

**Original article :**

## **Double Foramen Transversarium in Cervical Vertebra: Morphology and Clinical importance**

**Chaudhari ML\*\*, Maheria PB\*\*, Bachuwar SP\***

HOD and Professor\*, Assistant professor\*\*\*

Department of Anatomy, Gujarat Adani Institute of Medical Sciences, Bhuj, India

**Corresponding author :** Dr. Manisha Choudhari ; Email id :manishawow@yahoo.com

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**ABSTRACT:**

**Background :** The purpose of this study is to investigate the incidence of double foramina transversaria in the cervical vertebrae and its morphological and clinical importance.

**Methods:** Total 133 human dried cervical vertebrae were taken from the department of Anatomy, Adani medical college Bhuj. All the vertebrae were observed macroscopically for the presence of double foramen transversarium.

**Results:** Out of 133 cervical vertebrae, double foramen transversarium was observed in 22 vertebrae (23.15%), among them unilateral double foramen was found in 14 vertebrae (14.73%) and the bilateral was found in 8 vertebrae (8.42%).

**Conclusion:** Unilateral double foramen transversarium were more common than bilateral. This variation is important for the Neurosurgeon during cervical surgery. Under such condition the course of the vertebral artery may be distorted. It is also useful for Radiologist during CT and MRI scan.

**Keywords:** Accessory foramen transversarium, Cervical vertebra, Foramen transversarium

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**Introduction :**

The cervical vertebrae are identified by the presence of foramen transversarium (FT) in the transverse processes. This foramen transmits the vertebral artery, vertebral vein and sympathetic fibers from the inferior cervical ganglion. C<sub>7</sub> vertebra transmits only vertebral vein, sometimes this foramen is small or absent. Transverse process has anterior and posterior roots; terminating laterally as tubercles. Both these tubercles are joined by costo-transverse bar. Double foramen transversarium is a rare condition and this type of variation may affect the course of the vertebral artery. Variations in the number and size of the FT of the cervical vertebra may result in headack, migraine and fainting attack due to compression of vertebral artery<sup>1</sup>. The vertebral vessels in such situations may be compressed by head movements and may give rise to vascular insufficiency.

Clinically this type of variations is important for the radiologist while doing computed tomographic and magnetic resonant imaging scan. This variation of foramina transversaria is also important for surgeon during posterior cervical surgery<sup>2</sup>. There are various studies on the origin and course of vertebral artery but there is a paucity of studies regarding the morphology of accessory foramen transversarium in the cervical vertebrae and its incidence. Objective of our study was to study the morphology of double FT and to calculate its incidence. The foramina were macroscopically analysed and the incidence of double FT was calculated. The purpose of this study was to investigate the incidence of double foramina transversaria in the cervical vertebrae and its morphological and clinical importance

**Material and methods:**

This study was conducted using 133 dried human cervical vertebrae obtained from Department of Anatomy, Government Medical College, Bhavnagar. Among them 71 were typical cervical vertebrae (C3, C4, C5, and C6) and 62 were atypical cervical vertebrae (C1,C2 and C7). Each cervical vertebra was examined macroscopically for the presence of the double foramen transversarium on both the side. Defective bones were excluded from the study. Vertebrae having double FT were photographed. The data was compiled and analysed using Microsoft Excel software.

Photograph :1



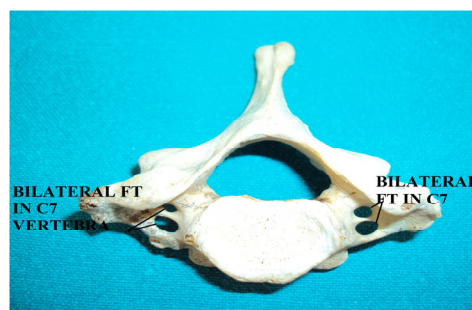
Photograph :2



Photograph :3



Photograph : 4



**Results:**

Out of 133 cervical vertebrae the double foramen transversarium was found in only 22 vertebrae. The incidence of which is calculated as 23.15%. Among them unilateral duplication was found in 7 number in typical thoracic vertebra (figure nu;1) and 7 found in 7<sup>th</sup> cervical vertebra (figure nu;2) and bilateral duplication was found in 5 typical thoracic vertebrae (figure nu;3) and 3 found in 7<sup>th</sup> thoracic vertebra (figure nu;4). Thus, unilateral double foramen was more common than bilateral one. Further, the accessory foramina were smaller than the regular foramina. Also the double foramina were observed only in the lower cervical vertebrae (C<sub>5</sub>, C<sub>6</sub>, C<sub>7</sub>). Each vertebrae was having at least one foramen transversarium on either side.

