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Musculoskeletal Radiology in Children - Part 1

Developed by Dr. Kai Homer and Dr. Adrienne Thompson for PedsCases.com.

Introduction:

Title Slide:

Hi, my name is Dr. Kai Homer, and I'm a resident in Radiology at the University of Alberta. This video is the first 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 first video will discuss terminology used to describe fractures in radiology, focusing on some concepts that are specific to pediatrics.

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. Classify pediatric fractures as incomplete and complete
2. Sub-classify pediatric fractures as transverse, spiral, etc.
3. Describe the radiographic appearance of a pediatric fracture to a consultant using appropriate terminology

First off, let's go over how to describe fractures on x-rays.

The first question we need to answer is: what type of fracture are we looking at? It is important to be able to do this because different types of fractures have different treatments, and in phone conversations where the person you are speaking with does not have the x-ray in front of them, they can get an idea of what the fracture looks like from your description.

From a radiology point of view, fractures can be classified as complete, and incomplete. We'll start with the complete fractures.

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Pretend this is the humerus.

Then, something happens to that humerus to cause a fracture.

In this case, this fracture is a complete fracture. It goes all the way across the humerus, breaking it into two separate pieces. Note, this is merely conceptual, in real life, the fracture line will not be perfectly straight.

If we say that the top of the slide is the shoulder and the bottom is the elbow, this illustrates a transverse fracture – one that goes straight across in the horizontal plane.

Now, let's look at another way bones can fracture. Another kid breaks their humerus, but this time...

It's still a complete fracture... because it goes all the way through our pretend humerus...

Except, this time, it would also be a complete oblique fracture, as it goes across the bone at an angle

Let's think in 3D now

This time it is a complete spiral fracture, where one piece is rotated from where it normally would have sit.

Not all fractures break the bone perfectly in two. Comminuted is the term used to describe fractures that have more than 2 parts to them. You can see here in the middle of the fracture line how there are a few chunks of humerus, so rather than a clean break through the humerus leaving you with a proximal fragment and distal fragment, comminuted fractures can leave you with any number of fragments.

The next set of fracture types we will talk about are considered incomplete because the fracture does not go all the way through the bone. Incomplete fractures are unique to pediatrics (Explain why!)

This type is called a bowing fracture. It is almost exclusively seen in pediatrics. Because kids' bones are softer, they can bend rather than break

This type of fracture would be called a buckle fracture.
It again is a pediatrics fracture, and there will be a bulge of cortex on the side of the compression (the side of the impact). On the side of tension (opposite the side of impact, there is usually no change.

This type of fracture would be called a greenstick fracture.

It has a discrete fracture line on the tension side that does not go through the opposite cortex - a 'bent but not broken' appearance

So to recap, fractures can be either complete, or incomplete.

Some examples of complete fractures are: transverse fractures, oblique fractures, spiral fractures, and comminuted fractures.

Some examples of incomplete fractures are bowing fractures, buckle fractures, and greenstick fractures. Note that those last three all are unique to pediatrics.

The second thing we need to be able to say about fractures on x-rays, is where the pieces are, using the right lingo.

As you know, the two pieces of bone in a fracture aren't always perfectly lined up. Fractures can have varying degrees of displacement

Here, you can see how when the pieces are half overlapping each other, that's 50% displacement. When the fragment is displaced one times its full width laterally, that would be 100% displacement.

Another thing that can happen to fractures is shortening, also called foreshortening or overriding. This is where the total length of the two pieces of bone doesn't add up to the original length of the bone before the fracture because the pieces overlap a bit.

Different places will have different conventions for the word used to describe 'shortening'. At our university, foreshortening is a commonly used term, but in some textbooks, this may be called overriding. Same thing, just a different name for it.

When the fracture rams the two pieces of bone into each other, the proper term to describe the length difference is impaction.

Distraction is kind of the opposite situation, when there is a fracture but the pieces go farther away from each other.

Again, taking the example of our pretend fractured humerus...

Angulation is the term used to describe when the fragments sit at an angle to each other

Rotation is when the fracture fragments twist from their original axis

Case Conclusion:

Review the initial X-ray and describe it like you would to a surgeon over the phone.

This concludes part 1 of this video. In the next video in this series we will discuss fractures involving the growth plate, using the Salter Harris classification system. Before we leave, we wanted to leave you with a few key take home points

- 1) Fractures can be classified as either complete or incomplete
- 2) Incomplete fractures include bowing, buckle, and greenstick fractures and are unique to pediatrics
- 3) The location of fracture fragments can be described by the terms displacement, shortening, impaction, distraction, angulation and rotation

Thanks for watching part 1 of the pediatric MSK radiograph series on PedsCases, and please stay tuned for the rest of this series.

References:

1. Radiopaedia.org

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