The Annual General Pediatric Review & Self Assessment

Nicklaus Children's Hospital

RADIOLOGY

Halley Park, MD

Attending, Pediatric Radiology

Nicklaus Children's Pediatric Specialists

Nicklaus Children's Hospital

Miami, Florida

Nicklaus Children's Hospital

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.

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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

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

1. Case 1 - 14 y M lethargic 2 days, fall off bicycle - What is the diagnosis?

A. Subdural Hematoma 0%

B. Epidural Hematoma 0%

C. Subarachnoid hemorrhage 0%

D. Hemorrhagic contusion 0%

E. Subdural abscess 0%

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^{++})
- Calcium is bright on CT
- CSF is black on CT
- Can be venous bleed

Epidural vs Subdural Hematoma

Epidural: lentiform

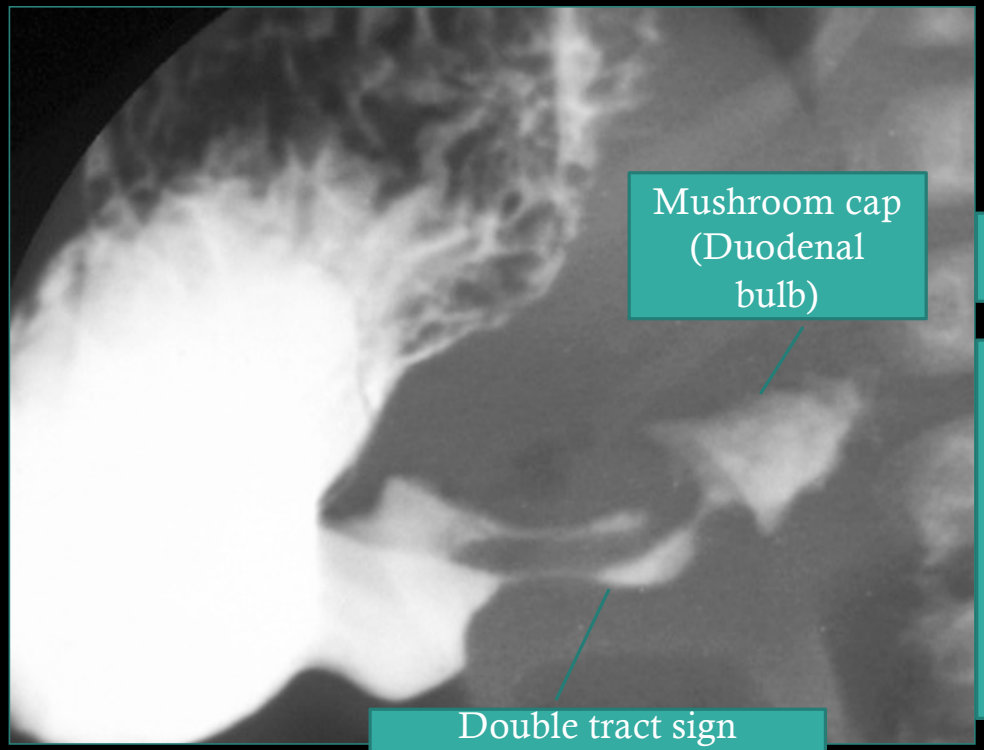
Acute: Very bright

Subdural: crescentic

Subcute: slightly bright

CT for head trauma: NO IV contrast!!
Can obscure small petechial bleed or contusion

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

2. 4-week M, vomiting and failure to thrive. What is our diagnosis?

A. Duodenal atresia 0%

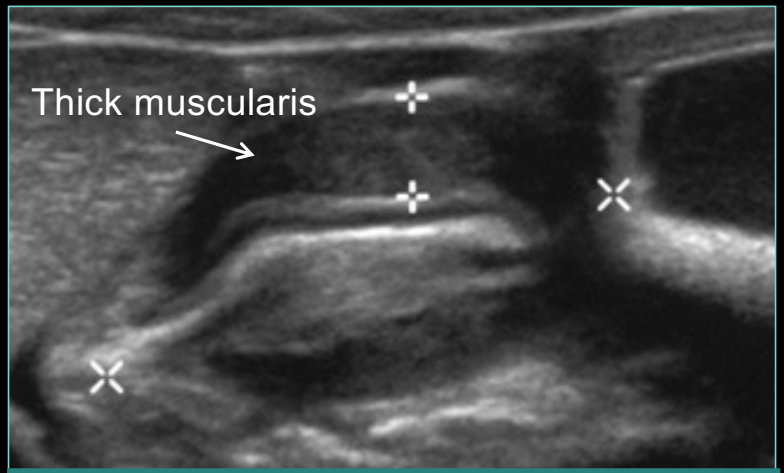
B. Pyloric stenosis 0%

C. Midgut volvulus 0%

D. Duodenal web 0%

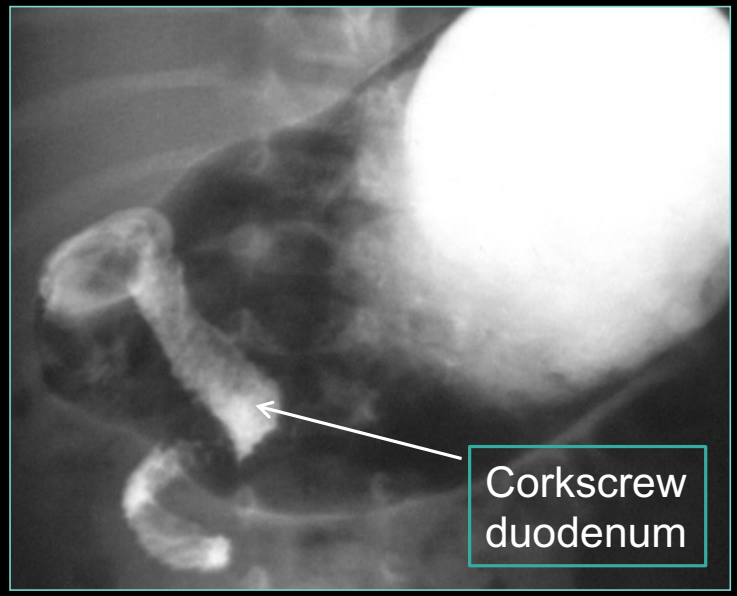
E. Intussusception 0%

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

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

3. Case 3: Irritable Toddler w/bloody stools RLQ ileo-colic intussusception. What is your next step?

A. CT scan 0%

✓ B. Air enema & surgical consult 0%

C. Barium enema 0%

D. Send the patient to the OR 0%

E. Chest radiograph 0%

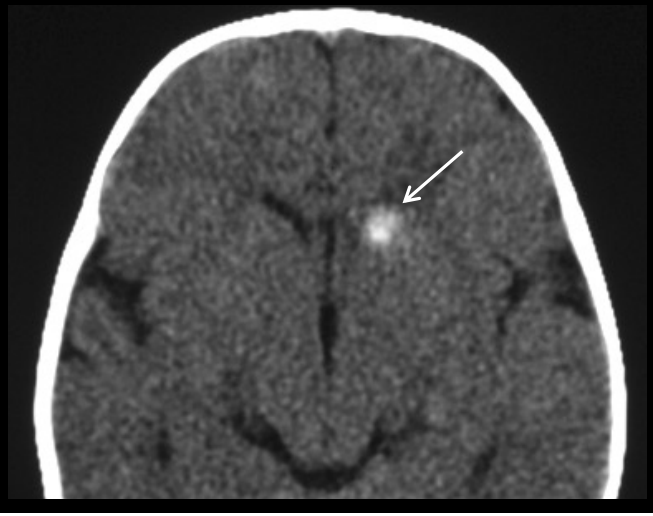
Case 3: Ileo-colic intussusception.
What is next? Air enema and surgical consult

