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Case Report

Atlas assimilation: a case report

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ABSTRACT

Congenital and acquired bony abnormalities of the cranio-vertebral junction may result in compression and distortion of the neural structures, vertebro-basilar vascular system, and cerebrospinal fluid channels. Ninety-eight human skulls of both sexes were examined for occipitalization of atlas. Two crania showed various degrees of assimilation of the atlas to the basicranium. One of the skulls showed complete fusion of the atlas with the occipital bone. Whereas, in the other skull atlas was partially fused to the occipital bone. Even though assimilation of the atlas is the most common anomaly found in cranio-cervical junction, head and neck surgeons should be aware that such an anomaly may exist without any typical symptomatic presentation, and thus, serious consequences of upper cervical spinal manipulative therapy may arise when a complete and adequate clinical assessment is missed. ***Neuroanatomy; 2007; 6: 32–33.***

Key words [occipital assimilation] [atlas assimilation] [occipitalization of the atlas] [cranio-vertebral anomaly] [atlanto-occipital fusion]

Introduction

Occipitalization of the atlas or atlanto-occipital fusion is one of the most common osseous anomalies of the cranio-vertebral junction. According to Yochum and Rowe [1], occipitalization represents the most cephalic 'blocked' vertebra encountered in the spine. It is characterized by complete or partial fusion of the bony ring of the atlas to the base of the occipital bone [2]. The patients with cranio-vertebral joint anomalies exhibit the first neurological signs and symptoms usually no sooner than the second decade of life [3].

In patients with the atlanto-occipital fusion, the clinical findings suggest that the major neurological compression is due to the odontoid projection into the foramen magnum. The signs and symptoms of pyramidal tract, anterior bulbar and cranial nerve involvement may be present [4].

Case Report

In this report, ninety-eight adult human skulls were used. All these skulls were of Indian origin (Kasturba Medical College, Mangalore). The each skull was carefully observed for any non-metric variations. We noted two skulls showing occipitalization of atlas.

Case 1

This skull showed complete fusion of the anterior arch of the atlas with the occipital bone on the left side and incomplete fusion on the right. Also, the posterior arch was incompletely fused with each other in the midline. The left transverse process of the atlas was fused with a spine like process of the occipital bone to form a foramen. Correspondingly, on the right side the spinous process showed an incomplete fusion with the transverse process of the atlas. The inferior articular facet on the left side appeared to be slightly larger and on the right side, two facets were present. Of which, one was seen on the lateral mass. On the right side the posterior arch was not fused with the occipital bone. The posterior arch on the left side was probably broken (Figure 1).

Case 2

In this skull both the anterior and the posterior arches were completely fused with the occipital bone. In addition, the transverse processes of the atlas were bilaterally fused to the occipital bone. The inferior articular process on the left side was larger than that of the right. Due to the invagination of the inferior articular process, the size of the foramen magnum was reduced (Figure 2).

Discussion

Assimilation of atlas is an osseous abnormality, which occurs in the base of skull in the region of foramen magnum. The union of the atlas with the occipital bone constitutes the anomaly. There may be partial or complete union [2]. The occipital bone is derived from basioccipital, exoccipital and supraoccipital portions, all of which surround the foramen magnum [5]. The basiocciput goes on to develop into four occipital somites. The caudal portion of the fourth occipital somite goes onto fuse with the cranial portion of the first cervical somite to form

Figure 1. Case 1: Showing incomplete fusion of posterior arch of atlas and complete fusion of anterior arch with the occipital bone on the left side. Color version of figure is available online. (***1:*** *incomplete fusion of posterior arch of atlas;* ***2:*** *complete fusion of anterior arch with the occipital bone on the left side;* ***3:*** *incomplete fusion of anterior arch with the occipital bone on the right side)*

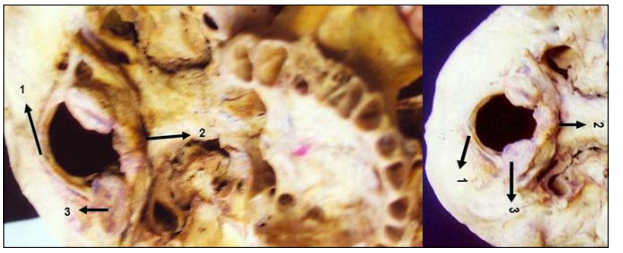

Figure 2. Case 2: Showing fusion of posterior and anterior arch of atlas with the occipital bone. Color version of figure is available online. (***1:*** *fusion of posterior arch of atlas with the occipital bone;* ***2:*** *fusion of anterior arch of atlas with the occipital bone;* ***3:*** *large inferior articular facet of atlas on the left side)*

the proatlas; the proatlas is assimilated into the occiput to form the articular condyles and the tip of the odontoid process. The caudal half of the first cervical somite along with the cranial part of the second cervical somite goes on to form the atlas and the odontoid process of the axis [6]. A paracondylar process represents vestiges of the cranial half of the first cervical sclerotome. This formation is referred to as a caudal shifting (a vertebra taking on the characteristics of its caudal neighbor) where the occipital vertebra separates from the occiput [6].

The symptoms and signs of pyramidal tract, anterior bulbar and cranial nerves involvement may be present [4]. Less commonly, if the compression occurred posteriorly by the posterior lip of the foramen magnum, are the symptoms and signs related to the involvement of the posterior column of spinal cord [4]. According to Hensinger [4] patients with occipitalization of the atlas have short neck and restricted neck movements. Symptoms referable to the vertebral artery compression, such as dizziness, seizures, mental deterioration, and syncope may occur alone or in combination with those of the spinal cord compression [4]. Spano and Darling [7] suggest that any morphological and structural alteration of the cervical spine may lead to stenosis or substenosis of the vertebral arterial circulation and hence to brain stem anoxia. Fusion between occiput and atlas occurs anteriorly between the arch and the rim of the foramen with some segment of the posterior arch of atlas present in some instances. This fragment can frequently constrict the spinal canal causing intermittent symptoms depending on the position of the head [8].

Although atlanto-occipital fusion is a congenital condition, many patients do not develop the symptoms until the second decade of life. This may be due to a gradual increasing degree of ligamentous laxity and instability with aging. The onset of clinical symptoms can be sudden and precipitated by relatively minor trauma, the most common course is a progressive, but sudden onset or instant death has also been reported [4]. Lopez et al. [9] reported that three patients with atlanto-occipital fusion have had cervical pain and two patients had tonic or clonic convulsions. Iwata et al. [10] reported a case of atlanto-occipital fusion with unusual neurological symptoms.

Even though assimilation of the atlas is the most common anomaly found in cranio-cervical junction, head and neck surgeons should be aware that such an anomaly may exist without any typical symptom presentation, and thus, serious consequences of upper cervical spinal manipulative therapy may arise if a complete and adequate clinical assessment is missed. The chiropractors, physicians, and physical therapists must obtain appropriate diagnostic imaging studies to ensure proper evaluation of structural integrity of the cervical spine before any treatment can be rendered.

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