

Accessory Foramen Transversarium an Osteological Study and Its Clinical Correlation

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ABSTRACT

Introduction: Foramen transversarium is a characteristic feature of Cervical vertebrae. This foramen transmits vertebral artery, vein and sympathetic fibers. The presence of accessory foramen transversarium may affect the course of these structures resulting in diverse clinical presentations ranging from headache to disturbances in equilibrium – vertebrobasilar insufficiency. Thus the knowledge of accessory foramen transversarium is essential for Neurologists, Neurosurgeons, Orthopaedicians and radiologists.

Material and Methods: Hundred adult Cervical vertebrae were taken for this study. Deformed and damaged cervical vertebrae were excluded from this study.

Results: Accessory foramen transversarium were found in 9 cervical vertebrae. Out of these in 5 cervical vertebrae accessory foramen transversarium was present unilaterally, in 3 vertebrae on left side and in case of 2 vertebrae on right side. Bilateral presence of foramen transversarium was observed in 4 vertebrae.

Conclusion: Unilateral Presence of accessory foramen transversarium is more common (5%) than bilateral (4%). The left sided accessory foramen transversarium are more frequent (3%) than the right sided (2%). Absent foramen Transversarium is rare. In our series of 100 cervical vertebrae we did not find it.

Keywords: Accessory Foramen transversarium, Typical cervical vertebra, Vertebral artery.

INTRODUCTION

The cervical vertebrae are characterized and distinguished from other vertebrae by the presence of foramen transversarium in each transverse process. This foramen transmits vertebral artery¹ vein and sympathetic nerves (a branch from the cervicothoracic ganglion) in all cervical vertebrae except seventh cervical which transmits only vertebral vein. The foramen transversarium is bounded anteriorly and posteriorly by anterior and posterior roots respectively. The lateral ends of anterior and posterior root are connected by costotransverse bar or intertubercular lamellae.² Sharma et al³, reported that vertebral foramen is at times divided into anterior (larger) and posterior (smaller) parts by a fibrous or bony bridge. Accessory vertebral foramen is the smaller posterior part of foramen transversarium, the larger anterior part encloses the artery and the smaller posterior part encloses the vertebral nerve and vertebral vein. An accessory foramen transversarium is commonly found in the sixth cervical vertebra and less frequently in the other vertebrae.⁴ Variations in number, size, shape are reported in the available literature.⁵ Very rarely cervical vertebra may be without foramen transversarium. These variations of foramen transversarium in size, shape have embryological basis or may be related to the course of the vertebral artery.⁵ Kaya et al⁶ reports that these variations in the number and size of cervical foramen transversarium can lead to symptoms like

headache, migraine and fainting attacks which may be due to the compression of vertebral artery. Keeping in view the diverse Clinical presentations due to accessory foramen, a thorough knowledge of these variations is necessary for General Practitioners, Neurologists, Cardiologist and Radiologists who are interpreting X-rays and CT scans.

The present study was aimed to find out the incidence of accessory foramen transversarium and compare it with earlier studies, to report and compare the incidence of unilateral and bilateral presence of accessory foramen transversarium and to find out incidence of absent foramen transversarium.

MATERIAL AND METHODS

The present study was carried out in the post graduate department of Anatomy at Government Medical College Karannagar Srinagar Kashmir, India after ethical approval. Hundred adult typical cervical vertebrae were taken for this study. Deformed and damaged cervical vertebrae were excluded from this study. These vertebrae were observed macroscopically for presence or absence of foramen transversarium. Also special attention was given to find out presence of unilateral or bilateral accessory foramen transversarium in these vertebrae.

STATISTICAL ANALYSIS-

Descriptive statistics like mean and percentages were used for the analysis with the help of Microsoft Office 2007.

RESULTS

Out of 100 cervical vertebrae, Accessory foramen transversarium was found in 9 (9%). Bilateral presence of accessory foramen transversarium was observed in 4 cervical vertebrae (4%) as shown in figure 1. Seven out of 8 accessory foramen transversarium were present posterior to the foramen transversarium. Only in one cervical vertebra accessory foramen transversarium was present anterior to the foramen transversarium. Absent foramen transversarium was found in none of these vertebrae.

