

FUSION OF C2 AND C3: EMBRYOLOGICAL AND CLINICAL PERSPECTIVE

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ABSTRACT

Skeletal abnormalities in the upper cervical region may result in severe neck ache, altered mobility, muscular weakness and sensory deficits. Fused cervical vertebrae (FCV) have been reported in literature, however cases with fused articular facets have scarcely been documented. During routine osteology demonstration, we came across fused axis and the 3rd cervical vertebra. There was complete fusion of the vertebral arch on the left side along with complete fusion between the inferior articular facet of C2 and superior articular facet of C3. There was partial fusion between the bodies of the vertebrae and the right half of the vertebral arch. Owing to the vital role of this region in various neck movements and spinal alignment, knowledge of such asymmetric variations in the upper cervical region, is of immense importance to orthopedicians, radiologists, neurosurgeons, anaesthetists, physiotherapists.

Key words: intubation, synostosis, axis, block vertebrae

INTRODUCTION

Skeletal abnormalities in the upper cervical region may result in severe neck ache, altered mobility, muscular weakness and sensory deficits (Kameyama et al, 1993). Fused cervical vertebrae (FCV) have been reported to be one of the common cause of such symptoms (Kaplan et al, 2005). FCV are not only structurally fused but, act as a single unit functionally, and this aspect makes the knowledge of variations in this region extremely pivotal. Owing to its critical role in movements, any anomalous variation especially asymmetric ones in the region of C3 (vertebra critica) adversely affects the stability of the cervical spine (Cave, 1937). The

presence of neurovascular structures and cervical enlargement of spinal cord in this region makes it even more vulnerable to neurological signs and symptoms in case of any variations. Owing to the common occurrence of such variants radiographic study should also be conducted prior to procedures in the cervical region such as endotracheal intubation, cisternal puncture etc. to prevent any iatrogenic injuries. Knowledge of FCV is extremely important while performing endotracheal intubation as extension of neck during the procedure may result in accidental disc injuries (Yadav et al, 2014).

CASE REPORT

During routine osteology demonstration, we came across fused axis and the 3rd cervical vertebra. There was complete fusion of the vertebral arch on the left side along with fused inferior articular facet of C2 and superior articular facet of C3. There was partial fusion between the bodies of the vertebrae, spine and the right half of the vertebral arch. The foramen transversarium were normal in size and appearance (Fig. 1: A, B, C, D).

DISCUSSION

The fusion of vertebrae seen in the present case could be an isolated feature or a part of the Klippel-Feil syndrome. Fused cervical vertebrae (FCV) can either be congenital or

acquired. Congenital FCV is one of the primary malformation of chorda dorsalis, and is associated with environmental and genetic derangements affecting the development of

the occipital and cervical somites during the critical period of vertebral development i.e. 3rd to 8th week of foetal life (Sadler and Langman, 2002; Bethany and Mette, 2000). Acquired FCV on the other hand is usually associated with diseases like tuberculosis, juvenile rheumatoid arthritis or trauma (Gray et al, 1964). Osseous fusion between contiguous laminae and pedicles are referred to as congenital bar. They

usually occur unilaterally and hence affect the stability of the spinal alignment. Unilateral neural arch ossification observed in the present case could be due to the formation of congenital bar on the left side. Since, this report is based on osteology study, the medical history of the donor was not known, and hence the exact cause of ossification cannot be ascertained.