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

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

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



4. Case 4: 8-yr w/seizures, mental retardation, adenoma sebaceum. What is your diagnosis??

A. CMV
0%

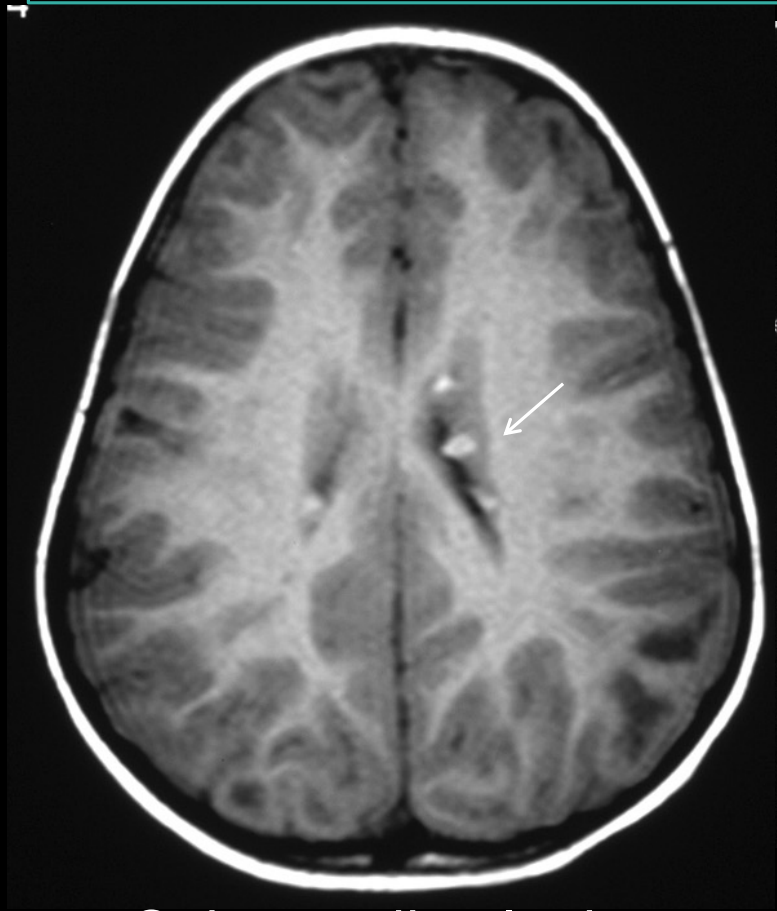
B. Hyperparathyroidism
0%

✓ C. Tuberous Sclerosis
0%

D. Oligodendrogliomas
0%

E. Von Hippel Lindau
0%

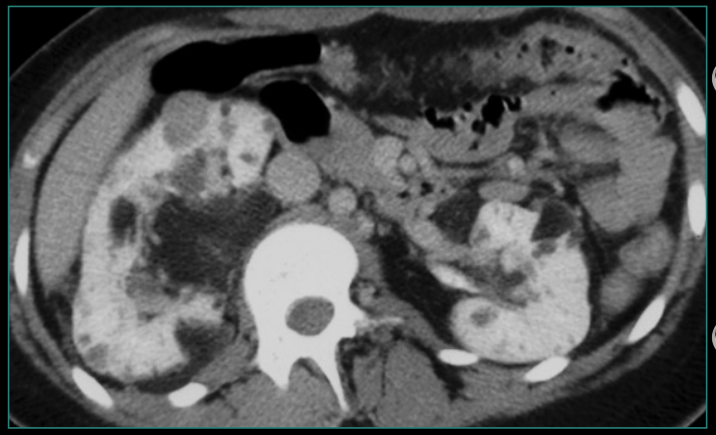
Tuberous Sclerosis



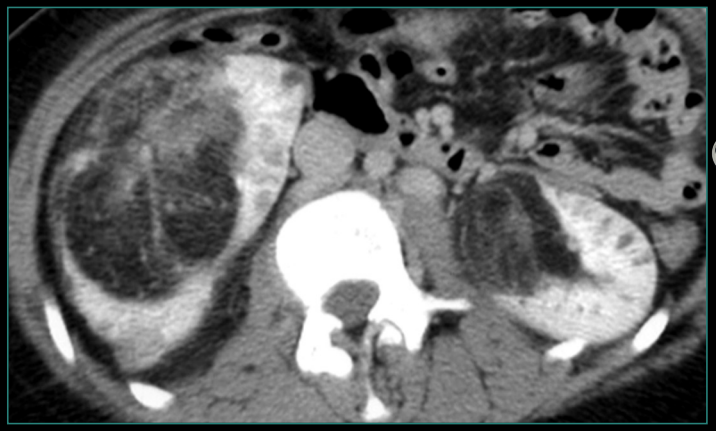
Subependimal tubers

Giant cell astrocytoma:
Foramen of Monroe

Tuberous sclerosis

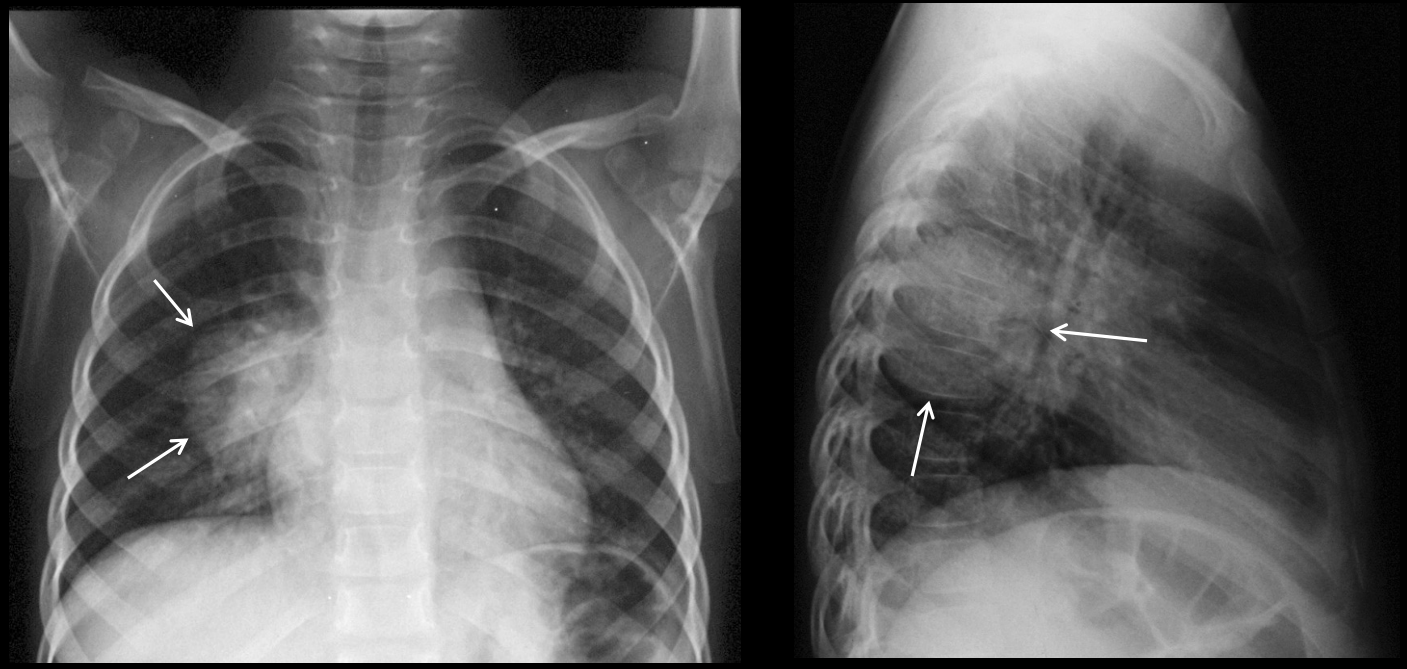


angiomyolipomas > 4 cm at risk bleed



- 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

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

5. Case 5: 5-yr F w/chest pain and cough for a week. What is your diagnosis?

A. Round pneumonia 0%

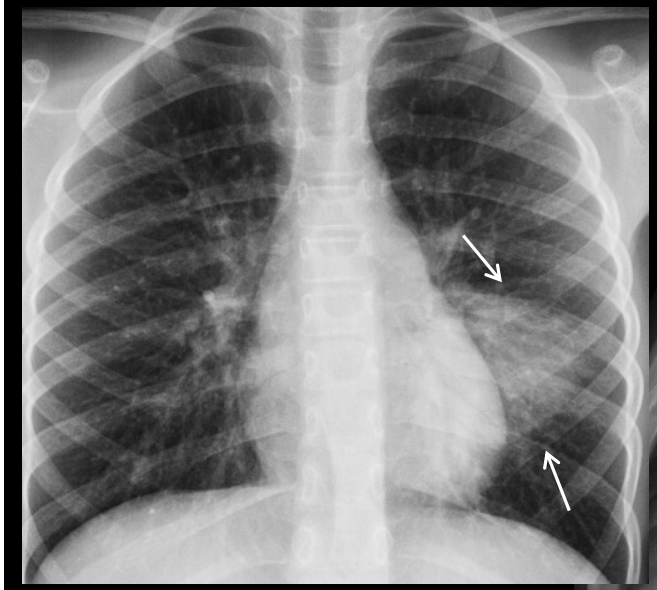
B. Mediastinal teratoma 0%

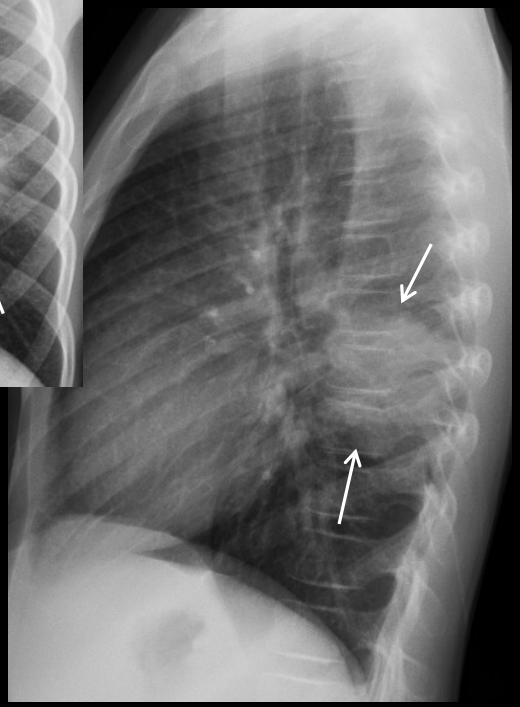
C. Congenital lobar emphysema 0%

D. Croup 0%

E. Neurogenic tumor 0%

Round Pneumonia





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

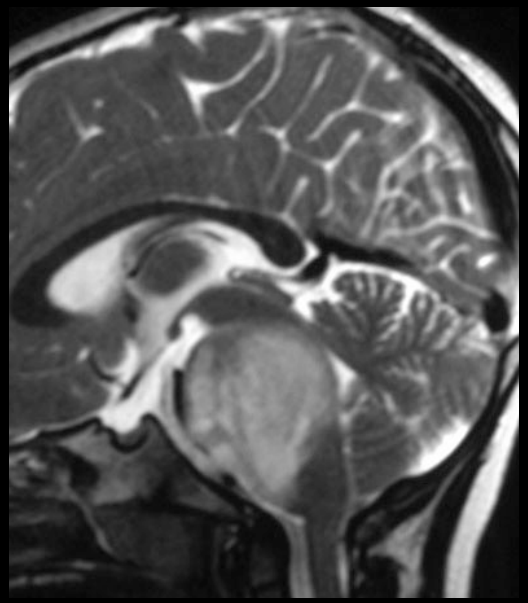
- Pneumococcus
- Usually between 2 – 8 y
- if older suspect immunodeficiency, atypical organism or neoplasm
- Lower lobes
- Touching the pleura
- Clinical history must correlate with findings

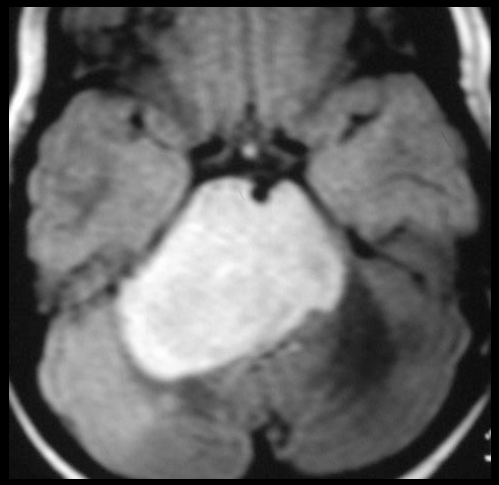
Pitfall case 12 yr old with chest pain and shoulder pain

Initial xray read a month later

Osteosarcoma of chest wall

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





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

6. Case 6: 6yr w/headaches, vomiting, diplopia & Rt fascial weakness & Lt hemiparesis. What is your diagnosis?

✓ A. Pontine Glioma

0%

B. Multiple sclerosis

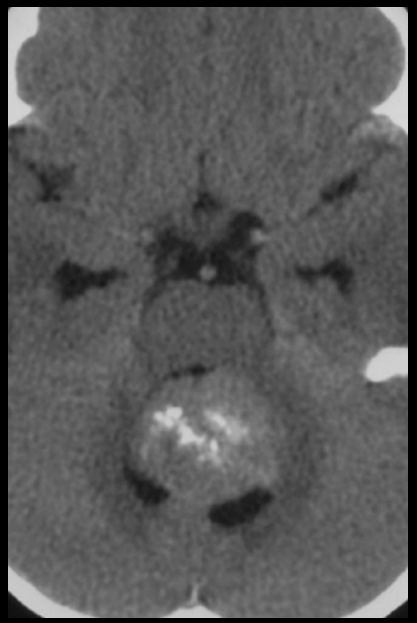
0%

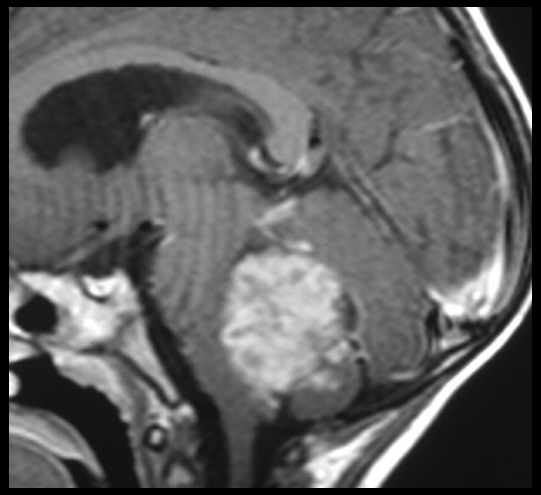
C. Brain abscess

0%

Pediatric Brain Tumors

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





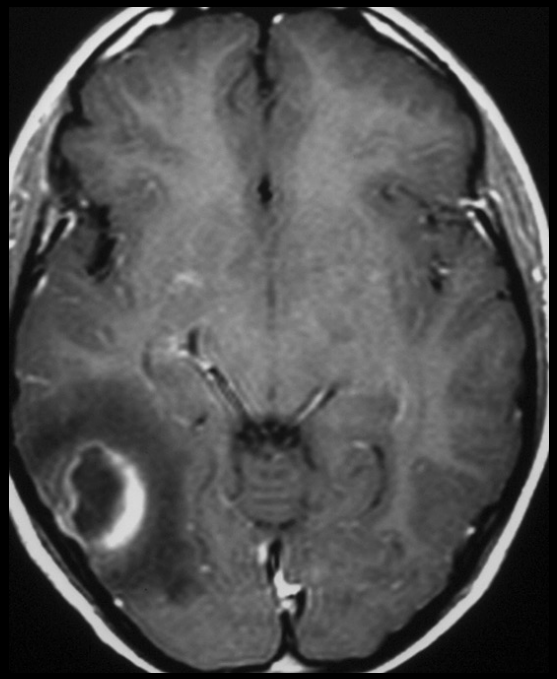
Ependymoma:
•Midline
•partially calcified posterior fossa mass