In 5 cervical vertebrae accessory foramen transversarium was present unilaterally (5%) as shown in figure 2, in 3 cervical

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vertebrae (3%) on left side and in case of 2 vertebrae (2%) on right side.

DISCUSSION

Foramen transversarium which is a characteristic feature of all cervical vertebrae transmits vertebral artery (only in upper six), vertebral vein and sympathetic plexus. The foramen transversarium is bounded anteriorly and posteriorly by anterior and posterior roots respectively.⁷ The lateral ends of these roots are bound by costotransverse bar or intertubercular lamella. Junctions of anterior and posterior roots with the costotransverse bar are marked by anterior and posterior tubercles respectively. The anterior root, anteriortubercle, costotransversebar, Posterior tubercle and lateral part of posterior root represent the costal element while the rest (medial part of posterior root represents transverse element of developing vertebrae.⁷ The foramen transversarium is formed by the vestigial costal element fused to the body and true transverse process of the vertebra.⁸ It is closed laterally by the costotransverse bar.⁹ The formation of foramen transversarium results by the fusion of the costal element of developing cervical transverse processes with the transverse element of developing vertebra. During this interaction the vertebral vessels and nervous plexus are caught between these two bony parts. Thus the course of vertebral vessels determines the formation of the foramen transversarium, it is believed that variations in the course of the vertebral vessels results in variation of foramen transversarium and vice versa. So variations of the foramen transversarium are associated with the variations of the vertebral vessels. Absence of foramen transversarium may be associated with absence of the vertebral artery or the artery running along the transverse process and not through the foramen transversarium. Quite often foramen transversarium is divided into a larger anterior foramen which transmits vertebral artery and narrow posterior foramen (accessary) which transmits vertebral vein. But even in this situation the larger anterior foramen is narrower than foramen transversarium and is associated with narrowing of vertebral artery and its clinical consequences resembling clinically features of vertebrobasilar artery insufficiency. Thus foramen transversarium is formed by the vestigial costal element fused to the body and true transverse process of the vertebra (4). It is closed laterally by the costotransverse bar.(5)

Blood supply of inner ear is derived 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. Compression of vertebral artery during neck movements are characterized

by headache, migraine and fainting attacks. Therefore, a sound knowledge of these variations is very essential for radiologists and clinicians in interpretation of X-rays, CT and MRI scans. It is also important for orthopedic surgeon during posterior approaches of cervical spines. In our present study we found that accessory foramen transversarium were found in 9 percent of cervical vertebrae. Out of these in 5 cervical vertebrae accessory foramen transversarium was present unilaterally in 3 vertebrae on left side and in case of 2 vertebrae on right side. Bilateral presence of accessory foramen transversarium was observed in 4 vertebrae indicating that unilateral presence

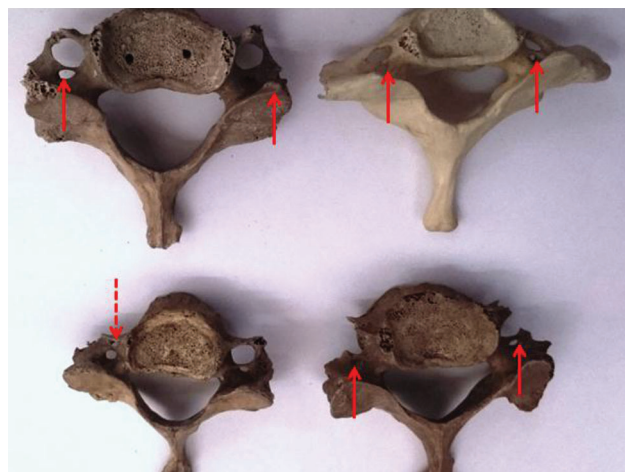


Figure-1: 4 vertebrae with bilateral accessory foramen transversarium (↑)

