IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 11 Ver. 4 (November. 2018), PP 35-39
www.iosrjournals.org

A Morphometric study of lamina of lumbar vertebrae: A dry bone study conducted in RIMS, Imphal

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Abstract: *The use of intralaminar screws (ILS), laminectomy and laminotomies are increasingly popular among spinal surgeons. A successful lamina surgery will require, sufficient understanding of the morphology and morphometry of the lamina. To our knowledge, there is little in the existing literature reporting on the morphometry of the lumbar spine lamina. 50 dry lumbar vertebrae were selected for the study and the morphometry of the lamina were recorded. The maximum mean height was recorded at L3 on the left and L2 on the right and gradually decreased towards L5.The width of the lamina showed a gradual increase from L1 to L5.The thickness was measured at 3 different levels, extending from upper to lower border of lamina. The mean thickness increased from upper border to the middle and then decreased towards the lower border in all the vertebrae from L1 to L5. In the present study the morphometry of the lamina of the lumbar vertebrae from L1 to L5 were recorded and presented. This may benefit the Spine Surgeons in the Decompression Surgeries like laminectomy done for the treatment of Spinal nerve Compression and also in the posterior spinal instrumentation using intralaminar screws and laminar hooks.*

Keywords: *Lamina, Laminectomy, lumbar vertebrae, Morphometry, Spine Surgeons*

Date of Submission: 02-11-2018 Date of acceptance: 16-11-2018

I. Introduction

A lumbar vertebrae is divided into 3 functional components- vertebral body, the pedicles and the posterior elements. The posterior elements of a vertebrae are the lamina, articular processes, and the spinous processes. The lamina are described as forming a bony protective covering over the neural contents of the vertebral canal [1]. The use of intralaminar screws (ILS), laminectomy and laminotomies are increasingly popular among spinal surgeons. Today the most common indication for which standard laminectomy is done is lumbar canal stenosis to relieve nerve compression. It is also done for lumbar disc herniation. Laminectomy is also an entry point to perform facetectomy in lateral recess stenosis and to perform foraminotomy in nerve root compression [2]. The use of intralaminar screws as a salvage stabilization technique for posterior spinal surgery has become increasingly popular among spinal surgeons [3]. Laminar hooks are also used in the spinal fixation in the lumbosacral spine for fracture reduction, scoliosis correction and stabilization in degenerative disease [4].To perform successful laminectomy, intralaminar screw fixation and laminar hook placement, the better understanding of morphometry of the lumbar spine lamina is very important. To our knowledge, there is little in the existing literature reporting on the morphometry of the lumbar spine lamina, which initiated us to take up the study.

II. Materials and methods

The study was conducted on dry lumbar vertebrae. 50 undamaged lumbar vertebrae were selected for the study, obtained from 10 spines collected from Department of Anatomy RIMS, Imphal. The vertebrae were identified from L1 to L5 and morphometry of the lamina and its changes from L1 to L5 was recorded and analysed using SPSS software version 21. Measurements of the lamina were recorded using a Digital Vernier Caliper (0-150mm with an accuracy of $\pm$ 0.02mm). The following measurements were taken

II.1. Height of the lamina- It is the distance from the midpoint of upper border of the lamina to the midpoint of lower border(fig.1).

Fig. 1. A photograph showing the measurement of height of the lamina of the lumbar vertebrae.

Fig. 2. A photograph showing the measurement of width of lamina

II.2. Width of the lamina- It is the distance between the midpoint of the lateral border to the midpoint of junction of lamina with the spine (fig.2.).

II.3. Thickness of the lamina was measured at 3 different levels

Fig.3. Measurement of thickness at upper border

Fig.4. Measurement of thickness at the middle of the lamina

Fig. 5. Measurement of thickness at the lower border

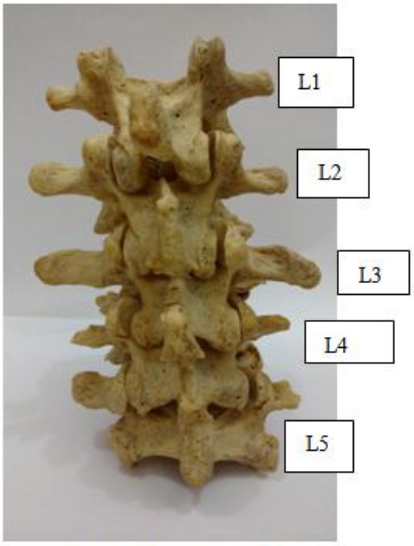

Fig. 6. Showing the lamina of lumbar vertebrae from L1 to L5.

III. Results and observations

Table.1. Showing the mean height of the lamina

	LEFT(mean)	RIGHT(mean)
L1	21.58mm	21.14mm
L2	21.95mm	22.41mm
L3	22.40mm	21.83mm
L4	21.16mm	20.28mm
L5	16.84mm	15.84mm

Table.2. Showing the mean width of the lamina

	LEFT(mean)	RIGHT(mean)
L1	9.58mm	10.09mm
L2	11.40mm	11.39mm
L3	12.28mm	12.56mm
L4	14.59mm	15.07mm
L5	18.49mm	18.09mm

Table.3. Showing the mean thickness at the upper border

	LEFT(mean)	RIGHT(mean)
L1	2.67mm	2.74mm
L2	2.30mm	2.36mm
L3	2.39mm	2.27mm
L4	1.94mm	2.12mm
L5	2.60mm	2.57mm

Table.4. Showing the mean thickness at the middle of the lamina

	LEFT(mean)	RIGHT(mean)
L1	5.99mm	5.68mm
L2	6.17mm	6.23mm
L3	5.93mm	6.01mm
L4	5.94mm	6.02mm
L5	5.28mm	5.04mm

Table.5. Showing the mean width at lower border

	LEFT(mean)	RIGHT(mean)
L1	4.70mm	4.66mm
L2	4.37mm	4.39mm
L3	4.39mm	4.42mm
L4	4.30mm	4.08mm
L5	3.03mm	2.93mm

In the present study the following observations were made-

From L1 to L5-On the left side there is a gradual increase in the mean height values from L1-L3 ranging from 21.58mm to 22.40mm followed by decrease from L3 –L5 and maximum mean height value was recorded at L3-22.40mm and the minimum mean height value was recorded at L5-16.84mm. On the right the mean height values increased from L1-L2 and decreased from L2-L5 and the maximum mean height value was recorded at L2-22.41mm and the minimum mean height value was recorded at L5-15.84mm (Table.1).

On the left side the minimum mean width value was recorded at L1-9.58mm and the maximum mean width value was recorded at L5-18.49mm and on the right side the mimimum was at L1-10.09mm and maximum value was at L5-18.09mm (Table.2.).

The mean thickness value at the upper border was maximum at L1-2.67mm on left and 2.74mm on right and minimum at L4 -1.94mm on left and 2.12mm on right (Table.3.). The mean thickness values at the middle of the lamina was maximum at L2-6.17mm on left and 6.23mm on right and minimum was at L5-5.28mm on left

and 5.04mm on right (Table.4.). The mean thickness values at the lower border of the lamina was maximum at L1-4.70mm on left and 4.66mm on right and minimum at L5-3.03mm on left and 2.93mm on the right (Table.5.).

The shapes of the lamina were drawn using the average mean height of the lamina on both the sides as the length and mean total width of the lamina both the sides as breadth at each level.

Table .6. showing the values of average height and total width of both sides of the lamina

S.No	Length	Breadth
L1	21.36mm	19.67mm
L2	22.18mm	22.79mm
L3	22.11mm	24.84mm
L4	20.72mm	29.66mm
L5	16.34mm	36.58mm

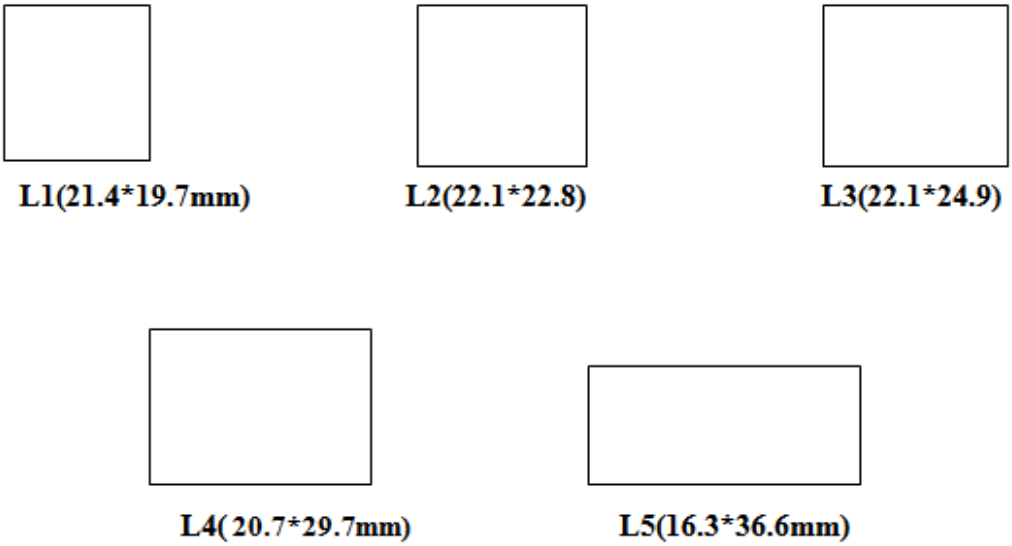

Fig.7. Shapes of the lamina at different vertebral levels

IV. Discussion

A successful surgery of the lamina of the lumbar spine requires a better understanding of the lamina. The surgeon must have a comprehensive understanding of anatomic morphology of the lamina and the limitations. Although intralaminar screws may provide a more reliable profile for direct visualization of the lamina at the time of screw insertion as well as screw position to the thecal sacs and nerve roots, the surgeons choice of technique depends largely on his/her knowledge of morphology [4]. To our knowledge there is limited literature available on the morphology and morphometry of the lumbar spine.

In the present study the height of the lamina increased towards the the mid lumbar spine and decreased towards L5. On the right the mean height values increased from L1-L2 and decreased from L2-L5 and the maximum mean height value was recorded at L2-22.41mm, coinciding with the Browner BD[5]. On the left side there is a gradual increase in the mean height values from L1-L3 and decrease from L3 –L5 and maximum mean height value was recorded at L3-22.40mm (Table. 1.). From L1 to L5, there is a gradual increase in the width on both the sides, with L5 having the maximum width coinciding with Browner BD[5] and results of the study done By Xu et al[6]. From L1 to L5, the laminae become more wider and shorter (fig.6). At all vertebral levels the upper border of the lamina is relatively thinner, similar to the findings of Lu J et al [7]. In the present study the maximum thickness was recorded at the middle of the lamina on both the sides (left side-6.17mm ; right side-6.23mm)(Table.4.).

Browner BD also stated that "the shape of the lamina dramatically influence the ability to position hardware". Therefore hook placement is easier proximally in spine but may cause impingement when placed over L5 because of its relatively shorter wavelength [5]." In the present study the mean height values were minimum at L5 on both the sides. The morphometry of the lamina also influences the shape along with other posterior elements which is said to be helpful in the identification of individual vertebrae as mentioned by Bonnick SL and Fawcett E in their books [8,9]. When the shapes of the lamina were drawn using the average height of both the sides of the lamina as length and the total width on both sides as breadth, the shape of the lamina at L1 is represented by a parellogram with length more than the breadth. At L2 it is represented almost as a square. From L3, the width gradually increased and at L5 it is represented by a rectangle with breadth more than the length (Table 6, fig.7).

V. Conclusion

In the present study we aimed to study the morphometry of the lamina of the lumbar vertebrae and the changing trends from L1 to L5. We hope that these findings may benefit the Spine Surgeons in the Decompression Surgeries like laminectomy done for the treatment of Spinal Nerve Compression, also in placing the laminar hooks and intralaminar screws to perform successfully with the better understanding of the lamina. This study may be also helpful to anatomists in understanding and identifying individual vertebrae. Due to importance of lamina in the clinical practice, we may kindly be allowed to suggest more studies on the lamina, especially lumbar vertebrae.

References

[1]. Bogduk N, Twomey LT. *Clinical anatomy of the lumbar spine*. (Singapore: Churchill Livingstone, 1991).
[2]. Ramani PS, Park CK, Loftus CM, Mizuno J, Bajamal AH, Osario Fonseca E, Patkar S. *Textbook of lumbar disc herniation*.(New Delhi:Jaypee, 2014).
[3]. Komurcu E, Kaymaz B, Adam G, Golge UH, Goksel F, Ozden R. Safety and feasibility of lumbar spine for intralaminar screw fixation: a computed tomography-based morphometric study. *Acta Orthopaedica Traumatologica Turcica , 49(5)*, 2015, 522–9.
[4]. Slone RM, MacMillan M, Montgomery WJ, Heare M. Fixation techniques and hardware for the thoracic and lumbosacral spine. *Radiographics, 13(3)*,1993, 521-543.
[5]. Browner BD. *Basic science, management and reconstruction*. (Philadelphia: Saunders, 2009).
[6]. Xu R, Burgar A, Ebraheim NA, Yeasting RA. The quantitative anatomy of the laminas of the spine. *Spine ,24(2)*,1999,107-13.
[7]. Lu J, Ebraheim N A, Yeasting R. Translaminar facet screw placement: an anatomic study. *American Journal of Orthopedics, 27(8)*, 1998,550-555.
[8]. Bonnick SL. *Current clinical practice: bone densitometry in clinical practice*. (New York: Humana press, 2010).
[9]. Fawcett E. A note on the identification of the lumbar vertebrae in man. (Edinburgh: J Neii.I. and Co. LTD., 1917).
[10]. Canale ST, Beaty JH. *Operative orthopaedics* (Canada: Elsevier, 2013).

Tharani P. "A Morphometric study of lamina of lumbar vertebrae: A dry bone study conducted in RIMS, Imphal". " IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 11, 2018, pp 35-39.