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Atlanto-occipital assimilation – case report with its clinico-anatomical correlations

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Abstract

Atlanto occipital fusion is a rare anomaly. It is also known as Assimilation or synostosis of Atlas. This is a congenital anomaly results due to failure of segmentation and separation of the caudal most occipital sclerotome and the first cervical sclerotome during the initial weeks (ninth to tenth week) of fetal life. First described by Rokitansky in 1844, this anomaly ranges from 0.08-3% of the general population. This type of Fusion can be complete or incomplete, and may alter the dimensions of foramen magnum and compresses the spinal cord. It may also compress the vertebral artery and 1st cervical nerve. It inhibits the nodding movement of the skull, as the gliding movement of the occipital condyles on the superior articulating facets of the atlas is locked. This fusion may cause dysphagia, torticollis and even dysarthria and may even prove fatal causing sudden unexpected death. The knowledge of such fusion is useful to the radiologists, Physiotherapists, orthopedic surgeons, neurosurgeons etc.

Key Words: First Cervical Vertebra (Atlas), Occipital condyles, Articulating Facets, arch of atlas, atlanto-occipital fusion/Assimilation, vertebral artery.

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Introduction

The atlas vertebra articulates superiorly with the occipital condyles at the base of occipital bone, situated on the either sides of foramen magnum, with a synovial joint of ellipsoid variety, enclosed by a synovial capsule. It has its blood supply from vertebral artery, and nerve supply from 1st cervical nerve [11,13]. It causes the nodding movement (flexion and extension and slight lateral flexion) [11, 13]. Even though cranio-vertebral anomalies are common and are often seen in morphological and clinical and radiological studies, atlanto-occipital fusion is a rare congenital anomaly seen at the craniovertebral junction [1, 2, 3]. The atlanto occipital fusion may reduce the foramen magnum dimension leading to neurological complications due to compression of spinal cord [1, 2, 6, 8, 9,16]. It can also compress or obliterate the passage of the vertebral artery, vertebral veins and the cervical and spinal nerves [6, 7, 8] and inhibits the nodding movement if skull [4]. These types of compressions of the spinal cord and vertebral artery may give rise to severe neurological disorders and hypoplasia of the basiocciput. It also, causes muscle weakness, ataxia and muscle wasting. Sudden death is also reported in some cases [6].

Case Report

80 dry adult skulls, 10 dry fetal and 2 dry infant skulls (total 82 dry skulls) obtained from 'The Department of Anatomy of Khaja Bandanawaz Institute of Medical Sciences, Gulbarga, Karnataka,

India, constitute the material for this present study. Out of these one skull (1.21%) showed atlanto-occipital assimilation. This specimen was a male skull aged around 25–30 years. The age and sex was identified by standard identification techniques described in standard text books [ref 11, 15]. This skull showed incomplete assimilation of the atlas with the occipital bone. The assimilation was limited only to the anterior arch and the superior articulating facets on the right side, whereas on the left side it was almost complete leaving only the foramen transversarium intact. This specimen was photographed for the study by a digital camera.

Observations: The Specimen showed incomplete assimilation of atlas vertebra with the occipital bone. The degrees of assimilation varied on left and right side (Figure 1).

On the left side, the anterior and posterior arches, and the transverse process of atlas vertebra showed complete fusion with the occipital bone along the circle of arches of atlas vertebra, and while the tip of left transverse process of atlas also fused with the occipital bone (Figure 4) the foramen transversarium however was intact and groove was created for the vertebral artery to exit form foramen transversarium of atlas towards the posterior arch of atlas. This groove led to an unusually formed foramen within the assimilated part of posterior arch of atlas and the occipital bone (where normally the atlanto-occipital membrane should have been). This foramen lied just anterior to the posterior condylar foramen. This foramen opened inside at the brim of foramen magnum (Figure 6).

The fusion was incomplete on the right side, with only a small part of anterior arch and superior articulating fascets of atlas, fusing with the occipital bone (Figure 3). On the right a groove on the occipital bone created by the vertebral artery was observed (figure 4). The groove is the result of compression of the arch with the occipital bone sandwiching the artery between its exit from foramen transversarium of atlas and posterior arch of atlas (suboccipital triangle). Interestingly, Foramen transversarium on both the sides of atlas were intact (Figure 3). The [2] posterior tubercle of atlas was missing which made the posterior arch deficit. It must have caused be due to non fusion of right and left arches.

The antero-posterior (longest) diameter of foramen magnum was noted to be 3.121cm. and the side to side (shortest) Diameter was noted to be 3.011cm (Figure 2). average area 7.383 cm which lies within a normal limit[3,5,7] as some studies suggest.

Foramen Magnum Dimensions in the specimen:

Antero-Posterior (longest diameter) - 3.121cm
Side to Side (shortest diameter) - 3.011 cm
Average area of foramen magnum in the specimen - 7.383sq cm.

Figure 1: Showing full view of the Skull base

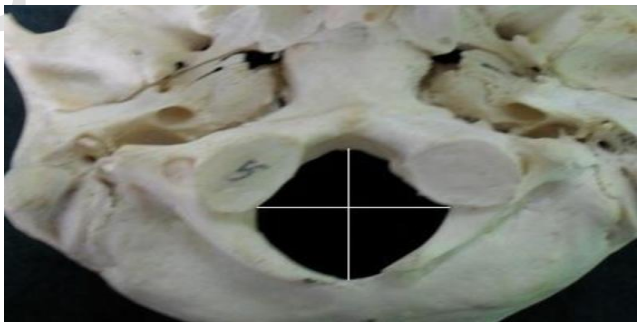

Figure 2: Showing antero-posterior and side to side diameter of foramen magnum

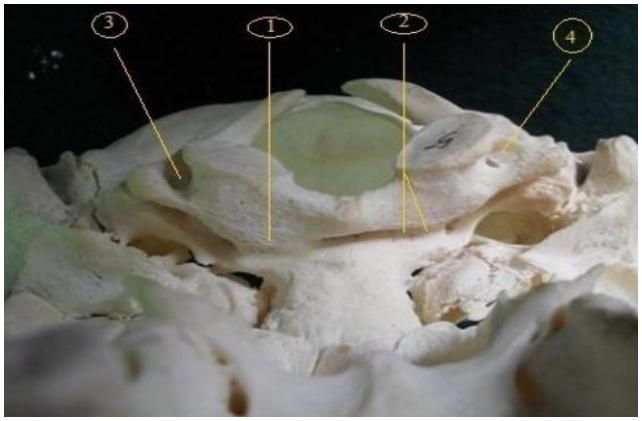

Figure 3: showing the anterior view of atlanto-occipital joint fusion. The fusion of anterior arch of

atlas is seen more on the left side (1) than the right side (2). Right (3) and left (4) foramen transversarium are seen intact. Where only the tip of Left transverse process is seen fusing with the occipital bone, the right transverse process has not fused.

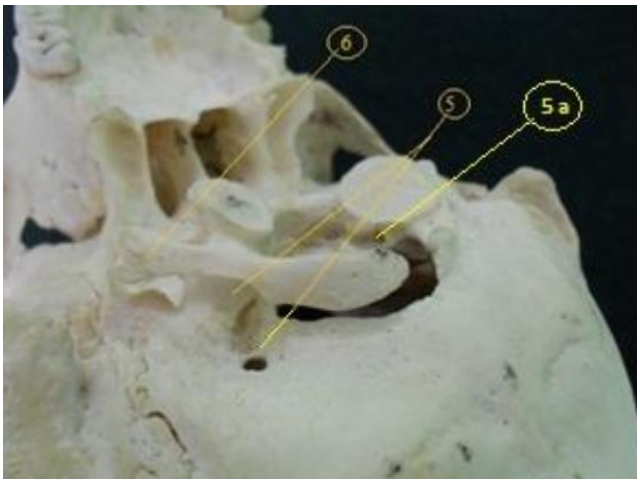

Figure 4: Showing the right side of the atlanto-occipital joint assimilation. Note the right transverse process (6) and the right posterior arch of atlas are not fused with the occipital bone. The part of occipital bone (5) looks engraved like a groove making a passage for vertebral artery, (5 a) Shows the opening of an unusually formed foramen on the left side of outer rim of foramen magnum, most probably for the passage of left vertebral artery.

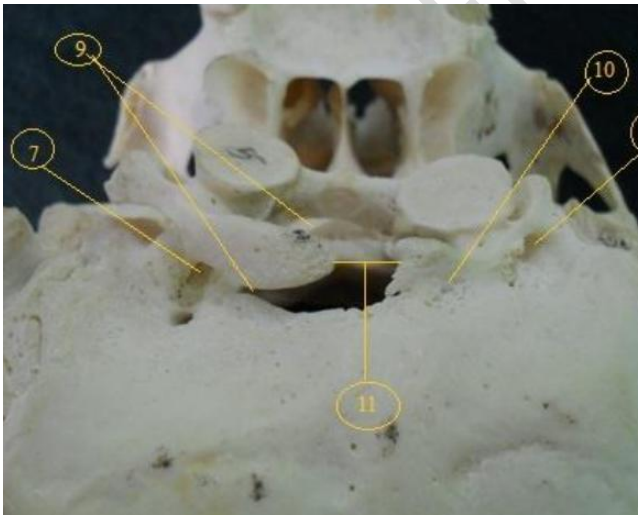

Figure 5: Showing the posterior view of the atlanto-occipital joint assimilation. (7) and (8) shows the groove formed below right and left foramen transversarium respectively. The non fused posterior and anterior arch of atlas (9) is seen. The left posterior arch (10) is seen completely fused.

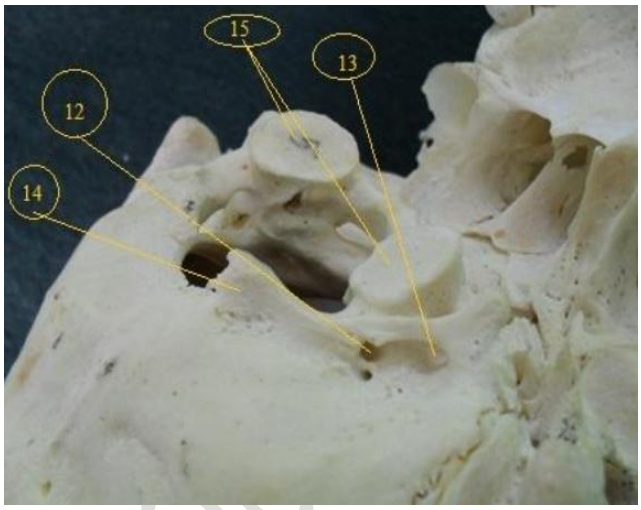

Figure 6: Showing left side of the atlanto- occipital joint assimilation. Where left posterior arch of atlas is completely fused with occipital bone (14) and the tip of left transverse process is fused with occipital bone. A separate foramen (12) is seen, most probably formed for the passage of vertebral artery. Also a groove (13) is seen formed below foramen transversarium, again, probably for vertebral artery. (15) Shows the inferior articulating facets of atlas vertebra.

Discussion:

In case of incomplete fusion, the atlas vertebra fuses only partially or unilaterally with the occipital bone and its condyles, this involves only half or a small part of the ring of atlas [3]. In the case of complete fusion of atlas, the entire superior surface of the ring of atlas, along with its superior articulating facets, transverse process and the foramen transversarium fuse completely with the occipital condyles and the adjoining circular area of atlas around foramen Magnum [3, 5]. In the present case unilateral fusion of atlas was observed on the left side. However on the right side, even though most of the ring of atlas had not fused with the occipital bone, a small part of anterior ring or arch of atlas on the right side, the right superior articulating facet did assimilated with the occipital bone. Even though on the left side the posterior ring of atlas was not fused with the occipital bone, the fusion of the articulating facet of the vertebra with the occipital condyle and a part of anterior arch articulating with occipital bone must have reduced the normal space

between these bones. However on the left side, the atlas had almost completely assimilated with occipital bone, interestingly leaving only the foramen transversarium intact.

As the vertebral artery comes out of the foramen transversarium it crosses the floor of the suboccipital triangle, passing posteromedially to the transverse process of atlas, it curves back and enters the subarachnoid space by piercing the atlanto-occipital membrane [11,12,13] which is present normally forming a supportive ligament for the atlanto-occipital joint[11,13]. In suboccipital triangle the artery lies between the posterior arch of atlas and the occipital bone. The suboccipital nerve emerges between the posterior arch of atlas and the vertebral artery [13]. In this case however, due to assimilation of atlas with the occipital bone the vertebral artery seems to have engraved its way out of foramen transversarium in the sub occipital triangle on both the sides.

On the right side, there was a groove formation observed, which as it appeared, was most probably formed for the course of right vertebral artery as it was curved corresponding to the path of right vertebral artery. However, as the posterior arch of atlas had not fused with the occipital bone, the vertebral artery then must have taken its normal course, thereon piercing the atlanto-occipital membrane. On the left side again, there was a curved groove formation observed corresponding to the path of left vertebral artery. The groove led to a foramen which was carved within the assimilated arch of atlas and the occipital bone. This was an unusual foramen most probably formed for the passage of vertebral artery, as it was carve along with the groove corresponding to the path of left vertebral artery. This foramen opened within the assimilated portion of the atlas vertebra and the occipital bone at the outer brim of occipital bone. It may have formed as a result of calcification of the atlanto-occipital membrane around the vertebral artery. It is noticeable here that this assimilation had happened in later ages when the blood supply to the brain had been established. In this case, it was observed that the foramen magnum dimensions were normal and the blood supply to the brain via vertebral artery was also maintained. It can be hence concluded that the assimilation did not affect the vertebral artery but may have caused spinal compression in this case.

