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Synostosis of Typical Cervical Vertebrae: Its Developmental & Clinical Insight - a Case Report

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ABSTRACT

Introduction: the typical cervical vertebrae (C3 – C6) is characterized by small bodies, triangular spinal canals, the presence of foramen transversarium, and short bifid spines. The congenital fusion of any of these vertebrae may lead to neurological symptoms due to nerve compression. The congenital synostosis of the cervical vertebrae is very rare with the prevalence ranging from 0.10% to 6.25% among several populations.

Aims & Objectives: to report a rare fusion of the typical cervical vertebrae (C5, C6) and to highlight the morphological variations and their developmental & clinical insight.

Methodology: during the routine osteology tutorial class for MBBS students, we observed a fused block of typical cervical (C5 & C6) vertebral complex in the Department of Anatomy of JSS Medical College, Mysore. The morphology of the complex was studied.

Result: the bodies of the typical cervical vertebral complex (C5 & C6) were fused over the posterior aspect and partially fused on the anterior aspect. The laminae on the right side were not fused and on the left side, it was totally fused. The inferior articular facets on both sides were totally fused with the superior articular facets of the typical cervical vertebra below. The foramen transversarium and vertebral canals were patent. The bifid spines were not fused.

Conclusion: the congenital fusion of the typical cervical vertebrae may lead to biochemical stress on the adjoining segments of the cervical vertebrae leading to cervical spondylosis and neurological complications due to nerve compression.

Keywords: Cervical vertebrae; Anatomical variations; Block vertebrae; Fusion of vertebrae.

Introduction

Normally the typical cervical vertebrae (C3 – C6) are characterized by small bodies, triangular spinal canals, presence of foramen transversarium, and short bifid spines. The congenital fusion of any of these vertebrae may lead to neurological symptoms due to nerve compression. The congenital synostosis of the cervical vertebrae is very rare with the prevalence ranging from 0.10% to 6.25% among several populations[1].

Developmental aspects: The vertebrae develop from the somites derived from the paraxial mesoderm which differentiates into sclerotome and dermatomes. The sclerotome forms the vertebral column. The mesenchymal cells condense to form the centrum which goes to form the body and the vertebral arches[2].

Erdil *et al* reported neck pain and muscular pain in the upper limbs in cases of cervical vertebral fusions[3]. The present study highlights the correlation between the osteological variations of cervical synostosis and its clinical implications.

Materials and Methods

During the routine osteology tutorial class for MBBS students, we observed a fused block of typical cervical (C5 & C6) vertebral complex in the Department of Anatomy of JSS Medical College, Mysore. The morphology of the bony complex was studied, analyzed, compared with the normal, and photographed from different aspects.

Results

The following observations were made:

1. The bodies of the typical cervical vertebral complex (C5 & C6) were totally fused over the posterior aspect and partially fused on the anterior aspect.
2. The laminae on the right side were not fused and on the left side it was totally fused. The transverse processes of both the vertebrae were fused bilaterally.
3. The inferior articular facets of C5 above on both sides were partially fused with the superior articular facets of C6 typical cervical vertebra below.
4. The foramen transversarium and vertebral canals of both the vertebrae were patent. The bifid spines of both the vertebrae were not fused. (Refer Figures 1,2,3,4).

Discussion

Developmental correlation: The fusion of the cervical vertebrae is believed to be due to defects

