

## Research Article

# Anatomical Variations in Foramen Transversarium

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### Abstract

**Objectives:** Foramen transversarium are located on the transverse process of cervical vertebrae and are the cardinal features of cervical vertebrae. These foramina are known to exhibit variations in size, shape and may be absent or duplicated. The objective of present study is to study the incidence and shape of accessory foramen transversarium in dried cervical vertebrae.

**Methods:** A total of 86 cervical vertebrae of unknown are analyzed to see the accessory foramen transversarium.

**Results:** In the examination performed in 86 cervical vertebrae, 15 (17.4%) double foramen transversarium and 14 (16.3%) asymmetric foramen transversarium variations were observed. In 11.6% of the cases, unilateral double foramen transversarium and 5.8% bilateral foramen transversarium were seen. The frequency of these variations was 10.5% in typical cervical vertebrae and 15.1% in atypical cervical vertebrae.

**Conclusion:** Knowledge of accessory foramen transversarium is important for clinicians because it may affect the course of vertebral vessels & nerves, which causes various symptoms to patients. These variations are important and helpful for anatomist, anthropologist, surgeons and radiologist.

**Keywords:** Cervical vertebrae, foramen transversarium, variations

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The foramen transversarium (FT) found in the processus transversarii of the cervicales vertebrae. These structures are crucial as inside them arteria vertebralis, vena vertebralis and sympathetic nerve fibers go.<sup>[1]</sup> The size, shape and number variations caused by the vertebral artery are common in the foramen transversariums for developmental reasons. These variations lead to various clinical symptoms.<sup>[2]</sup>

### Methods

86 cervical vertebrae available in Anatomy Laboratory of Medical Faculty are evaluated. We have observed three dif-

ferent variances related to the cervical vertebra collection performed. Variations in number and size were found in the foramen transversariums. They were bilateral, unilateral, and asymmetry.

### Results

Out of 86 cervical vertebrae 15 (%17.4) double foramen transversarium (Fig. 1) and 14 (%16.3) (Fig. 2) asymmetrical foramen transversarium variations were observed. Unilateral double foramen transversarium (Fig. 3) were existed in 11.6% cases while 5.8% cases showed bilateral double foramen transversarium (Fig. 4). The frequency of these varia-

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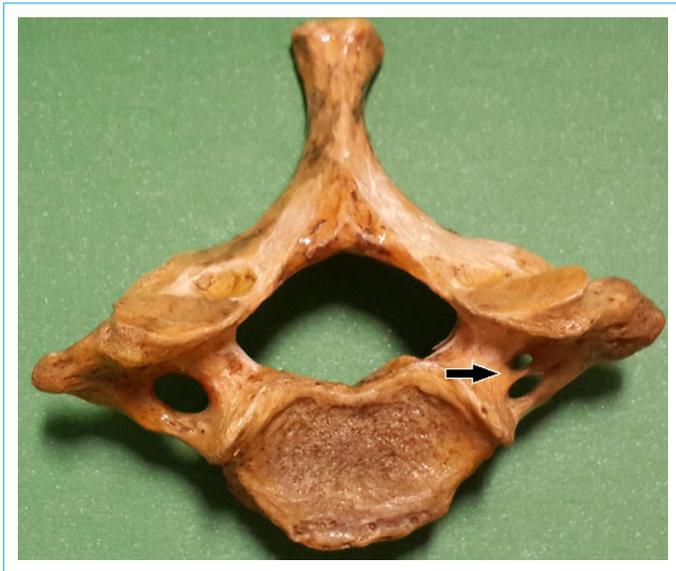
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**Figure 1.** Double foramen transversarium.



**Figure 3.** Unilateral double foramen transversarium.



**Figure 2.** Asymmetrical foramen transversarium.



**Figure 4.** Bilateral double foramen transversarium.

tions was 10.5% in typical cervical vertebrae, and 15.1% in atypical cervical vertebrae.

## Discussion

Many studies have been done by different authors on the variation of number, size & shape of FT in past.

Rathnakar et al.<sup>[3]</sup> found 5.7% vertebrae presented accessory foramen transversaria. 3.6% of these were unilateral, and 1.42% were bilateral. In 2005, Das S et al.<sup>[4]</sup> studied on 132 dried human cervical vertebrae & reported 1.5% double foramen transversarium. In another study examined 160 vertebrae, 2.5% unilateral FT, 1.25% bilateral FT and asymmetry was 0.625%.<sup>[5]</sup> Akhtar et al.<sup>[2]</sup> 174 vertebrae

examined 11.49% unilateral FT and 2.87% bilateral FT. Sharma et al.<sup>[6]</sup> observed accessory FT in 8% cases i.e. 16 among 200 cervical vertebrae, in which incidence of double FT was higher in C6 vertebra. Laxmi C et al.<sup>[7]</sup> on 210 cervical vertebrae, double FT was found only in 4.76%, in which 3.8% vertebrae have bilateral 0.95% vertebrae have unilateral double FT. In another study, 8% unilateral and 4% bilateral FT were detected.<sup>[8]</sup> A study conducted on 420 cadavers was detected in 5% bilateral and 8.81% in unilateral FT.<sup>[9]</sup> In a study of 31 cervical vertebra, 9.54% bilateral,

4.54% unilateral total 14.09% FT was found.<sup>[10]</sup>

In our study, 17.4% of the double FT, %16.3 asymmetry was found. 11.6% of these were uni lateral and 5.8% were bilateral.

Double foramen transversarium is also known as “foramen transversarium bipartitia”. Depending upon the course of vertebral artery it may be unilateral and bilateral. The tortuosity of vertebral artery along with embryological factors contribute important role in the development of FT bipartitia. But, the exact cause of double FT is not well known.<sup>[11]</sup>

Vertebrobasilar insufficiency is among one of them, which occurs as a result of compression of vertebral artery during neck movements, which is characterized by headache, migraine and fainting attack.<sup>[12]</sup>

Since, blood supply of inner ear also comes from vertebral and basilar arteries, so any spasm of these arteries due to irritation of sympathetic plexus, may causes labyrinthine or hearing disturbances along with neurological symptoms.<sup>[13]</sup>

Considering the anatomical details and variations of the foramen transversariums, we believe that it will be helpful for clinicians, radiologists and head and neck surgeons.

## Conclusion

Being aware of the variations of foramen transversarium is critical in characterization of vertebrobasilar insufficiency syndrome caused by compression of the anatomic components passing through. We also suggest that this would be useful in planning the cervical spine surgery and as well as avoiding postoperative complications.

## Disclosures

**Ethics Committee Approval:** The study was approved by the Local Ethics Committee.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – M.U.; Design – G.B.; Supervision – M.U.; Materials – G.B.; Data collection &/or processing – G.B.; Analysis and/or interpretation – İ.Z.; Literature search – S.A.; Writing – G.B.; Critical review – İ.Z.

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