

THE STUDY OF CERVICAL VERTEBRAE SHOWING VARIATIONAL PRESENTATION OF FORAMEN TRANSVERSARIUM

M.Y Dofe ^{*1}, A.P Kasote ², M.M Meshram ³.

^{*1}Assistant Professor, ² Associate Professor, ³ Professor and Head.

Department of Anatomy, Government Medical College, Nagpur, Maharashtra, India.

ABSTRACT

Foramen transversarium is formed by the vestigial costal element fused to the body and the true transverse process of the vertebra. Present study carried out on 60 cervical vertebrae that showing variations in the presentation of foramen transversarium. Among them, 25 vertebrae show double (accessory) foramen transversarium, 15 vertebrae having double bubble appearance (incomplete double foramen transversarium) and 20 vertebrae having asymmetrical foramen transversarium. The results of present study shows incidence of variations more common on right side as compare to left in which unilateral accessory foramen transversarium more common than bilateral, even incomplete double foramen transversarium and narrowing of foramen transversarium more common on right side. Conclusion from this study etiology of variation in foramen transversarium may be related with the variation in the course of vertebral artery due to development reason.

KEY WORDS: Foramen transversarium (FT), Cervical vertebrae, Vertebral artery.

Address for Correspondence: Dr Madhuri Yeshwant Dofe, Assistant Professor, Dept. of Anatomy, Govt. Medical College, Nagpur, Maharashtra, India. **E-Mail:** madhuridofe@gmail.com

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INTRODUCTION

The cervical vertebrae are identified by the presence of foramen transversarium (FT) in the transverse processes. This foramen transversarium is formed by the vestigial costal element fused to the body and the true transverse process of the vertebra. During the formation of foramen transversarium. The vertebral vessels and nervous plexus are caught between these two bony parts and closed laterally by the costotransvers bar, (thin plate of bone) that connect the rib element to the original transverse process [1].

The vertebral arteries constitute one of the important vascular components of the cervical region of the spinal column that ascend parallel

to the spines through the transverse foramina of the upper six cervical vertebrae along with vertebral vein and sympathetic fibers from inferior cervical ganglion and they supply the cervical part of spinal cord, spinal ganglions, meninges and duramater in the posterior cranial fossa. C7 vertebra transmits only vertebral vein. It was reported that this artery enters the foramen transversarium of vertebra at C6 in 88% of cases, and C7 and C5 in only 5% and 7% of cases [2]. For the formation of the foramen transversarium, vertebral artery is responsible.

Double foramen transversarium, incomplete double foramen transversarium and asymmetrical foramen transversarium are 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 headache, migraine, fainting attack and hearing problem due to compression of vertebral artery [3]. Clinically this type of variations is important for the radiologist while doing computed tomographic and MRI for reporting. Variations of foramina transversaria is also important for surgeon during posterior cervical surgery [4].

Objective of our study was to study the morphology of variations of foramen transversarium and to calculate its incidence. So for this study the foramina were macro-scopically analysed and the incidence of variations of foramen transvesarium was calculated.

MATERIALS AND METHODS



Typical vertebrae [(Unilateral double FT(right)]
Accessory foramen posteriorly



(Atypical C7 vertebrae incomplete or double bubble appearance of FT)



(Bilateral Foramen transversarium in C7 vertebrae)



Typical cervical vertebrae (narrow FT on right side)



(Bilateral FT –accessory FT, located posteriorly, in typical vertebrae)



Atypical cervical C7 vertebrae (narrow FT on left side)



Atypical vertebrae C7 [Unilateral double FT(right)]
Accessory foramen posteriorly

This study was conducted using 60 dried human cervical vertebrae that showing variations in foramen transversarium among them 25 vertebrae having double foramen transversarium, 20 vertebrae asymmetrical foramen transversarium and 15 vertebrae showing double bubble appearance of foramen transversarium all these vertebrae obtained from Department of Anatomy, Government Medical College, Nagpur . Each cervical vertebra was examined macroscopically for the presence of the double foramen transversarium either unilateral or bilateral presentation ,there double bubble appearance and asymetry of foramen transversarium. In cases of double Foramen transversarium larger foramen consider as main FT and smaller Foramen consider as accessory FT. Defective bones were excluded from the study. Vertebrae having double FT , asymmetric FT and incomplete double foramen transversarium were shown in figure (1) and results of incidence shown in table 1,2 and 3.

Table 1: Showing the frequency of incidence of accessory foramen transversarium.

