

## PRESENCE OF DOUBLE FORAMEN TRANSVERSARIUM IN CERVICAL VERTEBRA IN THE POPULATION OF UPPER ASSAM OF INDIA

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### ABSTRACT

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#### INTRODUCTION

The cervical vertebrae are the smallest of the moveable vertebrae, and are characterized by a foramen in each transverse process. The transverse process is morphologically composite around the foramen transversarium.

#### AIM

The present study has been undertaken to know the incidence of double foramen transversarium in dried cervical vertebrae in upper Assam population.

#### MATERIALS & METHODS

A total number of 210 dried cervical vertebrae of unknown age and sex were collected from the anatomy department. All the collected cervical vertebrae were examined macroscopically for the existence of the double foramen transversarium on both sides. The data was then compiled and later analyzed.

#### RESULTS

Out of 210 cervical vertebrae, the double foramen transversarium was found in 12(5.7%) vertebrae. Among these 12 specimens, the double foramen is by the addition of a small one behind the ordinary foramen in eight (0.6%) vertebrae; whereas in rest four (0.3%) vertebrae, on one side, there is an hour-glass contraction marking off two foramina. The incidence of unilateral duplication was higher than bilateral.

#### DISCUSSION

The incidence of double foramen transversarium reported by the various authors varies from 1.5% to 23.15%.

#### CONCLUSION

We know that the transverse foramina are unique to the cervical vertebrae and these foramina enclose and protect the vertebral artery; so the morphological knowledge of transverse foramina is clinically important to rule out any variation in the course of the vertebral artery. This will help to guide the radiologist and spine surgeon in making a diagnosis as well as surgeries of this region.

#### KEYWORDS

Foramen transversarium, Double foramen transversarium, Bifid foramen transversarium, Hourglass foramen transversarium

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**INTRODUCTION:** The cervical vertebrae are the smallest of the moveable vertebrae, and are characterized by a foramen in each transverse process. The transverse process is morphologically composite around the foramen transversarium. Its dorsal and ventral bars terminate laterally as corresponding tubercles. The tubercles are connected, lateral to the foramen, by the costal (or intertubercular) lamella: these three elements represent morphologically the capitulum, tubercle and neck of a cervical costal element. The attachment of the dorsal bar to the pediculolaminar junction represents the morphological

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transverse process and the attachment of the ventral bar to the ventral body represents the capitellar process.<sup>1</sup>

The cervical vertebrae are readily identified by the foramen transversarium (FT) perforating the transverse processes. This foramen transmits the vertebral artery, the vein, and sympathetic nerve fibres. The vertebral artery enters its vertebral course nearly always at the FT of C6; it is not surprising, therefore, that the foramen of C7, which transmits only the vein, is small or even sometimes absent. The deformation and variations of this foramen may affect the anatomical course of vital vascular and neural structures, and consequently cause pathological conditions.<sup>2</sup>

**AIM:** The present study has been undertaken to know the incidence of double foramen transversarium (FT) in dried cervical vertebrae in upper Assam population.

**MATERIAL & METHODS:** The present study was conducted in the department of anatomy, Jorhat Medical College and Hospital, Jorhat, Assam. A total number of 210 dried cervical vertebrae of unknown age and sex were collected from the bone keeping room. Among them, 120 were typical cervical vertebrae (C3, C4, C5, and C6) and 90 were atypical (C1, C2, C7). All the collected cervical vertebrae were examined macroscopically for the existence of the double foramen transversarium (FT) on both sides. Defective bones were excluded from the study. Vertebrae having double FT were photographed. The data was then compiled and later analyzed.

**RESULTS:** Of 210 cervical vertebrae, the double FT was found in 12(5.7%) vertebrae. Among these 12 specimens, the double foramen is by the addition of a small one behind the ordinary foramen in eight (8=0.6%) vertebrae; whereas in rest four (4=0.3%) vertebrae, on one side, there is an hour-glass contraction marking off two foramina.

The incidence of unilateral duplication was found in five (5) typical cervical vertebrae [Figure 1] and three (3) atypical cervical vertebra [Figure 2]. Vertebrae with unilateral hourglass appearance was found in one (1) typical vertebra [Figure 3], vertebrae with one side double FT and other side hourglass appearance in three (3) atypical vertebra [Figure. 4] (Table - 1).

Thus, unilateral double foramen was slightly more common than bilateral one. It was noticed that the double foramina were observed only in the lower cervical vertebrae (C6, C7).

**DISCUSSION:** Double foramen transversarium (FT) is reported by many authors. The incidence of double FT reported by the various authors varies from 1.5% to 23.15% [Table - 2].

The foramen transversarium is a result of the special 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. The vertebral vessels and nervous plexus are caught between these two bony parts. The foramen transversarium is closed laterally by the costotransverse bar, a thin plate of bone connecting the rib element to the original transverse process.<sup>3</sup>

Chaudhari et al reported that 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%).<sup>4</sup> Kaya et al stated that double FT was observed in 5(22.7%) cervical

vertebrae out of 22. The duplication was bilateral in 2 vertebrae and unilateral in 3 vertebrae. Asymmetrical FT was found only in one (4.5%) vertebra. In one individual skeleton, unilateral double FT was observed in C4 vertebra while bilateral in C5 level vertebra 2.

Professor Struthers examined 15 specimens of double foramen in the cervical transverse processes and reported that the double foramen is by the addition of a small one behind the ordinary foramen; except in one vertebra, in which, on one side, there is an hour-glass contraction marking off two foramina, of which the posterior is somewhat the larger.<sup>5</sup> In our study, we found three cases of hour-glass appearance.

Patra et al observed that 33 (22.00%) vertebrae had double FT out of 150 dried cervical vertebrae and among them 16 (10.67%) were unilateral vertebrae and 17 (11.33%) bilateral vertebrae.<sup>6</sup>

Sharma et al reported double FT both unilaterally and bilaterally in 16 (8%) vertebrae out of 200 typical cervical vertebrae. Incidence of double foramen transversarium is more in C6 than other typical vertebra.<sup>7</sup> Taitz et al reported double FT in 34 vertebrae out of 4803.

Rathnakar et al reported the incidence of double FT as a total of 5.7% (unilateral 3.6%, bilateral 1.42%) out of 140 vertebrae.<sup>8</sup> We also found the incidence of double FT 5.7% in our population, which is similar to this study.

Katikireddi and Setty studied 100 cervical vertebrae and noticed double FT in 3(3%) vertebrae, among them double foramen seen unilaterally in 2 (2%) vertebrae and bilaterally in 1(1%) vertebra.<sup>9</sup> Agrawal et al stated that unilateral double foramen transversarium were seen in 2.5% cases while 1.25% cases showed bilateral double foramen transversarium. 0.625% cases showed asymmetrical foramen transversarium and another 0.625% cases showed incomplete foramen transversarium.<sup>10</sup> Murlimanju et al reported, the incidence was 6 (1.6%) out of 363 vertebra, among them double foramina seen 5 (1.4%), three foramina were seen in 1(0.3%) and bilateral on only 1(0.3%), unilateral 5(1.4%).<sup>11</sup> El Shaarawy et al observed that, the occurrence of double foramen transversarium were most common at the lower cervical vertebra level (C5, C6 and C7) and frequently seen in C6 vertebra. Seventh cervical vertebra shows the maximum variability in FT among cervical vertebra.<sup>12</sup> The anatomy and morphology of double FT are helpful to the radiologists and spine surgeons in the interpretation of radiographic films and CT scans. Maintaining the vertebral artery intact constitutes an important concern during cervical surgical procedures.<sup>13</sup>

	Number of vertebrae observed	Vertebrae with unilateral double FT	Vertebrae with unilateral hourglass appearance	Vertebrae with one side double FT and other side hourglass appearance	Vertebrae with bilateral double FT	Vertebrae with bilateral hourglass appearance
Typical cervical vertebrae	120	5	1	nil	nil	nil
Atypical cervical vertebrae	90	3	nil	3	nil	Nil

Table 1

AUTHORS	Incidence of bifid foramen transversarium (%)
Das et al <sup>14</sup>	1.5
Murlimanju et al	1.6
Katikireddi and Setty	3
Chandravadiya et al <sup>15</sup>	4.76
Rathnakar et al	5.7
Taitz et al	7
Sharma et al	8
Nagar et al <sup>16</sup>	8.6
Patra et al	22
Kaya et al	22.7
Chaudhari et al	23.15
Present study	5.7

**Table 2**



**Fig. 1: Showing unilateral double foramen transversarium (FT) in typical cervical vertebrae**



**Fig. 2: Showing unilateral double foramen transversarium (FT) in atypical cervical vertebrae**



**Fig. 3: Showing unilateral hour glass appearance in typical cervical vertebrae**



**Fig. 4: Showing left side double foramen transversarium (FT) and right side hour glass appearance in atypical cervical vertebrae**

**CONCLUSION:** The double FT was found in 12(=5.7%) vertebrae out of 210 vertebrae. The double foramen was by the addition of a small one behind the ordinary foramen in 0.6% vertebrae; whereas on one side, there was an hour-glass contraction marking off two foramina in 0.3% vertebrae. The incidence of unilateral duplication was higher than bilateral.

We know that the transverse foramina are unique to the cervical vertebrae and these foramina enclose and protect the vertebral artery; so the morphological knowledge of transverse foramina is clinically important to rule out any variation in the course of the vertebral artery, which is one of the important vessel to supply the brain. This will help to guide the radiologist and spine surgeon in making a diagnosis as well as surgeries of this region.

#### REFERENCES:

1. Standring S. The back, in: Susan standring, gray's anatomy. Churchill Livingstone Elsevier, London. 2008;40th Edition:718.
2. Kaya S, Yilmaz ND, Pusat S, et al. Double foramen transversarium variation in ancient byzantine cervical vertebrae: Preliminary report of an anthropological study. Turk Neurosurg 2011;21:534-8.
3. Taitz C, Nathan H, Arensburg B. Anatomical observations of the foramina transversaria. J Neurol Neurosurg Psychiatry 1978;41(2):170-6.
4. Chaudhari ML, Maheria PB, Bachuwar SP. Double foramen transversarium in cervical vertebra: Morphology and clinical importance. Indian Journal of Basic & Applied Medical Research September 2013;2(8):1084-1088.
5. Struthers J. On the variations of the vertebrae and ribs in man. J. Anat. Phys 1874;9:17-96.
6. Patra A, Kaur H, Chhabra U, et al. Double foramen transversarium in dried cervical vertebra: An osteological study with its clinical implications. Indian Journal of Oral Sciences Jan-Apr 2015;6(1):7-9.

7. Sharma A, Singh K, Gupta V, et al. Double foramen transversarium in cervical vertebra an osteological study. *J. Anat. Soc. India* 2010;59(2):229-231.
8. Rathnakar P, Remya K, Swathi B. Study of accessory foramen transversaria in cervical vertebrae. *Nitte Univ J Health Sci* 2013;3(4):97-9.
9. Katikireddi RS, Setty SN. A study of double foramen transversarium in dried cervical vertebra. *Int J Health Sci Res* 2014;4(1):59-61.
10. Agrawal D, Mohanty BB, Sethy S, et al. Variations in foramen transversarium: an osteological study in eastern India. *International Journal of Current Research* September 2012;4(9):120-122.
11. Murlimanju BV, Prabhu LV, Shilpa K, et al. Accessory transverse foramina in the cervical spine: Incidence, embryological basis, morphology and surgical importance. *Turk Neurosurg* 2011;21(3):384-7.
12. Shaarawy EA, Sabry SM, Gammaroy T, et al. Morphology and morphometry of the foramina transversaria of cervical vertebrae: A correlation with the position of the vertebral artery. *Egyptian J Med Sci* 2008;29:1133-64.
13. Riew K. Microscope assisted anterior cervical decompression and plating techniques for multilevel cervical spondylosis. *Oper Tech Orthop* 1988;8:22-33.
14. Das S., Suri R, Kapur V. Double Foramen Transversaria: An Osteological Study with Clinical Implications. *Int Med J.* 2005; 12:311-313.
15. Chandravadia L, Patel S, Goda J, Chavda V, Ruparelia S, Patel S. Double foramen transversarium in cervical vertebra: Morphology and clinical importance. *Int J Res Med.* 2013; 2:103-5.
16. Nagar Y, Taitz C, Reich R. What can we make of these fragments? Excavation at "Mamilla" Cave, Byzantine period, Jerusalem. *Int J Osteoarchaeol.*1999; 9:29-38.