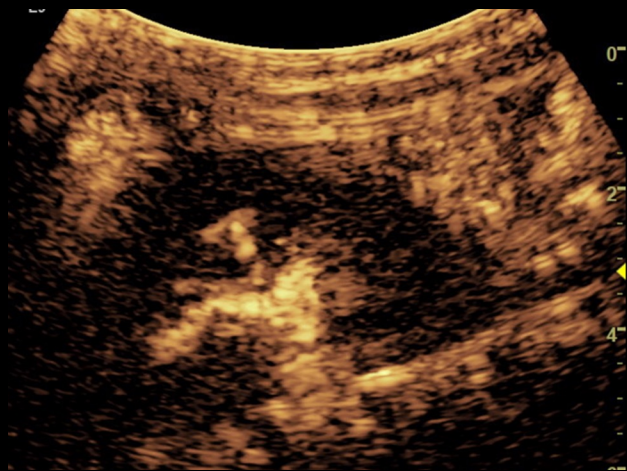


- ⊗ A. Prominent Column of Bertin
- ⊗ B. Reflux into a duplicated collecting system
- ⊗ C. Posterior urethral valves
- ⊗ D. Myelomeningocele

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### Companion case VUR

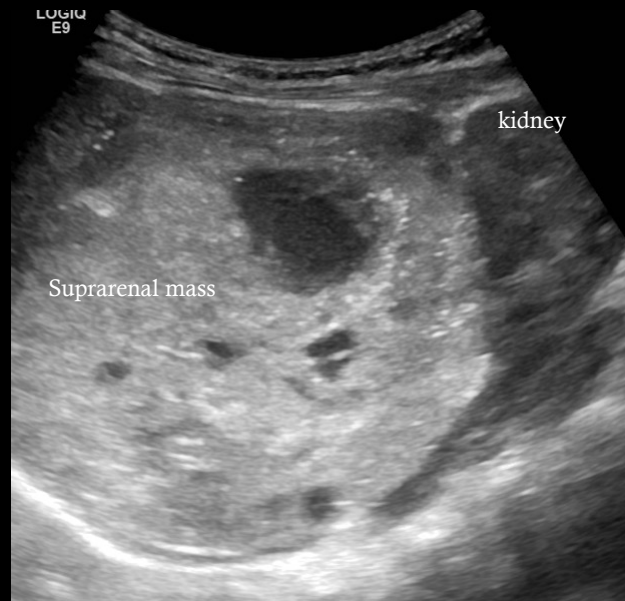
Left kidney grade 3 reflux on 4<sup>th</sup> n& 5<sup>th</sup> cycle filling



- ⊗ 20mo old Unexplained recurrent UTI
- ⊗ VCUG negative
- ⊗ Contrast enhanced voiding urosonography (ceVUS) was positive

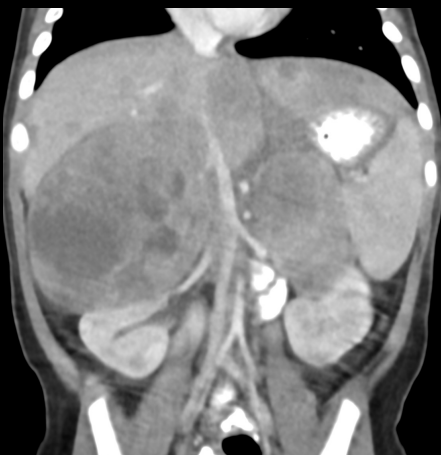
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## Bonus: 3mo old right eye hematoma & bruising. DX?