Double foramen transversarium 25 cases				
		Right	Left	% of incidence(Anterior &Posterior location)
		Unilateral (15 cases) [Typical=6, Atypical=9]		
Anteriorly	2		-	13.30%
Posteriorly	10		3	86.60%
Equal size	-		-	
% of incidence	80%		20%	
Bilateral (10) [Typical=6, Atypical=4]		Right	Left	
	Anteriorly	0	1	10%
	Posteriorly	8	8	80%
	Equal size	1	-	10%

Table 1 shows incidences of accessory foramen transversarium more common unilaterally on right side as compare to left with increasing frequency of posterior location of accessory foramen transversarium in both unilateral and bilateral presentation.

Table 2: Showing the frequency of incidences of Incomplete or double bubble appearance of foramen transversarium (FT).

Incomplete or double bubble appearance FT- 15cases		
	Right	Left
Typical cervical vertebrae (10 cases)	7	3
Atypical cervical Vertebrae (5 cases, all C-7)	4	1
% of incidence	73%	27%

Table 2 shows incidence of incomplete or double bubble appearance of foramen transversarium more common on right side than left side.

Table 3: Showing the frequency of incidences of asymmetrical foramen transarvarium (FT).

Asymmetrical foramen transarsarium (20 cases)		
	Right (narrow)	Left (narrow)
Typical cervical Vertebrae (12 cases)	9	3
Atypical cervical Vertebrae (8 cases) [C-7=6 , C-1=2]	4	4
% of incidence	65%	35%

DISCUSSION

Various studies has been done on morphology of foramen transversarium. Murlimanju et al, done study on 363 vertebrae, observed six vertebrae (1.6%) having accessory foramen. Among them five (1.4%) had double foramen and only one (0.3%) had three foramen [5]. While Sharma et al studied 200 cervical vertebrae and observed accessory foramen in 16 vertebrae and found incidence of accessory foramen was higher in c6 vertebrae [6]. Wysochiet et al. done study on morphological variants of 100 cervical vertebrae and they also found the divided foramen more commonly at c6(4.5-6%) [7].

In our study in 25 cases of double foramen transversarium , we also observed unilateral presentation of accessory foramen more common than bilateral and accessory foramen more commonly present posterior to main foramen in both unilateral and bilateral condition.

Stopford (1916) and Hardesty et al. (1963) have discussed the variability of the size of vertebral arteries and Epstein (1969) found that the arteries of the left side bigger than those of right side [8], and stated that bigger size of left vertebral artery may be possible reason for generally larger left foramen transversarium than right foramen transversarium.

In our study we also found that larger size of left foramen transversarium than right side.

Kovac (1955), Sheehan etal (1960) stated that impingement of osteophytes from uncinat process and articular process of cervical

vertebrae also responsible for narrowing of foramen transversarium and compression of vertebral artery or irritation of the surrounding sympathetic plexus [9].

Embryological development of vertebral artery may be closely related with development of these variations. As vertebral artery is developed from the fusion of longitudinal anastomosis that link the cervical intersegmental arteries, which branch off from the primitive dorsal aorta. These intersegmental arteries eventually regress, except for the seventh artery, which forms the proximal portion of the subclavian artery, including the beginning of the vertebral artery [10]. The duplication of vertebral artery is thought to represent the failure of controlled regression of two intersegmental arteries and a segment of the primitive dorsal aorta. Bilateral occurrence of these failures is the etiology behind bilateral.

It can be also assumed that variations in the presence and course of the vertebral vessels will manifest as variant foramen transversarium. In contrast, variations of the foramen transversarium can be useful in estimating the variations of the vessels. An absence of foramen transversarium could mean absent vertebral artery. While the narrowing of the foramina indicates narrowness of the vessels and so on [11]. But Epstein (1969) in their study also observed that vertebral artery run along the transverse process not through foramen transversarium and in double foramen transversarium one of the foramen may be occupied by the artery and other by vein or it may be occupied by branches of both vessel.

The morphological knowledge of this type of variation is clinically important because the course of the vertebral artery may be affected under such condition. The compression of artery may lead to neurological symptoms like headache, migraine, fainting attack and 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 for reporting. Our study will provide further information on incidence and morphological basis of foramina transversarium.

CONCLUSION

In the present study we observed that incidences of variations in foramen transversarium like double foramen transversarium, double bubble appearance of foramen transversarium and narrowing of foramen transversarium which is more common on right side and in cases of cervical vertebrae having double foramen transversarium the accessory foramen is mainly present posterior to main foramen. The morphological knowledge of this type of variation is also important clinically because the course of the vertebral artery may be distorted under such variant condition of foramen transversarium. From this study we draw the conclusion etiology of variation in foramen transversarium may be related with the variation in the course of vertebral artery and development reason.

Conflicts of Interests: None

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