



## EVALUATION OF THORACIC AND LUMBAR INSTRUMENTATION

### TORAKAL VE LOMBER ENSTRÜMANTASYONUN DEĞERLENDİRİLMESİ

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#### SUMMARY:

**Objective:** The aim of the study is to analyse the thoracal and lumbar instrumentation operations in two years.

**Materials and Method:** We inspected 160 patients who were operated for thoracal and lumbar instrumentation operations between June 2014 and June 2016 at Dr. Lütfi Kırdar Kartal Training and Research Hospital Neurosurgery Clinic.

**Results:** This study included a total of 160 patients, of whom 110 were female (68.8 %) and 50 were male (31.3 %). Mean age was  $55.6 \pm 11.5$  years for males, and  $52.1 \pm 11.6$  for females. There was no statistically significant difference between males and females ( $p=0.098$ ). The most frequent diagnosis was spinal stenosis ( $n=99$ ; 61.9 %), and most frequent type of operation was L3-4-5 TPV ( $n=28$ ; 17.5%).

**Conclusions:** Spinal instrumentation is the most common surgical technique used for spinal instability. Spinal stenosis, fractures and spondylolsthesis are the most common diagnosis for the causes of spinal instability.

**Key Words:** Lumbar spinal stenosis, thoracolumbar instrumentation, thoracic and lumbar fractures

**Level of evidence:** Retrospective clinical study, Level III

#### ÖZET:

**Amaç:** Çalışmamızın amacı iki yıl içerisinde yapılan torakal ve lomber enstrümantasyon ameliyatlarının değerlendirilmesini sağlamaktır.

**Materyal ve Metod:** Haziran-2014 ile Haziran-2016 tarihleri arasında Dr.Lütfi Kırdar Kartal Eğitim ve Araştırma Hastanesi Nöroşirurji Kliniğinde torakal ve lomber enstrümantasyon ameliyatı yapılmış 160 hasta retrospektif olarak incelendi.

**Sonuçlar:** 110 hasta kadın (% 68.8) ve 50 hasta erkek idi (% 31.3). Çalışmaya katılan popülasyonun ortalama yaşı kadınlar için  $52.1 \pm 11.6$ , erkekler için  $55.6 \pm 11.5$  olarak hesaplandı. Cinsiyet yönünden istatistiksel anlamlı fark saptanmadı( $p=0.098$ ). En sık konulan tanı spinal stenoz ( $n=99$ ; % 61.9) ve en çok yapılan ameliyat L3-4-5 TPV ( $n=28$ ; % 17.5) olarak bulundu..

**Çıkarım:** Spinal enstrümantasyon, spinal instabilite ameliyat teknikleri içinde en çok kullanılan tekniktir. Spinal stenoz, kırıklar ve spondilolistezis spinal instabiliteye sebep olan en sık konulan tanılardır.

**Anahtar kelimeler:** Lomber spinal stenoz, Torakolomber enstrümantasyon, Torakal ve lomber kırıklar

**Kanıt Düzeyi:** Retrospektif klinik çalışma, Düzey III

## INTRODUCTION:

For several years, spinal instability has been defined in terms of biomechanical alteration to any spinal element that could affect the vertebral column stability<sup>1</sup>. The best treatment choice for spinal instability is still a challenge for the medical and scientific community whether conservative modalities like physiotherapy, injection and radiofrequency treatments or surgery<sup>6,16-18,21-22</sup>.

The purpose of instrumentation is to stabilize the spine and fusion for the treatment of spinal stenosis, neoplasms, infections, fractures and spondylololsthesis<sup>11-12,14</sup>. Hadra et al had stabilized the spine of a patient who was diagnosed as Pott disease with wiring the spinous processes in 1891<sup>8</sup>. Spinal fusion was made by Fred Albee and Russel Hibbs at the same time in 1911<sup>9</sup>. First complex posterior stabilization system was used by Paul Harrington in 1962 for a spinal deformity surgery.

The aim of our study is to evaluate the thoracal and lumbar instrumentation operations in two years by diagnoses and type of surgeries.

## MATERIALS AND METHODS:

We inspected 160 patients who were operated for thoracal and lumbar instrumentation operations between June 2014 and June 2016 at Dr.Lütfi Kırdar Kartal Training and Research Hospital Neurosurgery Clinic (Figure-1). The informations were collected from the patients file archives rethrospectively.

Radiological data were inspected from the PACS system. The parameters that evaluated are diagnosis and type of surgery.

