Case Report

Fused cervical vertebrae - Case report

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Abstract

This paper aimed to report a rare case of fusion of 6th and 7th cervical vertebrae, called as block vertebrae. Block vertebrae was observed in the Department of Anatomy, SRM Dental College. The bodies of C6 and C7 were completely fused. Anterioposterior radiograph of the fused vertebrae bodies showed hypoplastic inter vertebral disc. Lateral radiograph showed partial fusion of articular processes on left but remain unfused at the right side. Congenital cervical vertebral fusion results due to non-segmentation of sclerotomes. It may be asymptomatic or may result in various clinical symptoms with limitation of neck movements. Knowledge about the variations in vertebrae especially in cervical region is essential for orthopedic surgeons, oral- maxillofacial surgeons and physical therapists for planning any surgeries involving the neck region.

Key words

Cervical vertebra, Congenital, Fusion, Articular processes, Inter vertebral disc.

Introduction

Fusion of vertebrae may be congenital or acquired. Fusion may be complete or incomplete, involving the body of the vertebra alone. In pathological conditions like Diffuse Idiopathic Skeletal Hyperostosis (DISH) or Ankylosing Spondylosis (AS), there will be ossification of paraspinal ligaments in addition to the fusion of body of vertebrae. The most common fusion is between the second and third cervical vertebrae. Fusion between Sixth and seventh cervical vertebra is rare.

Case report

On examining the 97 cervical vertebrae housed in the Department of Anatomy, SRM Dental College (Ramapuram campus), fusion of 6th and 7th cervical vertebrae was observed which was photographed and then radiographed. The transverse diameter (TrD) and Antero-posterior diameter (ApD) of the vertebral foramen and the vertebral body, TrD and ApD of the foramen transversarium of C6 and C7 was measured with digital vernier caliper and tabulated. The measurements of C6 vertebra in normal and fused vertebra were tabulated as per **Table - 1** and the measurements of C7 vertebra in normal and fused vertebra were as per **Table - 2**.

Table – 1: Measurements of C6 vertebra in normal and fused vertebra.

Sr. No.	C6 vertebra measurements	Antero-posterior (ApD)/ Transverse (TrD) Diameter	Fused cervical vertebrae (FCV)	Normal C6
1	Vertebral body	TrD	2.9cm	1.9 cm
	Vertebral body	ApD	2.6cm	1.2 cm
2	Left Foramen transversarium	TrD	1cm	0.5cm
	Left Foramen transversarium	ApD	0.8cm	0.5cm
3	Right Foramen transversarium	TrD	0.7 cm	0.5cm
	Right Foramen transversarium	ApD	0.7cm	0.5cm
4	Vertebral canal	TrD	2.3cm	2.1cm
	Vertebral canal	ApD	0.8cm	1.3cm

Table – 2: Measurements of C7 vertebra in normal and fused vertebra.

Sr. No.	C7 vertebra measurements	Antero-posterior (ApD)/ Transverse (TrD) Diameter	Fused cervical vertebrae (FCV)	Normal C7
1	Vertebral body	TrD	2.8 cm	2.2 cm
	Vertebral body	ApD	1.8 cm	1.9 cm
2	Left Foramen transversarium	TrD	0.5 cm	0.5 cm
	Left Foramen transversarium	ApD	0.5 cm	0.5 cm
3	Right Foramen transversarium	TrD	0.4 cm	0.5 cm
	Right Foramen transversarium	ApD	0.4 cm	0.5 cm
4	Vertebral canal	TrD	2.3 cm	2.4 cm
	Vertebral canal	ApD	1.2 cm	1.5 cm

The bodies of C6 and C7 was completely fused (**Figure – 1**). Posteriorly there was a bony thickening at the site of fusion. C6 vertebra shows a very large TrD and ApD of vertebral body (**Figure – 2**), enlarged foramen transversarium more on left side than the right (**Figure – 3**). Anterio-posterior radiograph of the fused vertebrae bodies (fvb) shows hypoplastic inter vertebral disc (**Figure – 4**). Lateral radiograph shows partial fusion of articular processes on left (**Figure – 5**) but remain unfused at the right side (**Figure – 6**). The inter vertebral foramen is present between the fvb.

