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FUSION OF AXIS WITH THE THIRD CERVICAL VERTEBRAE- A CASE REPORT

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ABSTRACT

Skeletal abnormalities of cervical region or in craniocervical region are of interest to the anatomists, orthopaedicians, neurologists, neurosurgeons and even orthodontists. These abnormalities may result in severe neck pain, decreased neck mobility, muscular weakness of both upper limbs, sensory deficits on arms and hands etc. In condition of fusion of the cervical vertebrae, two vertebrae appear not only structurally as one but also function as one. During the routine osteology teaching to 1st Prof. M.B.B.S students at Department of Anatomy, SGRDIMSAR, Amritsar, it was observed that the axis vertebrae is fused with the third cervical vertebrae. It was observed that body, laminae and pedicles of C2 and C3 were completely fused on both anterior and posterior aspects. The features of these fused cervical vertebrae were analysed and the specimen was photographed from different aspects.

Key Words: *Cranio-cervical, Fusion, Cervical Vertebrae*

INTRODUCTION

Cervical vertebrae are seven in number. C3-6 are typical whereas C1 (atlas), C2 (axis) and C7 (cervicae prominens) are atypical. C2 vertebrae is different from other by the presence of Dens (odontoid process), which projects cranially from the superior surface of the body. The axis acts as an axle for rotation of atlas and head around the dens Standring S (2008). The C3 vertebra is typical with the features similar to other cervical vertebrae.

Congenital anomalies at craniovertebral or cervical region are common Romanes (1981). Among these congenital anomalies the important ones are the fused cervical vertebrae (FCV). Congenital fusion of axis with the third cervical vertebrae limits the movements between these bones and because of this the third vertebrae was given the name as “*vertebrae critica*” by Cave (1937). As sacrum is a well known example of block vertebrae which is formed by the union of 5 sacral vertebrae, if we follow same principle for C2-C3 fused vertebrae, it can be given the name of *cervical sacrum*. This fusion of C2 with C3 may be associated with neurological signs and symptoms. Severe neck pain and sudden unexpected death may occur due to these abnormalities. (Tiwari A *et al.*, 2002)

MATERIALS AND METHOD

During routine osteology demonstration of cervical vertebrae to M.B.B.S. 1st prof. Students of SGRD Institute of Medical Sciences and Research, Amritsar, it was observed that axis was fused with the 3rd cervical vertebrae. The complete study of the vertebrae was done. Photographs were also taken.

RESULTS AND DISCUSSION

Body of axis and third cervical vertebrae are fused both anteriorly and posteriorly (Figs. 1 & 3). Pedicles were fused both anteriorly and posteriorly (Fig. 2). Laminae were also fused (Fig 2). Spines were not fused and the right half of the spine of third cervical vertebrae was not completely formed (Fig 3). Foramen transversarium were present on both the vertebrae.

Fused cervical vertebrae (FCV) have clinical and embryological importance. Anomalies of cervical vertebrae are of great importance to anatomists, orthopaedicians, neurologists, neurosurgeons and even

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orthodontists. In FCV, the fusion may be either congenital or acquired Erdil *et al.*, (2003). It is important to identify the case of FCV- whether it is congenital or acquired.

Acquired FCV is generally associated with diseases like tuberculosis, other infections, juvenile rheumatoid arthritis and trauma. Congenital FCV is one of primary malformations of chorda dorsalis (Besnick and Niwayama, 1985; Meschan 1973). These are thought to be due to defects which take place during development of occipital and cervical somites Dunsker *et al.*, (1980). A combination of environmental and genetic factors mainly during the third week after conception is thought to be the main causative factor for this anomaly Sherekar *et al.*, (2006).

All these abnormalities may lead to clinical signs and symptoms which are: Shortening of spine in the cervical region; The trapezei are unduly prominent laterally and give a webbed appearance; Limited neck motion; Osseous malformation (scoliosis, kyphosis, torticollis); Signs of peripheral nerve irritation such as pain, burning sensations and cramps; Signs of nerve compression such as hypoaesthesia/ anaesthesia, weakness/paralysis, fibrillations and reduced deep reflexes Tiwari A, Chandra N, Naresh M, Pandey A, Tiwari K (2002).

These signs and symptoms are similar with that of Klippel-feil syndrome (congenital fusion of cervical vertebrae, brevicollis). This is a clinical condition of congenitally fused and deformed cervical vertebrae that results in restricted neck motion and neurologic phenomena. Based on clinic-radiological features, we classify the Klippel – feil syndrome into:

- Type 1- Fusion of cervical and upper thoracic vertebrae with synostosis accounting for 40% cases.
- Type 2- Isolated cervical spine fusion accounting for 47% cases.
- Type 3- Cervical vertebrae with lower thoracic or upper vertebral fusion accounting for 13% cases.

The presence of block vertebrae results in more biomechanical stress in the adjoining segments leading to more degenerative changes. The other changes are rupture of ligaments (mainly transverse ligaments), tear of intervertebral disc resulting in herniation of nucleus pulposus resulting in compression of spinal cord, fracture of odontoid process and spondylosis Soni P *et al.*, (2008).

The radiologic appearance of congenital anomalies may be due to defects in fusion or normal segmentation, occipitalization of the atlas, odontoid and atlas malformations, spina bifida and abnormal ossifications. In about 70% of occipitalizations, we see an associated C2-C3 fusion with instability at the C1-C2 articulation Soni *et al.*, (2008). If these anomalies are diagnosed early, they will help us in finding the change due to an injury, ageing or progression of a degenerative process and also motivates the patient to change their lifestyles to lead a normal life. These anomalies like block vertebrae cannot be treated surgically as they carry a higher mortality and morbidity. Cervical vertebrae fusions are sometimes done following traumatic, degenerative and inflammatory dislocations of upper and lower cervical vertebrae Sherekar *et al.*, (2006).

Embryological Significance

Somites are formed from para-axial mesoderm that lie on each side of neural tube. The somites are divided into three parts: Ventromedial sclerotome; Intermediate myotome; and Lateral dermatome.

The vertebral column is formed from the sclerotome of the somites. Normal segmentation of the sclerotomes is important for the development of a normal vertebral column. But in certain cases due to decreased local blood supply during the third to eighth week i.e. embryonic period results in abnormal segmentation and formation of congenitally fused vertebrae or block vertebrae. Vertebral fusion anomalies are likely to be associated with disturbance of Pax-1 gene expression in the developing vertebral column. (David KM *et al.* 1996) Congenital fusion of vertebrae is most commonly seen in the cervical region. Although it may involve other segments of vertebral column. Sacrum itself is an example of block vertebrae Congenital vertebral defects. The incidence of CFCV of C2-C3 is around 0.4% to 0.7% with no sex predilection Soni *et al.*, (2008). According to the frequency of block vertebrae, the order is C2-C3, C5-C6, L4-L5 and thoracic spine (any segment) Block vertebrae.

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Clinical Significance

While doing endotracheal intubation, extension of the neck is done. So in persons with block vertebrae in cervical region we have to take care to prevent hyperextension as it can precipitate disc prolapsed.

If cisternal puncture or lumbar puncture is to be done, we should look for possibility of block vertebrae in cervical and lumbar regions respectively.



Figure 1. Axis with Third cervical vertebrae (anterior view)



Figure 2. Showing the fused vertebrae(lateral view)



Figure 3. Axis with Third cervical vertebrae(posterior view)

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