Conclusion:

Atlanto-occipital assimilation however is a rare anomaly and is seen in about 0.08-3% of people [5]. This anomaly should be checked in time, especially by the physiotherapists and the neurosurgeons, because it has been observed in some other cases that this anomaly can cause severe neurological symptoms, convulsions, seizures, severe neck pain and even sudden death [6, 2]. It can cause problems for cisternal puncture, so it is also of importance to anesthetists [7].

References:

1. Satheesha Nayak Venkata Ramana Vollala Deepthinath Raghunathan, Total Fusion of Atlas With Occipital Bone: A Case Report, *Neuroanatomy*. 2005;4:39–40.
2. Anu Vinod Ranade, Rajalakshmi Rai, Latha Venkatraya Prabhu, Mangala Kumaran, Mangala M. Pai. Atlas Assimilation: A Case Report, *Neuroanatomy*. 2007;6:32–33.
3. Royana Singh, Vineeta Saini, Manimay Bandopadhyay, Sunil Kumar Tripathi , Satya Narayan Shamal, Occipitalization Of The Atlas: its occurrence and embryological basis, *International Journal of Anatomical Variations*. 2009;2:65–68.
4. Zteou, F Bouhouch, A Zeroual, M Maaroufi, N Sqalli, Houssaini, S Tizniti, Cervicooccipital junction malformations Contribution of imagery, ICR 2008 Marrakesh (Morocco).
5. Rajani Sangeeta J, Suttarwala Ila M, Rajani Jitendra K, An Unusual Case Of Unilateral Atlanto-Occipital Assimilation With Skull Asymmetry. *National Journal of Medical Research.* 2012;2 (2):
6. Jayanthi V., Kulkarni, R. Kulkarni, R.N., Atlanto - Occipital Fusion – Report Of Two Cases, *J Anat. Soc. India*. 2003;52(1):71-73.
7. Surekha D Jadhav, Manoj P Ambali, Raosaheb J Patil, Megha A Doshi and Priya P Roy, Assimilation of Atlas in Indian Dry Skulls. JKIMSU, 2012;1(1): 102-106.
8. Erkan Kaptanoglu, Kagan Tun, Ozerk Okutan, Beril Gok, Ihsan Solaroglu, Etem Beskonakli, Inverted hypertrophy of occipital condyles associated with atlantooccipital fusion and basilar invagination: a case report. *Neuroanatomy*.2004; 3:43– 45.
9. Kassim NM, Latif AA, Das S, Gaffar NA, Suhaimi FH, Othman f, Sulaiman I,

Atlantooccipital Fusion, An osteological Study with clinical Implecations. Bratisl Lek Listy 2010;111(10).

10. Gholve PA, Hosalkar HS, Ricchetti ET, Pollock AN, Dormans JP, Drummond DS. Occipitalization of the atlas in children. Morphologic classification, associations, and clinical relevance. *J Bone Joint Surg Am*. 2007;89(3):571-578.
11. Susan Standring, Neil R Borley, Patricia Collins, Alan R Corssman, Michael A Gatzoulis, Jeremiah C. Healy, David Johnson, Vishy Mahadeved, Richard LM Newell, Caroline B. Wigley. Gray's Anatomy, The Anatomical Basis of Clinical Practice. 40 Edition (150th Anniversary Edition) Churchill Livingstone 2008. International Edition ISBN 978-0-8089-2371-8. (Chapter 26, Page no. 419-420)
12. Nafis Ahamad Faruqi, Human Osteology (A Clinical Orientation), Second Edition reprint 2007, CBS Publishers, ISBN: 81-239-0718-4
13. T. S. Ranganathan, A Textbook of Human Anatomy, Sixth Edition, S. Chand & Company, ISBN: 81-219-0445-5
14. Keith L. Moore, Arthur F. Dalley, Anne M. R. Agur, Clinically Oriented Anatomy, Sixth Edition, Lippincott Williams & Wilkins, 2010, Indian Reprint ISBN-13:978-818473-183-5.
15. Human Osteology, 3 rd edition, Tim D. White, Michael T. Black, Pieter A. Folkens, 2012 Elsevier, ISBN: 9780-12-374134-9. chapter 18, page no. 371-379)
16. Assimilation of the atlas and occiput: a case report, Games R. Grilliot, Christopher A. Oswald, *Journal of Canadian Chiropractic Association.*1988;32(4):195–198.