DCMC Emergency Department Radiology Case of the Month

These cases have been removed of identifying information. These cases are intended for peer review and educational purposes only.

Welcome to the DCMC Emergency Department Radiology Case of the Month!

In conjunction with our pediatric radiology specialists from ARA we hope you enjoy these monthly radiological highlights from the case files of the Emergency Department at DCMC. These cases are meant to highlight important chief complaints, cases, and radiology findings that we all encounter every day.

If you enjoy these reviews we invite you check out Pediatric Emergency Medicine Fellowship Radiology Rounds, which are currently offered quarterly and are held with the outstanding support of the pediatric radiology specialists at Austin Radiologic Association.

If you have any questions or feedback regarding the Case of the Month format, feel free to email Robert Vezzetti, MD at rmvezzetti@seton.org.

This Month: PART II: The Limping Child.
This month is the second part of a series of cases involving back pain and limping in children. The limping child is a common sight in Pediatric practice and can have multiple etiologies.

Last month we saw a case of a child with back pain and limping that had an impressive cause of his symptoms. This month, we have a some cases of limping in which time to diagnosis is critical for optimal outcome and reduction in morbidity, not to mention medicolegal risk.

Tony the Tiger Sang “You’re A Mean One, Mr. Grinch.” Boris Karloff narrated the show but he couldn’t sing. The show production team instead enlisted Thurl Ravenscroft to voice the musical number. You might know Mr. Ravenscroft better as the voice of Tony the Tiger. Now that’s GRRRRREAT!!
CASE 1: Let’s continue the parade of limping children! You pick up a chart that seems a little strange for the Pediatric Emergency Department, but really isn’t. The history states that this 3 year old child is here with intermittent left hip pain and limping for the past month. (A month of symptoms? In the Emergency Department at midnight? That’s right, folks, it happens all the time). At any rate, the mother states that her child has been complaining of this hip pain, which, at first, she thought was either growing pains, or some trivial injury, like a strain or bruise. As the symptoms began to persist, she went to the child’s pediatrician, who, after seeing the child, informed the mother that was likely to be musculoskeletal in nature and Motrin, along with time, will resolve the issue. It didn’t. She took the child back 3 more times but the diagnosis and treatment was the same. Now she is here in the Pediatric emergency Department, at midnight, frustrated, and “wanting something done.”

You take additional history and learn that, aside from an occasional viral URI, he has been healthy. He has met all of his developmental milestones and is fully immunized. There is no history of fever, abdominal pain, back pain (good thing!), incontinence, or trauma. He is afebrile and well-appearing. He does not have much to his exam except for, as you watch him ambulate, a mild limp to the left. He has good range of motion of the leg at the hip, but does complain of pain with extreme abduction, adduction, flexion, and extension. There is no erythema, warmth, or lesions to the hip area. He tells you that when he walks, he also has pain to the left knee.

What’s going on here? He certainly has discomfort ambulating. Septic joint? Contusion? Osteo? Imaging should be performed (it hasn’t yet), but what modality is best. Plain films? Ultrasound? MRI?

CASE 2: This is next case is a 10 year old female who, you guessed it, has been complaining of left knee pain and limping for the past 4 weeks. She has had no known trauma and really no other symptoms: no fever, abdominal pain, numbness, weakness, incontinence, or back pain. She is an active child her mother says, but you doubt just how active she really is, as she, while well-appearing on her physical examination, appears overweight. Slightly. Well, not so slightly as her weight is 60 kg. To her credit, she and her mother have both been attempting to improve her diet and increase her exercise, which is when the patient noticed that her knee began to hurt.

Her exam shows no fever and her vital signs are appropriate for her age. She ambulates down the hall for you, limping slightly as she appears to favor the left leg. When asked, she specifically tells you that her left knee hurts. The physical exam is remarkable for limited range of motion of the left leg at the HIP, rather than the knee. In fact, her knee exam is completely unremarkable: no tenderness, edema, erythema; the joint is stable. The pelvis itself is stable and there is no erythema or edema. The rest of the leg exam is normal. Hmm…Knee pain with hip tenderness. Any ideas? Imaging? Sure. Labwork? Not at this point. As you think about the workup, her mother asks how long is this going to take?

CASE 3: A very athletic (track star!) 14 year old male was running quite aggressively several days ago when, while doing the hurdles, he stretched his right leg “way far out” and felt a “pop” in her hip. He was able to continue running, but the hip began to hurt and she had to stop. Since then, he has had continued pain. There is no history of fever, back pain, incontinence, numbness, weakness, or any other symptoms. He states that ibuprofen has helped with the pain some. He saw his athletic trainer at school and was diagnosed with a hip strain. He has been working with the trainer, doing rehab exercises, but, when the pain persisted (and worsened slightly), especially during the exercises, his trainer advised him to see his physician. The physician saw him, and referred him to Pediatric Orthopedics in 2–3 weeks. The boy’s mother decided that was too long and came to the Emergency Department instead.

