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Accessory Foramen Transversarium in Cervical Vertebrae- An Osteological Study

*Dr.P.Prabavathi.MD
Senior Assistant Professor In Anatomy,
Department Of Anatomy,Government Mohan Kumaramangalam Medical College,Salem.
*Corresponding Author: *Dr.P.Prabavathi.MD*

Abstract:
Objective: *The present study was conducted to find the incidence of Accessory foramen transversarium in cervical vertebrae and its clinical implications.*
Methodology: *210 cervical vertebrae were studied. All broken and damaged vertebrae were excluded. Number of accessory foramen was calculated.*
Results: *Out of 210 cervical vertebrae 22(10.5%) vertebrae had Accessory foramen transversarium. Unilateral foramen was present in 10(4.8%) vertebrae and bilateral was present in 12(5.7%) vertebrae.*
CONCLUSION: *Anatomical knowledge from this study will be helpful for the vascular and spine surgeons in preparation, planning and for preventing injury to the vertebral vessels during cervical surgical procedures*.
Keywords: *Foramen transversarium , Cervical vertebrae, Vertebral artery, Accessory foramen transversarium- Unilateral, Bilateral.*

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I. Introduction

The presence of foramen transversarium differentiates cervical vertebrae from other vertebrae1. This foramen transversarium is formed by the vestigial costal element fused to the body and the transverse process of 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 costotransverse bar that connects the rib element to the original transverse process2. An Accessory foramen transversarium is seen smaller in size than the primary foramen, generally found in sixth cervical vertebra and lies frequently in the adjacent vertebra3.

The cervical skeleton is also a bony framework for the vertebral arteries in their course from the aortic arch to the cranial fossa. As a result of the large number of tasks performed by this part of skeleton, any disorder affecting it may lead to significantly lowering the quality of life4, 5. Variation in the number and size of foramen transversarium of cervical vertebrae may result in headache, migraine and fainting attacks due to compression of vertebral artery. The vertebral vessels in such situations may give rise to vascular insufficiency6. The aim of this study was to find the incidence of Accessory foramen transversarium in cervical vertebrae.

II. Materials And Methods

210 dried cervical vertebrae of human were taken for study of number of Accessory foramen transversarium. Among these 40 were C1 and C2 vertebrae, 120 were C3 –C6 vertebrae and 50 were C7 vertebrae. The cervical vertebrae were collected from department of Anatomy, Government Mohan Kumaramangalam Medical College,Salem. During this study all broken, damaged cervical vertebrae were excluded.Presence of Unilateral and Bilateral Accessory foramen transversarium were noticed and photographs were taken.

III. Results

The present study was done to find the presence of Accessory foramen transversarium in 40 numbers of C1 and C2 vertebrae, 120 numbers of C3 –C6 vertebrae and 50 numbers of C7 vertebrae. Unilateral and bilateral Accessory foramen transversarium were calculated.

C1 and C2 vertebrae:
No Accessory foramen transversarium was found in C1 and C2 vertebrae.
C3 –C6 vertebrae:
Among 120 numbers of C3 –C6 vertebrae, 7(5.8%) were found to have Unilateral Accessory foramen transversarium. In these 7 vertebrae, 4 (57.1%) were on right side and 3 (42.8%) were on left side (Fig-1).