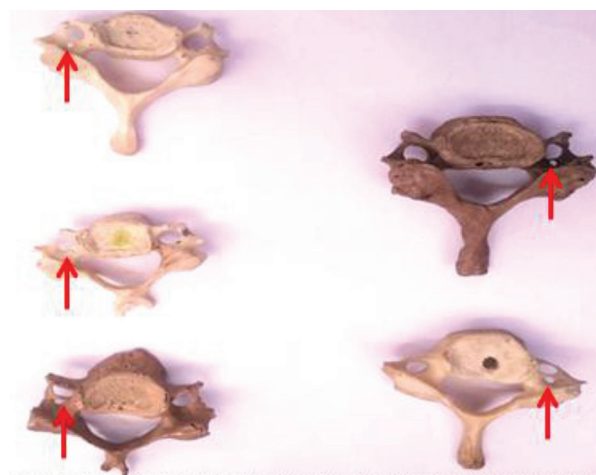


Figure-2: 5 cervical vertebrae with unilateral accessory (↑) foramen transversarium

Reference number	Authors/ year	Vertebrae Studied	FT present in	Bilateral	Unilateral
10	Pretty Rathnakar, Remya K and Swathi (2013)	140	8=5.7%	5 = 3.6%	2 = 1.42%
11.	Kalpna Ramachandran, Parvathavarthine Chetty Ravikumar, Mahima Sophia Manavalan (2014)	120	19=15.8%	10=8.3%	9=7.5%
12.	Bindu Aggarwal and Madhur Gupta (2014)	58	19= 32.75%	10=17.24%	09 = 15.51%
13.	Nilima P. Patil, S.S. Dhapate, SatishPorwal, V.B. Bhagwat (2014)	175	10 =5.71%	6= 3.42%	4=2.28%
14.	Apurba Patra, Harsimarjit Kaur, Usha Chhabra, SubhashKaushal, Upasna Kumar (2015)	150	33= 22%	16=10.67	17=11.33
15.	Md. Jawed Akhtar, Premjeet Kumar Madhukar, Shamir Rahman, NishantKashyap (2015)	174	25 =14.36%	20=11.49%	5=2.87%
	Present study	100	9 = 9%	5= 5%	4=4%

of accessory foramen transversarium are more common than bilateral and left sided accessory foramen transversarium are more frequent than the right sided. Results of studies conducted on accessory foramen transversarium are shown in given table. Earlier studies conducted by Researchers show that Accessory foramen transversarium are quite common. Its reported incidence in various studies¹⁰⁻¹⁵ ranges from 5.7 -32.75 percent. In our present study we reported an incidence of 9 percent in 100 cervical vertebrae. This incidence is higher than reported by earlier workers⁹ and lower than as reported by some other worker¹⁰⁻¹⁴ but one thing is common in all studies is that unilateral foramen transversarium is more common (3.6-17.24%) than bilateral (1.42-15.51%) foramen transversarium. In our present study the total incidence of accessory foramen transversarium was 9 percent (5% unilateral and 4% bilateral). Thus the observations made in our present study are concordant to those made by most of the earlier workers¹⁰⁻¹⁴

CONCLUSION

Accessory foramen transversarium is quite common. Its incidence reported in various studies conducted on dry cervical vertebrae ranges from 5.7 -32.75 percent. Accessory foramen transversarium may be present bilaterally in the same vertebra but its incidence is less common than unilateral accessory foramen transversarium. During development of cervical vertebra foramen transversarium results from fusion of costal element with the transverse element of developing vertebra entrapping vertebral artery, vein and sympathetic plexus. Any deviation in the development of foramen transversarium results in alteration in the course, relations and structure (stenosis and narrowing of lumen) of vertebral artery and its associated structures. Bilateral Stenosis of vertebral artery and irritations of sympathetic nerves around it may present with basivertebral insufficiency and symptoms like headache, vertigo and fainting attacks. Keeping in view the high incidence accessory foramen transversarium and associated alteration in the anatomy of vertebral artery and its clinical implications, a sound knowledge of it is essential for Clinicians and super specialists for accurate diagnosis and management of these disorders.

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