He is afebrile on exam and looks well. He ambulates, without a limp, but complains of right hip pain, generalized to the lateral aspect of the pelvis. He has good range of motion of the leg at the hip, but states it does hurt some when the leg is ranged. He has tenderness to the right upper pelvis with palpation. Time for some imaging. You decide to start with a plain radiograph and see what pops up.
“Dominick the Christmas Donkey” was a modest hit in the 1960’s. Even more interesting, though, is that the song’s production was financed by Carlo Gambino, of the Gambino crime family of New York. Yep, the mob liked the song...and you should too.

The Christmas classic “Do You Hear What I Hear” was written during, and inspired by, the Cuban Missile Crisis. The line “with a tail as big as a kite” is a reference to a missile, not a star!

An imaging test would be very helpful in this child. The problem appears to be with the child’s left hip, based on your physical examination. Which test? Well, it depends what is in your differential. Options include plain films, Ultrasound, CT Scan, and MRI. As in anything, there are advantages and disadvantages to each option. Certainly an MRI would be definitive, as this modality could detect inflammatory conditions, fractures, and fluid. But this would most likely require sedation to achieve an adequate study. An ultrasound could be useful in detecting fluid in the joint and even a fracture, but there has been no fever or other indication of infection. CT is excellent for fracture detection, but is radiation-heavy. Since no prior imaging has been performed, plain films would be the best option. In children with hip pain/limping, films of the pelvis with a frog leg view are indicated.

**CASE 1**

Here are normal xrays demonstrating AP and frog leg views of the pelvis.

Here are the images from our young patient. Notice anything amiss? The most glaring issue is the left femoral head, which looks atrophic compared to the right (red arrow). That happens to be the side that the child is limping on. What’s the diagnosis in this child?

**Why the Frog Leg View?**

This view of the hip is important to evaluate the hip joint and femoral neck better, as well as compare both sides. It is important looking for SFCE and LCP disease.

The Christmas classic “Do You Hear What I Hear” was written during, and inspired by, the Cuban Missile Crisis. The line “with a tail as big as a kite” is a reference to a missile, not a star!
The total cost if one were to purchase all of the items mentioned in the “12 Days of Christmas” song would be close to $120,000. The most expensive item (at nearly $7500 per performance) is the nine ladies dancing.

These films are concerning for Legg-Calve-Perthes Disease, which is an avascular necrosis of the femoral head. Blood flow to the femoral head is interrupted, causing disruption of growth. Eventually, blood flow is re-established and, as healing begins, bone mass is lost. This leads to bone deformity and, eventually, long term complications as an adult such as osteoarthritis and limited hip mobility.

Most commonly seen in children ages 4–8, clinical signs/symptoms include hip/knee/groin pain, which may be mild. Often, these pains are attributed to “growing pains” and are often unilateral, although bilateral LCP has been described.

While the direct cause of LCP Disease is not known, limitation of blood supply is the one constant. The cause of this may be linked to trauma, chronic medical conditions (including sickle cell disease and chronic renal disease), chronic endocrine and nutritional diseases, medications (chronic corticosteroid use), and inflammatory conditions.

Diagnosis is usually done with plain films, but changes noted on plain radiography may take up to 6 weeks to be seen, so MRI is another modality that can be used for early diagnosis, especially if there is high clinical suspicion.

**CASE 1**

**Radiographic signs of early LCP Disease include joint widening (purple arrow), blurring of the physeal plate (blue arrow), decreased density of the femoral head (yellow arrow), and flattening of the femoral head (red arrow).**

**Stage of Legg-Calve-Perthes Disease**

**Stage I Early**
- Widening of the joint space
- Blurring of the physeal plate

**Stage II Fragmentation**
- Subchondral lucency (crescent sign)
- Femoral head irregular
- Loss of bone density

**Stage III Reparative**
- Reossification
- Improved bone density

**Stage IV Healed**
- Appearance depends on severity

Here's a nice example of the Crescent Sign in LCP Disease

MRI demonstrating LCP Disease of the right femoral head.

**Treatment of LCP Disease:**

The overall goal of treatment is to reduce morbidity associated with this condition. While the disease is self-limiting, there are various treatment options to lessen poor outcomes and maximize patient comfort while allowing the bone to heal. These include nonsurgical options such as minimal weightbearing and protection of the joint. Bracing (such as the Scottish rite brace) helps to maintain the femur abducted and internally rotated. Physiotherapy may also be useful. Swimming has been found to be a good way to keep the child active while lessening the stress on the femur. Some children benefit from orthotics. Surgical options include femoral osteotomy (an attempt to redirect the femur into the acetabulum) or innominate osteotomy. Overall, younger children have a more favorable prognosis and males tend to do better owing to skeletal immaturity.

Arthur Legg
USA

Jacques Calve
France

Georg Perthes
Germany
CASE 2

You decide to obtain xrays of the pelvis (including the valuable Frog leg View). In limping, pelvis x-rays are a great place to start. If they are normal, then one can consider imaging other parts of the extremity, labwork, or MRI depending on clinical suspicion.

Notice anything unusual about these films? There is a slipped capital femoral epiphysis (SCFE) on the left. How do you know it’s there? Well, using Klein’s line is one was to help determine if there is a SCFE. Klein’s Line is drawn along the lateral edge of the femoral neck; it should intersect the epiphysis in a normal film. Let’s look at the Klein Line for our patient. On the right side, the line intersects as it should (Green Arrow), but on the left, the line does not (Red Arrow). This is consistent with a SCFE. In the acute phase of the condition, this is known as Threthower Sign.

SCFE: This is a fracture through the growth plate what results in slippage of the femoral epiphysis. This is the most common hip disorder in adolescents and often will present as groin or knee pain, rather than hip pain. It is much more common in obese children. Clinical signs of SCFE include limitations in hip flexion and internal rotation. Astonishingly, 20%-50% of SCFE cases are either misdiagnosed or missed on initial presentation!

Klein’s Lines are seen on the AP View

Because the slip is posterior, it is often seen better on the frog leg view. The left femoral physis looks irregular.

Southwick Angle Classification:
- Mild <30°
- Moderate 30-50°
- Severe >50°

The world’s largest non-Hanukkah 7-branched menorah is in Manado in Indonesia: a country with a Jewish population of less than 5% only. It stands at 62 feet tall.
Teaching Points

1. The differential diagnosis of the limping child is vast, but can be narrowed down by a thorough history and physical examination.

2. Plain radiographs are often the most efficient way to initially evaluate the limping child. They are readily available, require no sedation, and contain minimal amounts of ionizing radiation. When evaluating hip pain or limping and you want to image the hip, two views are most useful: AP Pelvis and Frog Leg (the knee flexed between 30 to 40 degrees and the hip abducted 45 degrees).

3. Don’t forget referred pain. Children with hip issues (SCFE, LCP Disease) will often have knee, not hip, pain.

4. The specific cause of Legg Calve Perthes Disease is unknown, but the end result is avascular necrosis of the femoral head. It can be associated with Sickle Cell disease, chronic inflammatory conditions (including chronic use of oral steroids), and Endocrine conditions. Treatment consists usually of prompt Pediatric Orthopedic referral, rest, low impact activity, anti-inflammatory medications (ibuprofen), and observation over time.

5. Slipped Capital Femoral Epiphysis is the most common hip disorder in adolescents. Obesity is a risk factor. Treatment consists of non-weightbearing until definitive surgical pinning by Pediatric Orthopedics is performed. Frog Leg views are very important, especially for SCFE!

6. Avulsion fractures of the hip are typically treated by rest and eventual physical therapy.

7. Consider labwork (ESR, CRP, CBC, etc) in children with chronic pain/limp (especially if the plain films are normal) and fever. Osteomyelitis, discitis, and other inflammatory conditions can present as limp or chronic pain.

References


2014 Cases

Jan - Elbow Injuries/Fx
Supracondylar Fx

Feb - Headaches
Cranioopharyngioma

March - Swallowed Foreign Bodies

April - Scrotal Edema
Epididymitis
Testicular Torsion
Hydrocele
Scrotal Hematoma
HSP

May - Nonaccidental Trauma

June - Osteomyelitis

July - Chest Trauma Imaging
Hemothorax
Pulmonary Contusion
Pneumothorax
Tension Pneumothorax

August - Blunt Abdominal Trauma
Spleen Laceration
Renal Laceration
Liver Laceration

September - Appendicitis

October - Abdominal Pain
Tubo-ovarian Abscess
Ovarian Torsion
Ovarian Cyst

November - Animal Bites
Dog attack/skull fx with shock
Dog bite contaminated wound

December - Vomiting Infant
Intussusception
Duodenal Atresia

2015 Cases

Jan - Neck Masses
Parotitis
Retropharyngeal Abscess
Cervical Lymphadenopathy

Feb - Abdominal Pain
Duodenal Ulcer with Perforation
Abdominal Abscess S/P Appy

March - Chest Mass (Ewing’s)

April - Abdominal Distention
Wilms Tumor
Abdominal Teratoma

May - Head Injuries
Skull fractures

June - Respiratory Distress
GAS Pneumonia/Sepsis
GAS Pneumonia/Toxic Shock

July - Summertime Potpourri
ADEM
Aeromonas hydrophilia infection

August - Fussy Infant
Septic Joint/Osteomyelitis

September - Abdominal Pain
SMA Syndrome
Chest Pain
Pneumomediastinum

October - Knee Pain
Suspected intra-articular Fx

November - Limping Child I
Yolk Sac Tumor of Spine

December - Limping Child II
SCFE
LCP disease
ASIS Avulsion Fracture

A Safe and Happy Holiday to All! We’ll see you in 2016!