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A Cadaveric Finding Of Congenitally Fused Second And Third Cervical Vertebrae

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ABSTRACT

The cervical spine is composed of seven vertebrae separated by intervertebral discs that provide mobility to the neck. However, in the presence of anomalies such as congenital cervical fusion, there may be decreased mobility, nerve root compression leading to pain and functional deficits, and even premature degenerative change due to biochemical stress in adjoining segments of the vertebral column. This case report presents a cadaveric finding of congenital fusion of the second and third cervical vertebrae. The fusion involved complete fusion of the spine, laminae, inferior articular facet of C2 to superior articular facet of C3, and the vertebral bodies, with partial fusion between the vertebral arches and none between the transverse processes. The complete fusion into a unitary block and the equivalent height of the fused vertebral bodies with the height of the two vertebrae and the intervertebral disc suggests a congenital fusion. No other anomalies were present in the cadaveric specimen. Congenital fusion of C2-C3 is a clinically significant form of cervical fusion, with implications for clinicians, orthopedics, radiologists and neurosurgeons, when performing procedures such as endotracheal intubation, cisternal puncture, and cervical surgeries. Accurate diagnosis and appropriate treatment are essential to prevent further complications and improve patient outcomes.

INTRODUCTION

The cervical spine is composed of seven vertebrae separated by intervertebral discs that provide mobility to the neck. However, there are instances when two or more adjacent vertebrae fuse. This fusion may remain asymptomatic and go undetected or may lead to a range of clinical manifestations, including neck pain, stiffness, headaches, muscle weakness and atrophy and neurological sensory deficits (1,2).

Fusion of cervical vertebrae may be due to either congenital or acquired factors. Acquired cervical fusion may be caused by various pathologies, such as tuberculosis and ankylosing spondylosis (1), while congenital cervical fusion may be present in rare conditions such as Klippel-Feil syndrome and Wildervanck syndrome, where adjacent vertebra fuse completely forming a unitary block (3). Two key factors are important in distinguishing the congenitally fused cervical vertebra from the acquired type. Firstly, there is a reduction in antero-posterior diameter in congenitally fused vertebrae, and secondly, the height of the two fused vertebral bodies is equal to the height of the two vertebrae and the intervertebral disc (4).

Vertebral fusion has an incidence of 0.4-0.7% and is most commonly reported to affect the cervical spine (2). The incidence of fusion of cervical vertebra in particular, according to a literature review by Paraskevas et al. (2019) is 0.5-6.25%, with the most common being fusion of C2 and C3 at a frequency ranging between 0.10% to 1.33% (1,5). Despite its rare occurrence, congenital cervical fusion may appear with serious manifestations associated with degenerative changes, typically in adulthood, ranging from osteoarthritis to disc hernias occurring above and below the fused level, causing nerve root compression. It has even been reported that cervical fusion especially at the central levels is a risk factor for the development of degenerative cervical myelopathy (6). Therefore, congenital fusion of cervical vertebrae remains of clinical importance whose radiological evaluation must be done for preventing serious damage by early diagnosis and treatment. The present study is aimed to report and study the congenital block (C2 and C3) vertebrae and its clinical importance.

CASE REPORT

This is a report of fused C2-C3 vertebrae identified during routine osteology at the Department of Human Anatomy, University of Nairobi. There was complete fusion of the spine, laminae, inferior articular facet of C2 and superior articular facet of C3 and the vertebral bodies. There was partial fusion between the vertebral arches and none between the transverse processes. Transverse foramina were present in both vertebrae (Figure. 1).

DISCUSSION

Previous studies have reported cases of fusion of the second and third cervical vertebrae giving significance to their rare yet implicative nature (2,7). Subbulakshmi et al. (2019) reported complete fusion between the vertebral bodies of C2 and C3, the

laminae and spines but no fusion of the pedicles, also noting unilateral fusion of the transverse process on the right side (1). Singh et al. reported C2-C3 fusion at the zygopophyseal joint on the right side as well as the lamina and spinous process are also fused (4). However, reports of C2-C3 fusion remain scarce in the Kenyan population.

Congenital fusion of cervical vertebrae is postulated as being due to notochord malformations associated especially with defects of the cervical somites (8). A disturbance of the normal spinal subdivision during somitogenesis, because of a combination of genetic and environmental

factors during the third week of embryological development, is suggested as being the reason for congenitally fused cervical vertebrae (5).