Contrast for tumors & infection

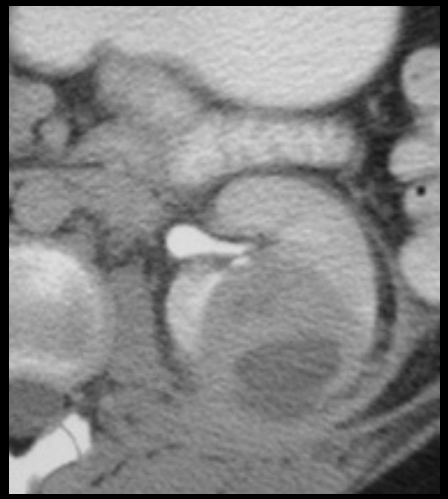
Cerebral abscess:

rim enhancing lesion surrounding edema

CT

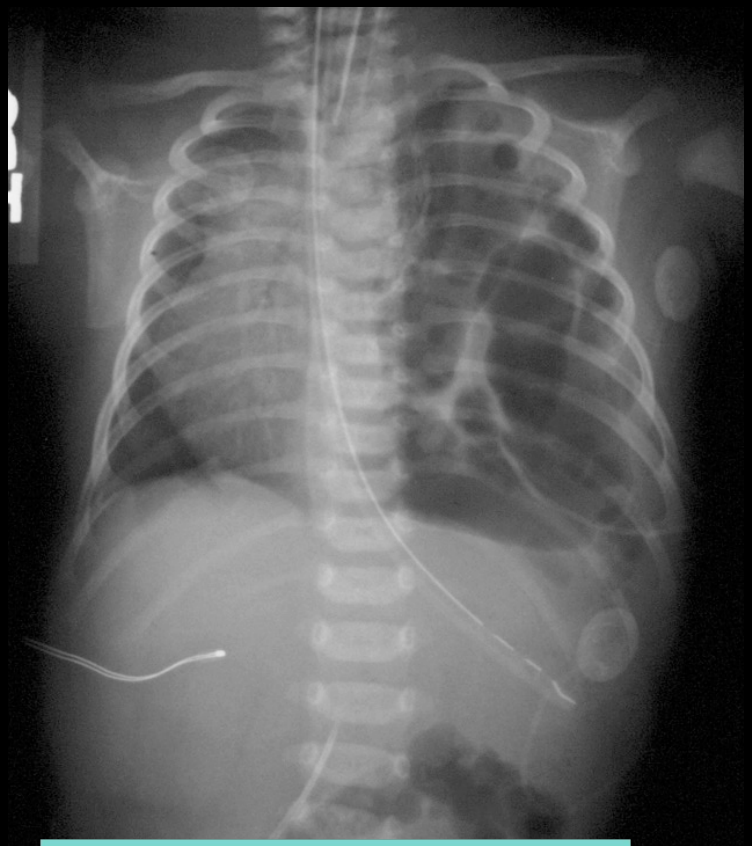


MRI



Patient also had
Renal abscess

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

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

✅ A. Persistent pulmonary hypertension

0%

B. Pyloric stenosis

0%

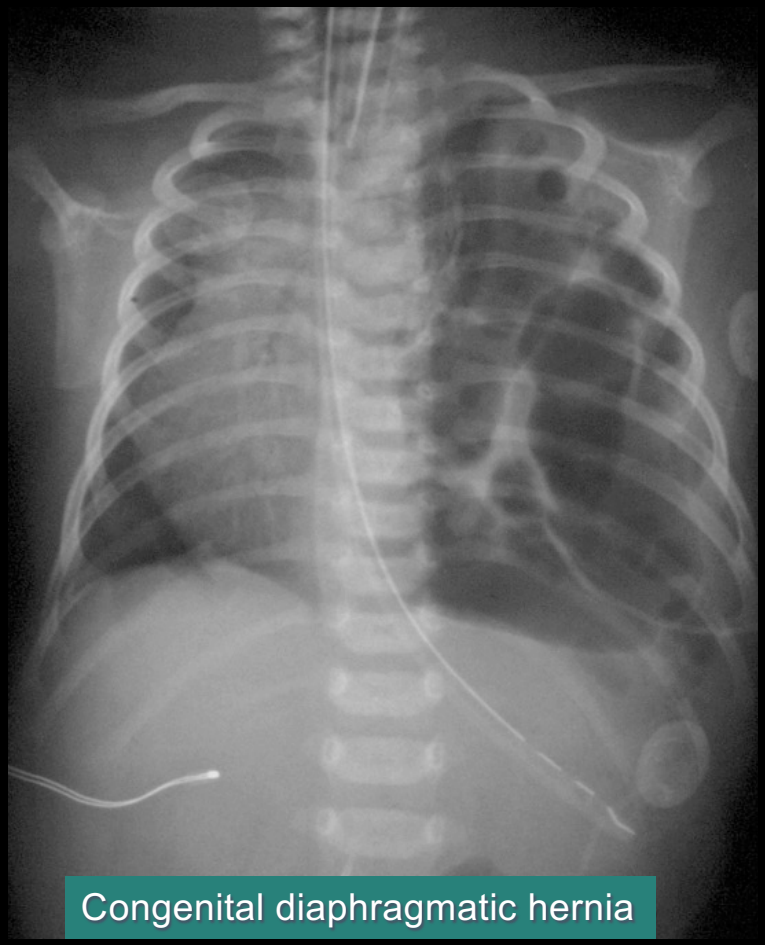
C. Tension pneumothorax

0%

D. Systolic murmur

0%

Persistent pulmonary hypertension

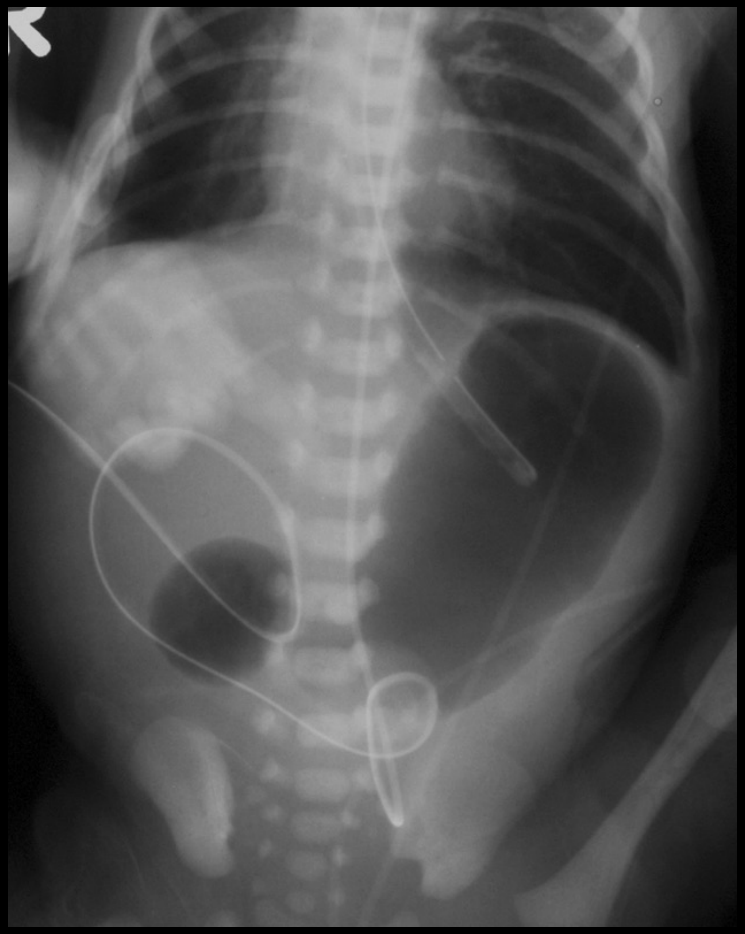


Congenital diaphragmatic hernia

Associated with:

- Congenital diaphragmatic hernia
- Meconium aspiration
- Occasionally with severe RDS
- Idiopathic

