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Cervical Vertebral Fusion: An Anatomical Consideration

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Abstract---Developmental anomalies of vertebral column are common especially in the cervical region and thus become the point of keen interest from long time to the anatomists and related health professionals. Normal typical cervical vertebrae i.e. 3rd to 6th are characterized by the presence of small body, triangular spinal canal, foramina transversarium, superior articular facet directed backwards & upward, inferior articular facet directed forward & downwards and a short bifid spine. Abnormalities in any of the features may be associated with neurological signs and symptoms. During the routine osteology classes we found two abnormally fused typical cervical vertebrae specimens in the Dept. of Anatomy, Desh Bhagat Dental College & Hospital, Mandi Gobindgarh. Both the pairs of cervical vertebrae were unilaterally fused at the zygapophyseal joints on the right sides and in one of the case the laminae were also fused partially on the right side. Congenitally fused vertebrae results in biochemical stress in the adjoining segments of the vertebral column leading to premature degenerative change and this can lead to consequences like distal tear, spondylosis, etc.

Keywords---cervical vertebrae, zygapophyseal joint, congenital anomalies.

Introduction

There are seven cervical vertebrae numbered 1-7 from above downwards forms the basis of bony skeleton of neck. They are small in size in comparison to thoracic and lumbar vertebrae as they have to carry less weight and Embryologically, the vertebrae develop from somites derived from paraaxial

mesoderm and differentiate in to the sclerotome (ventro-medial part) and dermomyotome (dorso-latrearal part). The sclerotome takes part in the development of vertebral column .The mesenchymal cells from sclerotome condense to form the centrum (forms the vertebral body), vertebral arches (forms the pedicles, laminae, spine, articular process and transverse process)¹. Congenital anomalies are common in the vertebral column². Variations in the cervical vertebrae have been recorded for many years in morphological and clinico-radiological studies. Normal typical cervical vertebrae i.e. 3rd to 6th are characterized by the presence of small body, triangular spinal canal, long and narrow lamina, foramen transversarium, superior articular facet directed backwards and upwards, inferior articular facet directed forwards and downwards and short bifid spine³. Abnormalities in any of the features may be associated with neurological signs and symptoms having clinical importance. Yin et al. analyzed 87 cases with fused cervical vertebrae at C2-C3 and C3 -C4 without any malformation⁴ but Erdil et al. reported neck pain, muscular weakness of both upper limbs and minor but intermittent head and neck pain ⁵. Keeping the view, present study has been designed to highlight the osteological variation and its clinical correlation for preventing any serious complication, misdiagnosis and early treatment.

Material and Method

During the routine osteology classes for BDS 1st year students in the Department of Anatomy at Desh Bhagat Dental College & Hospital, Mandi Gobindgarh (Punjab), India we came across two pairs of abnormally fused typical cervical vertebrae. The fused vertebrae were studied along with the normal typical vertebrae and were analyzed and photographed from different aspects.

Observations

Fig.1 shows the features of normal typical cervical vertebra.

We are presenting the details of the abnormally fused typical cervical vertebrae. It was observed that:

- The cervical vertebrae of both the specimens I and II were fused at the zygapophyseal joint on the right side (Figures 2a, 2b, 3a and 3b).
- In specimen I, the lamina and spinous process of upper and lower cervical vertebrae were also fused on the right side but it was not found in the specimen II (Figures 2a, 2b, 3a and 3b).
- In specimen I, the groove for the spinal nerve was also narrow on the right side (Fig.2c)

Discussion

Congenitally fused cervical vertebrae is one of the primary malformations associated with chorda dorsalis ^{6,7,8} which is believed to be due to defects which take place during the development of the occipital and cervical somites ^{9,10,11}. It is caused because of the combination of environment and genetics which occur during the 3rd week of pregnancy ¹². Its diagnosis is complex in young age, it may give the appearance of a normal disc area as the ossification of the vertebral body

is not complete till adolescence and the cartilage is also not ossified ¹³. It is important to differentiate between a pathologic condition and if it is congenitally fused cervical vertebrae or acquired ¹⁴ ¹⁵. The later can be associated with conditions like tuberculosis, juvenile rheumatoid arthritis and trauma ^{13, 14, 16} and even with Klippel- Fiel Syndrome ¹⁷. In the congenitally fused vertebrae, the antero-posterior diameter of the vertebra is decreased and the individual measurements of the two vertebrae's bodies height is equal to the two fused vertebrae's height including the inter-vertebral disc. Though the fusion may appear silent but in advanced age it causes degenerative changes in non segmented cervical regions and also leads to development of hypermobility and degenerative arthritis above and below the fused cervical region, webbed neck, kyphosis, torticollis, compression of nerve roots resulting in hypoesthesia and paralysis of the concerned parts of the body. Early diagnosis can help in the prevention of degenerative process by motivating the patients to change their life style for instance avoiding undue trauma, extension and rotational maneuvers which may place the spinal cord and vertebral artery at risk ¹⁸. In our both specimens, the vertebrae are fused on the right side at the zygapophyseal joint on the right side and in specimen II the groove for spinal nerve is reduced in size, so it may lead to compression of nerve roots resulting into hypoesthesia and paralysis of the concerned parts of the body. So diagnosis of congenital fusion of C₂-C₃ is helpful in treating and managing the related complicated outcomes yet to be appeared and its knowledge can further assist in planning the surgeries of head & neck.

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