Occipitalization and its clinical relevance: A case report

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Abstract

Occipitalization of the atlas or atlanto-occipital fusion is one of the osseous anomalies of the craniovertebral junction. This fusion may be partial or complete and can be due to failure in segmentation and separation of the most caudal occipital sclerotome and the first cervical sclerotome.We present a case report of complete occipitalization of the atlas which was observed during undergraduate teaching at Luxmi Bai Dental College, Patiala. Such an anomaly is of interest to anatomists, physicians, radiologists & neurologists as it can cause a variety of neurological symptoms. Occipitalization can cause sudden death and an antemortem record of such an anomaly can help in identification of the deceased. Hence, occipitalization can be of interest to the forensic investigators in establishing the identity of the deceased.

Keywords: Occipitalization, atlanto-occipital fusion, sudden death, identification.

Introduction

Occipitalization or fusion of atlas with occipital bone is a rare congenital malformation at the craniovertebral junction known as occipitocervical synostosis, occipitalization of the atlas, or atlanto-occipital fusion (1). During the fourth week of intrauterine life, the atlas partially or totally fuses with the occipital bone due to failure in segmentation and separation of the most caudal occipital sclerotome and the first cervical sclerotome (2). Such patients usually develop neurological symptoms after the second decade of life (3). Occipitalization of atlas may be partial or complete (4). Tubbs (5) stated that occipitocervical synostosis is usually congenital, but in rare cases, it may be a result of osteomyelitis, arthritis, syphilis or tuberculosis. Occipitalization of atlas can produce a wide range of neurological signs and symptoms varying from a transitory headache to full-blown neurological syndrome (6). This can even lead to sudden death (7). The knowledge of such an anomaly is important for anatomists, radiologists, orthopedists, neurosurgeons & forensic experts.

Case Report

During the osteology demonstration class for undergraduate students, a case of occipitalization of the atlas was observed (Fig 1). The skull of unknown origin and gender belonged to the archives of Luxmi Bai Dental College, Patiala. The following observations were made and the measurements were taken with Vernier calipers:

- The anterior arch was completely fused with the occipital bone, near the margins of the foramen magnum (Fig 2).
- The posterior arch was almost completely fused with the occipital bone, near the margins of the foramen magnum, leaving a small gap at the level of posterior tubercle of the atlas (Fig 3). This gap measured 8.5mm transversely & 4.5mm vertically.

- The lateral masses were fused with the occipital condyles completely.
- The transverse processes were fused to the occipital bone.
- The foramen transversarium were normal. The anteroposterior & transverse diameters of the right foramen transversarium were 6.45mmx6.68mm. The anteroposterior & transverse diameters of the left foramen transversarium were 6.45mmx6.64mm.
- The foramen magnum appeared normal. The dimensions of the foramen magnum were 30mm transversely and 32 mm anteroposterior.

Discussion

The bony anomalies at craniocervical junction have been studied previously by various authors (8), (9), (10),(11). Occipitalization of the atlas is a congenital synostosis of the atlas to the occiput, which is a result of the failure of segmentation and separation of the most caudal occipital sclerotome and the first cervical sclerotome during the first few weeks of fetal life (12). There may be varying degrees of bony fusion between atlas and occiput; partial or complete (13). The complete fusion of the atlas is more common than the incomplete (14). In the present study, one skull was observed with complete occipitalization. Similar findings were observed in two skulls by Saini (15)and in three skulls by Walia (16).

Foramen magnum normally measures about 30mm transversely and 35mm anteroposteriorly (17). Atlantooccipital fusion can reduce the foramen magnum dimension leading to neurological complications due to compression of the spinal cord, vertebral arteries, and first cervical nerve (18),(19), (20),(21). In the present study, dimensions the of the foramen magnum were 30mm transversely and 32 mm anteroposteriorly. In a study by Soni (22), the same diameters were reduced to 25mm x 19mm due to the fusion. In another study by Skrzat (23), the circumference of the foramen magnum was also diminished due to the fusion of atlas to the occipital bone.

According to some studies (24),(25),(26), atlantoaxial dislocation occurs in about 60% of patients with the anomaly of occipitalization of the atlas and can

Fig. 1: Fusion of atlas & occipital bone.