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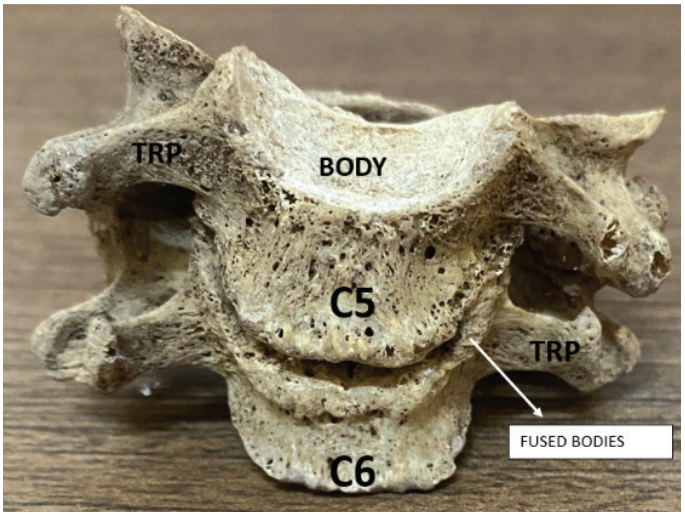

Figure 1. Anterior view of the Block cervical vertebrae C5-C6 showing the fused bodies and fused transverse processes (TRP).

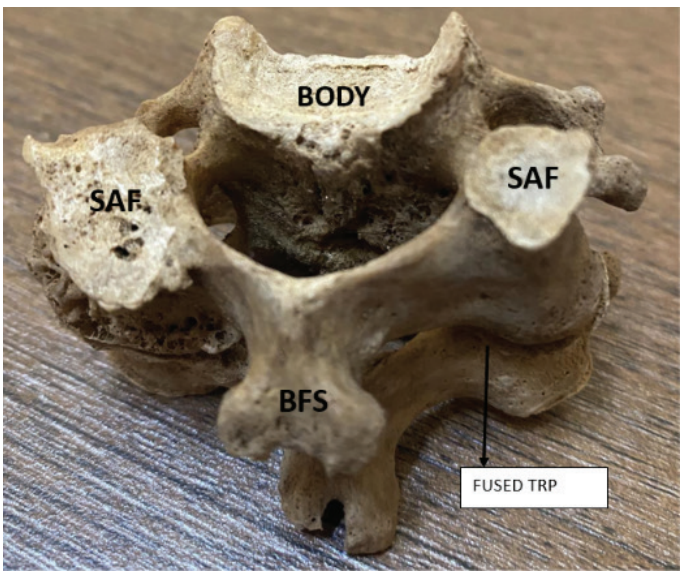

Figure 2. Postero-superior view of the Block cervical vertebrae C5-C6 showing the fused transverse processes - TRP and facets (SAF: Superior articular facet; BFS: Bifid spine).

taking place in the occipital and cervical somites[4,5]. The decreased local blood supply during the 3rd to 8th week of the embryonic period may result in abnormal segmentation & formation of congenitally fused vertebrae or block vertebrae. Such fusion is likely to be associated with the disturbance of Pax – 1 gene expression in the developing vertebral column[6].

It may also be due to environmental or genetic factors taking place in the 3rd week of gestation[7].

Clinical correlation: It may be congenital or acquired[8,9]. It may be associated with tuberculosis, juvenile rheumatoid arthritis, or trauma[10]. It may also be associated with Klippel–Fiel syndrome[11].

Soni *et al* reported fused C2 - C3 with an incidence of 0.4 to 0.7% with no sex predilection. The decreasing order of frequency of block vertebrae was found to be C2-C3, C5–C6, L4 – L5 & any section of thoracic region[12]. The cervical block vertebrae that we observed were C5 – C6 in our present study. (Refer Table 1)