Discussion

Block vertebra has been reported by Barclay Smith [1], Cave [2], Gray, et al. [3], Gunderson, et al. [4] and others. Block vertebra is most commonly found at C2-C3, C5-C6, T12-L1 and

L4-L5, in order of incidence. Sclerotome consists of loosely arranged cells cranially and densely packed cells caudally. Some densely packed cells move cranially, opposite the centre of the myotome, where they form the inter vertebral disc. The remaining densely packed cells fuse with loosely arranged cells of the immediately caudal sclerotome to form mesenchymal centrum, the primordium of body of a vertebra. Non-segmentation of somites at cervical region between 3rd and 8th week of gestation results in congenital cervical fusion**.** Smith and Tuan [5] studied HuP48, a member of PAX gene family, which is expressed in a segmented pattern in the developing spine of 7 to 8 weeks fetus. Fusion of vertebrae may be related to disturbance of PAX−1 gene, which is expressed in all sclerotomal cells of epithelial somites and plays an essential role in the development of vertebral column [6]. Sharma, et al. [7] suggested that acquired fusion of vertebrae may be due to Tuberculosis, Juvenile rheumatoid arthritis and trauma.

Figure - 1: The bodies of C6 and C7 were completely fused.

Klippel and Feil described a syndrome with congenital fusion of cervical vertebrae in 1912. In 1919, Feil classified this syndrome into three types based on the extent and type of cervical fusion [8], Type I– massive fusion of many cervical and upper thoracic vertebrae into bony blocks; Type II – fusion of only 1 or 2 interspaces, usually C2-C3 or C5-C6, but there can be intra-familial variability; Type III – both cervical fusion and lower thoracic or lumbar fusion, often associated with multiple organ anomalies and subsequent neurologic compromise.

Figure - 2: C6 vertebra shows a very large TrD and ApD of vertebral body.

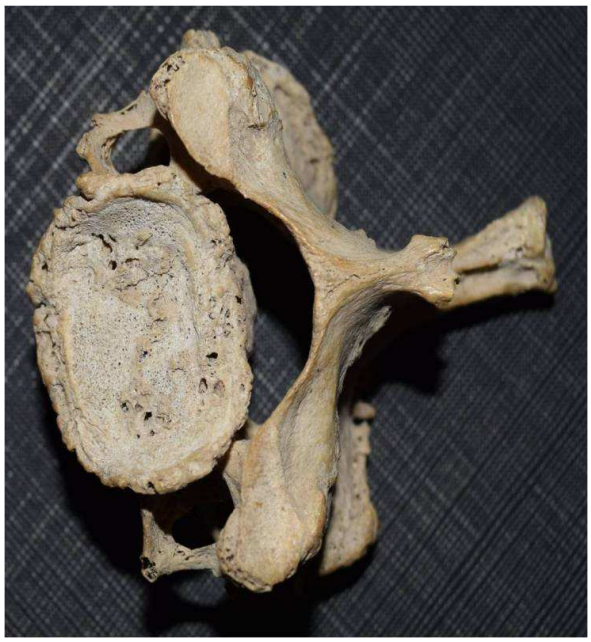
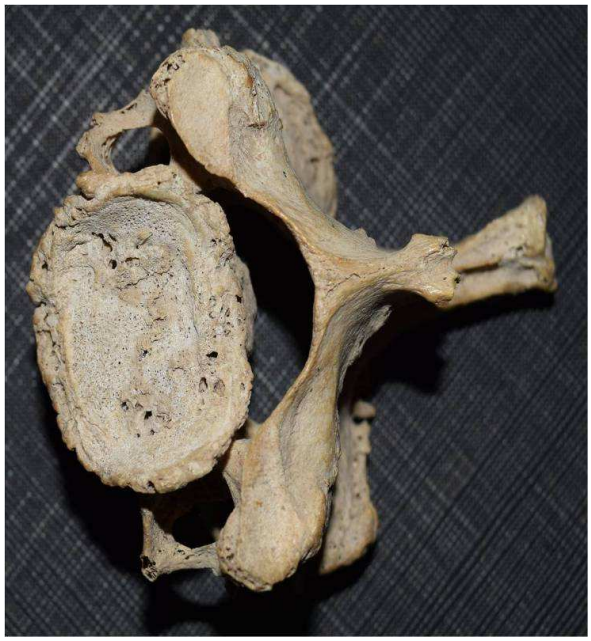


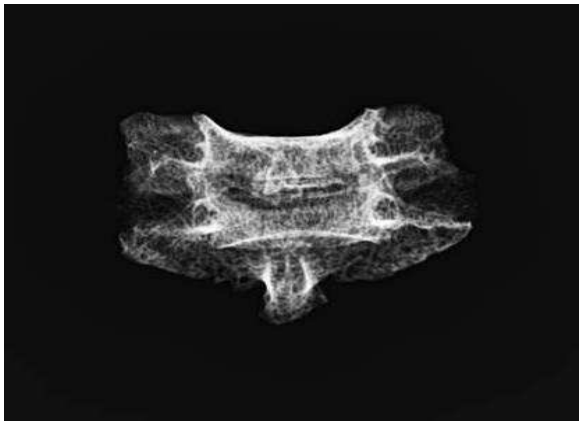
Figure - 3: Enlarged foramen transversarium more on left side than the right.



