International Journal of Anatomy and Research,
Int J Anat Res 2013, Vol 1(2):57-60. ISSN 2321- 4287

Case Report

FIFTH LUMBAR VERTEBRA ASSOCIATED WITH ABSENCE OF SPINOUS PROCESS, LAMINAE AND INFERIOR ARTICULAR PROCESSES – A CASE REPORT

Prathap Kumar[1], Roopa Kulkarni[2]*.

[1]Assistant Professor, [2]*Professor,

Department of Anatomy, M.S.Ramaiah Medical College, Bangalore – 560054, India.

ABSTRACT

Background: The vertebral disorders are the ones which lead to disability and lot of health problems. Since the lumbar part of the vertebral column is the main weight bearing and weight transmitting region, if there is a defective development, the area for muscle attachment and the strong bony structure for the transmission of weight would be missing leading to instability at an early age. In the present case dry and processed fifth lumbar vertebra, of unknown sex which presented the features with absence of spinous process, laminae and the inferior articular processes on both sides which were obtained for teaching the medical undergraduate students in M.S.Ramaiah Medical College, Bangalore. There was absence of spinous process, laminae and the inferior articular processes of fifth lumbar vertebra leading to a wide spina bifida with absence of laminae, inferior articular processes on both sides and spinous process of fifth lumbar vertebra which could be a developmental anomaly.

KEY WORDS: SPINA BIFIDA; SUPERIOR ARTICULAR PROCESS; INFERIOR ARTICULAR PROCESSES; FIFTH LUMBAR VERTEBRA; VERTEBRAL ARCH.

Address for Correspondence: Dr. Roopa Kulkarni. Professor, Department of Anatomy, M.S.Ramaiah Medical College, Bangalore – 560054, Karnataka. India. Contact Number: 080. 236905408(O), 09880134985(M) **E-Mail:** drroopa9@rediffmail.com

Access this Article online

Quick Response code

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 23 July 2013
Peer Review: 23 July 2013 Published (O):23 Aug 2013
Accepted: 20 Aug 2013 Published (P):30 Sep 2013

INTRODUCTION

Lumbar vertebrae are five in number and identified by the presence of large, kidney shaped body. The fifth lumbar vertebra is atypical. It is identified by the presence of thick, conical spinous process, conical transverse processes which are attached to the pedicle and encroach on to the body of the vertebra. At the junction of pedicles and laminae the superior and inferior articular processes project and possess articular facets. The superior facets are concave and face anteromedially whereas inferior facets are convex and directed posterolaterally. There are mamillary and accessory processes at the roots of the transverse processes [1, 2].

The vertebrae develop from the sclerotome parts of the somites of paraxial mesoderm during fourth week of gestation. During the precartilagenous stage in the development of vertebra, the mesodermal cells of the sclerotomes spread around notochord, around the neural tube and near the body wall. Each pair of sclerotomes consists of a cranial loosely arranged and caudal densely arranged mesenchyme.

Some densely packed cells spread to the centre of myotome to form intervertebral disc. The remaining densely arranged cells merge with the loosely arranged cells to form the centrum of the vertebra which is the primordium of the vertebral body. Chondrification begins in the

mesenchyme present around the neural tube to form the neural arch which gives rise to laminae, pedicles, articular processes, transverse processes and spinous process. Ossification starts in the neural arches by 8th week of gestation and at the time of birth the vertebra consists of three parts, - a centrum and two halves of the neural arch/ vertebral arch. These halves fuse with each other between third and fifth years of postnatal life. As the development proceeds, all the three parts fuse and form a single vertebra [3,4].

If the mammillary and accessory processes excessively develop then the vertebra presents anterior and posterior segments; the anterior segment consists of body of the vertebra, pedicles, transverse processes and superior articular processes. The spinous process, laminae and inferior articular processes form the posterior segment. The Posterior segment may remain separate and fuse with first sacral vertebra leaving a big gap in the vertebral arch of fifth lumbar vertebra and called spina bifida with absence of laminae and inferior articular processes bilaterally [5].

This is one of the causes of backache. Therefore the knowledge of anomalies of fifth lumbar vertebra is very essential.