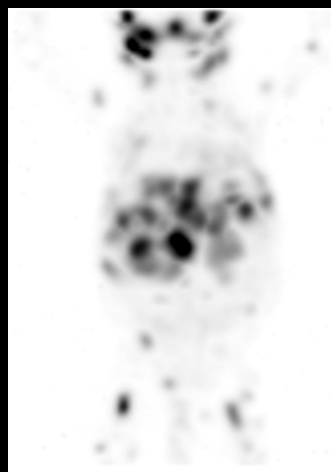


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## Neuroblastoma



Bilateral suprarenal masses, liver mets



MIBG: bone & skin mets

Most common malignancy in infant

Commonly originates in medulla adrenal gland/retroperitoneal mass

Paraneoplastic syndrome: opsoclonus-myoclonus

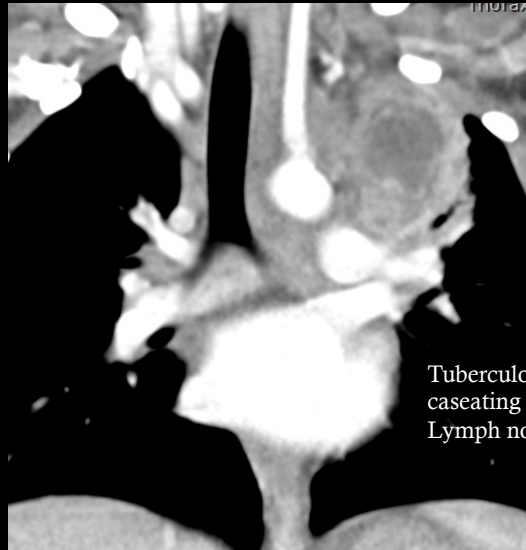
Elevated urine catecholamines

Surrounds vascular structures w/out invading

50% calcification

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Bouns: 6 yr M w/ hemoptysis. Just finished 6 mo course of observed tx for TB. What do you do next?



Tuberculoma with caseating necrotic Lymph nodes

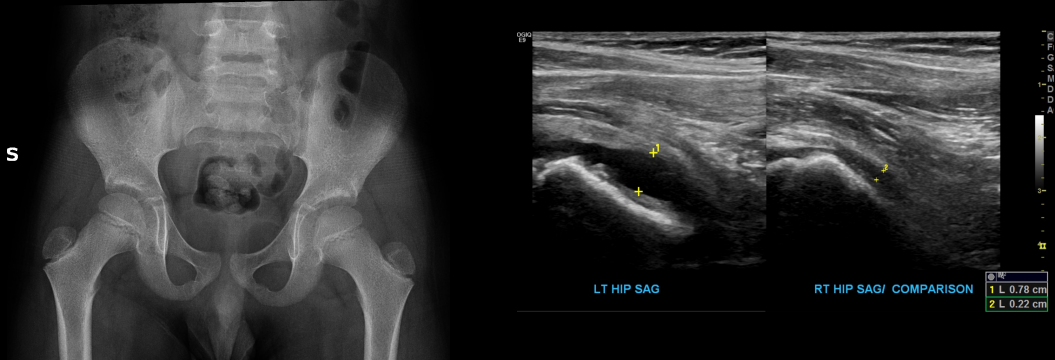
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# Limping child

review

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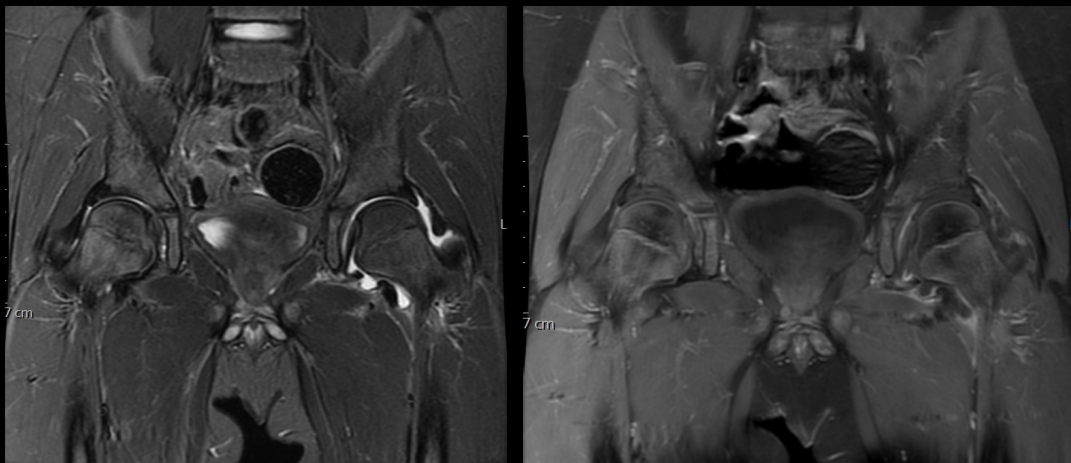
7 year old limping and hip pain for 3 days



Ddx?

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Mri next morning



NEXT STEP?