Case 8: 1-day old baby with vomiting



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

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

A. Pyloric stenosis — 0%

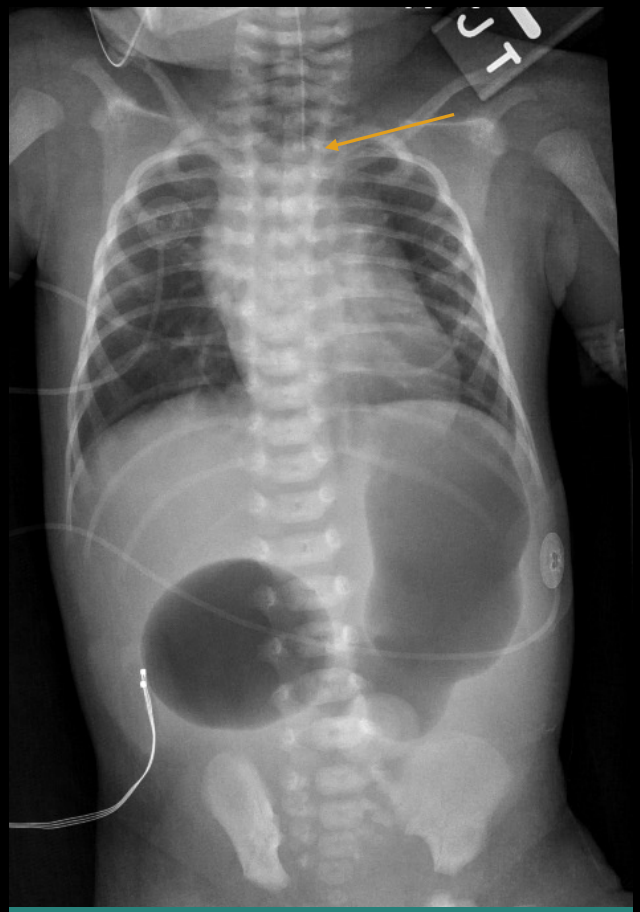
✓ B. Duodenal atresia — 0%

C. Ileal atresia — 0%

D. Duodenal hematoma — 0%

E. T-E fistula — 0%

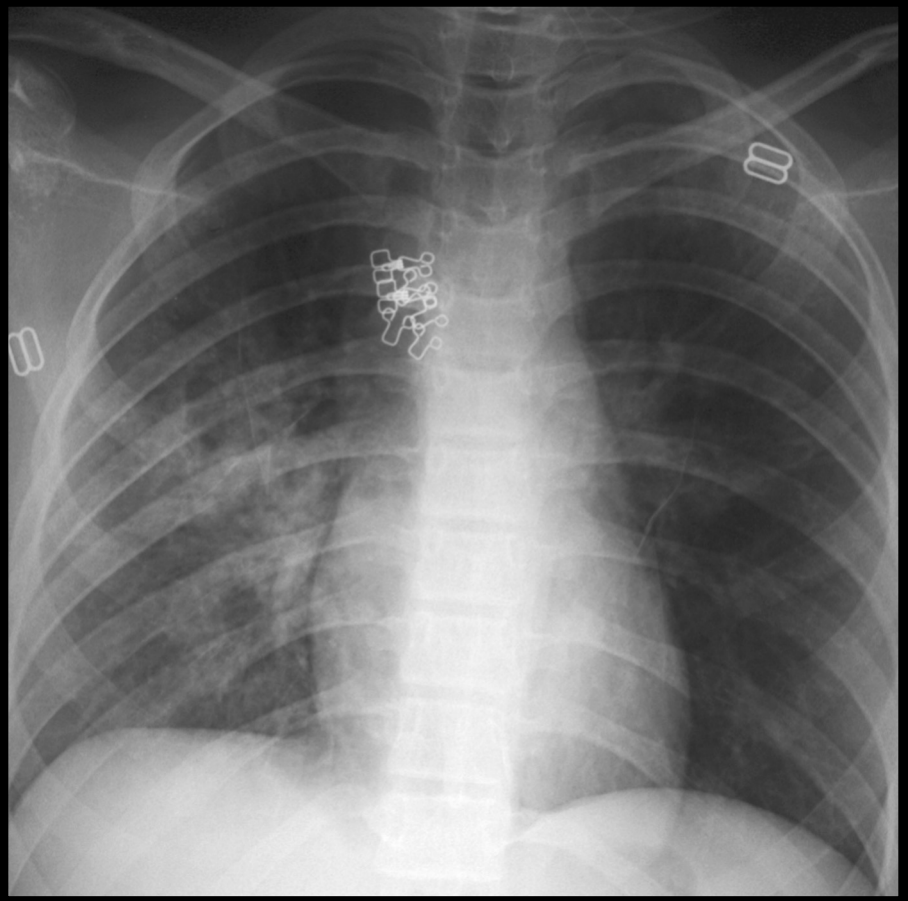
Duodenal atresia

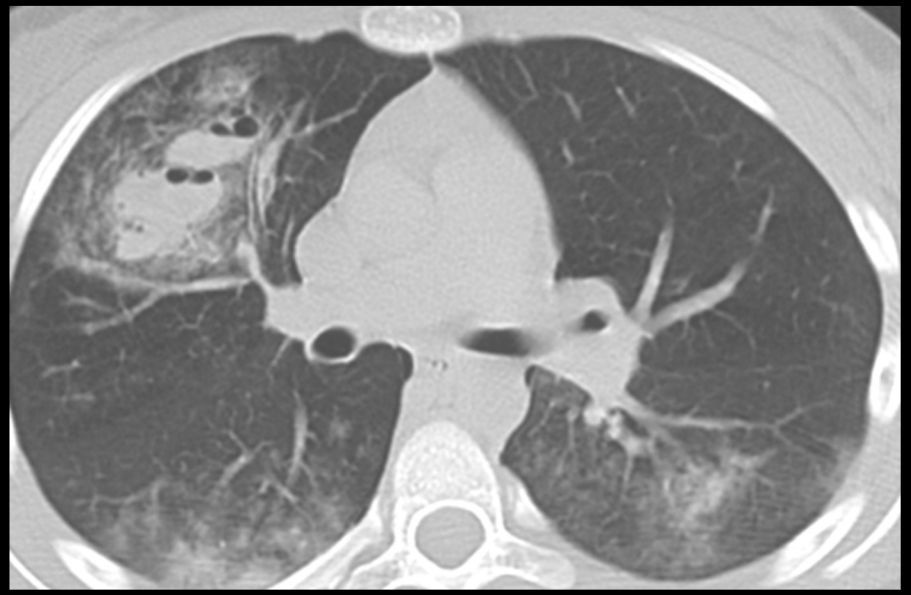


1day old trisomy & TEF

- 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

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

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

A. Aspiration 0%

B. Pneumothorax 0%

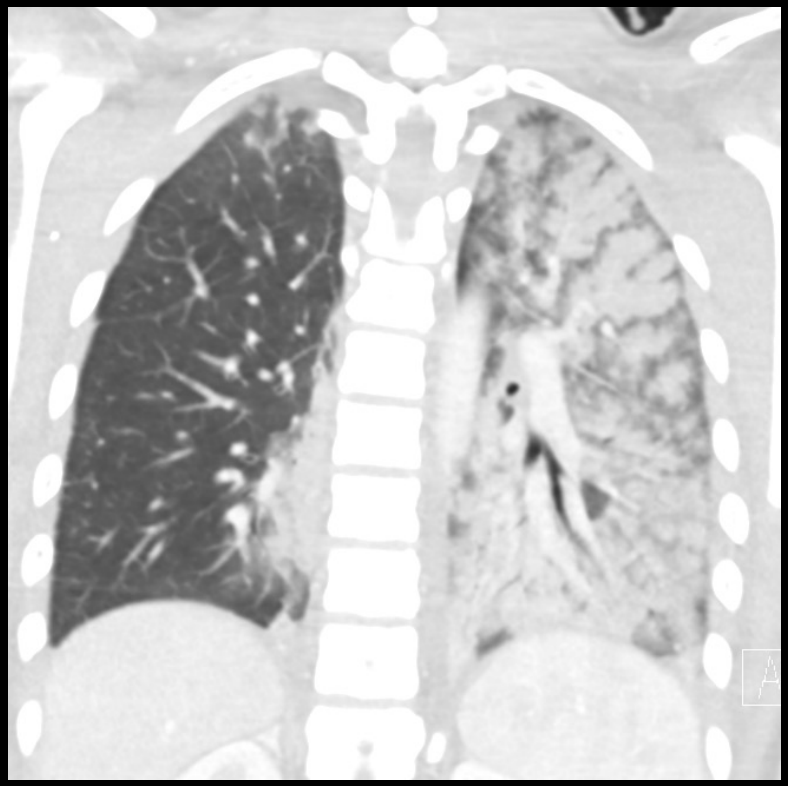
✓ C. Traumatic pneumatocele 0%

D. CPAM 0%

E. Necrotizing pneumonia 0%

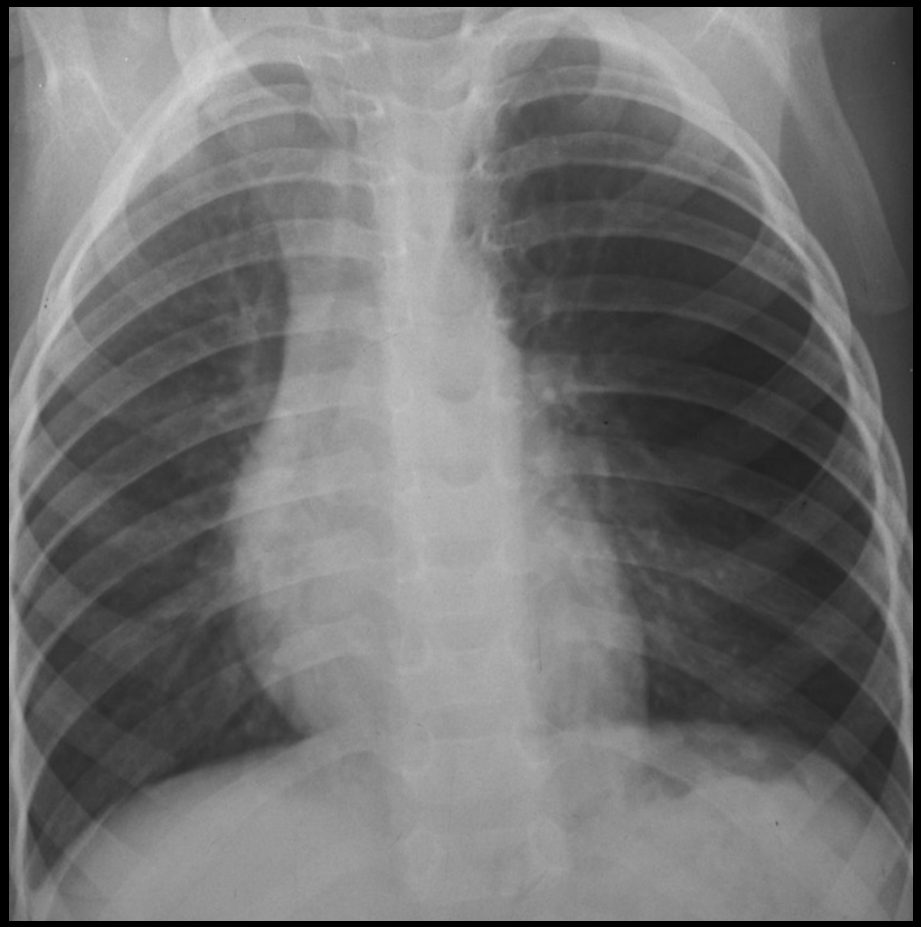
Traumatic pneumatocele/Pulmonary contusion