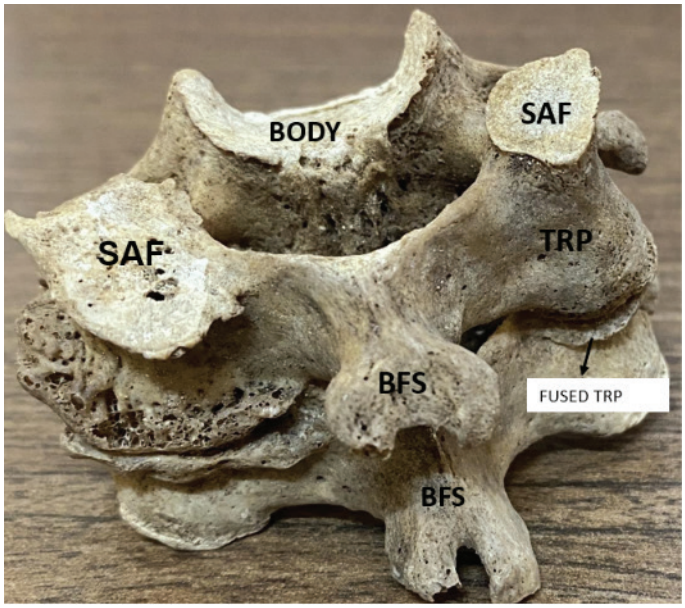

Figure 3. Postero-lateral view showing the fused transverse processes – TRP and unfused bifid spines of the block vertebrae C5-C6 (SAF: Superior articular facet; TRP: Transverse process; BFS: Bifid spine).

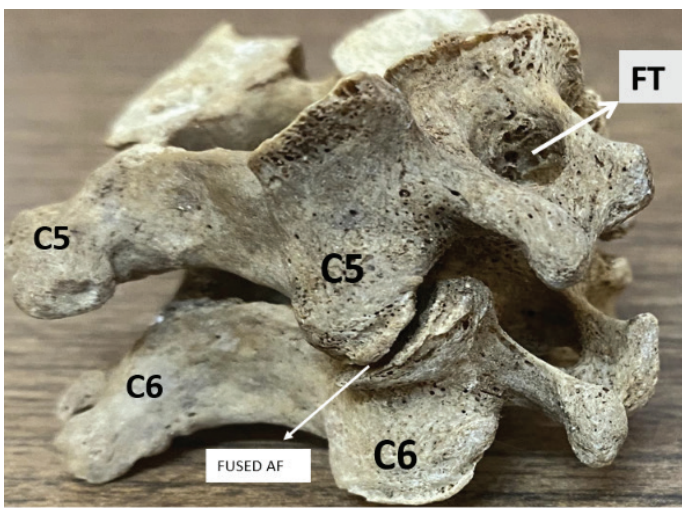

Figure 4. Lateral view showing the partially fused articular facets – AF with the patent Foramen Transversarium (FT) of the block vertebrae C5- C6.

Table 1. Percentage Of Incidence Of Block Vertebrae At Different Levels.

Authors	Block cervical vertebrae (%)	Block thoracic vertebrae (%)	Block lumbar vertebrae (%)
Nazeer *et al*[13]	0.5	0.08	0
Deepa *et al*[14]	2.0	4.0	2.0
Sharma *et al*[15]	6.25	4.16	2.08

The Klippel–Fiel syndrome (KFS) is a rare congenital disorder occurring in 0.6% of cases and presenting with a triad of short neck, limited neck movements, and low posterior hairline[16]. The C2 – C3 fusion is most common in patients with KFS, incidence of 72.7%. Symptoms seen are pain in the neck region & neurological signs due to nerve compression like numbness and decreased range of cervical movements[17]. KFS is linked

with mutations taking place at GDF6, GDF3 & MEOX1 genes. The first two are essential for bone and joint formation and the latter plays a role in separating the vertebrae[18].

Conclusion

While doing surgical procedures like endotracheal intubation and cisternal puncture, neck movements like hyperextension and hyperflexion of the neck can precipitate disc prolapse in the presence of such block vertebrae. Since such block vertebrae cannot be treated surgically as they carry high mortality and morbidity rates, their early diagnosis will help us to find the changes occurring due to trauma, aging, or the progression of a degenerative process.

Limitations of This Study

The unknown age & sex of the subject and the probable pathological background/medical history are not known. Lack of information regarding the malformation of other vertebrae in the same subject.

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Mini Curriculum and Author's Contribution

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