

This podcast can be accessed at www.pedscases.com, Apple Podcasting, Spotify, or your favourite podcasting app.

INTRO TO PEDIATRIC MSK RADIOGRAPHS: APPROACH TO SHOULDER RADIOGRAPHS

Developed by Dr. Kai Homer for PedsCases.com.
Oct. 19, 2020

Introduction:

Hi, my name is Dr. Kai Homer, and I'm a resident in Radiology at the University of Alberta. This video is the second in a series discussing musculoskeletal radiology in children. We're going to focus on musculoskeletal injuries, and going through some cases to help you understand how radiology fits into the whole clinical picture. This fourth video will discuss ossification centres in the elbow.

This module was reviewed by Dr. Adrienne Thompson, a pediatric radiologist at the University of Alberta. I'd like to thank the University of Alberta Department of Radiology for allowing access to images from real cases. All images have been de-identified and are used here for educational purposes only. These slides are available at www.pedscases.com and on the Canadian Association of Radiologists website.

After watching this video, the learner should be able to:

1. List the ossification centers in the pediatric elbow
2. Use the CRITOE mnemonic to recall the order in which ossification centers appear
3. Use knowledge of ossification centers in the pediatric elbow to recognize avulsion fractures in the pediatric elbow

So now let's look at ossification centers of the elbow. Elbow ossification occurs at six centers in a predictable order as we age. Generally the appearance and fusion of the ossification centers in girls occurs up to two years in age younger than boys. A commonly used mnemonic to remember the order in which the ossification centers appear is CRITOE. C stands for capitellum, R stands for radial head, I stands for internal epicondyle, which is also known as the medial epicondyle, T stands for trochlea, O stands for olecranon, and E stands for external or lateral epicondyle. One way to remember the approximate ages at which the ossification centers appear is the odd number rule, so the capitellum would ossify at age 1, radial head would ossify at age 3, internal epicondyle at 5, and so on until the final center to appear, the external epicondyle, ossifies at age 11. In reality, that's not quite accurate, and the average ages are one year of age for the capitellum, 5 to 6 years of age for the radial head and medial epicondyle, 8 to 10 years of age for trochlea and olecranon, and 11 years of age for the external or lateral epicondyle. So here this illustration shows the ulna, radius, humerus and the olecranon - and it shows the rough location of the capitellum. Here's a radiograph to illustrate with the tracing labeled C the capitellum ossification center, so this is the first ossification centre in the elbow. The second ossification centre is the

Developed by Dr. Kai Homer for PedsCases.com.
Oct. 19, 2020

radial head, which we see here. The third would be the internal or medial epicondyle, as you can see with the letter I marking the internal epicondyle on this radiograph. The fourth would be the trochlea, and the fifth would be the olecranon. We see both the trochlea and olecranon ossification centres here on this radiograph. Last, we have the external epicondyle, which we see here. So that completes the CRITOE mnemonic

Let's do a case now. The following patient's a 14-year-old boy who comes in with pain and swelling of the left elbow after falling on an outstretched left-hand. On exam, he has a visibly dislocated left elbow with decreased range of motion and tenderness to palpation. Radiographs are ordered. Is there a fracture? So here we have a lateral view of the left elbow. The first thing to notice is that there's moderate soft tissue swelling - there's lots of fluid density around the which would correspond to the swelling clinically. The next thing to notice is that the radiocapitellar and ulnotrochlear joints are aligned. The radiocapitellar joint is between the radius and capitellum, the radial head is in blue, and the capitellum is in yellow. The ulnotrochlear joint is between the ulna, which is outlined in green, and the trochlea which is outlined in pink. One thing about elbow x-rays is that the radius and capitellum should normally align on all views of the elbow no matter how the x-ray is taken. So you should be able to draw a straight line through the radius and capitellum. Here, we can see that there's a small linear ossific density along the lateral aspect of the radiocapitellar joint and there's also a small avulsion fracture off of the capitellum. An avulsion fracture is a fracture caused by a ligament pulling off the piece of bone that it attaches to, breaking it off from the rest of the bone. Now let's look at some CT images from that same day and the same patient. So here we have a slice through the elbow we see the radius, the ulna, and the CT a defect in the cortex of the medial epicondyle of the humerus. This is the donor site for the fracture fragment that is displaced into the elbow joint - so the donor site refers to where the piece of bone broke off from. This CT slice shows a 13 mm fracture fragment sitting in the ulnotrochlear joint. This has avulsed off of the medial epicondyle from the last slide. Because it's perfectly behind the ulna, the overlap that makes it so that the avulsion fracture is not well seen on the radiograph, but you can see it clearly here. This CT image shows the avulsion fracture fragment in another orientation. Some of the fracture fragments are displaced into the radiocapitellar joint as we see here. A 3-D construction using the same CT images shows the fracture fragments suspended in the joint space between the ulna and humerus.

This concludes part 4 of this video series. In the next video in this series we will look at injuries in the pediatric wrist. Before we leave, we wanted to leave you with a few key take home points

- 1) Ossification occurs at six distinct centers in the pediatric elbow in a predictable order
- 2) The mnemonic CRITOE can help you remember in which order the ossification centers appear
- 3) The odd number rule can help you remember at which ages the ossification centers appear

Thanks for watching part 4 of the pediatric MSK radiograph series on PedsCases, and please stay tuned for the rest of this series.

References:

Developed by Dr. Kai Homer for PedsCases.com.
Oct. 19, 2020

1. DeFroda SF, Hansen H, Gil JA, Hawari AH, Cruz Jr AI. Radiographic evaluation of common pediatric elbow injuries. Orthopedic reviews. 2017 Feb 20;9(1).
2. Sułko J et al: Capitellar fractures in children. Ortop Traumatol Rehabil. 16(6):573-9, 2014

All other images are images contributed to **Radiopaedia** that are accessible online (<http://radiopaedia.org/licence>) Please enter the **rID** (radiopaedia ID) listed for any given image into the search box on the Radiopaedia home page (<http://radiopaedia.org>) to retrieve the case from which the images were obtained