

Case report: A case of fusion of thoracic vertebrae.

Dr. Gudipati Prasanna Lakshmi^{1*}, Dr. Sucheta Chaudhary²

¹Third Year Resident, ²Professor and Head, Department of Anatomy, B. J. Medical College, Ahmedabad, Gujarat, India.

Abstract:

Vertebral Column (spine) provide support to trunk, protect spinal cord and spinal nerves also provide attachment to muscles. vertebrae are integral part of vertebral column. Any abnormal fusion of vertebrae is known as vertebral synostosis or vertebral fusion or Block vertebrae. Vertebral fusion may be congenital or acquired. During an inspection of the osteology section of Anatomy Department, BJMC, Ahmedabad we came across one specimen of fusion between thoracic vertebrae. Specimen was analyzed and measurements were taken. There was complete fusion of bodies of 4 typical thoracic vertebrae, partial fusion of spinous processes and lamina. Superior and inferior facets are present but not fused. Intervertebral foramina are present. Recognition of fused thoracic vertebrae at an early age can prevent many disabilities and complications. The causes of fusion vertebrae may be congenital vertebral malformation, acquired causes like tuberculosis, juvenile rheumatoid arthritis and trauma.

Key Words: Fusion of thoracic vertebrae, Vertebral fusion, Vertebral synostosis.

Introduction:

Adult vertebral column functions to support trunk, protect spinal cord, provide attachment to muscles which usually consists of 33 vertebral segments. Vertebral column comprising of vertebrae and intervertebral discs is derived from sclerotomes of somites which is one among the chief manifestations of body segmentation¹. Fusion of two or more vertebrae is a congenital anomaly of vertebral column which is called as vertebral synostosis or spinal fusion or block vertebrae².

Acquired fusion of vertebrae may be secondary to Trauma, Tuberculosis, Juvenile Rheumatoid Arthritis³. Surgical fusion of two vertebrae is known as Spondylodesis or Spondylosyndesis.

Congenital fusion may be due to failure of segmentation of sclerotomes at certain levels at the time of organogenesis, manifesting into Klippel Feil Syndrome or other associated spinal deformities such as scoliosis⁴. This knowledge helps in determination of the embryological time period for occurrence of synostosis. Congenital fusion of vertebrae can occur in different regions of spine. For e.g., Cervical Region – Klippel - Feil syndrome, Occipitalization of Atlas, Sacralization of 5th lumbar vertebra⁵. The fusion of thoracic

*Corresponding Author:

Dr. Gudipati Prasanna Lakshmi
Email: prasannamdprep@gmail.com

QR Code:



vertebrae can present clinical signs like congenital scoliosis early in life and shortening of the trunk with scoliosis and/or lordosis in older children⁶.

Case report:

During an inspection of the osteology section of Anatomy Department, BJMC, Ahmedabad we came across one specimen of fusion between thoracic vertebrae. Specimen was analyzed and measurements were taken using digital Vernier calipers. In the present study, fusion between 4 typical thoracic vertebrae was found. Bodies and lamina of all 4 vertebrae were symmetrically fused. On the left side, facet joints between upper two vertebrae were only fused whereas on right side all were partially fused. Assuming the 4 vertebrae as T3, T4, T5, T6 findings are noted in tables given below:

Table no. 1 is showing dimensions of central canal which includes antero-posterior (AP) and transverse dimensions. Decrease in AP diameter towards lower foramina was observed.

Table no. 2 is showing dimensions of body of vertebrae among which increase in AP diameter has been observed.

Table 1 Dimensions of Vertebral Foramina / central canal

VERTEBRAL FORAMINA / CENTRAL CANAL		
	AP (mm)	Transverse (mm)
Upper	10.52	14.22
Lower	8.68	15.86
Observation	AP Diameter has decreased towards lower foramina	

Table 2 Dimensions of body of vertebrae

BODY OF VERTEBRAE		
	AP (mm)	Transverse (mm)
T3	22	26.2
T6	30	26.2
Observation	AP Diameter has increased towards T6	

Table no. 3 is showing dimensions of intervertebral foramina among which length was increased towards lower foramina.

Table no. 4 is showing status of fusion i.e., either fused or unfused, completely fused or partially fused.

Table 3 Dimensions of intervertebral foramina

INTERVERTEBRAL FORAMINA		
	LENGTH	BREADTH
UPPER	5.95	2.96
MIDDLE	9.02	2.08
LOWER	10.48	4.86
Observation	Length is increased towards lower Foramina.	