- 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

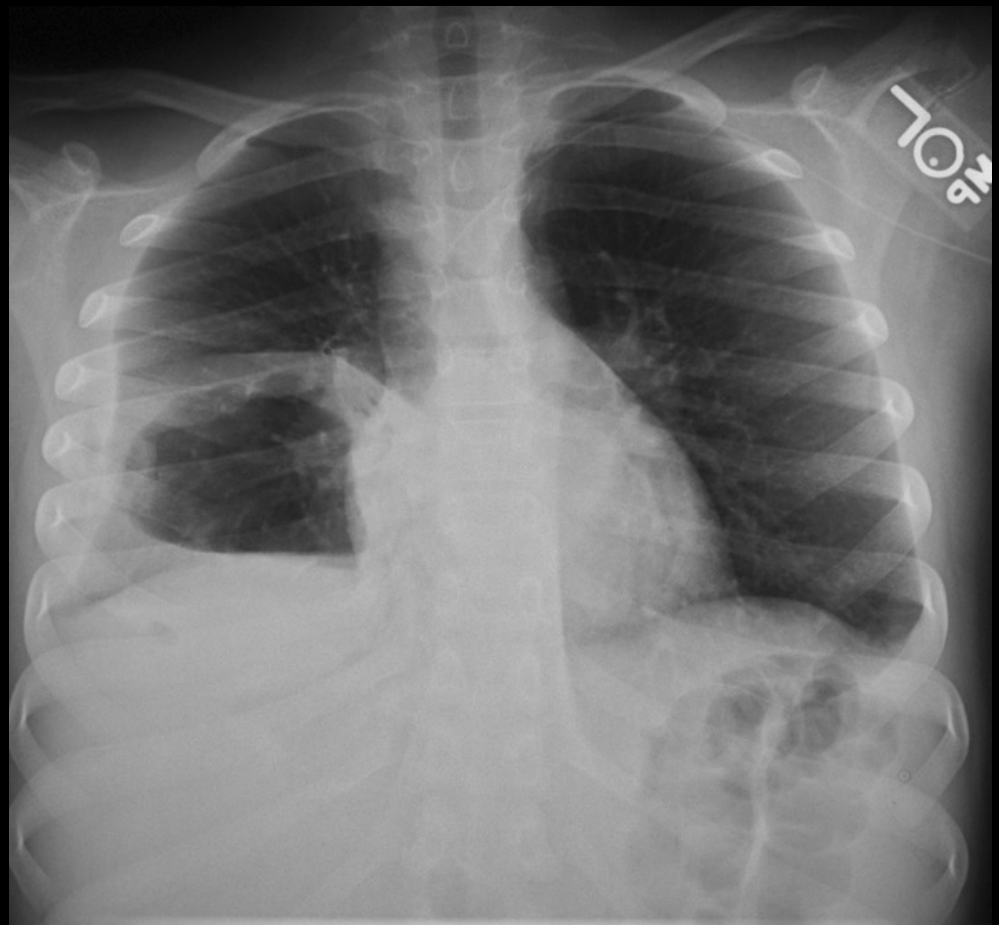


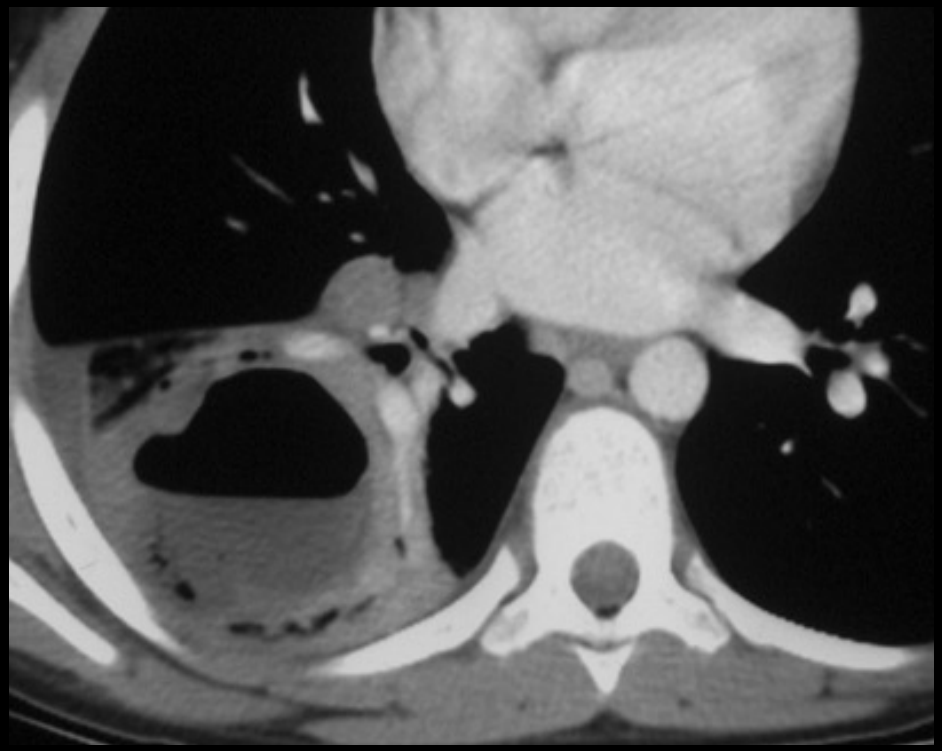
MVA Rollover 17yr f other occupants perished,
Neg CXR, but CT showed extensive contusion & hemorrhage

Cystic pulmonary masses:
Congenital Cystic Pulmonary Adenomatoid Malformation: CPAM



Cystic Pulmonary masses: Pulmonary abscess





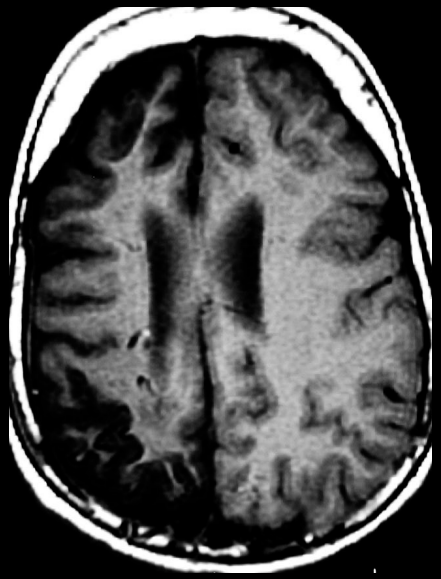
IV Contrast (CT & MRI)

