Original Research Paper

Volume-8 | Issue-7 | July-2018 | PRINT ISSN No 2249-555X

Anatomy

ABSENCE OF SPINOUS PROCESS, INFERIOR ARTICULAR FACETS AND LAMINAE ENCOUNTERED IN A FIFTH LUMBAR VERTEBRA OSTEOLOGY DEMONSTRATION: CASE REPORT

Dr. Prerna Jagdish* Assistant Professor, Department of Anatomy, KD Medical College, Mathura *Corresponding Author

Dr. Sumit Kumar Junior Resident III, Department of Radiodiagnosis, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry

Dr. R. K. Ashoka Professor & Head, Department of Anatomy, KD Medical College, Mathura

ABSTRACT There are total of five lumbar vertebrae. Out of five, four lumbar vertebrae show typical features. The fifth lumbar vertebra shows certain atypical features. Lumbar vertebrae are identified as having massive kidney-shaped bodies, superior and inferior articular facets, pedicles and thick and quadrangular spine. We observed a malformed lumbar vertebra in college bone bank during routine Osteology tutorials.

KEYWORDS : Fifth lumbar vertebra, articular facet, laminae, centrum

Introduction:
Of the total set of vertebrae in the vertebral column, there are five lumbar vertebrae in total. They are identified by the presence of massive, kidney shaped or reniform body. The transverse diameter of the vertebral body is greater than its anteroposterior diameter. Also, anterior surface of the vertebral body has a greater surface area than its posterior surface, creating a sharp lumbosacral angle. First four lumbar vertebrae are typical but the fifth lumbar vertebra is atypical. It is characterized by a thick and square spinous process, conical transverse processes and pedicles. Two articular processes, superior and inferior with respective articular facets are present. The superior facets are concave and are directed anteromedially whereas inferior facets are convex and face posterolaterally. Two processes, mamillary and accessory, are located at the roots of the transverse processes[1,2].

Relevant Embryology:
The vertebrae develop from sclerotome of paraxial mesoderm during the 4th week of gestation. The mesenchymal cells of the sclerotome migrate towards the notochord, around the neural tube and near the body wall. Each pair of sclerotome consists of a cranial, loosely arranged and a caudal, densely arranged mesenchyme. Re-segmentation occurs in the sclerotomes. The centrum of each vertebra develops from the adjacent halves of sclerotomes; formed from the cranial less dense halves of sclerotomes above with the dense ones of sclerotomes below[3]. This centrum serves as primordium of the vertebral body. Chondrification of mesenchyme present around the neural tube gives rise to future neural arch which creates the laminae, pedicles, articular processes, transverse processes and spinous process. By the 8th week of gestation, ossification begins in the neural arches. The vertebra, at the time of birth, comprises of three parts, a centrum and two halves of the neural arch/ vertebral arch. Between 3 to 5 years of postnatal life, these halves fuse with each other. With further developmental progression, all the three parts fuse and form a single vertebra[4,5].

Case Report:
During the routine medical undergraduate Osteology tutorial on lumbar vertebrae, in KD Medial College, Mathura, the fifth lumbar vertebrae was seen with absent spinous process, laminae and both inferior articular processes in the fifth lumbar vertebra. The bone was identified as the fifth lumbar vertebra by the attachment of the pyramidal transverse processes to the pedicles.

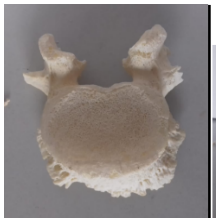

Figure I: Superior surface

Figure II: Anterior surface Figure

III: Posterior surface

The figures above depict the photographs of the reported fifth lumbar vertebra from superior, anterior and posterior view.

Discussion:
Conditions like spondylolisthesis, spondylolysis, spina bifida, hemi-vertebra and absence of the vertebral arch are associated with anomalous development of vertebrae. In the current report, the fifth lumbar vertebra was found deficient of spine, laminae and inferior articular processes. A fifth lumbar vertebra with similar findings was reported by Kumar and Kulkarni[6]. It is important to determine the type of malformation, the specific region of the spine where the malformation occurs and the resulting deformity when discussing relevant congenital abnormalities. Signals from the notochord induce a normal bony development and mesenchyme lays down a model for the development of bony structures. Therefore, an abnormal mesenchyme or an abnormal notochord or even genetic abnormalities affecting signaling can predispose to an abnormal development of the bony skeleton. The congenital anomalies of the spine can manifest as a direct result of one or a mixture of the aforementioned defects[7].

Failure of the fusion of the two halves of embryonic vertebral arch could lead to spina bifida, the most common neural arch defect. The type of spina bifida is determined by the pattern and interplay of involvement of the vertebral arch, meninges, spinal cord, and the overlying dermis. The spinal cord defect may present at any vertebral level with most common being the lumbosacral region. The lumbosacral region is the commonest site of neural tube and arch defects[3].

