

# ASSESSMENT OF THE CORRELATION BETWEEN ANTHROPOMETRIC PARAMETERS (WEIGHT AND HEIGHT) AND THE L4 ROOT TOPOGRAPHY AT THE L4-L5 INTERTRANSVERSE SPACE THROUGH PARAMEDIAN ACCESS TO THE SPINE: AN ANATOMIC RESEARCH ON TWENTY ONE CADAVERS

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## SUMMARY

Far lateral disc hernias account for ten percent of all symptomatic disc hernias, usually located at L3-L4 and L4-L5 levels. For many years, the surgical approach to foraminal and extraforaminal lumbar disc hernias was provided through the median posterior access way, with total or partial hemilaminectomy and facetectomy. The advantage of the surgical approach for this pathology through the paramedian way, between the multifidus and longissimus muscles (Wiltse's access) is to spare patients from bone losses and to allow a more oblique view of the neuroforamen. Moreover, this approach allows for accessing the L4-L5 disc and its potential

extraforaminal herniations with minimum L4 root mobilization. Our objective is to assess the potential correlation between anthropometric parameters and the L4 root topography. Twenty-one cadavers (42 sides) were dissected and some parameters were measured: cadavers' weight and height, width of the L5 transverse process, distance between L5 transverse process base and the point where the L4 root crosses it. The analysis of data allows us to conclude that no statistically significant correlation exists among the involved variables.

**Keywords:** *Radiculopathy; Low back pain; Spine; Laminectomy; Sciatic neuropathy.*

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## INTRODUCTION

Knowing a nerve root's anatomical arrangement in its extraforaminal path is important in many situations, whether due to the need of a direct approach to the root or other structures adjacent to it.

Its relative importance on lumbar spine is even more evident when it involves one of the most common conditions of the axial skeleton: the disc hernia. Among its potential locations, the far lateral disc hernia causing compression of the nervous root

laterally to the intervertebral foramen, is an uncommon variant, but not less considerable.

Although most disc hernias can be approached by a median access, the surgeon must be familiar to the paramedian approach and with the topography of anatomical structures in it in order to reduce the risk of iatrogenic injuries inherent to it when this is required<sup>(1)</sup>. And so, this problematic was the starting point for the authors hereof to study the potential correlation between anthropometric data (weight and height) and the location point of the L4 root on L4-L5 inter-transverse space.

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## MATERIALS AND METHODS

### Anatomical evaluation

For conducting this study, 21 cadavers (42 sides) originated from University of São Paulo's Death Examination Service of the Capital city of São Paulo (SVOC), randomly selected, were used. On these cadavers, the L4-L5 inter-transverse space was exposed through the Wiltse's access and the distance between L5 transverse process base and the point where L4 root crossed it was measured. Each cadaver's weight and height were documented.

### Inclusion criteria:

a- age above 18 years (skeletal maturity);

### Exclusion criteria:

a - bone deformities on dorsal lumbar segment, visible when positioning the cadaver lying with the face down;  
b - skin scars on lumbar region, suggesting previous spinal surgery;  
c - vertebral malformations seen during dissection;  
d - fractures of the transverse processes or other relevant bone protuberances during dissection;

### Access ports

The cadavers were positioned lying with face down. A longitudinal paramedian access port was built (3 cm lateral to the mid line) approximately 8 cm long, taking as a reference point the cadaver's iliac crest (L4-L5 level) 4 cm proximal and 4 cm caudal to this anatomical parameter. The level was confirmed by palpating the inter-spinal intervals from S1 (first sacral vertebra) spinous apophysis. The L4-L5 inter-transverse space was accessed through the plane between the multifidus and longissimus muscles (Wiltse's approach). The muscles and the inter-transverse membrane of the same level were removed in order to expose L4 root (Figure 1).

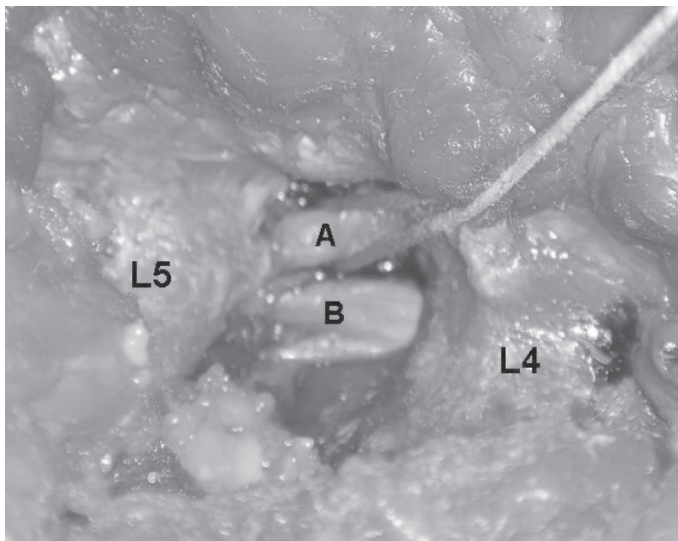


Figure 1 – Wiltse's approach. Final appearance of the dissection.