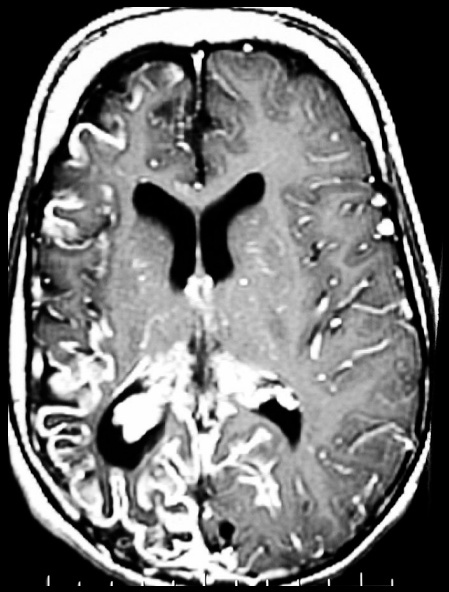
In general for evaluation of

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

Exception: Sinusitis

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





A. Hypopigmented skin lesions
B. Port wine stain
C. Agenesis of corpus callosum
D. Periostitis of the long bones

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

A. Hypopigmented skin lesions

0%

✓ B. Port wine stain

0%

C. Agenesis of corpus callosum

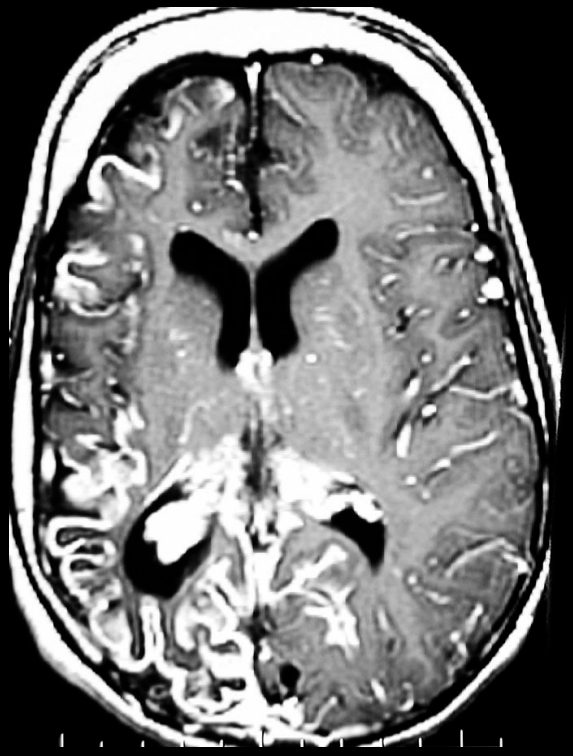
0%

D. Periostitis of the long bones

0%

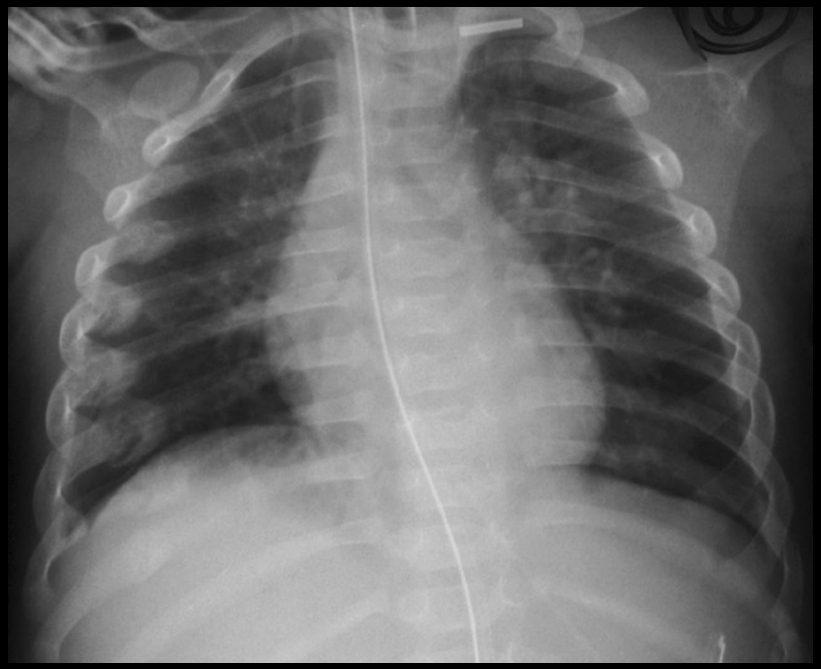
Sturge Weber Syndrome

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



leptomeningeal angiomatosis

Case 11: 2 mo. Infant with hypotonia



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

11. Case 11: 2 mo. Infant with hypotonia

A. Osteogenesis imperfecta — 0%

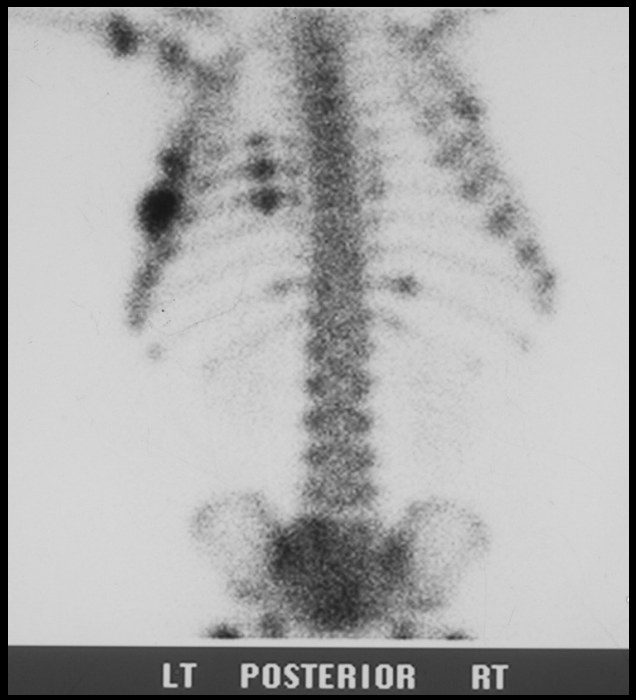
B. Thanatophoric dysplasia — 0%

C. Congenital syphilis — 0%

✓ D. Non accidental trauma — 0%

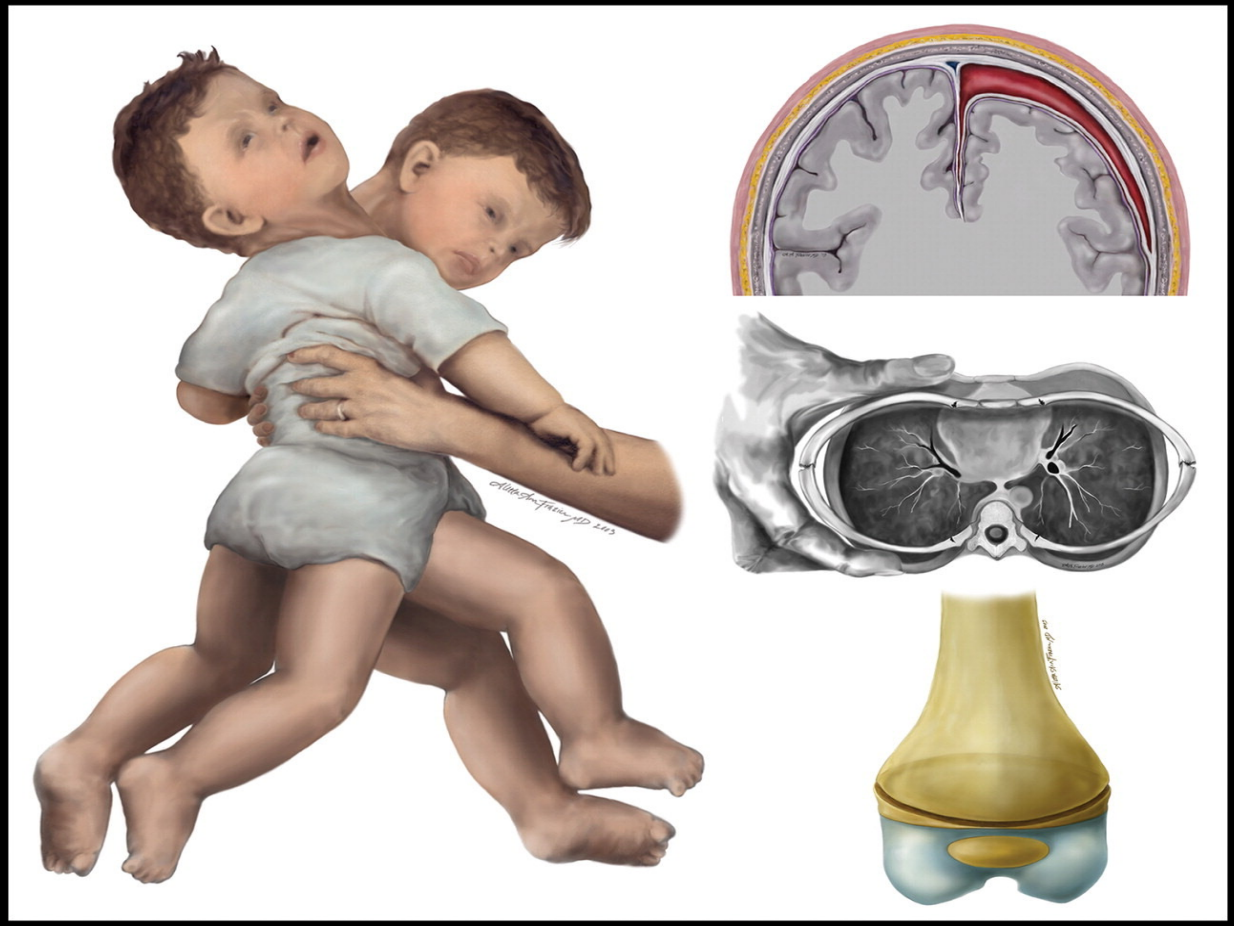
E. Osteopetrosis — 0%

Child Abuse



Multiple fractures in different stages of healing

Mechanism of Injury



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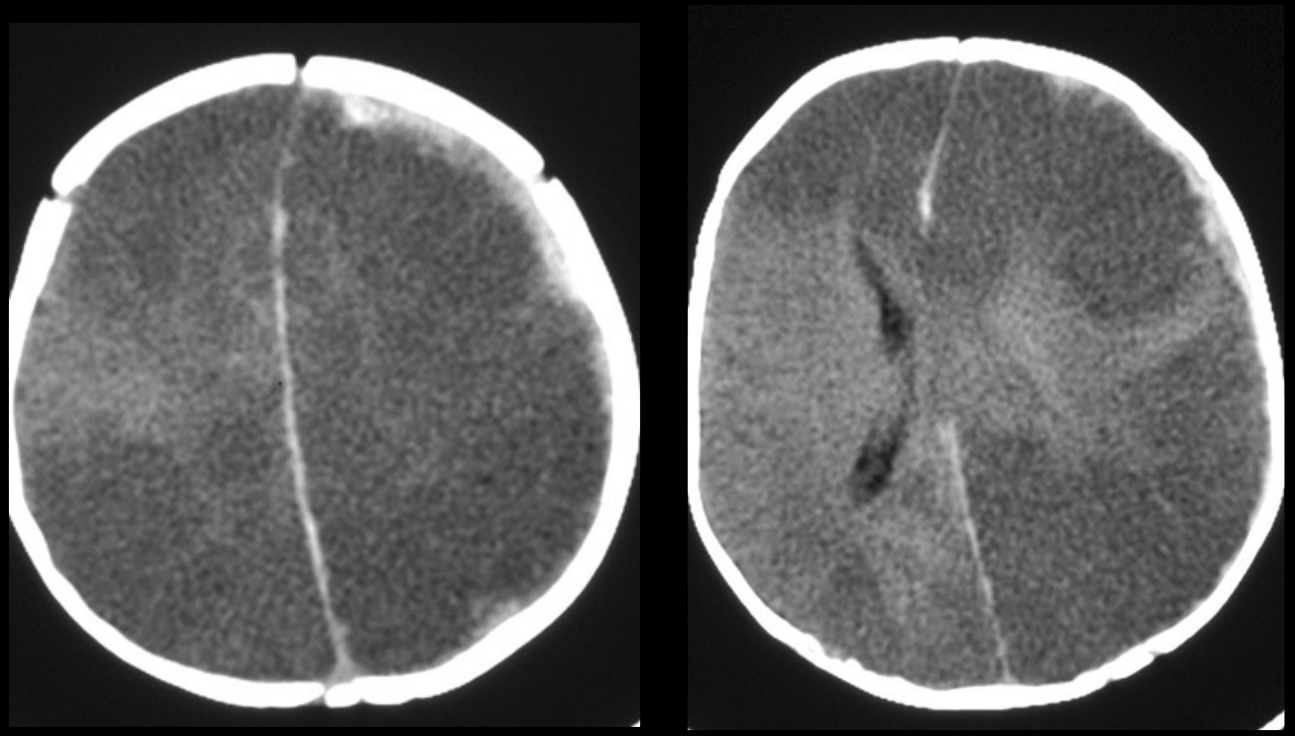
DOI: 10.1148/rg.234035030

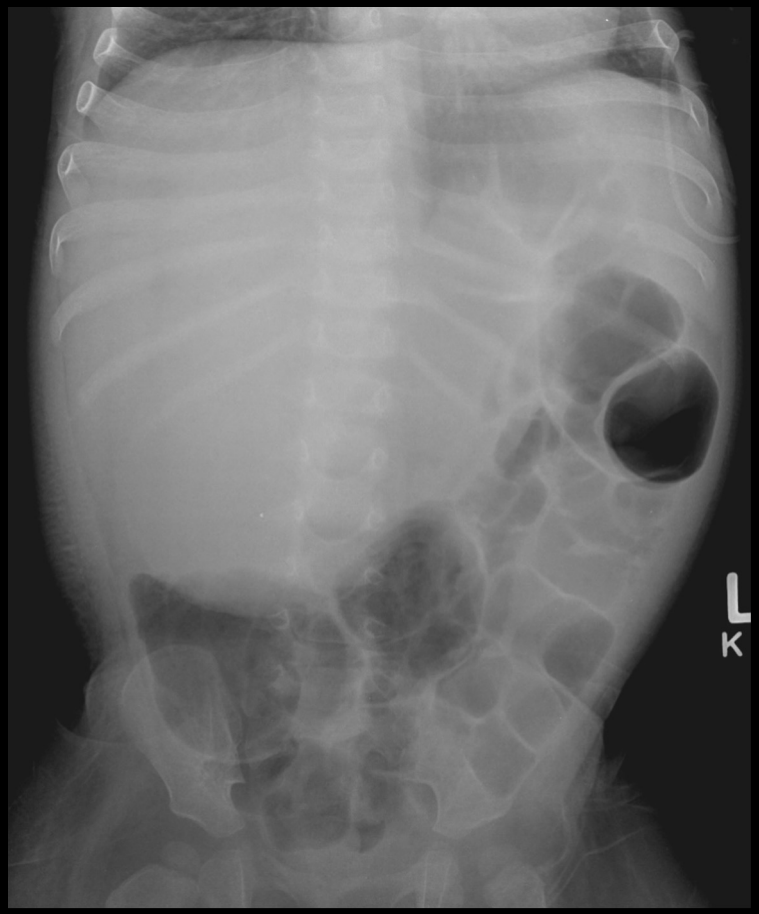
NAHI: Acute SDH, diffuse edema & ischemia

supposedly hit by brother with toy truck



Bone Survey: multiple rib fractures

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

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

✓ A. Alpha-fetoprotein

0%

B. Beta HCG

0%

C. CEA

0%

D. CA 125

0%

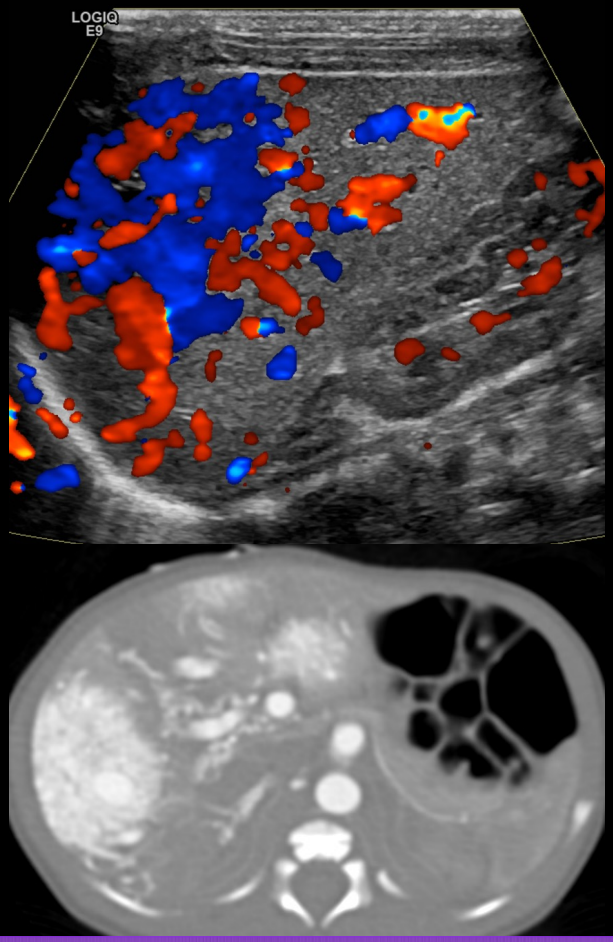
Hepatoblastoma

- 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 polypois coli,
  - Gardner syndrome

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

Liver neoplasms

- Liver 3rd 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 Propanol & steroids

