



Research Article

Morphological Study of Accessory Transverse Foramina in the Cervical Vertebrae

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ABSTRACT

Aim: To study the incidence of accessory transverse foramina in the cervical vertebrae and analyze them morphologically. **Material and Method:** The study included 675 human cervical vertebrae which were procured from the bone collections of the Department of Anatomy. The transverse foramina were observed macroscopically on both sides of all the vertebrae; the accessory foramina were noted. **Results:** Out of 675 Cervical vertebrae, only 94 (13.94%) showed accessory transverse foramina. Among them 93 (13.77%) had double foramina and only 1 (0.15%) vertebra (C1) showed three foramina on left side. Out of 94 vertebrae, 46 (6.81%) had double foramen on both sides and 48 (7.11%) had double foramen on one side (28 (4.15%) on the right side and 20 (2.96%) on the left side). No vertebrae showed the absence of transverse foramina. **Conclusion:** The present study observed the accessory transverse foramina in 13.94% of cases. The unilateral presence was more common than the bilateral. Accessory transverse foramina were more common in vertebrae prominens (C7). The surgical anatomy of these variations is important since the course of the vertebral artery may be distorted in such situations and also for radiologists for interpreting the computed tomogram and magnetic resonance image scans.

Keywords: Accessory transverse foramina, cervical vertebrae, Foramen transversarium

INTRODUCTION

There are seven cervical vertebrae (C1-C7). The C1 (atlas), C2 (axis) and C7 (vertebra prominens) vertebrae are atypical while C3-C6 vertebrae are typical. They are the smallest of the movable vertebrae, and are characterized by a foramen in each transverse process⁽¹⁻¹³⁾. The foramen transversarium present on the transverse process of cervical vertebrae are known to transmit the vertebral artery, vertebral veins and sympathetic nerves⁽⁶⁾. The vertebrae of the cervical part and the proximal thoracic part of the human vertebral column are the area undergoing the most intense transformation during phylogeny, leading to many anatomical variants^(4,9).

MATERIAL and METHOD

The study included 675 human cervical vertebrae (400 were typical cervical vertebra (C3, C4, C5 and C6), 100 atlas (C1), 100 axes (C2) and 75 vertebra prominens (C7)) which were procured from the bone collections of the Department of Anatomy. The age and sex of the bone were not known. The 24-gauge needle was used to check the patency of foramen transversarium. The defective and broken vertebrae were excluded from the study. The transverse foramen was observed macroscopically on both sides of all the vertebrae, the accessory foramina were noted and photographed. The data were collected on standardized collection sheet.

RESULTS

Out of 675 Cervical vertebrae, only 94 (13.94%) showed the formation of accessory foramina. Among them 93 (13.77%) had double foramina (fig: 1 & 2) and only 1 (0.15%) vertebra (C1) showed three foramina on left side (fig: 3). Out of 94

vertebrae, 46 (6.81%) had double foramen on both sides (fig:2) and 48 (7.11%) had double foramen on one side (fig:1) out of which 28 (4.15%) on the right side and 20 (2.96%) on the left side. Out of 100 atlas 1 had bilateral and 8 had unilateral accessory transverse foramina out of which 3 on right side and 5 on left side. Out of 100 axis vertebrae no vertebrae showed accessory foramina. Out of 400 typical cervical vertebrae (C3, C4, C5, C6) 60 had bilateral and 35 had unilateral accessory transverse foramina out of which 19 on right side and 6 on left side. Out of 75 vertebra prominence 25 had bilateral and 10 had unilateral accessory transverse foramina out of which 6 on right side and 9 on left side. Incidence of accessory foramen was 9% in C1, 15% in typical vertebrae and 30% in C7. No vertebrae showed the absence of transverse foramina.

TABLE:1 INCIDENCE OF ACCESSORY FORAMINA						
TYPE OF VERTEBRA	NO OF VERTEBRA EXAMINED	VERTEBRA WITH UNILATERAL ACCESSORY TRANSVERSE FORAMINA		VERTEBRA WITH BILATERAL ACCESSORY TRANSVERSE FORAMINA	TOTAL NO OF VERTEBRA WITH ACCESSORY TRANSVERSE FORAMINA	INCIDENCE IN (%)
		Right	Left			
ATLAS (C1)	100	3	5	1	9	9
AXIS (C2)	100	-	-	-	-	-
TYPICAL CERVICAL VERTEBRA (C3,C4, C5,C6)	400	19	6	35	60	15
VERTEBRA PROMINENCE (C7)	75	6	9	10	25	30
TOTAL	675	28	20	46	94	13.92

Figure 1: Accessory foramen transversarium in Typical Cervical Vertebrae



Figure 2: Accessory foramen transversarium in C7 Cervical Vertebrae



Figure 3: Accessory foramen transversarium in C1 Cervical Vertebrae



DISCUSSION

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 ⁽¹⁴⁾. The vertebral artery is developed from the fusion of longitudinal anastomoses that link the cervical intersegmental arteries, which branch off from the primitive dorsal aorta. The duplication 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 duplication of the vertebral artery ⁽⁷⁾. C. TAITZ et al (1978), studied 480 FT in dry cervical vertebrae of 36 spines. 34 showed doubling of foramina transversaria. 1 showed triple FT. In 3 C4 and 1 C6 vertebrae, the transverse process showed no FT ⁽¹⁴⁾. MS Jovanovic et al. (1990), studied 42 previously dried vertebral columns. In 3 instances a double foramen was found on the right side, and in 1 on the left side. A double foramen was found in 2 cases bilaterally ⁽¹⁰⁾. Jarosław Wysocki et al. (2003), studied 100 adult, human vertebral columns, In 1 case, concerning vertebra C7, the foramen of the transverse process was triplicated, and in 1 case it did not occur. The incidence of arcual foramen (accessory foramen in c1) is 13.8% ⁽⁸⁾. Akram Abood Jaffar et al. (2004), studied 30 sets of dry cervical vertebrae and found variation in number in lower cervical vertebrae. The axis did not show accessory foramina in the series observed. ⁽¹⁾ Das Srijit et al. (2005), studied 132 specimens, double FT was detected only in 2 different cervical vertebrae. ⁽⁶⁾ Archana Sharma et al. (2010), studied 200 typical cervical vertebrae and found 16 vertebrae having double foramen transversarium out of which 9 were bilateral and 7 were unilateral. ⁽²⁾ Serdar Kaya et al. (2011), studied double foramen transversarium variation in 22 ancient byzantine cervical vertebrae, double FT was found in 5 (22.7%) vertebrae, while unilateral in 3

(13.6%) and bilateral in 2 (9%).⁽¹²⁾ B.V. Murlimanju et al (2011), studied 363 specimens, only 6 (1.6%) vertebrae showed the accessory foramina. Among them 5 (1.4%) vertebra had double foramina and only 1 (0.3%) vertebra showed three foramina. Only 1 (0.3%) vertebrae showed the foramen on both sides and the remaining 5 (1.4%) had unilateral foramina. Among the unilateral cases, 4 were present on the right side and only 1 was on the left side. All the accessory foramina were observed in the lower vertebrae (C6 and C7). The accessory foramina transversaria were smaller than the regular foramina in all cases. There were no variations observed in the atlas and axis bones. No vertebrae showed absence of foramen transversarium.⁽³⁾ Subhash et al observe 150 cervical vertebrae, accessory foramen transversarium was found in 41 (27.33%) vertebrae. Among 41 vertebrae unilateral accessory foramen transversarium was found in 27 (18%) vertebrae and bilateral was found in 14 (9.33%) vertebrae⁽¹⁵⁾. Dr. Urmila patelia et al observes 440 cervical vertebrae, accessory foramen transversarium was found in 89 (20.22%) vertebrae. Among 89 vertebrae unilateral accessory foramen transversarium was found in 57 (64%) vertebrae and bilateral was found in 33 (37%) vertebrae⁽¹⁶⁾. The Present study observed the accessory transverse foramina in 13.94% of cases. The unilateral presence was more common than the bilateral. Accessory transverse foramina were more common in vertebrae prominens (C7) 30%. No accessory foramina were noted in axis vertebrae examined. No vertebrae showed the absence of transverse foramina.

CONCLUSION

Present study shows more frequency of transverse foramina in lower cervical vertebra. The variations in number and size of foramina transversaria of cervical spine may be one of the causes for complaints like headache, migraine, and fainting attacks and are due to the compression of vertebral artery.⁽⁵⁾ It should be remembered that the vertebral and basilar arteries contribute to the blood supply not only of the brain, but also the inner ear. Compression or spasm of the vertebral artery is manifested not only by neurological symptoms but also by hearing disturbances.⁽¹¹⁾ The anatomical details of foramen transversarium variations are important to the clinicians and radiologists in interpreting X-ray and CT scan. ⁽⁶⁾

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