CASE REPORT

During the routine medial undergraduate osteology class on lumbar vertebrae, in M.S.Ramaiah Medial College, Bangalore, a dry and processed bone was observed to be with absence of spinous process, laminae and both inferior articular processes in the fifth lumbar vertebra. The body of this vertebra appeared shorter than the other same sized fifth lumbar vertebrae. The bone was identified as fifth lumbar vertebra by the attachment of transverse processes to the pedicles and conical in shape(Figures 1, 2 and 3).

Figure 1: Posterior view of L 5 showing absence of vertebral arch.

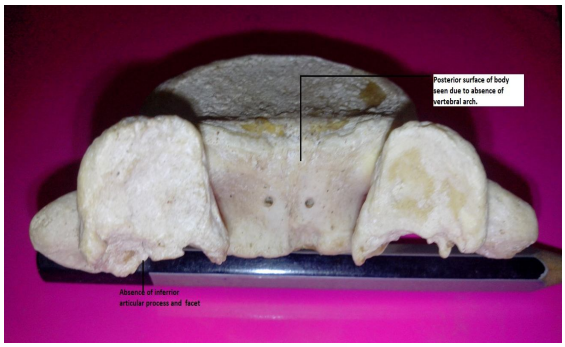

Figure 2: Posterior view of L 5 showing absence of spinous process, laminae and inferior articular processes. The posterior part of the body can be seen.

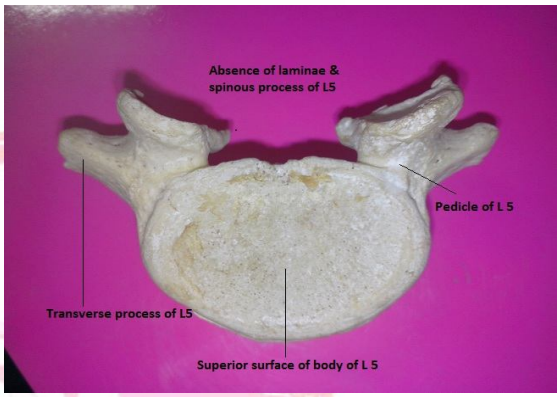

Figure 3: Superior view of L 5 showing the absence of spinous process and both laminae.

DISCUSSION

The fifth lumbar vertebra is broad and transmits the axial weight to the hip bones through the sacrum. This vertebra presents various anomalies like spina bifida, absence of vertebral arch and lumbosacral transitions. The fifth lumbar vertebra is the most common site of spondylolisthesis and spondylolysis [6].

One of the types the fifth lumbar vertebra presented two segments: one is, anterior segment, consisted of pedicles, superior articular processes and transverse processes; and the other, posterior segment, consisted of spinous process, laminae and inferior articular processes. The anomaly with the absence of the posterior segment presented with absence of spine, absence of laminae and failure of fusion of the halves of vertebral arch leading to spina bifida [7]. The present case had absence of spinous process, laminae and both inferior articular processes. (Figures 1,2,3.)

There are other anomalies like spondylolytic defects and spondylolisthesis which are congenital and involve fifth lumbar vertebra. The spondylolisthesis are classified into five grades based on the severity.

Grade I is dysplastic and results from congenital abnormality in which the inferior articular facets of fifth lumbar vertebra slip on first sacral vertebra and resulting in deformity of vertebral arch of fifth lumbar vertebra. In Grade II there are sacral and neural arch deficiencies and with isthmic type there is dissolution of pars interarticularis and separation of the posterior segment or the vertebral arch due to stress. In Grade III there is degeneration caused by multiple compression fractures of inferior articular processes and cause slipping forward. This leads to more horizontal position of the inferior articular processes. Grade IV is traumatic. Grade V results due to localized bone disease and weakness such as osteogenesis imperfecta [8].

There were cases of congenitally absent pedicles and neural arch which required surgical correction [9].

Asymmetric inferior articular processes have been observed in which the left inferior articular process was rudimentary and it is important in the axial weight transmission and orientation in the movement, back ache and prolapse of intervertebral disc [10].

The spinal and laminar dysmorphism of fifth lumbar vertebra and sacrum resulted due to developmental anomalies of central nervous system like spina bifida. There may be deviation of the spinous process and it is difficult to interpret the anomaly in the anteroposterior radiographs [11].