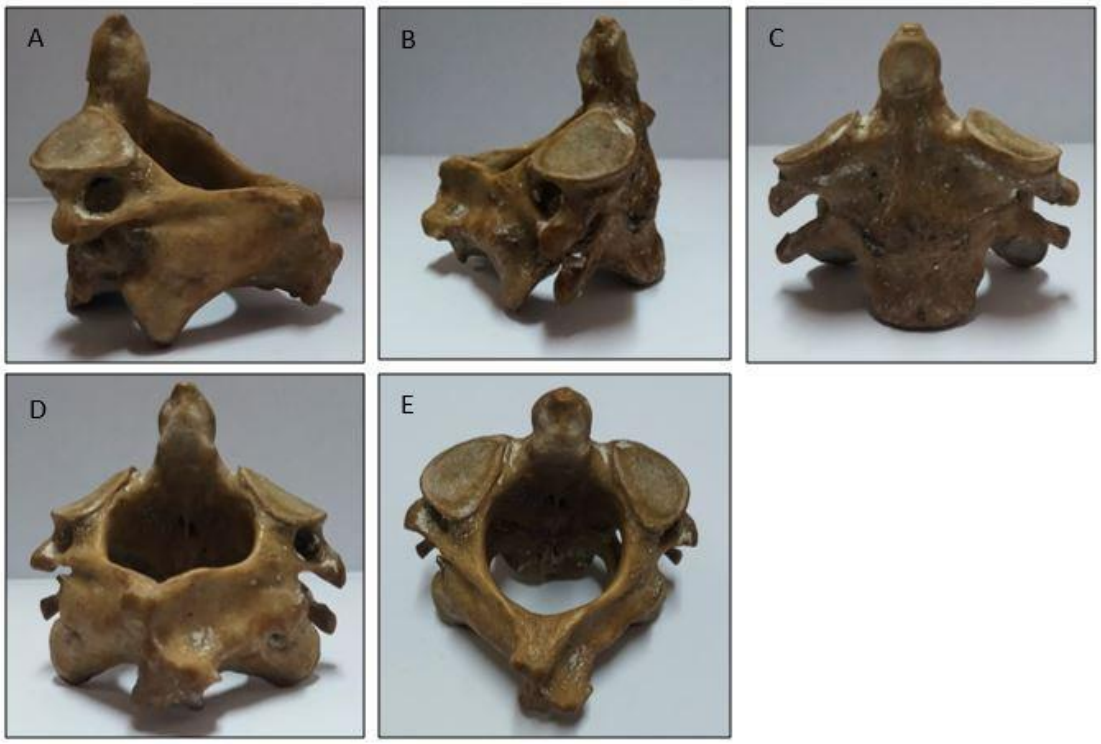

Figure 1 Illustrating Fused 2nd and 3rd Cervical Vertebrae. (A)Lateral view1; (B) Lateral view2; (C) Anterior view; (D) Posterior view; (E) Postero-superior view. There is complete fusion of the spine, laminae, inferior articular facet of C2 to superior articular facet of C3 and the vertebral bodies. There is partial fusion between the vertebral arches and none between the transverse processes.

Fusion of the second and third cervical vertebrae has been reported in up to 70% of cases of occipitalization with associated instability at the C1-C2 joint (9). Flexion, extension and lateral rotation of the neck are decreased. As such, long standing fusion may lead to stretching and laxity of ligaments between the occiput and atlas, resulting in excessive motion and brainstem or cord compression (1). Moreover, the

presence of block vertebrae increases the biomechanical load on adjacent spinal segments, which can cause complications such as disc tears, transverse ligament tears, odontoid process fractures, and spondylosis (9).

Knowledge on cervical vertebrae fusion is important in patient management as it informs decisions such as lifestyle modification. This is important to prevent excessive head movements, which may cause cord, nerve and/or arterial compression. Information on such vertebral anomalies is important for anaesthesiologists during intubation, for neurosurgeons during surgeries of the neck as well as orthopedics for exploring the biomechanics of spinal stabilization. It may also help clinicians in general to better diagnose and manage spinal disorders, improve patient outcomes, and provide insights into the evolutionary development of the human spine. Accurate diagnosis and appropriate treatment are essential to prevent further complications, and further research into the natural history and impact of C2-C3 fusion may lead to improved clinical outcomes for patients with this condition.

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