



Anthropology Section - 2016

A22 Traumatic and Congenital Anomalies of the Atlas: A Forensic Identification Case Report

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After attending this presentation, attendees will recognize which traumatic and congenital abnormalities of the craniovertebral junction can be used to identify skeletal remains.

This presentation will impact the forensic science community by providing information on the various existing traumatic and congenital anomalies of the cervical atlas. These rare abnormalities provide important data that could lead to a positive identification, such as in this case report.¹

A partially skeletonized and unidentified body was discovered during the winter in northern France, hidden by vegetation and partially submerged in a swampy area. The identification card found in his clothes corresponded to a 48-year-old man. The victim had an old psychiatric illness and escaped from the hospital during the previous summer. Despite searches conducted by the police, he was never found.

Anthropological analysis revealed that the victim was an adult male, 170cm to 180cm in height, and 36 years to 54 years of age, which was compatible with the presumed identity. A callus was observed on the left clavicle and the examination of the cervical spine showed an old fracture of the atlas with two disjunct zones: one on the anterior arch and another on the posterior arch of the vertebra. Bone margins showed osseous changes associated with skeletal healing processes and remodeling (a Computed Tomography (CT) scan was performed in order to document this injury). The medical records of the victim mentioned an old fracture of the distal end of the left clavicle in 2006, compatible with the postmortem findings, without any other traumatic injury. Given the specific psychiatric history (schizophrenia and chronic alcoholism), several CT brain scans were performed during his hospitalizations and their analyses confirmed the atlas condition: a bursting fracture called the Jefferson fracture. This old fracture was never treated surgically and was never reported in the medical record (there was no sign of neck injury in the decedent's medical past). These bifocal fractures are rare and should not be confused with congenital abnormalities of the craniovertebral junction.

Unlike other cervical vertebrae that develop embryologically from three ossification nuclei (one in the vertebral body and one in each lateral mass), the atlas grows from two lateral ossification centers.² Around the seventh week of intrauterine life, ossification begins and extends dorsally. During the second year of life, a separate ossification center appears from the posterior tubercle of the atlas and these posterior arches fuse between three and four years of age. For the anterior arch, one or more ossification centers could appear during the first year of life, but it is possible that no ossification center arises; in that case, the anterior arch is formed from the lateral masses. The fusion is complete between six and eight years of age.³ Because arches fuse anteriorly and posteriorly progressively, hypoplasia or aplasia might occur on the arches, as well as fusion anomalies (rachischisis or clefts). A rachischisis is possible for the anterior or posterior arches, and the "split atlas" is a fusion anomaly of both anterior and posterior arches. It is therefore important to recognize a split atlas as these osseous gaps may mimic a Jefferson fracture.

The Jefferson fracture results from an axial compressive force applied to the vertex with the neck held rigidly erect.³ These arch fractures usually occur near the lateral masses (as in this case) and are difficult to observe on conventional radiographs. A CT scan is therefore essential for diagnosis.

Numerous congenital anomalies of the atlas vertebra exist. They must be known to the pathologists and anthropologists to differentiate them from fractures, because many fractures in this area are treated conservatively: Jefferson fractures are typically treated by a hard collar immobilization, provided that the transverse atlantal ligament is considered intact.²⁻⁴ Furthermore, their rarity in the population can be a key element in identifying skeletal remains.



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Reference(s):

1. Kanchan T., Shetty M., Nagesh K.R., Menezes R.G. Lumbosacral transitional vertebra: clinical and forensic implications. *Singapore Med J.* 2009;50(2):e85-7.
 2. Bonneville F., Jacamon M., Runge M., Jacquet G., Bonneville J.F. Split atlas in a patient with odontoid fracture. *Neuroradiology.* 2004;46(6):450-2.
 3. Gehweiler J.A., Jr, Daffner R.H., Roberts L., Jr. Malformations of the atlas vertebra simulating the Jefferson fracture. *Am J Roentgenol.* 1983;140(6).
 4. Stewart G.C., Jr, Gehweiler J.A., Jr, Laib R.H., Martinez S. Horizontal fracture of the anterior arch of the atlas. *Radiology.* 1977;122(2):349-52.
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Positive Identification, Cervical Atlas, Congenital