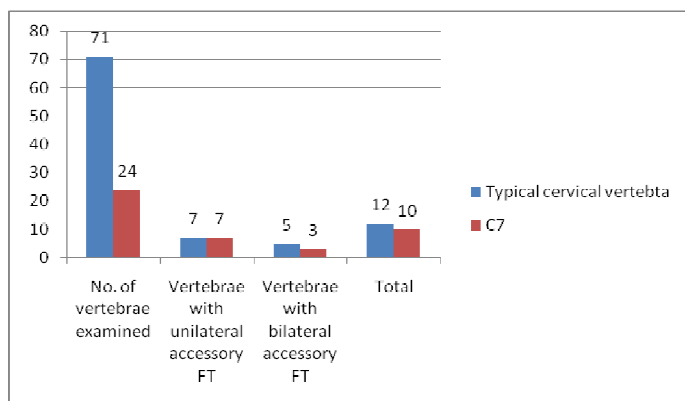


Table 1: showing the incidence of double FT in lower cervical vertebrae

Type	No. of vertebrae examined	Vertebrae with unilateral accessory FT	Vertebrae with bilateral accessory FT	Total	Incidence in %
Typical cervical vertebra	71	7	5	12	16.19%
C7	24	7	3	10	41.66%

Discussion:

The foramen transversarium is formed by the particular formation of the cervical transverse processes. It is formed by the vestigial costal element fused to the body and the true transverse process of the vertebra<sup>3</sup>. It is closed laterally by the costotransverse bar<sup>4</sup>. In vertebral artery some portion of the primitive dorsal aorta may not degenerate along with the two intersegmental arteries which connect the vertebral artery and this arrangement may lead to double origin and duplication of the vertebral artery<sup>5</sup>. The vertebral arteries supply the cervical part of spinal cord,

spinal ganglions, meninges and duramater in the posterior cranial fossa. The transverse foramen of the seventh cervical vertebra contains some branches of vessels and nerves as well as fibrous and adipose tissues<sup>6</sup>.

We found out 22 vertebrae out of 133 that are having double FT either unilaterally (14) and bilaterally (8). Further, double FT was seen only among the lower cervical vertebrae i.e. from C5 to C7. The percentage of occurrence of double found higher in cervical 7 vertebra compare to other typical cervical vertebra.



Table 2: Showing prevalence of double transverse foramina in different study populations.

Author	Year	Presence of double foramina	Study sample	Population
Taitz <sup>4</sup> et al	1978	7%	480	Indian
Nagar <sup>7</sup> et al	1999	8.6%	1388	Roman-Byzantine Jews
Das <sup>8</sup> et al	2005	1.5%	132	Indian
Kaya <sup>9</sup> et al.,	2011	22.7%	262	Jewish
Present study	2013	23.15%	133	Indian

As the vertebral vessels are the important in the formation of the foramen transversarium, it can be apparent that variations in the presence and course of the vertebral vessels will result in variation in foramen transversarium. A narrowing of the foramina indicates narrowness of the vessels and so on. The accessory foramina transversaria were most common at the lower cervical vertebrae (C5, C6 and C7), mostly in C6. The surgical anatomy of the foramen transversarium and vertebral artery are important to the neurosurgeons and radiologists<sup>10</sup>. Their anatomy and morphology is useful to the operating spine surgeons and radiologists in the interpretation of radiographic films and computed tomogram scans. Compression of the vertebral artery may lead to neurological and hearing disturbances.

**Conclusion:**

In our study we observed the double foramen transversarium in 23.15% of the cases. The unilateral double foremen were more common than

the bilateral. All the double foramina were observed in the lower cervical vertebrae (C5,C6,C7). The percentage of occurrence of double foramen transversum found higher in cervical 7 vertebra comparison to other typical cervical vertebra.

The morphological knowledge of this type of variation is clinically important because the course of the vertebral artery may be distorted under such condition. The compression or other pathology of such aberrant artery may lead to neurological symptoms and at times hearing disturbances. Also the knowledge of this type of variation is important for the neurosurgeon during posterior cervical surgery. It is also useful for radiologist during CT and MRI scan.

Our study will provide further information on incidence and morphological basis of foramina transversarium. It will help in radiological imaging, neurological diagnosis and in complex surgical procedures in the cervical area.

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