The vertebral body appeared shorter than the usually observed massive sized fifth lumbar vertebrae. To draw a comparison, the anterior and posterior heights of five fifth lumbar vertebrae with normal osteology were measured. The average anterior and posterior heights of the five fifth lumbar vertebral bodies were measured as 25.8 mm and 24.6 mm respectively. The anterior and posterior height of the reported vertebral body was measured as 20 mm and 18 mm respectively. The normal 5th lumbar vertebra is lordotic in its shape; the anterior height is more increased than the posterior one. This is more marked in females than males. Any abnormal increase in such lordosis might be a risk factor for backache[4]. Such backache might occur in our case due to complete absence of the posterior part of neural arch that could exaggerate lordosis. The fifth lumbar vertebra is the most massive lumbar vertebra. It plays a pivotal role in transmitting the axial weight of the body to the lower limbs. Knowledge of variations in the morphology of lumbar vertebrae may prove to be very helpful to the clinicians. Radiologists will be able to better interpret the radiographs of the lumbar region, Orthopaedicians will benefit in making diagnosis of low backache, while the Physicians can be aided by such knowledge in diagnosing the cause of neurological deficit in the lower limb. Awareness of such a malformation may also help the Orthopaedic and Neurosurgeons to correctly approach the regional area[8].

The vertebral column forms a central axis (much similar to a pillar)

which forms the main support for bones and muscles. It is so mechanically designed in the human body so as to protect the spinal cord, to support the weight of the body and transmit the same to the ground through the pelvic girdle and inferior extremities. Weight bearing also involves the neural arch component[9]. Thus, weight is transmitted through two columns. An anterior column that is formed by the vertebral bodies and intervertebral discs and a posterior column that is formed by successive articulations of laminae at their articular facets and posterior ligament complexes. The vertebral column is reinforced by the pedicles which firmly join the columns to each other at each vertebral level. Pedicles also transfer the weight between each other according to the line of gravity[10].

The vertebral column performs a very important function of weight bearing and transmission. Any pathology or malformation encountered in even a single or more vertebrae can lead to crushing of the affected vertebral segment by the superincumbent weight[11].

Conclusion:

The 5th lumbar vertebra was observed with no spinous process, no laminae and both inferior articular processes were also absent. The vertebral body appeared shorter than the usually observed massive sized fifth lumbar vertebrae. The bone was identified as the fifth lumbar vertebra by the attachment of the pyramidal transverse processes to the pedicles. Any pathology or malformation encountered in even a single or more vertebrae can lead to crushing of the affected vertebral segment.

Acknowledgement:

We are grateful to Mr. Ram Ikbal Kushwaha, Sr. Technician, Department of Anatomy, for his technical assistance.

References:

1. Williams A, Newell RLM. Back and macroscopic anatomy of spinal cord. In: Susan Standring, editor. Gray's anatomy. 39 edn. Edinburgh: Elsevier Churchill Livingstone. 2005; 748-49, 791-97.
2. Hollinshead W H. Anatomy for surgeons. The back and limbs. Vol 3, 3rd edn. Harper and Row, Philadelphia 1982; 87-88.
3. Hegazy A. Clinical Embryology for medical students and postgraduate doctors. LAP Lambert Academic Publishing, Berlin, 2014.
4. Hegazy A, Hegazy R. Midsagittal anatomy of lumbar lordosis in adult Egyptians: MRI Study. Anatomy Research International, 2014(2014):1-12, doi: 10.1155/2014/370852.
5. Keith L. Moore, T.V.N.Persaud. The developing human-clinically oriented embryology. 8th edn, 2008. Saunders. Elsevier. 344-46.
6. Andrew, J. Sacralization: An aetiological factor in lumbar intervertebral disc lesions, and a cause of misleading focal signs. Brit. J. Surg. 1954; 42:304-311.
7. Prathap Kumar, Roopa Kulkarni. Fifth lumbar vertebra associated with absence of spinous process, laminae and inferior articular processes – A case report. Int J Anat Res, 2013;02:57-60.
8. Kaplan KM, Spivak JM, Bendo JA. Embryology of the spine and associated congenital abnormalities. The Spine Journal. 2005; 5; 564-76.
9. Khanna J, Chauhan R. Congenital malformation of fifth lumbar vertebra: a case report. Int J Res Med Sci 2013;1:153-5.
10. Pal. GP, Routal R V. Transmission of weight through lower thoracic and lumbar region of vertebral column in man. Journal of Anatomy (London) 1987; 152: 93-105.
11. Louis, R. Spinal stability as defined by three column spine concept. Anatomica Clinica.1985;7 :33 - 42.
12. Decker, G.A.G. and du Plessis, D.J.. Lee McGregor's Synopsis of Surgical Anatomy. 11th edition, John Wright and sons Ltd. Bristol. 1975:124 – 125.