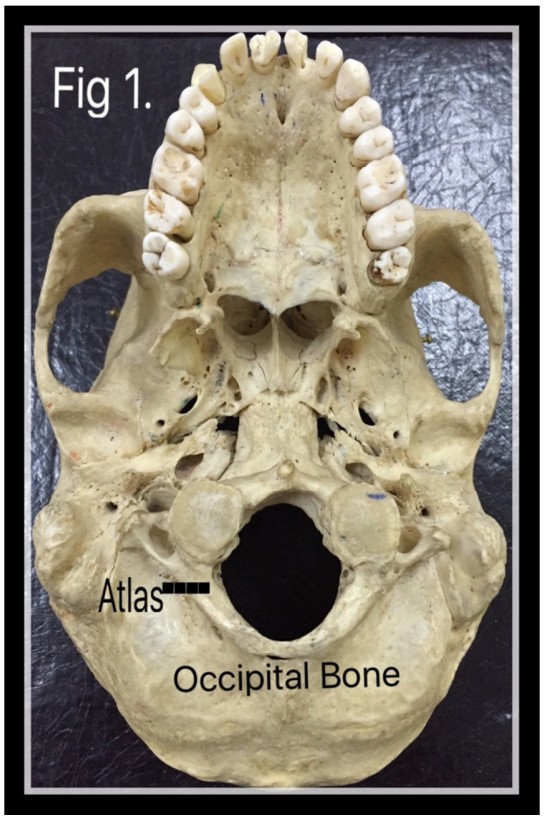

Fig. 2: Anterior arch of Atlas fused completely with occipital bone.

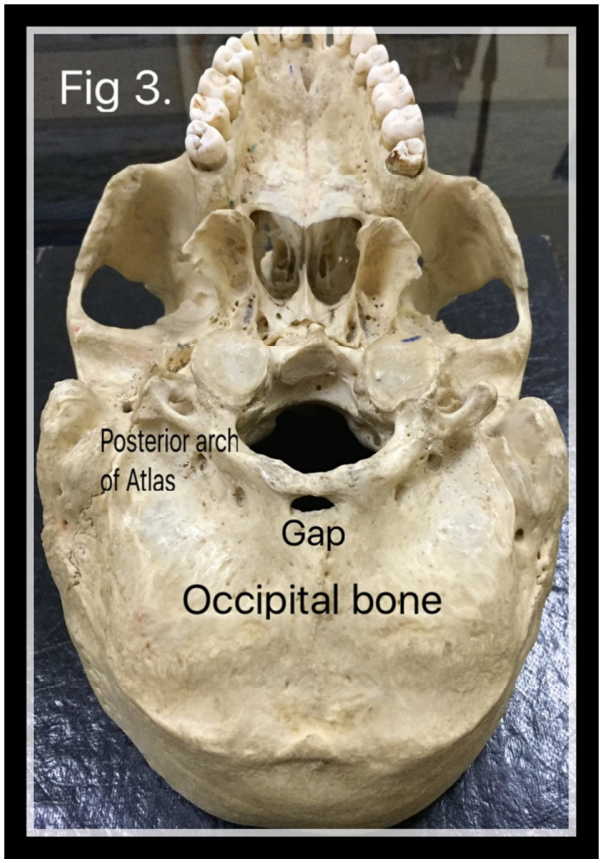

Fig. 3: Posterior arch of Atlas fused almost completely with occipital bone, leaving a small gap at the level of posterior tubercle of the atlas.

neurological symptoms. The neurological symptoms vary from a transitory headache to full-blown neurological syndrome. Skeletal abnormalities at the craniocervical junction may result in sudden death (7),(16),(27),(28),(29).

The skeleton which is the most durable part of the body (30), furnishes information to the Forensic investigators who are primarily concerned with personal identification. Examination of the skeletal remains in comparison with the antemortem details like dental charts, medical records and x-rays of the suspected victim provide important means of comparative identification (31),(32),(33).

Conclusion

From the present study, we can conclude that occipitalization of the atlas is an anomaly where the atlas is fused with the occipital bone. Such a fusion can lead to narrowing of the foramen magnum. These anomalies are also more likely to have cause atlantoaxial dislocations. These conditions can cause neurological symptoms ranging from a headache to full-blown neurological syndrome to sudden death. The neurological complications can occur due to compression of the spinal cord, vertebral arteries, and first cervical nerve. The antemortem records of such an anomaly can help in the identification of the deceased. This study is therefore of interest to anatomists, radiologists, neurologists, orthopedists & forensic investigators.

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