Clinical And Embryological Rationale Of Occipitalization Of Atlas

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ABSTRACT

Introduction

Anatomical variations have always been fascinating topics for research, revealing the hidden and rare findings. We have observed a skull assimilated with first cervical vertebra (atlas) leaving some perforations along the line of fusion. Atlas does not bear body like other cervical vertebrae, forms atlano-occpital joint which allow flexion, extension particularly nodding movement to the head.

Case Report

We have come across with total fusion of atlas with skull during undergraduate medical teaching. The skull was completely examined. The lateral mass showed complete fusion with occipital condyles. Anterior arch was completely fused with occipital bone whereas there were some perforations along the line of fusion between posterior arch and occipital bone.

Conclusion

Occpitalization of atlas may severe complications ranges from headache to spinal cord compression. This condition may be characterised by headache, cervical pain, postural abnormality, restricted flexion and extension of neck specially nodding movement, pain and numbness in the upper limb(s).

Key words: Assimilation, Atlas, Atlanto-occipital joint, Occipitalization

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INTRODUCTION

The incidence of atlanto-occipital fusion ranges from 0.14%-0.75% of the population, equally effecting both genders [1]. The atlanto-occipital fusion/ occipitalization of atlas was first explained by Rokitansky in 1844 and demonstrated by roentgenographically by Schuller in 1911 [2] .The first cervical vertebra is developed from three primary ossification centres: one

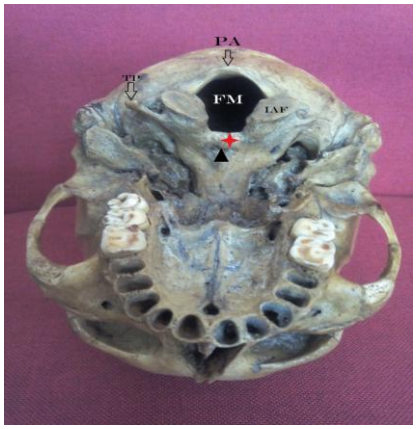
for each neural arch and one for the body. Incomplete segmentation of the basal occipital sclerotome and the first spinal sclerotome may cause the assimilation of atlas and occipital bone [3]. Occipitalization may also be due to developmental variation of first branchial arch which may include malformation of occipital bone, shortening of clivus, non-formation or inadequate formation of atlanto-axial joints and platybasia [4,5] . The ventral and dorsal parts of sclerotome surround the notochord and neural tube respectively. The ventral portion develops in to vertebral body and dorsal portion give rise to the posterior vertebral arch. The cephalic half of the first cervical sclerotome fuses with the caudal half of the last occipital sclerotome to form the base of the skull, while the caudal half of the first cervical sclerotome combines with the rostral half of the second cervical sclerotome to form atlas [6]. The formation and the rearrangement of segmental sclerotome in to definite vertebra are complicated. A disruption in this process may leads to abnormality, fusion or variation in number of vertebrae.

CASE REPORT

We have come across with total fusion of atlas with skull during undergraduate medical teaching. The skull was completely examined. The lateral mass showed complete fusion with occipital condyles except a foramen on each side possible for the path of vertebral arteries (fig: 1). Anterior arch was completely fused with occipital bone whereas there were some perforations along the line of fusion between posterior arch and occipital bone. Both the transverse processes were directed downward and laterally, free from occipital bone. Right costotransverse bar was broken, causing an incomplete foramen. A median slit was identified between the anterior tubercle of atlas and basi-occiput (fig: 2). Both hypoglossal canals were present.

Fig: 1: Forcep showing the path of vertebral artery on left side, similarly observed on right side

Fig: 2:Inferior view of skull: foramen magnum (FM) surrounded by transverse processes (TP), inferior articular facets (IAF), posterior arch (PA) of atlas. Red mark indicating the complete occipitalization of anterior arch of atlas. Black arrow showing a median slit.



DISCUSSION

Complete and hemifusion of atlas with occipital bone have been documented by various authors. Most of the studies have shown assimilation of atlas with bifid posterior arch [7-11]. We have found a complete posterior arch fused with occipital bone showing few perforations along the line of fusion. The sagittal diameter of spinal canal behind the odontoid process equal to or less than 14 mm may cause compression of cord [2]. Occipitalization of atlas may occur due to improper fusion of sclerotomes. This condition may be characterised by headache, cervical pain, postural abnormality, restricted flexion and extension of neck specially nodding movement, pain and numbness in the upper limb(s). Physical appearance may show low hairline and abnormal short neck. Neurological findings may include tinnitus, visual disturbances due to involvement of associated cranial nerves [12]. Absolute immobility of occipitalized atlas results in compensatory hypermobility of atlanto-axial joint [13] .

CONCLUSION

Present study may be fruitful finding for the clinicians, physiotherapist dealing with neck pain and neurosurgeons dealing with abnormalities of cervical spine. Patient with this condition may have difficulty in nodding movements of spine and in worst scenario compression of cervical spine

REFERENCES

1. Lanier RR. An Anomalous cervico-occipital skeleton in man. Anat Rec1939a; 73: 189-207.
2. Sharma M, Singh B, Abhaya A and Kumar H. Occipitalization of atlas with other associated anomalies of skull Eur J Anat 2008;12 (3): 159-67.
3. Goel A, Sharma P, Dange N, Kulkarni AG. Techniques in the treatment of craniovertebral instability. Neurol India 2005; 53: 525–33.
4. Chamberlain WE .Basilar impression (platybasia). Yale J Biol Med. 1939; 11: 487–96.
5. Wysocki J, Bubrowski M, Szymanski I. Developmental abnormalities of the craniovertebral region and their significance for heating and balance disorders. Otolaryngologia 2003 ; 2: 65–71.
6. Sadler TW. Langman's Essential Medical Embryology. 10th Ed., Baltimore, Lippincott William and Wilkins. 2007: 125–141.
7. Nimje DA, Wankhede HA. Atlanto-occipital fusion: A rare anomaly of the craniocervical junction. Edorium J Anat Embryo 2014;1:1–4.
8. Bose and Shrivastava. Partial occipitalization of atlas. International Journal of Anatomical Variations 2013;6: 81–84.
9. Campos D, Silva TH, Ellwanger JH, Goerck ML, Kipper JF, , Piazza JL and Kraether Neto L Atlanto-occipital fusion and its neurological complications: a case report. J. Morphol. Sci 2012; 29(2): 111-13.
10. Rajani Sangeeta J, Suttarwala Ila M, Rajani Jitendra K. An unusual case of unilateral atlantooccipital assimilation with skull asymmetry. National Journal of Medical Research 2012; 2(2):238-40.
11. Saini V, Singh R, Bandhopadhyay M, Tripathi SK, Shamal SN. Occipitalization of the atlas: its occurrence and embryological basis. International Journal of Anatomical Variations 2009; 2: 65–68.
12. Mc Rae DL, Barnon AS. Occipitalization of atlas. Am J Roentgenol Radium Ther Nucl Med 1953; 70:23–46.
13. Warner WC. Pediatric cervical spine. In: Canale ST (ed). Campbell's Operative Orthopaedics, 10th ed. Vol. 2.Mosby, St. Louis, 2003;1736-3