Clinical History:

This 8-year-old boy presented at the emergency department following a neck injury. He landed on his occiput with a hyperflexion injury to his neck whilst attempting a somersault on a bouncy castle. He had immediate onset of right sided neck pain with no associated neurological symptoms or signs.

Imaging Findings:

Anterior subluxation of C2 on C3. No soft tissue swelling. Normal bony alignment along the posterior cervical line indicating that this was pseudosubluxation rather than pathological subluxation.

Discussion:

Diagnosing injuries of the paediatric cervical spine can be difficult due to anatomical variations in this patient group. In trauma, injuries to the upper cervical spine are relatively more common in children than adults. Therefore it is important to have knowledge of anatomical variants in order to avoid over-diagnosing serious injury and exposing children to further unnecessary investigations. Although the Canadian C-spine Rules and NEXUS criteria are widely used in adults, to date there are no clear validated guidelines for imaging of the cervical spine in children. The NICE guidelines suggest reserving CT imaging in children unless the GCS<8, plain films are inadequate or there is a strong clinical suspicion of injury despite a normal x-ray.

Displacement of C2 on C3 is a normal variant in children, unlike in adults. It is thought that this may occur due to ligamentous laxity, lack of development of the uncovertebral joints of Von Luschka or horizontal alignment of the apophyseal joints.

Cattel [1] reported C2/C3 pseudosubluxation in 24% of C-spine x-rays in non-trauma patients aged 1-7 years. It has also been reported in non-trauma patients up to the age of 18, although is much less common in later teenage years [2].

A recent study by Shaw [3] found the prevalence in 138 poly-trauma paediatric patients to be around 21.7%. None of these turned out to be true subluxations thus highlighting that this is a very rare injury.

Swischuk [4] developed a method for differentiating pseudosubluxation from true subluxation which can occur with a Hangman's fracture for example. This is illustrated in Figure 2. A line is drawn through the anterior cortex of the posterior arches of C1 - C3. In physiological displacement the line should pass through, touch or lie up to 1 mm anterior to the cortex of the posterior arch of C2. If the cortex of the posterior arch lies more than 2 mm behind the line, this strongly indicates a true subluxation and should prompt further imaging. No other abnormal radiographic signs, such as soft tissue swelling should be present if the posterior cervical line technique is to be used.

In this case, the initial x-ray was felt to be abnormal by the emergency physician. On re-examination of the neck the
clinical probability of an injury was felt to be very low. Use of Swischuk's Line helped to confirm that the x-ray appearance was in keeping with pseudosubluxation and no further imaging was performed.

**Differential Diagnosis List:** C2/C3 pseudosubluxation, Pseudosubluxation, Pathological Subluxation

**Final Diagnosis:** C2/C3 pseudosubluxation

**References:**


Description: Lateral C-Spine radiograph showing apparent subluxation of C2 on C3 Origin:
Description: Lateral C-spine radiograph demonstrating the use of Swischuk’s Line

Origin: