

OSSIFIED ANTERIOR LONGITUDINAL LIGAMENT: A STUDY IN ADULT HUMAN DRY VERTEBRA IN CENTRAL INDIA

Ashita Kaore^{*1}, Ashish kamdi², M.P Fulpatil³.

^{*1} Assistant Professor, Department of Anatomy, Government Medical College, Nagpur, Maharashtra, India.

² Assistant Professor, Department of Anatomy, Chandulal Chandrakar Memorial Medical college, Durg, Chattisgarh, India.

³ Professor and Head, Department of Anatomy, Government Medical College, Nagpur, Maharashtra, India.

ABSTRACT

Introduction: The anterior longitudinal ligament is a broad and strong band of fibrous tissue that runs along the anterior surface of the bodies of the vertebra extending from the axis to the upper, pelvic surface of the sacrum.

Aim of the study: The present study was undertaken to evaluate the incidence of ossified anterior longitudinal ligament in adult dry human vertebra in central india.

Materials and Methods: This study was carried out on 50 sets of dry human vertebral columns irrespective of age and sex at Government medical college, Nagpur, Maharashtra, India.

Results: It was observed that out of 50 sets of vertebral columns, 8 (16%) vertebral columns showed ossification. Out of 8 vertebral columns, 2 (4 %) vertebral columns showed segmental type of ossification, 4(8%) vertebral columns showed continuous type of ossification and 3 (6 %) vertebral columns showed mixed type of ossification at different vertebral levels.

Conclusion: Ossification of anterior longitudinal ligament in vertebrae noted in this study may increase the stiffness of the backbone and the restriction of thoracic mobility for respiratory movements and may lead to development of pulmonary diseases. Such type of ossification in the lumbar region affects the biomechanics of the lumbar spine and results in low back pain, kyphosis, scoliosis. Ossification at the level of the 5th lumbar vertebra and sacrum may lead to increased risk for advanced disc degeneration or disc herniation above the vertebrae. Hence, knowledge of such abnormalities should be kept in mind to minimise serious complications in any surgical intervention or investigative procedures in the region.

KEY WORDS: Ossification, Anterior longitudinal Ligament, Vertebrae, Thorax mobility, Respiratory movements.

Address for Correspondence: Dr. Ashita Kaore, Assistant Professor, of Anatomy, Government Medical College, Nagpur, Maharashtra, India. Mobile No. +919096609763

E-Mail: kaoreashita@gmail.com

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INTRODUCTION

The anterior longitudinal ligament is a broad and strong band of fibrous tissue that runs along the anterior surface of the bodies of the vertebra

extending from the axis to the upper, pelvic surface of the sacrum. It is thicker in the thoracic than in the cervical and lumbar regions. The ligament is relatively thicker and narrower at the

vertebral level than at the level of vertebral symphyses. The longitudinal fibres are relatively adherent to the intervertebral discs, hyaline cartilage end plates and margins of adjacent vertebral bodies. At these vertebral levels, the ligamentous fibres blend with the subadjacent periosteum, perichondrium, and peripheral fibres of annulus fibrosus of intervertebral discs. Anterior longitudinal ligament prevents the hyperextension of the vertebral column [1-4].

Resnick et al and Resnick, Shaul and Robins coined the term diffuse idiopathic skeletal hyperostosis for Forestier's disease. A part of this entity is the ossification of the spinal ligaments. They defined diffuse idiopathic skeletal hyperostosis as showing calcification or ossification along the anterior to anterolateral aspect of contiguous vertebral bodies with relative preservation of the height of the intervertebral disc in the affected areas, distinguishing it from degenerative discogenic disease [5,6].

Disordered ossification or calcification of ligaments or cartilages may compress neurovascular structures and can cause serious implications in any surgical intervention in the region, and may lead to false neurological differential diagnosis [7,8].

Ossification of the anterior longitudinal ligament is radiologically classified as follows:

- I. Segmental type of ossification (partial or total ossification over a vertebral body without involving the disc space).
- II. Continuous type of ossification (Continuous ossification over many disc spaces as well as the vertebral body).
- III. Mixed type of ossification (combination of the segmental and continuous types) [9, 10].

Ossification of the anterior longitudinal ligament has not been widely described in the modern medical literature.

Accordingly, in the present study we aimed to evaluate the incidence of ossification of anterior longitudinal ligament in adult human vertebra as segmental or continuous or mixed type.

MATERIALS AND METHODS

The study was conducted in the department of Anatomy, Government Medical College, Nagpur.

The study was carried out on 50 sets of dry vertebral columns irrespective of age and sex at Government Medical College, Nagpur. The incidence of calcification and ossification of anterior longitudinal ligament in adult human vertebra was recorded, also it was noted whether ossification of anterior longitudinal ligament was segmental, continuous or mixed type.

RESULTS

Table 1: Showing different types of ossification of anterior longitudinal ligament at different vertebral levels.

Vertebral Level	Segmental type of ossification	Continuous type of ossification	Mixed type of ossification
Cervical (C)	-	-	-
Thoracic (T)		In 2 Vertebral Columns: i) T3 To T5 ii) T9 To T12 Vertebrae	In 1 Vertebral Column: T10 To T12
Lumbar (L)	In 1 Vertebral Column: L1 to L3	In 2 Vertebral Columns: i. L1 To L3. ii. L4, L5 and sacrum	In 2 Vertebral Columns: i. L1 To L3. ii. L4, L5 and sacrum

Fig. 1: Showing continuous types of ossification (Green arrow) of anterior longitudinal Ligament at lumbar level L1, L2, L3 vertebrae.

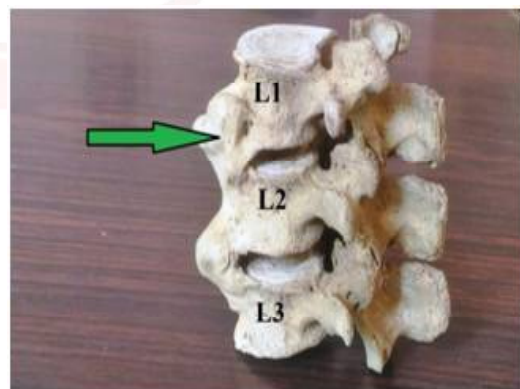


Fig. 2: Showing mixed type of ossification (Green arrow-continuous type, Yellow arrow – segmental type) of anterior longitudinal ligament at thoracic region- T10, T11 vertebrae and lumbar region L1, L2, L3 Vertebrae.

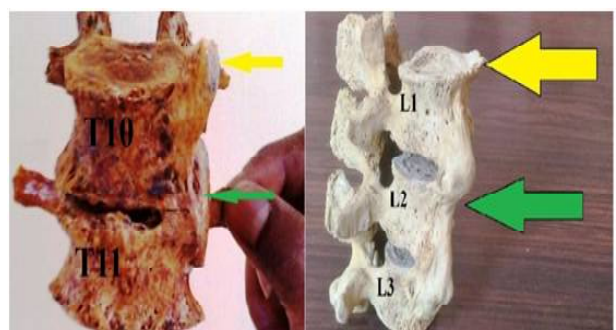


Fig. 3: Showing continuous type of ossified (green arrow) of anterior longitudinal ligament at L4,L5, sacral level.

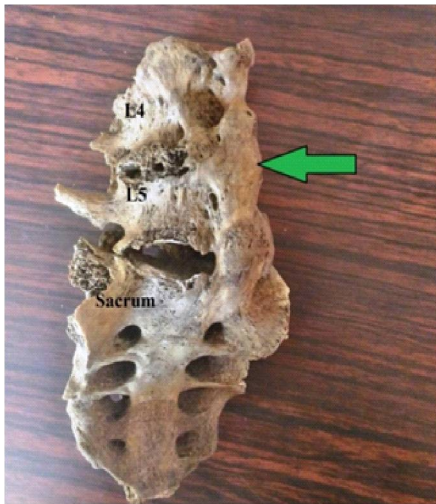


Fig. 4: Showing mixed type of ossification (green arrow- continuous type, Yellow arrow – segmental type) of anterior longitudinal ligament at L4,L5 sacral level.

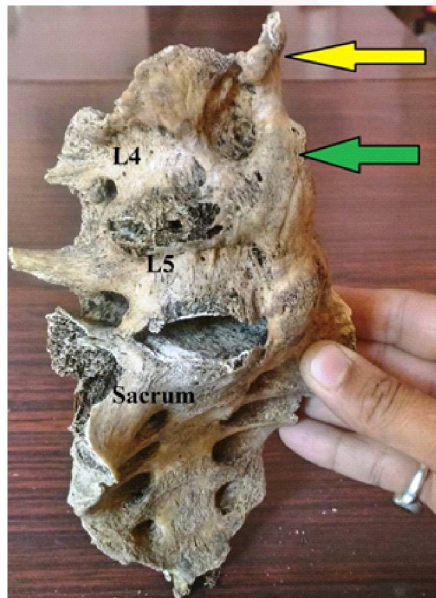
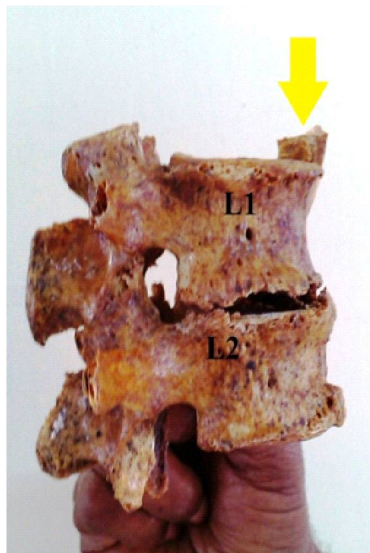