Raas-Rothschild, et al. [9] suggested a type 4 with an association of sacral agenesis and

cervical fusion. Our fused vertebral specimen may belong to Type II –KFS. Allan H. Ropper, et al. [10] reported narrowed foramen transversarium, frequent syncopal attacks and vertebral fusion in KFS is sometimes associated with syringomyelia. Many authors claim that Klippel−Feil syndrome (KFS) has genetic background. Some of them maintain that it is related to a sporadic mutation of autosomal dominant. The mutation causes a failure of the normal segmentation and fusion of the mesodermal somites at embryo (fusion occurs between the third and the seventh week of embryonic development). Reason for the KFS may be the mutation of either p12 or q34 loci of chromosome 2 [11]. Manuel O. Lagravère, et al. [12] presented type II category of KFS with a short neck, limited neck movements and a low-set posterior hairline with symptoms including heart murmur and fusion of the C2-C3 vertebrae without elevation of the scapula.

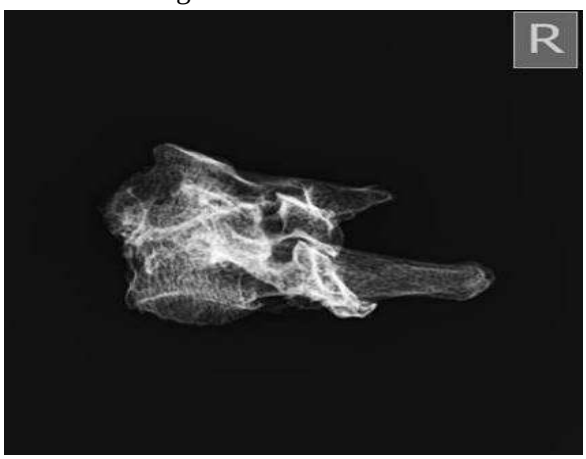
Figure - 4: Anterio-posterior radiograph of the fused vertebrae bodies (fvb) shows hypoplastic inter vertebral disc.



Cervical vertebral fusions may produce an abnormally short neck with restriction of neck movements. Absence of motion segment can cause stress in the free articulations above and below the block segment, which can result in premature degenerative spondylosis and arthrosis, especially below the fusion site. Fusion of upper cervical vertebrae may lead to stretching and laxity of the ligaments between the occiput and the atlas. This can result in excessive motion and brainstem or cord compression [13].

Figure - 5: Lateral radiograph shows partial fusion of articular processes on left side.

Figure – 6: Lateral radiograph of fused cervical vertebrae showing the articular process are unfuse at the right side.



Hwan-MoLee, et al. [14] stated that the antero-posterior diameter of cervical spinal canal is more useful than transverse diameter in the diagnosis of cervical spinal stenosis. In our case the ApD is greatly reduced compared to the normal ApD of C6, and vertebral body shows massive hypertrophy compared to the normal dimensions. The TrD of foramen transversarium is nearly doubled in left side and the AP diameter is also increased, it may be due aneurysm or any other vascular abnormalities. Freilich M, et al. [15], has reported that tortuosity of vertebral artery leads to enlarged foramen transversarium.

In our present case by observing the dimensions, and other features like enlarged vertebral bodies, foramen transversarium, narrowed spinal canal and fusion of transverse processes, reveals that it

is likely to be congenital compensatory adjustments due to limited cervical movements and abnormal posture of the affected person. Being a dry bone, the exact etiology of the fused vertebra remains obscured.

Conclusion

Mobility of cervical region is greater compared to other levels of vertebral column, fusion of vertebrae in these region affects the day to day activities of a person. Therefore patients with classical triad of short neck, low hair line and restricted neck movements favor the clinical diagnosis of KFS. As this syndrome is generally associated with cardiovascular and other visceral organ defects, early diagnosis may be helpful to prolong the normal life and to plan proper corrective surgical measures, knowledge about the rare fusion of vertebrae is essential for clinical anatomists, radiologists and forensic medicine experts.

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