Table 4 Status of fusion of various parts of vertebra

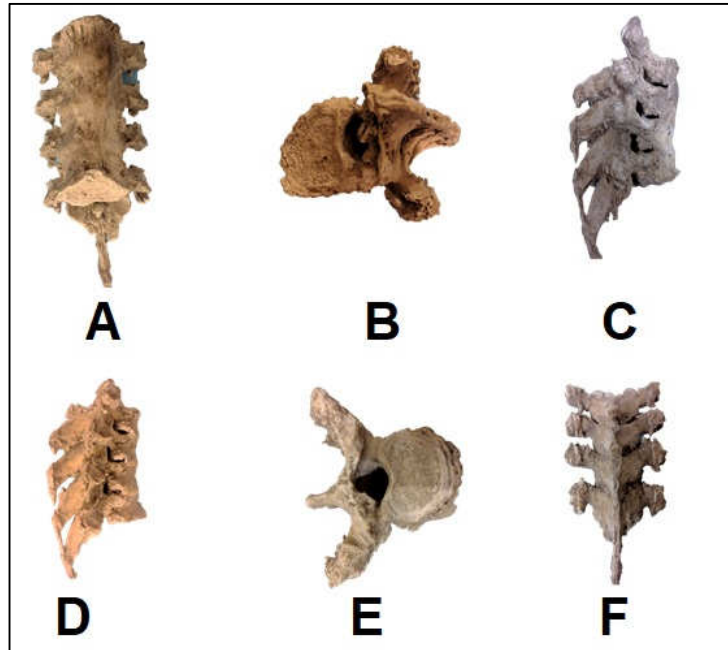
Parts of Vertebra	T3-T4	T4-T5	T5-T6
Vertebral Body	Partial Fusion on Right & Left	Complete Fusion on Right & Left	Complete Fusion on Right & Left
Pedicle	Unfused	Unfused	Unfused
Lamina	Fused	Fused	Fused
Articular Process	Unfused	Fused	Fused
Spinous Process	Unfused	Unfused	Unfused

Discussion:

Non segmentation of primitive sclerotome is the cause for fused vertebrae or block vertebrae. Shape of vertebrae will be under effect of HOX gene. Vertebral fusion anomalies are associated with disturbance of Pax -1 gene expression in developing vertebral column⁷. Fusion of vertebrae can lead to narrowing of intervertebral disc space, shortening of vertebral

column, narrowing of thorax and can also lead to respiratory distress. Asphyxiating thoracic dystrophy is caused by narrow thorax and short ribs^{8,9}. Vertebral fusion can be associated with Radiculopathy, Myelopathy. Congenital vertebral malformation can be associated with kyphosis, scoliosis, neck and back pain, disability, pulmonary compromise, functional distress and cosmetic disfigurement¹⁰.

Image 1 Specimen of Fusion of Thoracic vertebrae (Various Views)



A – Anterior, B - Inferior, C- Right lateral, D – Left lateral, E - Superior, F - Posterior.

Various syndromes can accompany vertebral fusion like segmental syndrome with laryngeal malformation, VACTERL¹¹ (Vertebral, Anal, Cardiovascular, Tracheo-oesophageal, Renal & Limb abnormalities ± Single umbilical artery), MURC (Mullerian duct aplasia, Renal Aplasia, Cervico-thoracic somite dysplasia), Down's syndrome¹² etc.

In my observation fusion was found between 4 typical thoracic vertebrae whereas in different case reports by Dr. mohd nazeer and nivedha viswanathan on fusion of typical thoracic vertebrae^{13, 14}, specimen with fusion between 3 typical thoracic vertebrae were presented. In my study bodies and lamina of all 4 vertebrae were symmetrically fused. On the left side, facet joints between upper two vertebrae were only fused whereas on right side all were partially fused. As observed by Dr. mohd nazeer there is complete fusion between bodies on right side and partial fusion on left side. The articular processes, laminae and spinous processes were unfused. In case report by nivedha viswanathan it was noted that the bodies of typical thoracic vertebrae were partially fused on right side and partially fused on left side. The pedicle, laminae articular processes, and spinous processes were unfused.

In my study decrease in antero-posterior diameter of central canal towards lower vertebra and increase in antero- posterior diameter of body of vertebrae towards T6 has been observed. In case report by nivedha viswanadhan increase in antero-posterior diameter of body and spinal canal had been observed towards lower vertebrae.

Conclusion:

Recognition of fused thoracic vertebrae at an early age can prevent many complications discussed above. The embryological time period for occurrence of synostosis can be analyzed. Pathological causes of fusion are fibrodysplasia, progressive juvenile rheumatoid arthritis, post traumatic, post-surgical, infectious causes like tuberculosis which affects thoracic and lumbo-thoracic vertebrae.

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