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

Thickend colonic walls, no small bowel involvement

A. Crohn's

B. Ulcerative Colitis

C. Irritable Bowel Syndrome

D. Lactose Intolerance

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

A. Crohn's

0%

✓ B. Ulcerative Colitis

0%

C. Irritable Bowel Syndrome

0%

D. Lactose Intolerance

0%

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

Complex collection appendix not seen
extensive inflammation RLQ

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

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

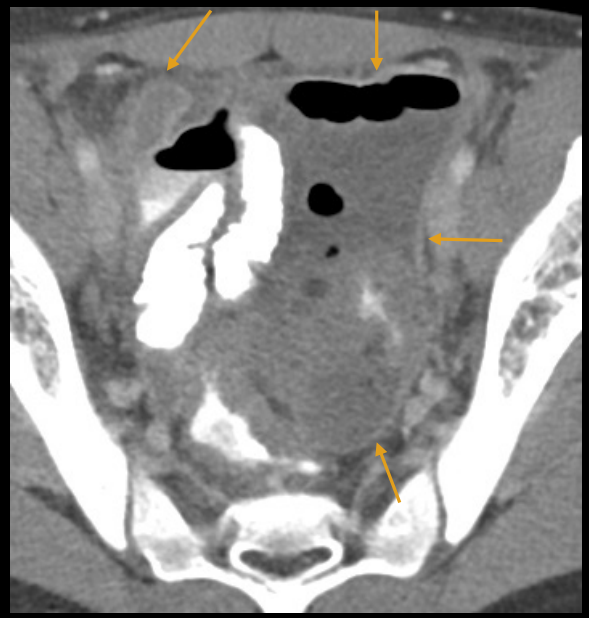
A. Perforated Appendicitis — 0%

B. Ulcerative Colitis — 0%

C. Crohn's Disease — 0%

D. Sprue — 0%

Case 14: Perforated Appendicitis

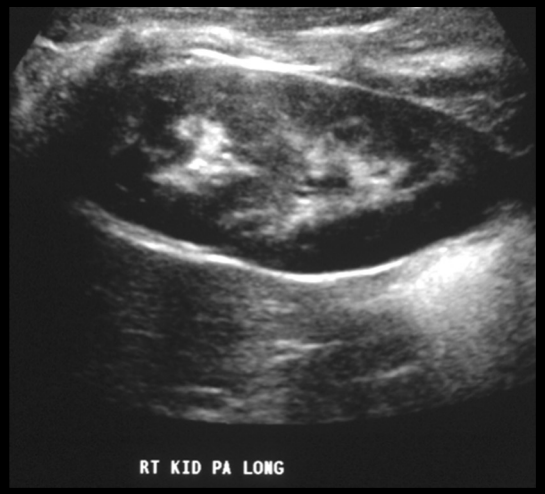


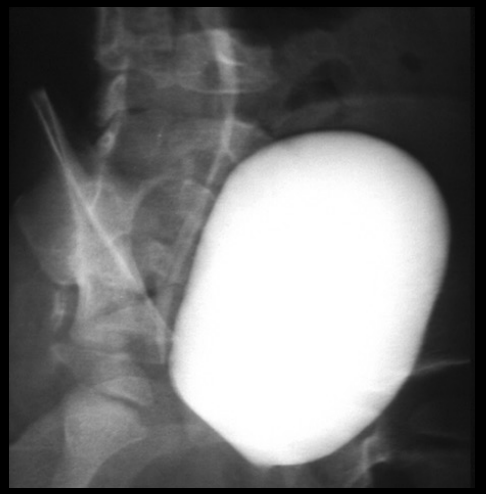
Deep pelvic abscess
US guided transrectal drainage with TPA

Appendicitis

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

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

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

A. Prominent Column of Bertin

0%

✓ B. Reflux into a duplicated collecting system

0%

C. Posterior urethral valves

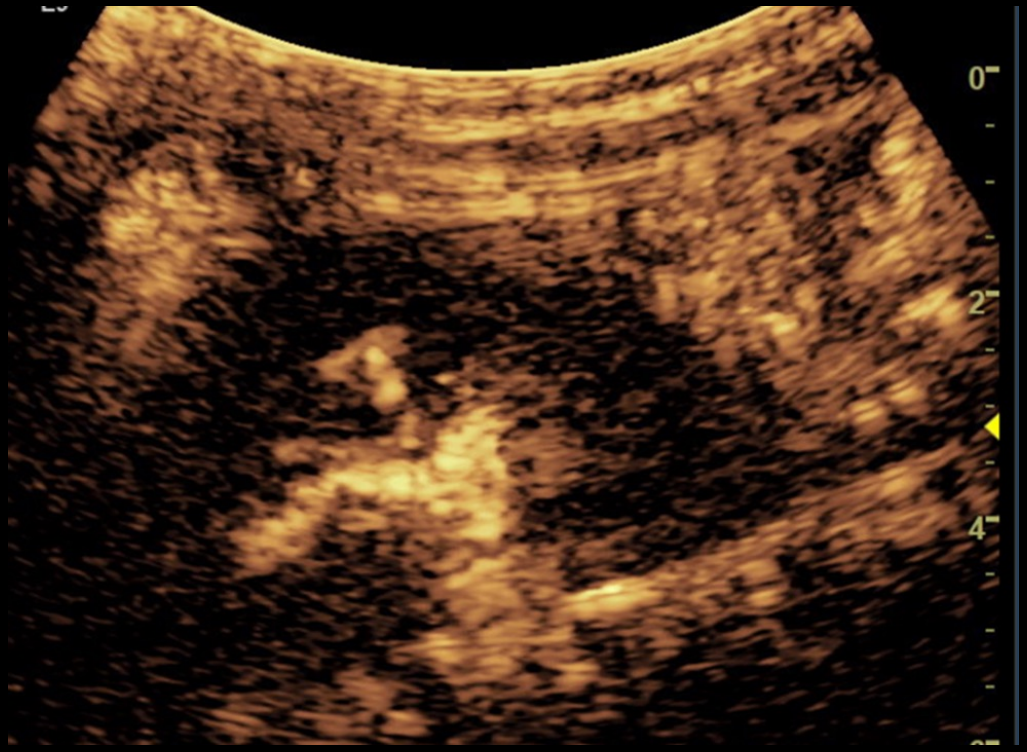
0%

D. Myelomeningocele

0%

Companion case VUR

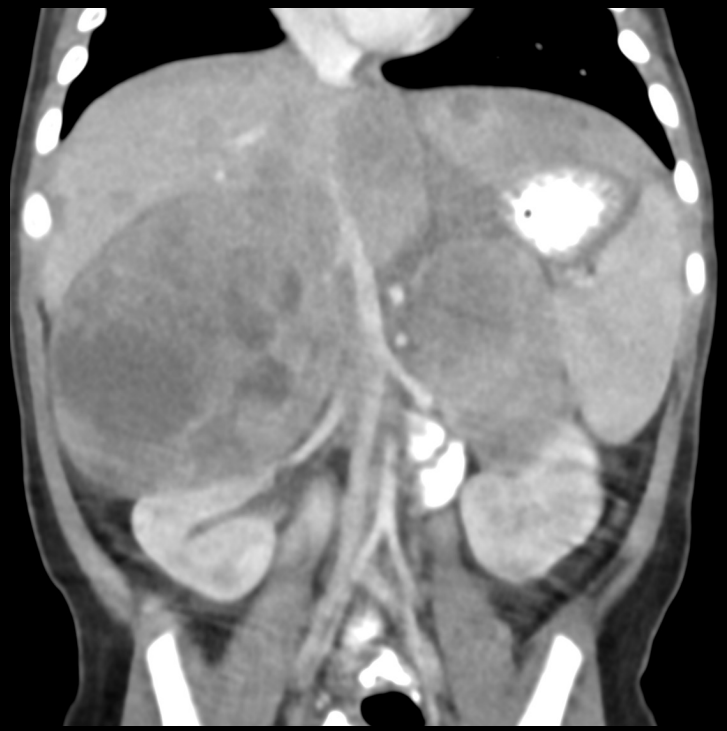
Left kidney grade 3 reflux on 4th n& 5th cycle filling



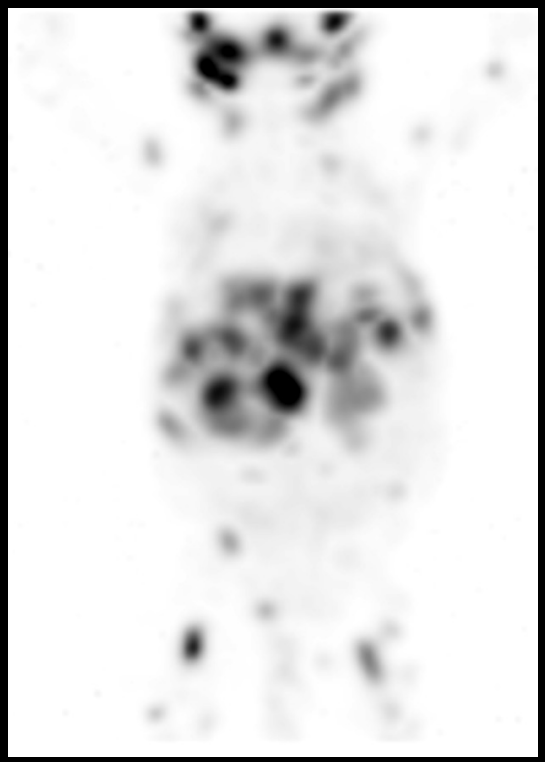
- 20mo old Uneplained recurrent UTI
- VCUG negative
- Contrast enhanced voiding urosonography (ceVUS) was positive

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

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

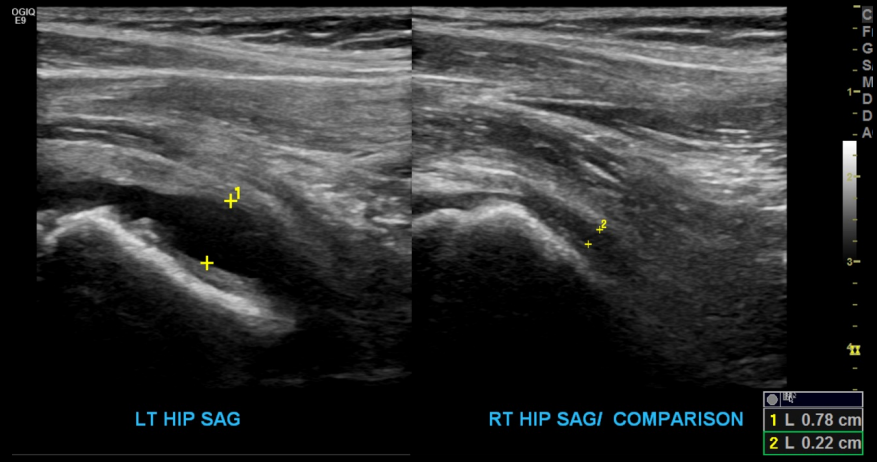
Bouns: 6 yr M w/ hemoptysis. Just finished 6 mo course of observed tx for TB. What do you do next?