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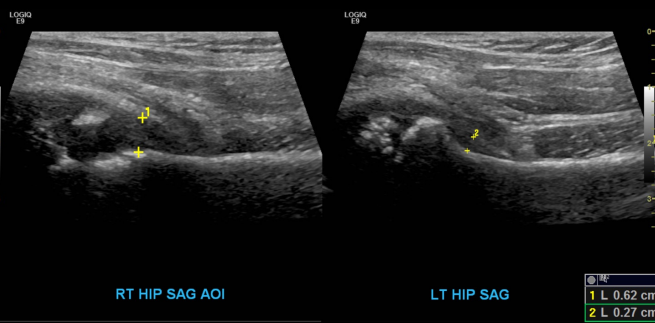


# Joint aspiration: Toxic (transient synovitis) synovitis



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# 3 yr old rt hip pain for 1 week and fever US. Arrived in am from NY requested by er



DDX? Brodies abscess

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## F/U MRI: Septic joint & osteomyelitis



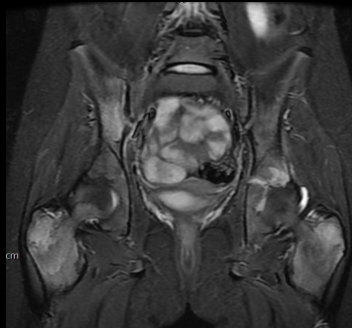
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## JIA: 12 yr M, lt hip pain & limping 24 hrs s/p recent fall.

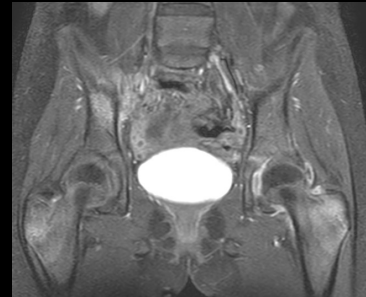


68

CNO: 12 yr F Gymnast w/nontraumatic right buttock pain x 4 days. HX of ulcerative colitis



Multiple areas enhancing BM edema



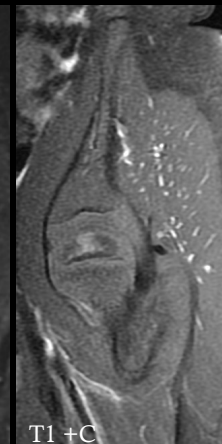
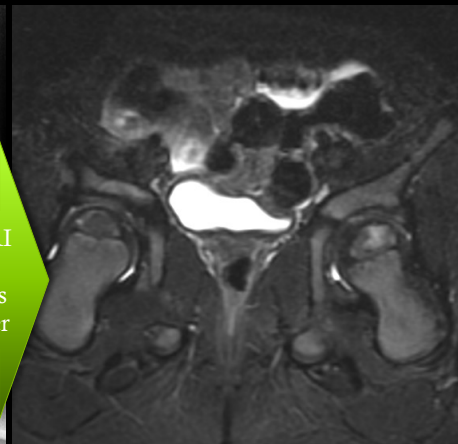
Dramatically improved now on methotrexate

69

2 yr old limping. DDX?



MRI  
3  
wks  
later

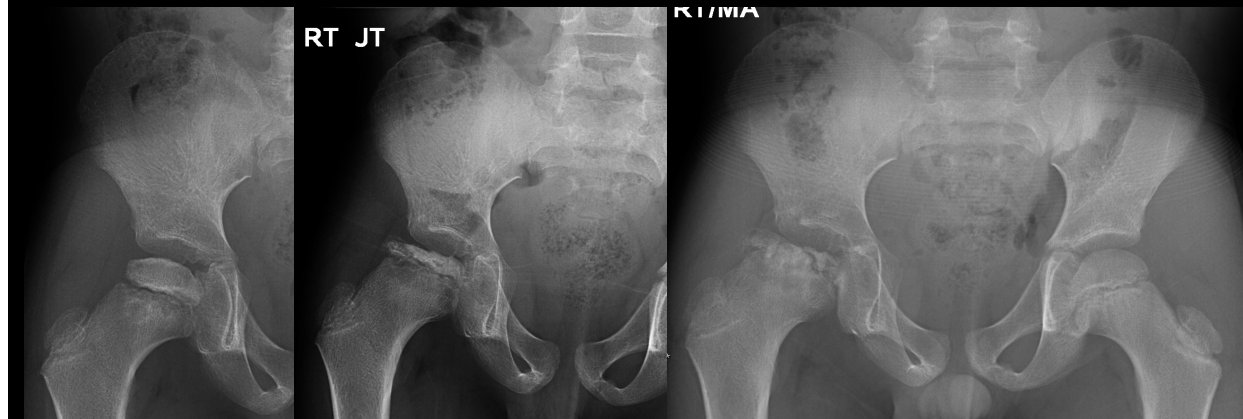


T1 + C

Early Legg-Calve-Perthes Disease

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Perthes: early at 6yr, 7yrs fragmentation phase, 12yrs progressive



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