

Is It a Pseudosubluxation or a True Subluxation?

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The patient is a six year old with a history of minor trauma and a painful neck. (That's all you get for history and clinical findings, 'cause that is more than I usually get when receiving films to review!)

The term "subluxation" is highly controversial, mainly because its definition varies depending upon the frame of reference of the individual using the term. This is accepted as a legitimate entity, but it is often not recognized or accepted by radiologists despite documentation to the contrary. There is also an entity called "pseudosubluxation," which further muddles the issue.

For the purpose of discussion, let's define the term "subluxation" simply as a "radiographic entity." It is a disrelationship between contiguous vertebrae, due to either trauma or disease or both. In traumatic injuries of the cervical spine, a subluxation generally can be demonstrated radiographically in the lateral projection. A problem arises when the subluxation is found at the C2 or C3 level in children. Developmental variants of the cervical spine in young children can be difficult to deal with, when interpreting radiographs using measurement parameters based on adults.

The space between the atlas and the odontoid can be 4-5 mm in children up to age 15 years, compared to 2-3 mm for adults. This is because the odontoid is not fully ossified. The radiograph shows only the ossified core, while the outer layers of the odontoid are still cartilaginous and not visible on radiographs.

Depending on the positioning of the child's neck, it is not unusual to see a straight cervical spine on the lateral view without the usual lordosis. In adults, the absence of lordosis is an indirect sign of muscle spasm, possibly due to an occult fracture. However, in children, the absence of lordosis is not necessarily indicative of muscle spasm.

In children up to age 10 years, flexion and extension are greatest at approximately C2 and C3. C2 may appear to be anterior relative to C3 by as much as 5 mm. This pseudosubluxation is increased if the radiograph is taken with the neck flexed. This finding may be present in as many as one-third of all lateral cervical spine films in children.

It is extremely important to distinguish true subluxation from pseudosubluxation. It would be unwise to assume the presence of pseudosubluxation until this is certain. The pseudosubluxation phenomenon may result in a delay in establishing the diagnosis of a true subluxation. Such patients should be treated conservatively with cervical spine immobilization until the true diagnosis has been ascertained.

In the subject case, the neck is positioned in flexion. Is this a pseudosubluxation or a true subluxation?

The two most common causes of C2-C3 malalignment are pseudosubluxation and a "hangman's"

fracture. L.E. Swischuk, MD has devised a method to distinguish these two: He performed a study of 500 children up the age of 14 and determined a method of differentiating the true from the false subluxation. (This is described in *Radiology*, vol 122. 1977 p 759.) Swischuk defined a posterior cervical line drawn from the cortex of the posterior arch of C1 to the cortex of the posterior arch of C3. This line should pass through or be less than 1 mm anterior to the posterior arch of C2. If this distance is greater than 1 mm (possibly up to 1.5 or 2 mm may be normal), this indicates a fracture of the arch of C2 (The vertebral body moves anteriorly, while the arch and the spinous process move posteriorly).

Additionally, pseudosubluxations are most pronounced with the neck flexed. C2/C3 malalignment should not persist if the neck is placed in a more neutral or extended position. Persistence of the subluxation in extension is felt to be due to injury (nonphysiologic).

The Swischuk line is drawn on our patient's radiograph. The posterior arch of C2 is pointed out; however, in this example, the posterior arch of C2 is poorly identified because the radiograph's angle is slightly oblique. The distance from the Swischuk line to the posterior arch of C2 is about 1.6 mm. This is more than the 1 mm upper normal limit described by Swischuk; however, other reports have indicated that this distance can be up to 1.5 or 2 mm. Note that this radiograph is taken with the neck in flexion. This artificially amplifies the degree of C2/C3 pseudosubluxation. Ideally, the radiograph should be taken in a neutral or extended position to minimize the C2/C3 pseudosubluxation.

Remember, pediatric radiology is a separate field and often difficult because communication with the patient is not always easy. It is usually best to treat a malalignment in the spine as a true subluxation until proven otherwise, particularly in association with any history of trauma.

References

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