### Mapping

Measurements were made using a rule and a pachymeter with increments of 1 mm (Figure 2).

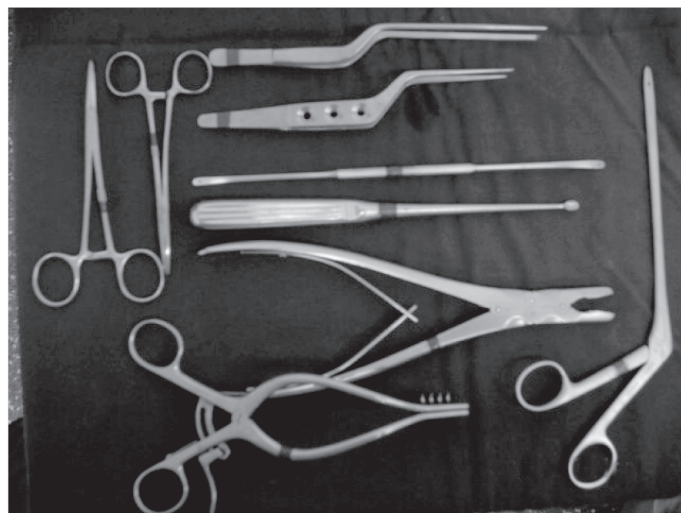
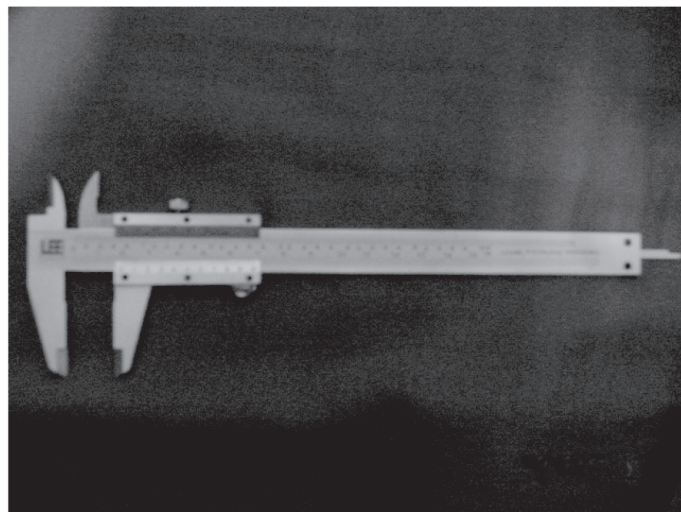


Figure 2 – Material employed for mapping and dissection.

### Statistical Analysis

The statistical analysis was performed with the SPSS software version 14.

### RESULTS

The measures were assessed and recorded for each dissected root (Table 1). From these measures, the following results were determined for each parameter: maximum value, minimum value, mean, median, and standard deviation (Table 2). Clinical criteria provided by SVOC have also been recorded.

### DISCUSSION

It is estimated that approximately 10% of all symptomatic disc hernias are far lateral type. More commonly located at L4-L5

Clinical Parameters				Anatomical Parameters	
Gender	Age (years)	Weight (Kg)	Height (cm)	Side	1 (mm)
M	72	70	170	LEFT	8
				RIGHT	7
M	71	70	170	LEFT	5
				RIGHT	5
M	64	70	180	LEFT	5
				RIGHT	4
M	78	69	180	LEFT	5
				RIGHT	6
M	63	70	185	LEFT	6
				RIGHT	4
F	73	65	170	LEFT	7
				RIGHT	6
M	61	70	185	LEFT	4
				RIGHT	4
M	60	70	180	LEFT	3
				RIGHT	4
M	78	65	170	LEFT	5
				RIGHT	3
M	79	65	165	LEFT	6
				RIGHT	4
M	61	80	170	LEFT	4
				RIGHT	4
M	51	67	170	LEFT	5
				RIGHT	6
M	40	73	180	LEFT	6
				RIGHT	6
M	46	70	180	LEFT	4
				RIGHT	5
M	54	65	180	LEFT	6
				RIGHT	6
M	83	60	185	LEFT	7
				RIGHT	6
F	39	60	170	LEFT	5
				RIGHT	5
M	44	70	170	LEFT	5
				RIGHT	4
M	80	36	170	LEFT	6
				RIGHT	6
F	61	75	170	LEFT	6
				RIGHT	6
M	32	65	180	LEFT	7
				RIGHT	7

**Table 1 – Anatomical results**

and L3-L4 levels, they affect a population of patients of an older age group than the posterolateral hernias<sup>(2-5)</sup>. As a corollary to its mid-lumbar location or even at upper levels, patients with sensitive changes on anterior thigh surface, quadriceps paresis, positive passive stretching test of the femoral nerve or abolished patellar reflex should be investigated for their potential to present extraforaminal disc hernia. Pain can also be more severe than the experienced in posterolateral hernias due to its location and compression of the nervous root ganglion<sup>(6)</sup>.

Statistics	Clinical parameters			Anatomical parameter
	Age (years)	Weight (kg)	Height (cm)	X(mm)
Mean	61.5	66.9	175	5
Median	61	70	175	5
Standard deviation	15.1	8.4	6.4	1.18
Maximum	83	80	185	8
Minimum	32	36	165	3

Legends: X-Distance between L5 transverse process base and the point where the L4 root crosses it;

**Table 2 – Descriptive statistical analysis**

Once the surgical procedure of discectomy is started, we lie on a new dilemma: how to address this hernia? Some surgical access possibilities exist for extraforaminal hernias, each one with advantages and disadvantages. For many years, the surgical approach to foraminal and extraforaminal lumbar hernias was made through the median access port followed by total hemilaminectomy at the concerned level<sup>(7-9)</sup>. Despite of the good visualization to the root and hernia achieved with this method, the emergence of low lumbar pain is common due to the vertebral instability created. A number of variations have been proposed for this technique in order to avoid facetectomy and its biomechanical repercussions.

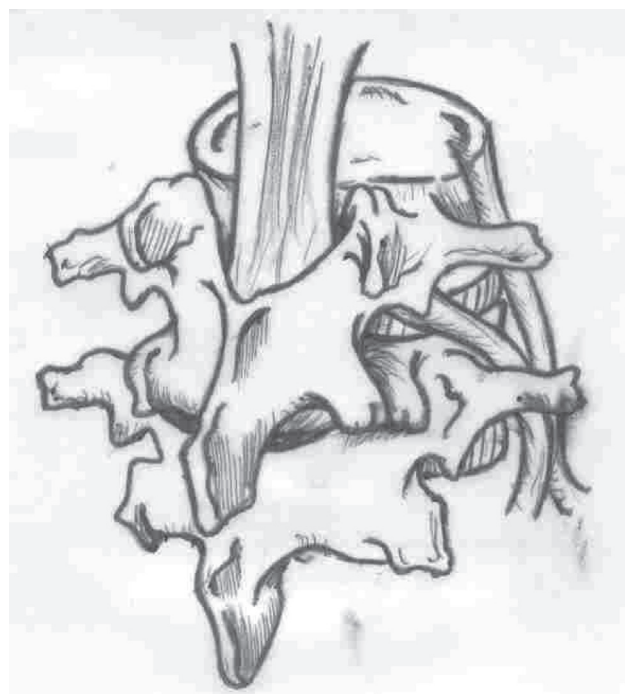
Despite of the attempts, the "iatrogenic lumbalgia" has remained as one of the biggest concerns on the postoperative evolution of these patients. The need to reduce per-operative damages to the bone frame and to paravertebral musculature led to the development of access ports and minimally invasive and less traumatic discectomy techniques. The paramedian port following the plane between multifidus and longissimus muscles<sup>(10-13)</sup> has the advantage of sparing the patient from bone losses, such as laminotomies and facetectomies, as well as to allow a more oblique vision of the neuro-foramen. Its versatility is more notorious on lower levels (L4-L5, L5-S1), where the far lateral hernia is even less accessible through median port than it is in other levels<sup>(4,14)</sup>. Clinical studies such as the one by Bradley and cols.<sup>(15)</sup> confirmed good outcomes with the use of the paraspinous port for treating far lateral lumbar disc hernias, with up to 85% of the patients presenting

satisfactory levels of quality of life and algic picture resolution. Poor surgical familiarity, deep dissection, poor visibility, challenges to enucleate the intervertebral disc and potential risk of emerging nervous root injury are some of its disadvantages. Although scarce, comparative studies of the techniques show better results when the lateral transmuscular port is performed in extraforaminal discectomies<sup>(16)</sup>. Once the L4-L5 inter-transverse space is reached and the inter-transverse membrane is resected, we are faced with two adjacent roots: L3 (laterally) and L4 (medially), already inside the core of Psoas Major muscle. This approach allows the access, with minimum mobilization of the L4 root, to L4-L5 disc and to eventual extraforaminal herniations in it. Despite of the considerations of safety and morbidity, many surgeons still use the “anatomically familiar” posterior medial port with total or partial hemilaminectomy and facetectomy<sup>(16)</sup>.

## CONCLUSION

The measures obtained with the topographic positioning of the L4 root (Figure 3) are not statistically associated with an individual's weight or height.

However, we recognize that the limited sample size compromises a really significant conclusion.



**Figure 3** – Measured anatomical parameter (distance between L5 transverse process base and the point where L4 root crosses it)

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