



## Study of pleurapophyseal malformation of human atlas vertebrae and its clinical significance in Jharkhand region

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**ABSTRACT**

**Aim:** To find the incidence and clinical correlation of pleurapophyseal malformation in atlas vertebrae.

**Objective:** To understand the variations of foramen transversarium in the atlas vertebrae in the form of absence of costal element as an anatomic entity for the knowledge of clinicians and surgeons.

**Material and methods:** 48 human atlas vertebrae of unknown age and sex were examined for the presence of pleurapophyseal malformation. The samples were obtained from the Department of Anatomy, RIMS, Ranchi.

**Results:** In the present study, out of 48 atlas vertebrae, two vertebrae (4.1%) were noted to have absence of costal element bilaterally.

**Conclusion:** The knowledge of variation in foramen transversium of atlas vertebrae is of clinical importance as the second part of vertebral artery passing through this foramen may be injured while operating at the craniovertebral region.

**KEYWORDS :** atlas vertebrae, pleurapophyseal malformation, foramen transversarium

**INTRODUCTION:**

The atlas vertebra lacks a vertebral body and has a ring like shape. It has a short anterior arch and a long posterior arch with bulky lateral masses containing superior and inferior articular facets. The transverse processes of atlas vertebrae are long and enclose the foramen transversarium by its anterior and posterior root [1]. Developmentally, in cases of cervical vertebrae, the pleurapophysis or costal element grows backwards to join the diapophysis or transverse element thereby enclosing a foramen called the foramen transversarium (FT). In atlas vertebrae, anterior tubercle in front of the lateral mass and the anterior bar represent the costal element; posterior bar represent the transverse element [1]. Pleurapophyseal malformation in the form of a defect, formed due to improper fusion of costal element with transverse element, may be present wherein the FT is bounded only posteriorly by the transverse element. So, there is a loss of bony protection of the vertebral artery which might compromise the blood flow during rotatory movements of the neck. Therefore the knowledge of pleurapophyseal malformation is important for neurologists, neurosurgeons and radiologists.

**MATERIAL AND METHODS:**

48 human atlas vertebrae of unknown age and sex from Jharkhand region were grossly studied. The specimens were fully dried and intact and were obtained from Department of Anatomy, RIMS. Each atlas vertebra was observed for the presence or absence of pleurapophyseal malformation and also noted whether this malformation was unilateral or bilateral.

**RESULTS:**

In the present study, out of 48 dried human atlas vertebrae, 2 cases (4.16%) of pleurapophyseal malformation were noted. The malformation in one case was found bilaterally with foramen transversarium being completely deficient anteriorly. The malformation in the second case was found bilaterally with FT being only partially deficient anteriorly.

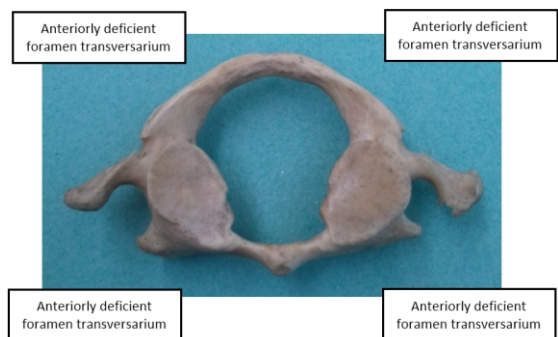
**Table 1: Table showing number and percentage of vertebrae with pleurapophyseal malformations.**

No. of atlas vertebrae studied	No. of vertebrae with deficient FT	Distribution of pleurapophyseal malformation		Percentage of incidence
		Bilateral	Unilateral	
48	2	2	0	4.16%

**Fig 1: Photograph of superior aspect of atlas vertebra showing pleurapophyseal malformation bilaterally (anteriorly deficient FT on both sides)**



**Fig 2: Photograph of inferior aspect of atlas vertebra showing pleurapophyseal malformation bilaterally**



**DISCUSSION:** Gray's anatomy describes the course of the second part of the vertebral artery as ascending through the transverse foramina of upper six cervical vertebrae along with vertebral venous plexus and sympathetic plexus [1].

Complete absence of the costal element leading to an open FT where it is only bounded posteriorly by the bony transverse element, exposes the vertebral artery and venous plexus.

Jaroslav Wysocki et al studied the anatomical variants of the cervical vertebrae in man and found the greatest variability in the first cervical vertebra. In their study on 100 first cervical vertebrae

(37 females and 63 males), they found 3 male vertebrae (2.7%) and 5 female vertebrae (6.7%) showing pleurapophyseal malformation in the form of anteriorly split foramen of the transverse process[2]. It was an effect of reduction of anterior lamina of the transverse process and never of the posterior lamina. Dhanraj Singh detected pleurapophyseal malformations in 12% cases out of 253 atlas vertebrae [3]. N. Vasudeva and R. Kumar presented a case report on absence of foramen transversarium in human atlas vertebra[4]. Qudusia Sultana et al found 5 cases out of 100 atlas vertebrae where pleurapophyseal malformation was found in 2 vertebrae unilaterally and in 3 vertebrae bilaterally[5]. Shaikh Jasmeen Vajir et al found 5% incidence of pleurapophyseal malformation [6]. Chauhan et al reported absence of costal element in 10% cases in their study[13]. In our study, we found 4.16% incidence of pleurapophyseal malformation in Jharkhand region. The occurrence of incomplete FT can be confused with fractures and other anomalies which should be known to Radiologists for accurate interpretation of radiographs and CT scans [2,10,11]. The vertebral artery may be dislodged and be prone to injury due to incomplete formation of FT.

### CONCLUSION:

The knowledge of variation of foramen transversarium in atlas vertebra in the form of absence of costal element is an anatomical entity of clinical importance, as the second part of vertebral artery passing through this foramen may be injured while operating at the craniovertebral region. Also, it is one of the proposed causative factor for cervicogenic headache.

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