Case Report

Unilateral absence of foramen transversarium in the human atlas vertebra: A case report

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Abstract

Variations in the number and size of foramen transversarium of cervical vertebrae are commonly observed. The atlas vertebra has many unique features. It is located at very critical point close to vital centre in medulla oblongata. The first cervical vertebra i.e. Atlas does not possess body or a spinous process. It has narrow anterior arch and posterior arch. The transverse process projects laterally from the lateral mass. They are unusually long which provides efficient lever for rotation of atlas. It shows presence of foramen transversarium which provides passage for second part of vertebral artery and sympathetic and venous plexus surrounding it. The foramen transversarium which transmits vertebral vessels is the result of special formation of cervical vertebral transverse process. It is formed by vestigial costal element fused to the body of originally true transverse process of vertebra. In the atlas where vertebral artery exist the foramen transversarium to enter into the cranial cavity, many variations have been described. During routine osteology demonstration classes for undergraduate medical students, we noticed unilateral absence of foramen transversarium in atlas. Many important neurovascular structures are present in close relation with foramen transversarium and transverse process of atlas. Unilateral absence of foramen transversarium may creates confusion and much difficulty for identification of nearby structures which may leads to injury to any important structure, can result in life threatening complications.

Keywords: Atlas, foramina transversarium and vertebral artery.

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INTRODUCTION

The atlas, the first cervical vertebra, supports the head. It is unique in that it fails to incorporate a Centrum, whose expected position is occupied by the dens, a cranial protuberance from the axis. The atlas consists of two lateral masses connected by a short anterior and a longer posterior arch. The lateral masses are ovoid, their long axes converging anteriorly. Each bears a kidney shaped superior articular facet for the respective occipital condyle. The Inferior articular facet of the lateral mass is almost circular and is flat or slightly concave. The posterior arch forms three fifth of the circumference of the atlantal ring. The superior surface bears a wide groove for the vertebral artery and venous plexus immediately behind; and is invariably hung by lateral mass.[1] The transverse process of atlas is longer than that of all cervical vertebras except C_7. It is signified by the presence of foramina transversarium. Its unilateral or bilateral absence has been reported previously. The possible factors responsible for this interesting variant are discussed.

CASE REPORT

During routine osteology demonstration classes for undergraduate medical students, it was observed that foramina transversarium was absent on one side in atlas. It is left side of atlas vertebra. Photographs were taken by using different views. We measured the length of transverse process and the diameter of foramina transversarium, on both sides by using digital vaernier

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caliper. On right side the length of transverse process is 13.16 mms and on left side 13.34 mms. On left side foramina transversarium was absent. On right side it appears to be of normal having diameter of 6.08 mms. We also observed for the posterior arch groove lodging vertebral artery. On both sides the groove is present. No any other variation was found in the atlas vertebra.

Figure 1: Showing Superior view of Atlas vertebra

1. Lateral mass showing superior articular facet
2. Left transverse process without foramina tranversarium
3. Anterior arch with median anterior tubercle
4. Posterior arch showing groove for vertebral artery
5. Posterior arch
6. Right transverse process with foramina tranversarium

Figure 2: Showing Inferior view of Atlas vertebra

1. Lateral mass showing inferior articular facet
2. Left transverse process without foramina tranversarium
3. Anterior arch with median anterior tubercle
4. Posterior arch showing groove for vertebral artery
5. Posterior arch
6. Right transverse process with foramina tranversarium

DISCUSSION

The embryological development of atlas and axis is complicated and much different from that of other typical cervical vertebrae. The caudal part of fourth occipital somite fuses with cranial part of first cervical somite to form what is known as proatlas. In man it gets assimilated into the occipital condyles and apex (Ossiculum terminale) of the odontoid process of axis. The caudal part of first cervical sclerotome forms the lateral mass and anterior and posterior arch of atlas. At birth atlas is represented by two bony masses with a facet on superior and inferior surfaces and a large nutrient foramina. The groove for the vertebral artery is present behind the superior articular facet and posterior arch curves towards the midline. The anterior bar is not present at this stage and superior articular facet may look somewhat foreshortened and neurochondral junction. The transverse process is represented by a thick posterior bar, but this eventually fuse with thinner anterior bar, which develops from the articular pillar between the third and fourth year. It is clear that the posterior tubercle is formed from the thick posterior bar which fuses with anterior bar to complete the foramina transversaraium.[2] Several authors (Christ B 1992[3]; Dalgleish AE 1985[4];) have correctly focused on the importance of distinguishing developmental events in the lateral region from those in the central column. Muller and Rohilley (1994)[5] studied serial sections of 108 human embryos and confirmed the existence of four occipital somites. They also found developmental distinction between axial or central and lateral components in the occipital and vertebral region. The sclerotomes are concerned with the lateral region whereas perichondral sheath is essential one for central column differentiation. The central portion of the axis is derived from components, which were designated as XYZ complex.

X-Proatla

Y-Considered to represent the centrum of the axis

Z-Centrum of the axis

They identified complete centrum that develops in the region of atlantoaxial region, although they are related to only 2.5 Sclerotome and two neural arches. They concluded that these three centra which they termed as XYZ complex, belong ontogenetically to axis so that atlas does not appears to possess a central element.[5] Since the presence of vertebral vessels is an important factor in genesis of foramina transversarium, a variation in its course will influence the presence or absence and indeed the form of foramina transversarium. So it is not going to apparent by 3 years of age, if not earlier. Satheesha Nayak (2007) mentioned a case report of bilateral absence of foramena transversarium in atlas vertebra.[6] Vasudeva N and Kumar R (1995) reported a case of atlas vertebra, the

transverse process of which did not exhibit this foramen on the left side. However, they observed that the groove for the vertebral artery was present bilaterally on the posterior arch.[7] In this present case the exact mechanism behind the agenesis of foramina tranversarium is not known. It seems that many factors are involved in causing this morphological variation of foramina tranversarium including developmental factors, mechanical stress. Hence neurosurgeons should be aware about the variations of the foramina tranversarium to prevent further complications.

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