A study was conducted in salmon and observed that the fusion process in the development of the vertebrae involves molecular regulation and cellular changes through cell proliferation. Nonfusion of the various segments during the development of the vertebra are probably the loss of cell integrity through cell proliferation and metaplastic shifts [12].

The genetic causes have been studied in mouse and are localised and absence or faulty genes Pax1 and Pax9 will lead to morphological abnormalities of axial skeleton during embryogenesis. Double mutant Pax 1/Pax 9 genes lead to lack of medial derivatives of sclerotomes. In Pax 1/Pax 9 double homologous mutant genes the formation and anteroposterior polarity of sclerotomes appear normal but the loose arrangement of mesenchyme around the notochord occurs. Gradual loss of Sox 9 and collagen II expression later lead to apoptosis of the cells leading to the prevention of formation of vertebrae and intervertebral discs [13].

CONCLUSION

The fifth lumbar vertebra is the broadest lumbar vertebra which transmits the axial weight of the body to the lower limbs. The fifth lumbar vertebra is associated with anomalies like spondylolisthesis, spondylolysis, spina bifida, hemi-vertebra and absence of the vertebral arch. In the present study the fifth lumbar vertebra was short with absence of spine, laminae and inferior articular processes. This anomaly could be due to excessive growth of mamillary and accessory processes which leads to two segments of the vertebral arch consisting of anterior segment made up of pedicles, superior articular processes and transverse processes whereas the posterior segment is made up of spine, laminae and inferior articular processes. If there is failure of fusion of these two segments and dissolution of the posterior segment leads to absence of spine, laminae and inferior articular processes. The cause of this anomaly is probably double mutant Pax1 and Pax 9 genes which lead to interference in the development and differentiation of sclerotomes. The deficient area in the bone leads to lesser area for muscle attachment and cause weakness and backache.

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. P87-88

3. Keith L. Moore, T.V.N.Persaud. The developing human-clinically oriented embryology. 8th edn, 2008. Saunders. Elsevier. 344-46

4. 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

5. Cunningham DJ. Cunningham's text book of anatomy 1909.75-96. Retrieved fromhttp://books.google.co.in/books/about/Text_book_of_anatomy.html?id=c7e1ovgvUtAC&redir_esc=y

6. Beutler WJ, Fredrickson BE, Murtland A, Sweeney CA, Grant WD, Baker D.The natural history of spondylolysis and spondylolisthesis:45 Year follow up evaluation. Spine (Phila Pa 1976). 2003 May 15;28(10):1027-35

7. Bergman RA, Afifi AK, Miyauchi R. Opus V: Skeletal System: Vertebral column: Alphabetical Listing of Skeletal System: V vertebrae. In: Bergman RA, Afifi AF, Miyauchi R, editors. Illustrated Encyclopedia of Human Anatomic Variation. Available from:URL:http://www.anatomyatlases.org/AnatomicVariants/SkeletalSystem/Text/ LumbarVertebrae.shtml

8. Veterans Affairs Canada 2005. Disability Benefits. Entitlement Eligibility Guidelines - Spondylolysis and Spondylolisthesis. Available from: URL: http://www.veterans.gc.ca/pdf/dispen/eeg/spondylolisthesis.pdf

9. Villas C, Barrios R H. Congenital absence of the pedicles and the neural arch of L2. Eur Spine J 1997 (6): 354-56.

10. Das S, Suri R, Kapur V. An asymmetrical inferior articular process of a lumbar vertebra. Folia morphologica 2006; 65(1):96-99

11. Mellado J M, Larrosa R, Martín J, Yanguas N, Solanas S, Cozcolluela M R. MDCT of Variations and Anomalies of the Neural Arch and Its Processes: Part 1-Pedicles, Pars Interarticularis, Laminae, and Spinous Process. Musculoskeletal Imaging. American Journal of Roentgenology 2011;197 (1):104-113

12. Ytteborg E, Torgersen J, Baeverfjord G, Takle H. Morphological and molecular characterization of developing vertebral fusions using a teleost model. BMC Physiology 2010; 10:13 Available from: URL: http://www.biomedcentral.com/1472-6793/10/13

13. Peters H, Wilm B, Sakai N, Imai K, Maas R, Balling R. Pax1 and Pax9 synergistically regulate vertebral column development.Development 1999; 126(23):5399-5408.

How to cite this article:

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.