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: With the weather warming up, kids are
outside and active! We’ve had some requests for an
orthopedic topic, which I think is timely. These cases
demonstrate that pediatric elbow injuries can be quite high
risk!

April 23 - St George's Day in England. St George was a Turkish Christian (born in 270AD) who fought for the Romans
under the pagan emperor Diocletian. Legend has it that among his many adventures St George slayed a dragon in Silene,
Libya, to save a king’s daughter.
April is national kite month, when more than 700 kite events are expected to take place around the world. Legend has it that the first kite was flown centuries ago by a Chinese farmer who tied a string to his hat to keep it from going aloft.

Case 1: The weather is pretty nice outside and it’s a weekend; in any other circumstance in life this is a great thing, but in the Pediatric Emergency Department, this spells disaster. Children are out and about, playing, having fun, and injuring themselves in all kinds of imaginable ways. Sure enough, EMS brings a child in who fell off some money bars while playing at the park.

On exam, he is obviously in a significant amount of pain. He is conversing and states he remembers falling off the monkey bars. He denies he is hurt anywhere else. His exam is significant for a large amount of swelling to his XXX elbow. He has decreased range of motion secondary to pain. He is grossly neurovascularly intact. As you decide to provide pain control for this child, you start to think about which imaging test to obtain.

Case 2: Just as you are settling in the child from the first case, the anxious parents of a 5 year old child bring him in for yet another elbow injury. Apparently this young daredevil was jumping on his bed with his brother and sister when he fell off and landed on his elbow. He sustained no other injury and, in fact, did not tell his parents about his fall until several hours later, then they noticed that he was not moving his right arm normally.

In the ED, he is alert and in not much distress, until you start to examine his elbow, which is slightly edematous; he has minimally limited range of motion secondary to pain. He is neurovascularly intact. Like a good clinician, you examine him for other injuries and find nothing. Is this a contusion? Perhaps just a sprain? Does he really need imaging? He really does look pretty good; how could he possibly have a fracture?

Injury patterns in children with regard to elbow can result from several mechanisms. Hyperextension of the elbow joint is usually due to a fall on an outstretched arm. The other factor to consider in an elbow is valgus. The elbow is already in a values position. When a child sustains a fall, this can result in extreme values, causing a dislocation or fracture.

Four Important Questions
- Joint effusion?
- Normal alignment?
- Ossification centres normal?
- Subtle fracture?

Reading pediatric elbow films can be tricky. The text box above provides some nice reminders about what to look for when reading a pediatric elbow film. As another reminder, the box to the left illustrates the Salter-Harris Classification of fractures in children. It is important to familiarize yourself with this classification, as it helps to guide treatment as well as communication with a Pediatric Orthopedist.

April 15th - Income Tax Day in the US!
Reading pediatric elbow radiographs is not easy. Sometimes there is an obvious problem, but in many instances the problem is not as apparent. Being able to read these films is a huge asset, not only for immediate treatment but also when communicating to a pediatric orthopedist.

One way to optimize your ability to read an elbow film is proper positioning of the patient as well as knowing what films to order. Most of the time, a complete elbow series (3 views – AP, Lateral, and Oblique) is needed to identify fractures, which may be visible on only some of the views.

Here are some examples of the three view elbow series with, conveniently, anatomic landmarks identified. This is a mature elbow, so you must remember that, depending on the age of the child, not all of the bones have ossified, making fracture identification more challenging.

Confused about ossification centers? Don’t be! Above is a handy guide to ossification centers as well as the ages that they close.

In 1705, Russian Emperor Peter the Great placed a tax on beards, hoping to force men to adopt the clean-shaven look that was common in Western Europe.

During the 1st century AD, Roman emperor Vespasian placed a tax on urine. The buyer(s) of the urine paid the tax. The urine from public urinals was sold as an essential ingredient for several chemical processes.
When reading elbow films, there are several anatomic lines that you should be familiar with. Knowing where the lines are will help you catch fractures and dislocations that may be subtle, which in children, they often are. Here are few examples of the most important anatomic lines you should know when reading pediatric elbow film:

**Radiocapitellar Line**

This line is very useful for detecting radial head dislocation. Draw the line down the radial neck. This is important, because if you draw the line down the radial shaft, it will not intersect the capitellum (which the line should do) due to slight angulation of the radius, which is normal. The line should...

**Anterior Humeral Line**

This line is drawn using the lateral elbow view. Draw the line along the anterior surface of the humerus. This line should pass through the the middle third of the capitellum. In supracondylar fractures, the line may pass through the anterior third or in front of the capitellum.

**Fat Pads:** Clinicians who are familiar with reading pediatric elbow X-rays know that the presence of a posterior fat pad is indicative an occult fracture. The presence of an anterior fat pad is normal and not due to a fracture. The posterior fat pad becomes visible due to distention of the joint, which is due to a fracture.
Back to our cases...So, for these children, imaging is in order. But remember, the radiology techs will have to position these injured extremities to obtain the best views possible. The first order of business is pain control.

The most frequently used medication in the DCMC ED is intranasal Fentanyl, which is safe and effective. The typical dose is 2 micrograms/kg and can be repeated twice. The maximum dose for this is 100 micrograms per dose. It is worth noting that most EMS systems in the Austin area are using this medication.

Knowing the types of pediatric supracondylar fractures is extremely important, as this guides treatment. Some fractures need operative repair and some don’t. Also, knowing the types of fractures makes communication with the pediatric orthopedic team much much easier!
In 1712, England imposed a tax on printed wallpaper. Builders avoided the tax by hanging plain wallpaper and then painting patterns on the walls.

This is why these fractures are extremely high risk (despite being very common). There is a risk for neuromuscular compromise in these children. These fractures should NOT be manipulated in the Emergency Department unless it is done by a pediatric orthopedic surgeon!

Here is a nice example of a Type II supracondylar fracture. Notice how the posterior portion is still attached to the humerus (like a “hinge”; red arrow). There is also a fat pad (green arrow).

Here’s a nice exam of a selected image from a Type I supracondylar fracture. Notice the posterior fat pad (red arrow). One limitation of this film if the that it is not a true 90 degree lateral. There is, though, a significant amount of soft tissue swelling (blue arrow). This may have limited this child’s ability to fully flex to 90 degrees.

What happened to the patient from Case 1? Read on…….

Good thing you got an xray. In this selected image, there is a lateral condyle fracture (red arrow).

Lateral condyle fractures account for 12% of all distal humerus fractures. The frequency of the fracture peaks at age 6, but case reports range from 2 to 14 years of age.

This is a Salter-Harris IV fracture. The displacement of the fracture is often more than is appreciated and they do have a tendency to displace further.

Two theories exist concerning the mechanism of lateral condyle fractures: Pull Off (avulsion occurs at the origin of the extensor/supinator musculature) or Push Off (fall causing an impaction of the radial head in the condyle).
Here are a couple of nice examples of lateral condyle fractures. The image on the far left is, I think, pretty apparent. The image on the immediate left is a little more subtle (red arrow). On the lateral view, there is a posterior fat pad (purple arrow).

Lateral condyle fractures are notorious for further displacement. Therefore, the majority of these children will require operative repair. Usually, this takes the form of ORIF (Open Reduction and Internal Fixation). Another viable option is closed reduction with percutaneous pinning. Both methods have been studied and results are equally good if there is limited initial displacement. In children with greater displacement, though, ORIF is preferred.

Here are post-operative images of an ORIF procedure for a lateral condyle fracture. Complications from these fractures include nonunion, premature growth arrest of the capitellar physis, cubitus varus, and ulnar nerve palsy. Once there are radiographic signs of union, the K wires are removed (typically 6 weeks).

In 1883, Stimson first described the fracture patterns in lateral condyle fractures in his book Treatise on Fractures.

In Arkansas, body piercings, pet grooming, and petter cleaning are all subject to a 6% sales tax.
Here is another example of an obviously severe fracture. This child, though, had a very small laceration at the antecubital fossa. This is significant, because, while this child was destined to have to go to the operating room for repair, this small wound makes it an open fracture. In patients with open fractures, the sooner to the OR the better. In the meantime, IV antibiotics should be started (typically Ancef, though this varies depending on the circumstances of the laceration, such as if there is contamination from dirt, etc). The wound should be covered with Betadine gauze, the extremity splinted, and pediatric orthopedics immediately consulted.

Here is another very common presentation of a supracondylar fracture, although there was some debate if this was a minimal lateral condyle fracture. If this was a lateral condyle fracture, there is minimal displacement, so ORIF was not needed.
Case Resolutions

Case 1: This young man required, unfortunately, pinning of his Type III supracondylar fracture. Since he was getting a cast, this nicely treated his buckle fractures of the distal radius and ulna. Fortunately, he did not have apparent neuromuscular compromise and was followed up post-op in the Pediatric Orthopedic Clinic. He did well and recovered from his injuries.

Case 2: This patient sustained a legal condyle fracture. The displacement was enough to warrant pinning in the operating room by Pediatric Orthopedics. Fortunately for him, the fracture did not undergo any further displacement and he, too, recovered from his injury.

Teaching Points

1. Pediatric elbow fractures are extremely common injuries in children, but are high risk fractures that can have many complications, including nonunion, malunion, neuromuscular compromise, and permanent disability/limited range of motion.

2. Get to know pediatric elbow X-rays! Knowing where and when ossification centers arise is a very useful tool to use than reading pediatric elbow films.

3. Make good use of the radiocapitellar and anterior humeral lines; they can help you identify fractures as well as dislocations. They are extremely useful in evaluating Monteggia’s or Galleazzi fractures (more on those two types of injuries in a future issue).

4. NEVER manipulate an elbow fracture! The risk of causing or worsening neuromuscular compromise is very real. It is best to splint the injured elbow as best you can (the “comfort splint”) and immediately contact Pediatric Orthopedics, especially for Type II and Type III supracondylar fractures.

5. Know the supracondylar fracture classification types! It will guide treatment and allow optimal communication between you and your Pediatric Orthopedist.

6. Lateral condyle fractures are very commonly unstable and should be referred immediately to Pediatric Orthopedics. Often, they are pinned the day of injury, but at the most within 48 hours of injury.

7. Open fractures need immediate attention. IV antibiotics should be started (typically Ancef, but this does depend on if there is wound contamination and the mechanism of injury), the wound should be covered with Betadine gauze, and immediate Pediatric Orthopedic consultation should be obtained.

References


Looking for back issues? You can find them all on the Dell Children’s Medical Website: www.dellchildrens.net