Midline anterior and posterior atlas clefts may simulate a Jefferson fracture

A report of 2 cases

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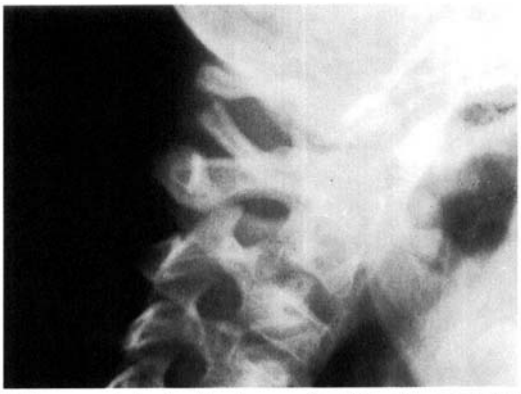
Case 1

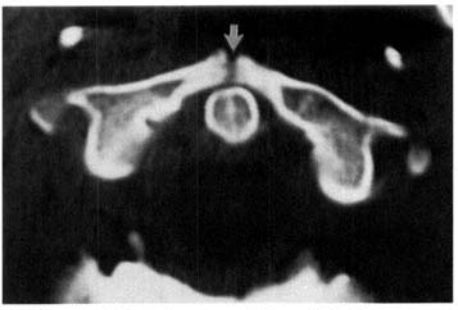
A 9-year-old girl crashed into the wall of the pool while swimming. Because of immediate neck pain and stiffness she was brought to a local hospital where cervical spine films were interpreted as normal. Since the pain persisted, a CT examination was also performed and a fracture in the anterior arch together with a spina bifida of the posterior arch of the atlas were diagnosed.

When reviewing the initial cervical films on admission to our hospital, we suspected an anomaly in the anterior arch. Additional oblique cervical films showed a spina bifida in the posterior arch of the atlas and a standard odontoid view demonstrated the lateral masses of C 1 hanging over the lateral masses of C 2 by 1–2 mm. Supplementary examinations including CT and MRI were performed. CT showed an anterior cleft of the atlas with well defined cortical margins and MRI did not reveal any signs of a fracture (Figure 1).

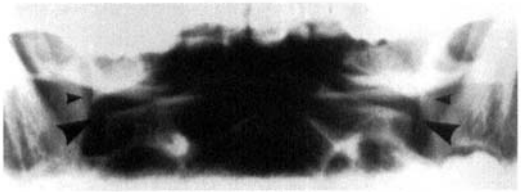
Figure 1. Case 1.



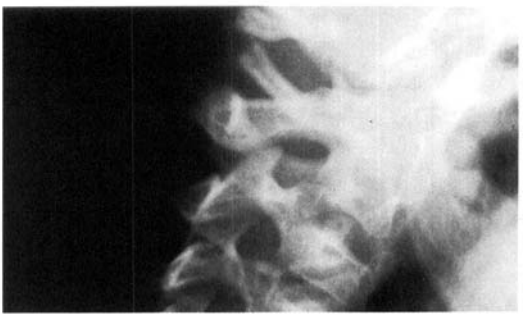
Oblique cervical spine film shows spina bifida of the posterior arch of the atlas (arrow).



Axial CT-scan of C 1 shows a midline defect in the anterior arch of the atlas (arrow) with sharply corticated margins.



Standard odontoid view showing the lateral masses of C 1 (small arrowheads) hanging over the lateral masses of C 2 with 1–2 mm.



Axial MRI-scan of C 1 shows a midline defect in the anterior arch (arrow) without any signals indicating a fracture.

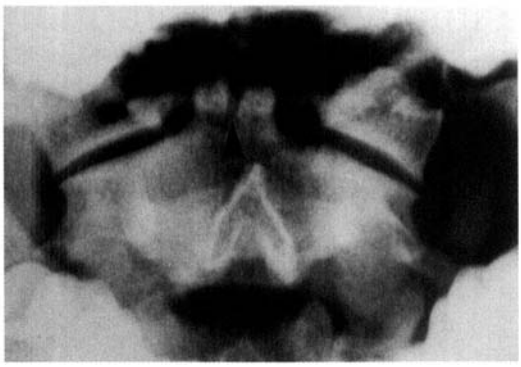
The findings indicated a rare congenital anomaly affecting both the anterior and posterior arches of the atlas. The clinical condition improved after some days.