Tuberculoma with caseating necrotic Lymph nodes

Limping child

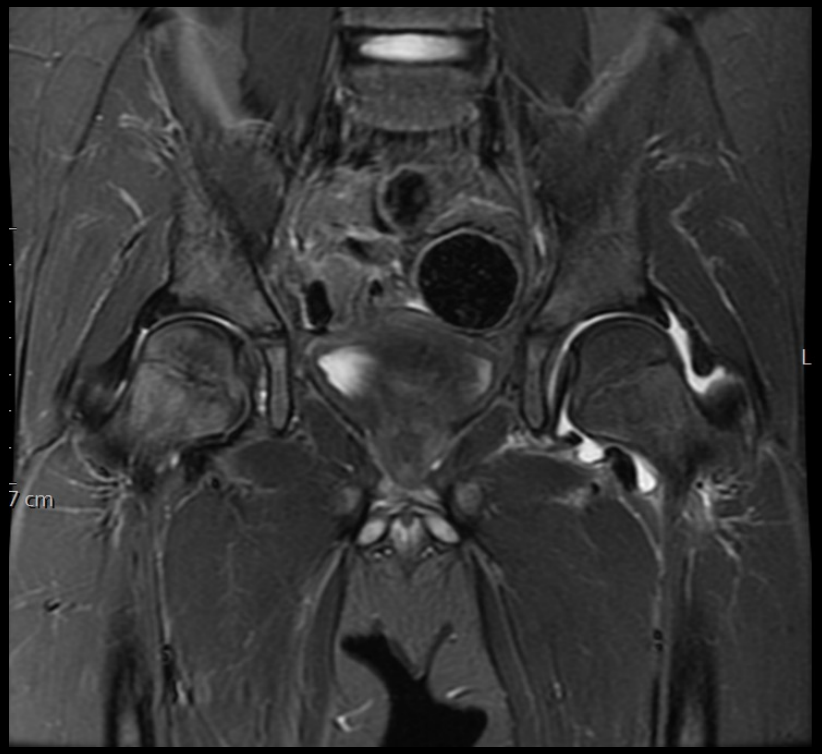
review

7 year old limping and hip pain for 3 days



Ddx?

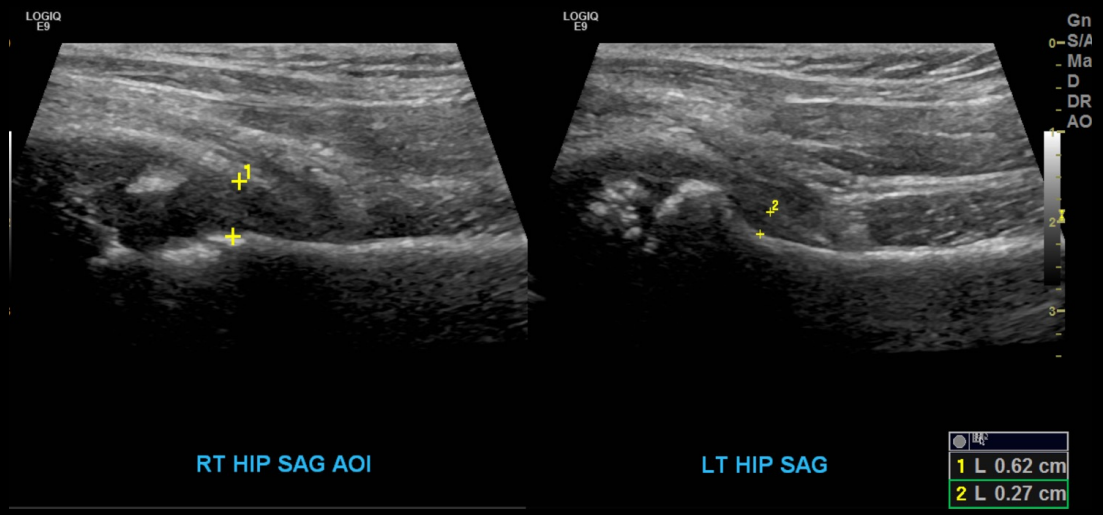
Mri next morning



NEXT STEP?

Joint aspiration: Toxic (transient synovitis) synovitis

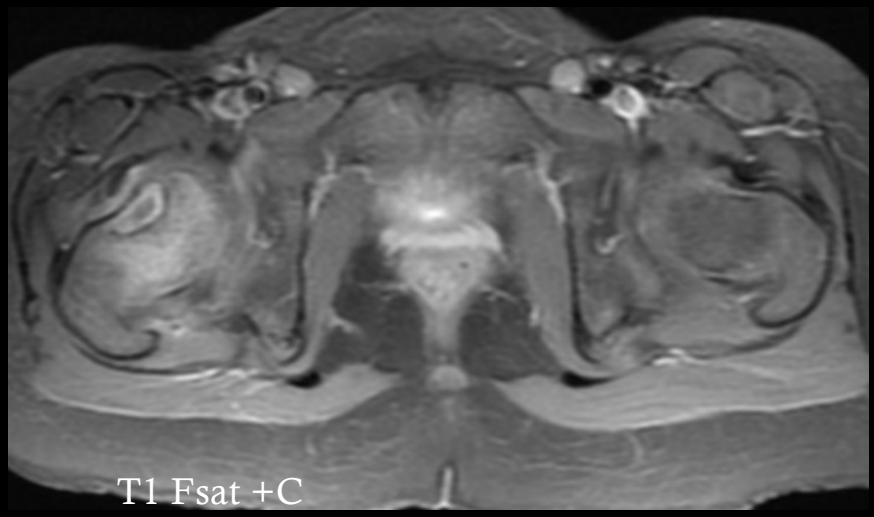
3 yr old rt hip pain for 1 week and fever US. Arrived in am from NY requested by er



DDX? Brodies abcess

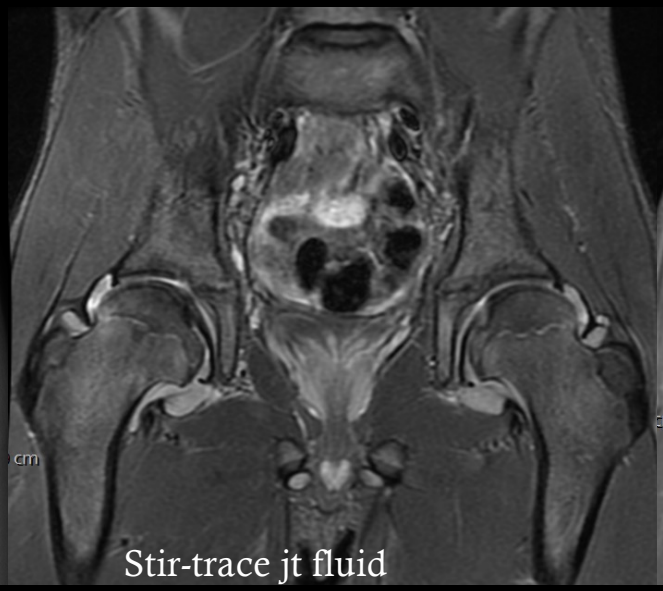
F/U MRI: Septic joint & osteomyelitis

STIR



T1 Fsat +C

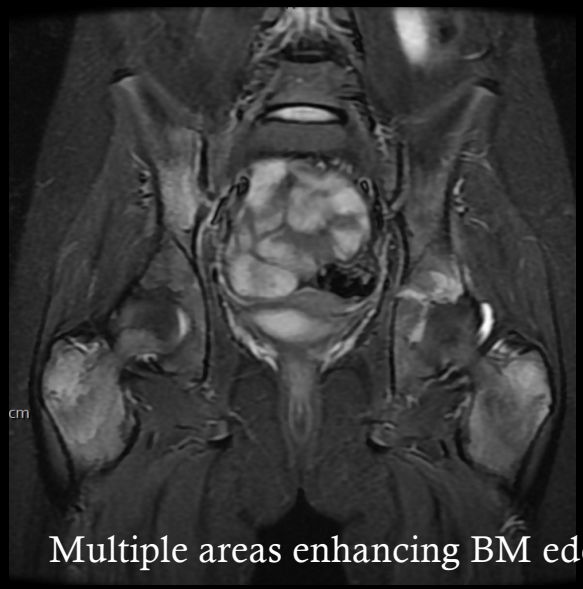
JIA: 12 yr M, lt hip pain & limping 24 hrs s/p recent fall.



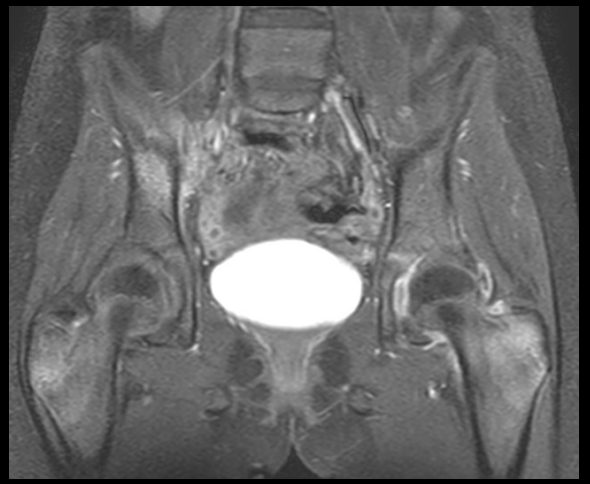
Stir-trace jt fluid

T1 FS +C: Thick enhancing synovium

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

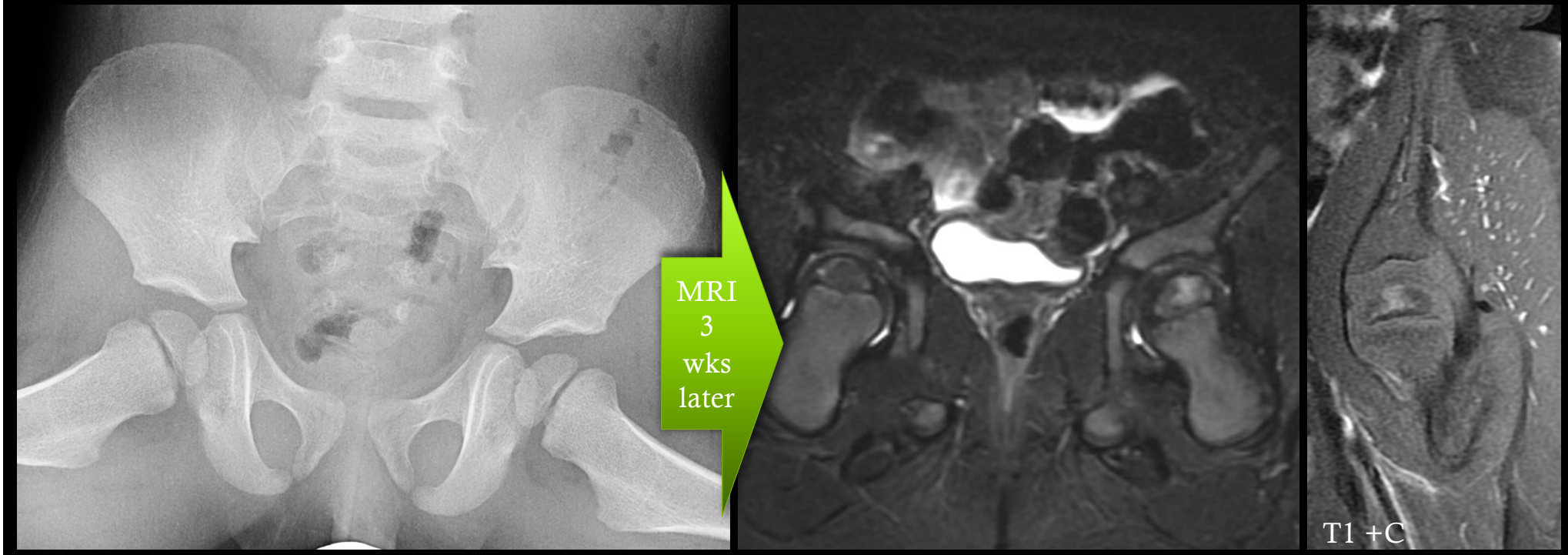


Multiple areas enhancing BM edema



Dramatically improved now on methotrexate

2 yr old limping. DDX?



Early Legg-Calve-Perthes Disease

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