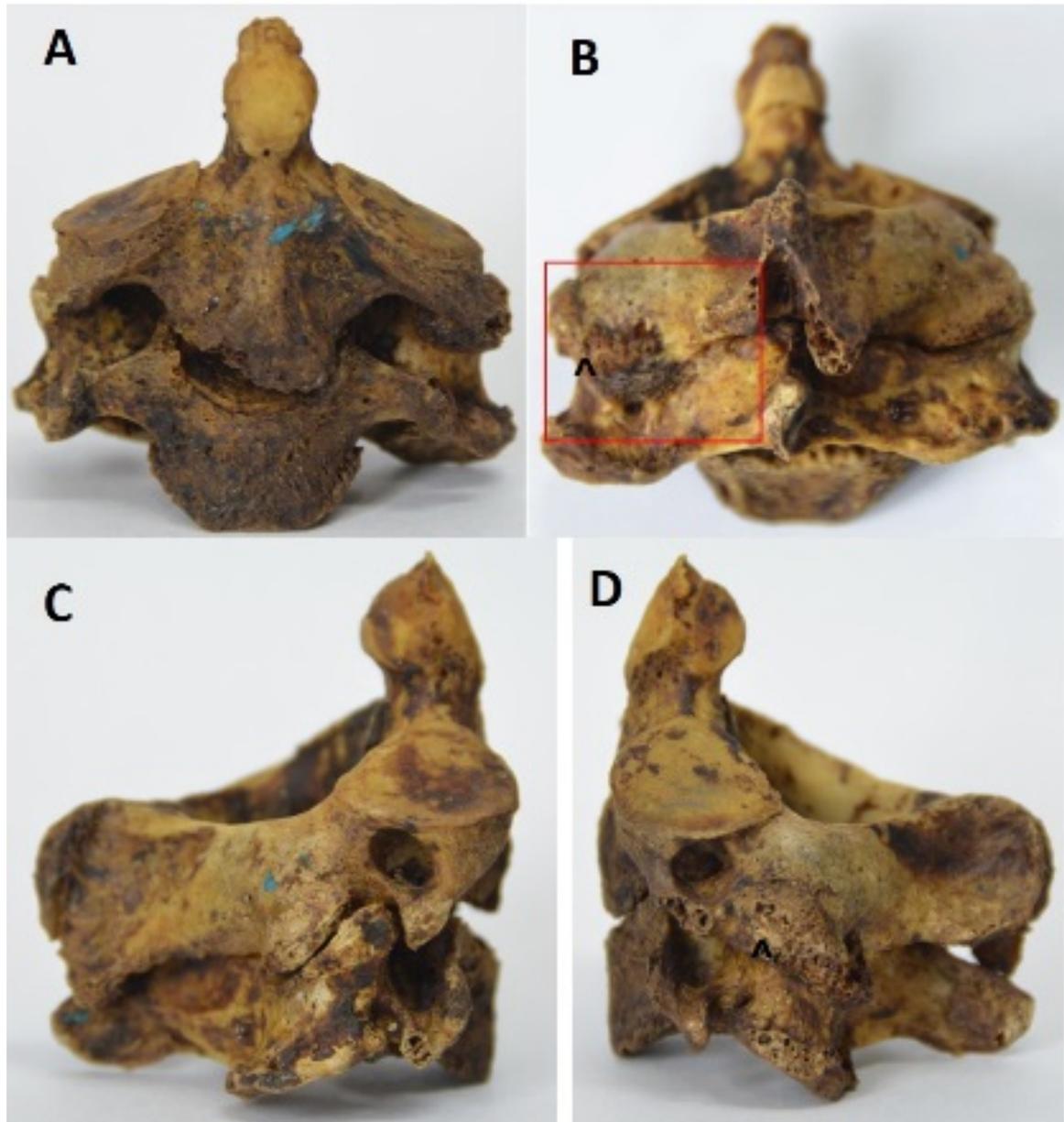


Figure 1. A. Anterior B. Posterior C. Right lateral D. Left lateral view of the fused C2 and C3 vertebrae. Note: complete fusion of the vertebral arch on the left side along with fused inferior articular facet of C2 and superior articular facet of C3 (^) and partial fusion between the bodies of the vertebrae, spine and the right half of the vertebral arch.

The vertebral column is the pivot of correct posture, providing stability and initiating movements. Any abnormalities in this region may interfere in day to day activities depending on the severity of the variation. The symptoms may range from neck ache, neurological signs to sudden unexpected death (Yadav et al, 2014). Developmentally the vertebral column is derived from the paraxial mesoderm, which differentiates into somites. The somites further divide into sclerotome, myotome and dermatome. The process is highly complex and regulated by a number of genes. Vertebrae are intersegmental in origin and are formed by the fusion of caudal half of the upper sclerotome and cranial half of the lower sclerotome (Sadler and Langman, 2002). FCV usually occurs due to failure or altered segmentation and fusion of the somites. This abnormal fusion of vertebrae has been associated with disturbance in the expression of PAX-1 gene and notch signalling

pathway during the course of development (Kaplan et al, 2005). Decrease in the local blood flow in the developing vertebral region during the critical period of development has also been proposed as one of the factors triggering vertebral anomalies (Soni et al, 2008). FCV may be symptomatic or asymptomatic depending on the severity of the variation. The effects of FCV are not isolated, but exert biomechanical stress on the adjoining segments leading to their premature degeneration (Soni et al, 2008). Hence, the knowledge of such variations is extremely important to radiologists for diagnosis, orthopaedic surgeons, neurosurgeons etc. while performing surgeries in this region and anaesthetists doing endotracheal intubation. Besides, early diagnosis of such variations, makes the patient aware of the activities to be avoided to lower the risk of injury.

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