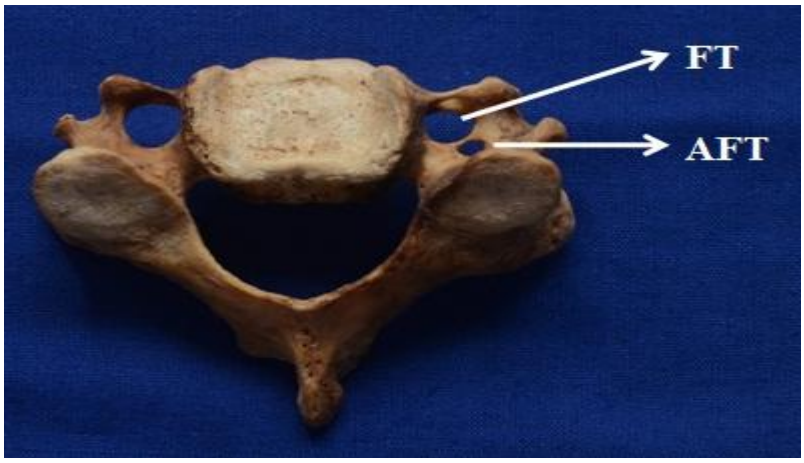

Fig-1: Unilateral Accessory Foramen Transversarium in C3 –C6 Vertebrae.

FT- Foramen Transversarium, AFT -Accessory Foramen Transversarium. Among 120 numbers of C3 –C6 vertebrae, 8(6.6%) were found to have Bilateral Accessory foramen transversarium.(Fig-2)

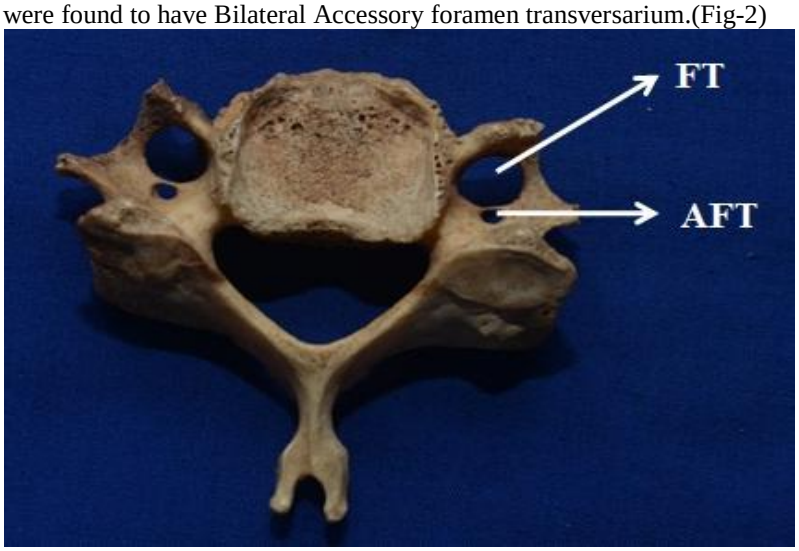

Fig-2: Bilateral Accessory Foramen Transversarium in C3 –C6 vertebrae.
FT- Foramen Transversarium, AFT -Accessory Foramen Transversarium.

C7 vertebrae:

Out of 50 numbers of C7 vertebrae, 7 (14%) had Accessory foramen transversarium. In these 7 vertebrae, 3 (6%) had Unilateral Accessory foramen transversarium. Among these 3, one (33.3%) vertebra had Accessory foramen transversarium on Right side, 2 (66.6%) vertebrae on Left side. (Fig-3)

Fig-3: Unilateral Accessory Foramen Transversarium in C7 vertebrae.

FT- Foramen Transversarium, AFT -Accessory Foramen Transversarium.

4 (8%) vertebrae had Bilateral Accessory foramen transversarium among 50 numbers of C7 vertebrae. (Fig-4)