Case 2

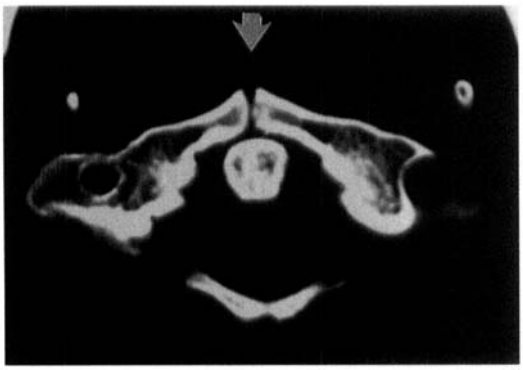
A 19-year-old boy fell down from a staircase 1.5 m onto the floor. After a few days, pain and stiffness in the neck occurred. Radiograms revealed a defect in the anterior arch of the atlas. An additional CT-examination confirmed a midline defect in the anterior arch of the atlas. MRI confirmed the findings, with no signs of a fracture (Figure 2).

The diagnosis was a congenital anomaly, with clefts in both the anterior and posterior arches of the atlas. The patient recovered without treatment.

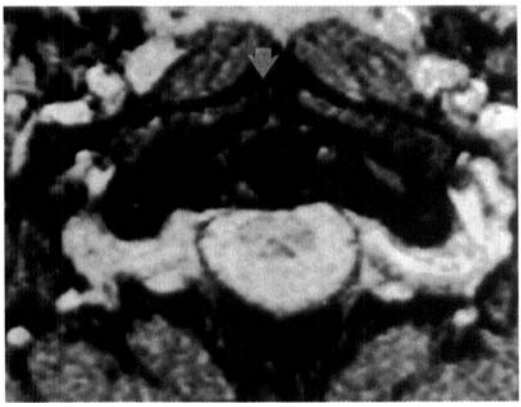
Figure 2. Case 2.



Standard odontoid view shows a cleft in the anterior arch of the atlas (arrow).



Axial CT-scan of C 1 showing a midline defect in the anterior arch of the atlas (arrow).



Axial MRI-scan of C 1 shows a midline defect in the anterior arch of the atlas (arrow) without any signals indicating a fracture.

Discussion

Congenital defects in the atlas can involve the anterior or the posterior arch of the atlas, or both. A posterior cleft occurs in about 4% (Geipel 1955, Schulze and Buurman 1980). An anterior cleft is observed in only 0.1% of the population (Geipel 1932). In most patients, the anteror cleft is associated with anomalous development of the dorsal arch (Desgerez et al. 1965, Gamble and Rinsky 1985). The rarest abnormality is an anterior defect alone, which is reported in a few cases only (Teichert 1956, Tänzer 1957).

The atlas most commonly consists of three primary ossification centers: one anterior for the tubercle and two lateral for the lateral masses and the posterior arch (Sarwar et al. 1983). While the anterior arch of the atlas usually is cartilaginous at birth, 20% of newborns have an ossification center at that location. Ossification varies, with one or more centers appearing during the first year of life (Gehweiler et al. 1980). By the sixth to eighth year of life, fusion of the anterior arch to the lateral masses is completed (Engländer 1934, Bailey 1952, Geipel 1955, Von Torklus and Gehle 1972, Gehweiler et al. 1980). An anterior atlas cleft may occur in the absence of an anterior ossification center and the lateral masses do not fuse anteriorly, or no fusion of two anterior ossification centers takes place (Chalmers and Gallegos 1985).

Fractures of the atlas vertebra account for 6% of cervical vertebral column injuries (Gehweiler et al. 1983). One third of these fractures are the bursting fracture of Jefferson (1920). The injury results from an axial compression force applied to the vertex of the skull with the head and neck held rigidly erect. The classic radiographic findings are bilateral atlantoaxial lateral offset of 3–9 mm. Lateral mass offset greater than 7 mm probably indicates a rupture of the transverse ligament of the atlas, resulting in instability.

Developmental anomalies may be associated with atlantoaxial offset of 1–2 mm, if both anterior and posterior defects are present. In a young population (3 months to 4 years old), the lateral masses of C 1 commonly extend 1–3 mm beyond the margins of the axis, secondary to different growth patterns of the vertebral bodies. This is called pseudospread of the atlas (Suss et al. 1983).

CT of an anterior cleft of the atlas demonstrates a small defect in the anterior arch. This defect is often located in the midline and has smooth corticated margins. A Jefferson fracture has a sharp non-corticated appearance. When available, MRI is an excellent method for distinguishing between a fracture and an anomaly. However, most hospitals will have to rely on conventional radiography and CT, the latter being very helpful. The most important, however, is to think about the possibility of an anomaly as a differential diagnosis to a fracture.

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