Fig. 5: Showing segmental type of ossification (Yellow arrow) of anterior longitudinal ligament at L1, L2 level.



It was observed that out of 50 sets of dry human vertebral columns 8 (16.00%) vertebral columns showed ossification of anterior longitudinal ligament [Table-1].

Out of 8 vertebral columns the following types of ossification of anterior longitudinal ligament were noted- [Table-1].

I. Segmental type of ossification {2(4.00%)}: [Fig-5].II. Continuous type of ossification {4 (8.00%)}: [Fig-1, 3].

III. Mixed type of ossification {3 (6.00%)}: [Fig- 2].

Maximum length (12.72 cm) of continuous type of ossified anterior longitudinal ligament was noted in one vertebral column. [Fig-1.] In all 8 cases , the intervertebral disc space was found to be maintained and zygoapophyseal joints were found to be free. The intervertebral foraminae and vertebral canal appeared normal.

DISCUSSION

Diffuse idiopathic skeletal hyperostosis (DISH), a condition characterized by calcification and ossification in the axial and peripheral enthesial locations, was first described by Forestier et al. in 1950 [11]. It is characterized by a tendency toward diffuse calcification and ossification of ligaments. The incidence of this disease is about 6–12 % [12] and shows a male predominance [13]. It is noted predominantly in elderly individuals usually after 50 years. But some had observed paediatric cases with ossification of anterior longitudinal ligament of cervical spine [14]. DISH commonly affects the anterior longitudinal ligament. Ossified anterior longitudinal ligament typically characterized by variable thickness and seems to be like candle wax dripping down the spine[15]. Suba Anathi K et al., [16] reported continuous type of ossification of the anterior longitudinal ligament in the cervical region [cervical vertebrae (C2 -C6)]. Kalyan Chakravarthi Kosuri et al [17] noted segmental and mixed type of ossification in the cervical region, where as in this study we did not find any case of ossified anterior longitudinal ligament in cervical region [Table 1].

In our study we found 2 cases of continuous type and 1 case of mixed type of ossification of anterior longitudinal ligament in the thoracic region. Such type of ossification of anterior

longitudinal ligament in the thoracic vertebrae [Table 1] noted in this study may increase the stiffness of the backbone and the restriction of thoracic mobility for respiratory movements and may lead to development of pulmonary diseases [17].

Ossification of anterior longitudinal ligament in the lumbar region affects the biomechanics of the lumbar spine and results in low back pain, kyphosis, scoliosis and Bechterew's disease (Ankylosing Spondylitis). Ossification of anterior longitudinal ligament at the level of the 5th lumbar vertebra and sacrum may lead to increased risk for advanced disc degeneration or disc herniation above the vertebrae [18]. One such continuous type of ossification of anterior longitudinal ligament in the region of L4, L5, sacrum was seen in our study.

Kalyan Chakravarthi Kosuri et al [17] noted a higher incidence of segmental type of (17.89%) whereas in our study we noted only 4% incidence of segmental type of ossification. In our study we noted maximum incidence, 8% of continuous type of ossification in the thoracic and lumbar region.

Increased tension upon certain fibers of the longitudinal ligaments [19], disordered pyrophosphate metabolism hypercalcemia may play a key role in the ossification of anterior longitudinal ligament.

Knowledge of such ossification is important not only for the orthopaedic surgeons but also vital for the clinical anatomist, Radiologists, Forensic experts, and morphologists.

CONCLUSION

Ossification of the Anterior longitudinal ligament in the vertebrae is one of the components of Diffuse Idiopathic Skeletal Hyperostosis (DISH) otherwise known as forestier's disease. Ossification of Anterior longitudinal ligament may increase the stiffness of the backbone and the restriction of thoracic mobility. It will affect the biomechanics of the lumbar spine and may result in low back pain, kyphosis. There is scarcity of data in Indian population, so this kind of study would be useful for orthopaedic surgeons, radiologists, forensic experts and morphologists to minimise serious complications

in any surgical intervention or investigative procedures in the region.

Conflicts of Interests: None

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