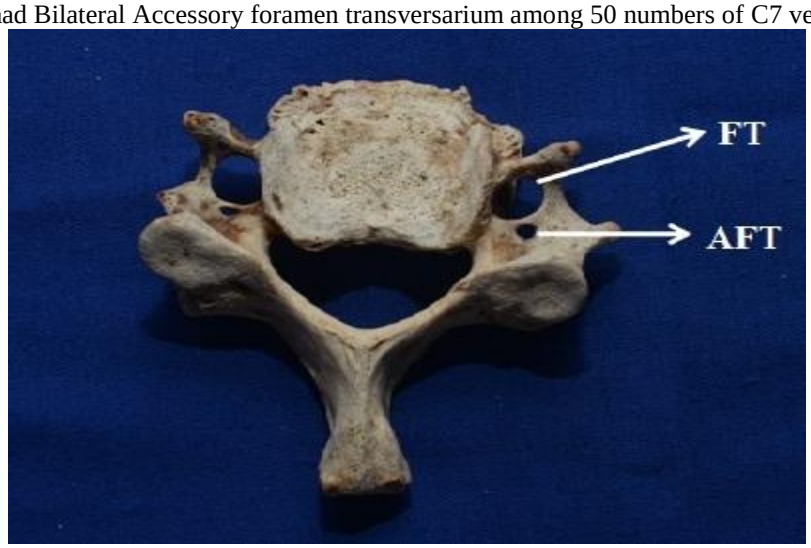

Fig-4: Bilateral Accessory Foramen Transversarium in C7 vertebrae.
FT- Foramen Transversarium, AFT -Accessory Foramen Transversarium.

IV. Discussion

Various studies were there on the presence of Accessory foramen transversarium (Table.1). Our present study (Table.2) was done to find the incidence of Accessory foramen transversarium and its clinical importance.

S. No	Authors	Unilateral Aft		Bilateral Aft
		Right	Left	
1	Archana Sharma Et Al 2010	7		9
2	Murlimanju Et Al 2011	4	1	1
3	Pretty Rathnakar 2013	5		2
4	Rekha Et Al 2014	3	2	1
5	Gyan Prakash Mishra 2014	10		18
6	Nilima Patil Et Al – July 2014	6		4
7	Shital T Shah Dec 2014	12	8	
8	M.Y. Dofe 2015	12	3	10
9	Subash M. Gujar 2015	27	14	
10	Poonam Varma 2016	3		13
11	Apurva Patra – April 2016	16		17
12	Snobar Gul 2017	2	3	4

Table 1: Incidence of AFT in various studies. (AFT-Accessory Foramen Transversarium)

Vertebrae	Unilateral Aft			Bilateral Aft
	Right	Left	Total	
C1 -C2	0	0	0	0
C3- C6	4	3	7	8
C7	1	2	3	4

Table 2: Incidence of AFT in present study. (AFT-Accessory Foramen Transversarium)

Archana et al (2010)7 found 7 Unilateral and 9 Bilateral Accessory foramen transversarium. Murlimanju et al (2011) 8found 4 right sided and one left sided Unilateral Accessory foramen transversarium. Bilateral Accessory foramen transversarium was present in one vertebra. It was totally about 1.6%. But in our present study Bilateral Accessory foramen transversarium was found 6.6% in C3–C6 vertebrae and 6% in C7 vertebrae. Their study stated that Unilateral presence of Accessory foramen transversarium was more common than Bilateral foramen. But in our study Bilateral was more than Unilateral foramen.In Pretty Rathnakar et al (2013)9 and Rekha et al (2014)10 studies were found that Unilateral foramen was more than Bilateral foramen. Our present study was not correlated with this one. Gyan Prakash Mishra et al (2014)11 stated that Bilateral (21) presence was more than Unilteral (10) foramina which correlated with our study. Nilima Patil et al (2014)12, Shital.T.Shah(2014)13, M.Y.Dofe(2015)14, Snobar Gul(2017)15 and Subash M.Gujal(2015)16 studies were found that Unilateral foramina were more than Bilateral presence of Accessory foramen transversarium. But in our study among 120 C3 –C6 vertebrae and 50 C7 vertebrae, we found Bilateral presence of Accessory foramen

transversarium was more common than Unilateral presence of Accessory foramen transversarium which did not correlate with these studies.

In Poonam Varma(2016)17 and Aporva Patra (2016)18 studies, Bilateral foramina were more than Unilateral foramina. This study correlated with our present study. In our present study incidence of Accessory foramen transversarium was more common Bilaterally which correlates with some of the above studies.

V. Conclusion

Anatomical knowledge of variations of cervical vertebra like Accessory foramen transversarium is clinically more important since their variations may endanger during surgeries of Cervical region. The knowledge of this study will be helpful for Neurosurgeons and Radiologist who interprets CT, MRI etc.

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