Series of vertebral synostosis-clinically implied

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Abstract

Introduction: During the formation of vertebral column, in the fourth week of intrauterine life the sclerotome part of somites migrate around the notochord and the neural tube and undergo a process called resegmentation. Any defect in such a process can lead to vertebral anomalies causing neurological and vascular deficits. But fusion of vertebrae can be congenital or acquired. Acquired fusion of vertebrae can be due to diseases such as Tuberculosis, Juvenile rheumatoid arthritis and trauma. Fusion of vertebrae can lead to compression, distortion of the neural structures and interference with muscular movements as well as cerebrospinal fluid channels. The present study was conducted to find out the incidence of fusion of vertebrae at different levels.

Materials and Methods: The current study was done on 50 dry adult vertebral columns obtained from the Department of Anatomy, Sri Manakula Vinayagar Medical College, Pondicherry. The bones were observed for fusion at the level of body, transverse process, lamina and spinous process. Results: The results are reported in a tabular format. In the cervical region two typical vertebrae were fused. In the thoracic region, two typical thoracic vertebrae were fused and T11 and T12 were fused. In the lumbar region, two typical lumbar vertebrae were fused. There were two sacralisations of lumbar vertebrae.

Discussion: An intense knowledge on the occurrence of vertebral synostosis is essential to interpret varied forms of clinical presentations through relevant physical examination. It has to be borne in mind that the anomalies could be congenital or acquired. Based upon the inference, the treatment could be carried on a righteous and justified path.

Key words: Somite, synostosis, vertebral anomaly, spinal fusion

Introduction: The vertebral column not only functions as a support to the body, it also acts as a pathway for the spinal cord. Therefore for the spinal cord to work efficiently it is mandatory that the vertebral column follows a normal pathway of development. Development of the spine occurs through a number of complex steps which involve the genes, signalling pathways and many metabolic processes. Somites are derived from paraxial mesoderm of intraembryonic mesoderm. Sclerotome parts of the somites give rise to the vertebrae. Migration of sclerotome cells around neural tube and notochord occur during the fourth week of intrauterine life. In due course, the sclerotome part of each somite undergoes a process called resegmentation. This leads to the formation of definitive vertebra being derived from adjacent sclerotomes. Any defect in the above process can lead to one or more congenital vertebral anomalies like Klippel-Feil sequence (Brevicollis), spina bifida, abnormal spinal curvatures like scoliosis etc. which can cause neurological and vascular deficits. But these deficits can also be acquired due to tuberculosis of spine, arthritis, trauma etc. fusion of vertebrae can lead to compression and distortion of the neural structures and cerebrospinal fluid channels. It can also lead to interference with muscular movements, spinal deformities, less mobile pelvis leading to painful and obstructed labour.
The present study was conducted to find out the incidence of fusion of vertebrae at different levels.

**Materials and Methods:** The current study was conducted on 50 South Indian, dry, adult vertebral columns obtained from the Department of Anatomy, Sri Manakula Vinayagar Medical College, Pondicherry. The vertebrae of all the regions were inspected to find if there exists any abnormal fusion between adjacent vertebral bodies, pedicles, laminae, spines or transverse processes.

**Inclusion criteria:** All intact adult dry vertebrae were included.

**Exclusion criteria:** Broken, damaged and neonatal bones were excluded

**Results:** Results are reported in a tabular format.

<table>
<thead>
<tr>
<th>Location of fusion</th>
<th>Number of fusions between 2 vertebrae at given level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusion between typical cervical vertebrae</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Fusion between typical thoracic vertebrae</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Fusion between T11 and T12 vertebrae</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Fusion between typical lumbar vertebrae</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Fusion between last lumbar and 1st sacral vertebrae</td>
<td>2</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Table 1: Showing incidence of fusion in a total of 50 vertebral columns**

**Cervical Vertebral Synostosis:** Two typical cervical vertebrae were fused showing complete fusion of both the bodies, fusion of transverse processes on the right side and fusion of laminae on the right side.

Thoracic Vertebral Synostosis was seen at two levels:
1. Fusion of two typical thoracic vertebrae showing fusion of their bodies only on left side.
2. Fusion of T11 and T12 wherein bodies were fused incompletely on right and left sides.

**Lumbar Vertebral Synostosis:** Two typical lumbar vertebrae were found to be fused between the bodies on the right side.

**Lumbosacral Vertebral Synostosis:**
1. Complete fusion of last lumbar vertebra with sacrum
2. Incomplete (unilateral)fusion of last lumbar vertebra with sacrum on the left side.

**Discussion:** Various studies have been done to record the incidence of vertebral anomalies and it is not uncommon to find such variations not only in dry bones but also in clinical cases. A spectrum of vertebral synostosis in cervical, thoracic, lumbar regions in dry bones was reported and it was speculated that it could have been a case of Klippel-Feil Syndrome \(^4\) suggesting that such variations if identified early can indicate the presence of congenital defects. In one study axis vertebra was fused with the 3rd cervical vertebra.
with complete fusion of vertebral body, arches and spine which could have resulted in interference with neck movement, or muscular weakness, atrophy and neurological sensory loss [5]. In a study by Kubavat sacralisation of fifth lumbar vertebra was seen in 21 (11.1 %) cases and lumbarisation of first sacral vertebra was seen in 3 (1.3%). The author speculated that these anomalies can be a cause of low backache, less mobile pelvis in females leading to difficult labour [6]. Fusion between the typical thoracic vertebrae and lumbar vertebrae were reported by Vadgaonkar et al[7] which can cause low back ache. A case of congenital abnormal cervical vertebrae with two typical cervical vertebral laminae fused on left side along with the failure of development of pedicle, costal element and anterior tubercle of transverse process of lower cervical vertebrae was reported by Tiwari et al[8]. Five clinical cases of congenital fusion of cervical vertebrae were observed by Erdil et al which could be due to defect in the development of the occipital and cervical somites[9]. A study by Yogesh et al. has noted that cervical vertebral synostosis can lead to severe neck pain, muscular weakness and sensory involvement of bilateral upper limbs and even sudden unexpected death [10].

The findings of the present study coincide with a study by Sharma et al. which also conclude that vertebral fusion (block vertebra) is most commonly seen in the lumbo sacral region than in any other region [11].

**Conclusion:** Synostosis of vertebrae can be congenital or acquired. The observations in this study have to be kept in mind while dealing with clinical cases, because it is not uncommon to come across conditions which are basically caused by such vertebral anomalies, like muscular weakness, restriction of movements, sensory involvement, obstructed labour and many others depending on the area of involvement. If similar variations are identified as early as possible, morbidity and mortality due to the afore mentioned clinical conditions can be reduced. The present study was done in a small sample size. However, the incidence of vertebral synostosis may be higher if the study is done in a larger sample size.

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**Conflict of interest:**
Conflict of interest none to declare.
References:


