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Original Research Article

AN OSTEOLOGICAL STUDY OF DOUBLE FORAMINA TRANSVERSARIA OF CERVICAL VERTEBRAE

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ABSTRACT

Study was planned with objective to observe and analyze the variations in foramen transversarium (FT) of cervical vertebrae. In this study a total of 420 cervical vertebrae belonging to 60 sets of skeletons were observed. Double FT was observed in 58 cervical vertebrae that make up 13.81 percent of all vertebrae studied. 5 percent vertebrae presented with bilateral FT whereas 8.81percent of all vertebrae had unilateral FT. Maximum number of double FT was observed in sixth cervical vertebrae. Percentage of double FT in 6th cervical vertebrae was 46.84 of all double FT. Out of 79 double FT, 42 (53.16 percent) were observed as bilateral occurrence. Knowledge of anatomical variations of foramen transverium is important in spine surgeries especially in posterior approaches.

KEY WORDS: Cervical Vertebrae, Double Foramen Transversarium, Vertebral Artery, Spine Surgery.

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INTRODUCTION

Foramen transversarium is exclusively present in cervical vertebrae. It is one of the most characteristic features of cervical vertebrae [1]. Transverse process of cervical vertebrae presents anterior and posterior bars ending laterally into anterior and posterior tubercles. Lateral to FT, anterior and posterior bars are connected by costo-transverse bars [2].

The FT transmits the vertebral artery, vertebral veins, and sympathetic nerves from inferior cervical ganglion. Knowledge of variations in FT is important for safety in posterior surgical approaches of the cervical spine [3-4].

MATERIALS AND METHODS

In present study 420 human dried cervical vertebrae from 60 different skeleton sets were included. The cervical bones were stored in dry boxes in skeleton collection of Department of Anatomy of University of Health Sciences, Rohtak. All skeletons were of adult age group and belonged to both sexes. All cervical vertebrae were observed for variations in number of foramina transversaria. Vertebrae having variations in foramina transversaria were photographed. Observations were entered in excel spreadsheets. The gross anatomical variations of these vertebrae were noted, tabulated

and analyzed.

RESULTS

In present study 60 percent spines showed at least one double FT (36 skeletons out of total 60). Out of total 420 cervical vertebrae 58 vertebrae showed unilateral or bilateral double FT. Out of vertebrae showing double FT, 21 vertebrae (5% of all cervical vertebrae) showed bilateral double FT whereas 37 vertebrae showed unilateral double FT (8.81% of all cervical vertebrae)

Fig. 1: Cervical vertebra showing bilateral double FT.

Fig. 2: Cervical vertebra showing unilateral double FT

Out of all cervical vertebrae included in study no double FT was observed in either first or second cervical vertebrae. However double FT were observed in all other cervical vertebrae. Double FT was observed in 58 cervical vertebrae that make up 13.81 percent of all vertebrae studied.

Proportion of double FT is more on right side than on left side. Maximum number of double FT is observed in sixth cervical vertebrae. Percentage of double (FT) in 6th cervical vertebrae was 46.84 of all double (FT) observed.

Table 1: Showing percentage of double cervical vertebrae in various cervical vertebrae.

cervical vertebrae	Right (percentage)	Left (percentage)	Total
first	0	0	0
second	0	0	0
third	3.8	3.8	7.59
four	5.06	6.32	11.39
five	12.66	6.33	18.99
six	27.85	18.99	46.84
seven	7.59	7.6	15.19
percentage	56.96	43.04	100

DISCUSSION

The observation that 60 percent of spines show at least one double FT shows that occurrence of double FT is very common. Usually a fibrous band separates vertebral artery from vertebral vein in foramen transversarium [5]. Tondury described a smaller posterior foramen due to division of the foramen transversarium a bony bridge [6]. In the present study percentage of cervical vertebrae showing double (FT) is 13.81 percent. Results from studies from north and west India show a percentage of about 22 percent. In these studies authors have not included atlas and axis vertebrae. If the atlas and axis vertebrae are excluded from sample of present study then this percentage rise to about 22 percent which is also observed in studies done in and west India.

Table 2: Prevalence of different double Double FT(%) in different studies.

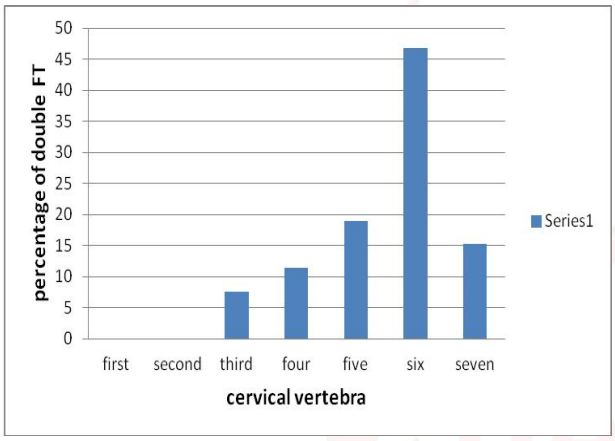
Authors	Sample size	Unilateral Double FT (%)	Bilateral Double FT (%)	Total Double FT (%)
Kaya et al [5]	22	13.63	9.09	22.72
Katikireddi and Setty [7]	100	2	1	3
Chaudhari et al [8]	133	14.73	8.42	23.15
Rathnakar et al [9]	140	3.6	1.42	5.02
Chandravadiya et al [10]	140	3.8	0.95	4.75
Apurba Patra [1]	150	10.66	11.33	21.99
Sharma et al [11]	200	3.5	4.5	8
Murlimanju et al [12]	363	1.4	0.3	1.7
Taitz et al [13]	480	-	-	7
Present Study including atlas and axis	420	8.81	5	13.81
Present Study excluding atlas and axis	300	12.33	8.81	21.14

El Shaarway et al observed that accessory foramen transversaria were more common in lower cervical vertebrae mostly in C6 [14]. Present study unambiguously supports this observation of El Shaarway as in this study about 48 percent

of foramina transversaria are present in sixth cervical vertebrae (Figure I). Double FT could mean duplication of vertebral artery [14].

However; this hypothesis doesn't seem to have much evidence in literature. Further radiological studies can help in throwing light on this subject. Variations of the FT can be useful for estimating changes or variations of the vessels and accompanying nerve structures [5].

Fig. 3: Percentage distribution of double FT among cervical vertebrae.



CONCLUSION

In present study about 13.8 percent of cervical vertebrae have been observed to have double foramina transversaria. However, if the atlas and axis vertebrae are also excluded from sample then this percentage rise to about 22 percent which is also observed in studies done in and west India.

Conflicts of Interests: None

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