## STATISTICAL ANALYSIS:

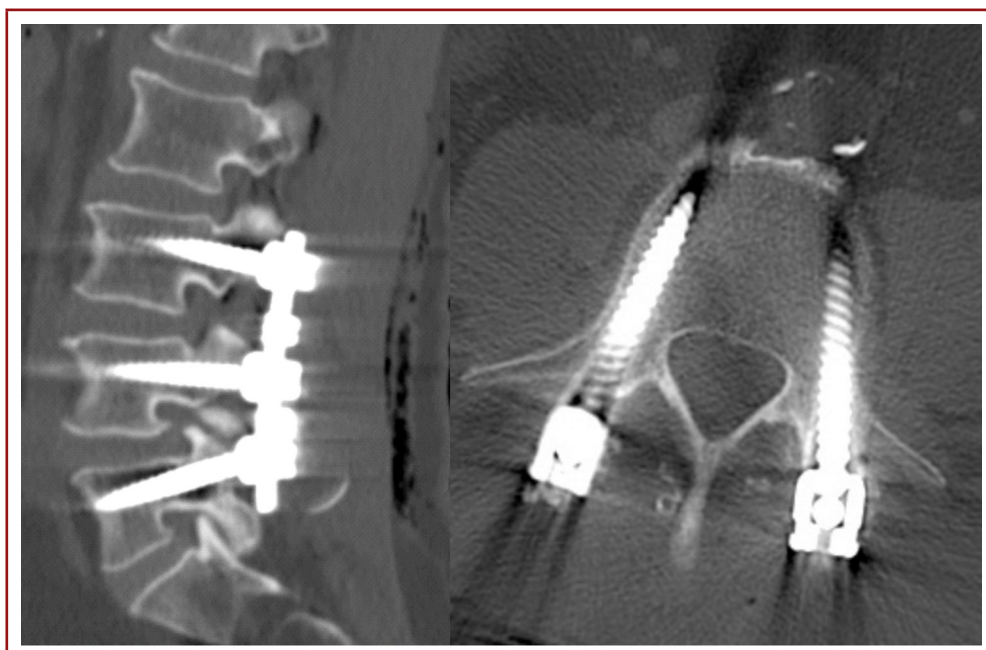
Descriptive data were presented by using mean and standard deviation, and frequencies and percent. Mann-Whitney U test, and Chi-square test were used for comparisons between the independent groups of the study, and statistical significance was evaluated according to a two-sided Type-I error level of 5%. Statistical Package for the Social Sciences (SPSS) 21 software (IBM Corp. in Armonk, NY) was used for all statistical analyses of this research.

## RESULTS:

This study included a total of 160 patients, of whom 110 were female (68.8 %) and 50 were male (31.3 %). Mean age was  $55.6 \pm 11.5$  years for males, and  $52.1 \pm 11.6$  for females. There was no statistically significant difference between males and females ( $p=0.098$ ).

The most frequent diagnosis was spinal stenosis ( $n=99$ ; 61.9 %), and most frequent type of operation was L3-4-5 TPV ( $n=28$ ; 17.5 %). The general characteristics of study population were presented in Table-1.

Comparisons between males and females regarding disease and operation type were presented in Table-2. Between-gender comparisons could not be analyzed due to heterogeneity of the parameters.



**Figure-1.** Sagittal and axial computed tomography postoperative images of L3-4-5 transpedicular screw instrumentation

**Table-1.** General characteristics (TPS: Trans pedicular screw, PLIF: Posterior lumbar interbody fusion, XLIF: Lateral lumbar interbody fusion)

	Mean±SD
Age (years)	54.5±11.6
	n (%)
<b>Sex</b>	
Female	110 (68.8)
Male	50 (31.3)
<b>Diagnosis</b>	
Spinal Stenosis	99 (61.9)
Spondylolisthesis	30 (18.8)
L1 Fracture	10 (6.3)
L2 Fracture	8 (5)
L3 Fracture	4 (2.5)
T11 Fracture	3 (1.9)
T12 Fracture	2 (1.3)
Lumbar Disc Herniation	1 (0.6)
T10 Fracture	1 (0.6)
T5 Fracture	1 (0.6)
T7 Fracture	1 (0.6)
<b>Operation</b>	
L1-2-3-4-5 TPS	1 (0.6)
L2-3 TPS	1 (0.6)
L2-3-4 TPS	4 (2.5)
L2-3-4-5 TPS	17 (10.6)
L2-3-4-5 TPS and PLIF	7 (4.4)
L2-3-4-5-S1 TPS	5 (3.1)
L3-4 TPS	2 (1.3)
L3-4-5 and PLIF	1 (0.6)
L3-4-5 TPS	28 (17.5)
L3-4-5 TPS and PLIF	15 (9.4)
L3-4-5-S1 TPS	12 (7.5)
L3-4-5-S1 TPS and PLIF	1 (0.6)
L4-5 TPS	9 (5.6)
L4-5 TPS and PLIF	3 (1.9)
L4-5-S1 TPS	15 (9.4)
L4-5-S1 TPS and PLIF	1 (0.6)
L4-5-TPS and XLIF	1 (0.6)
L5-S1 TPS	6 (3.8)
L5-S1 TPS and XLIF	1 (0.6)
T10-11-12-L1 TPS	1 (0.6)
T10-11-12-L1-2 TPS	1 (0.6)
T10-11-12-L1-2-3 TPS	1 (0.6)
T11-12-L1-2 TPS	7 (4.4)
T11-12-L1-2-3 TPS	2 (1.3)
T11-12-L1-2-3-4 TPS	2 (1.3)
T11-12-L1-2-3-4-5-S1 TPS	2 (1.3)
T11-12-L2-3 TPS	2 (1.3)
T12-L1-2 TPS	1 (0.6)
T12-L1-2-3 TPS	4 (2.5)
T12-L1-2-3-4 TPS	1 (0.6)
T12-L1-2-3-4-5 TPS	1 (0.6)
T4-5-6 TPS	1 (0.6)
T5-6-7-8 TPS	1 (0.6)
T8-9-10-11-12-L1 TPS	1 (0.6)
T9-10-11-12-L1 TPS	2 (1.3)

**Table-2.** Between gender comparisons (TPS: Transpedicular screw, PLIF: Posterior lumbar interbody fusion, XLIF: Lateral lumbar interbody fusion)

	Female	Male	p
	Mean±SD	Mean±SD	
	n (%)	n (%)	p
Age	55.6±11.5	52.1±11.6	0.098
<b>Diagnosis</b>			-
Spinal Stenosis	73 (66.4)	26 (52)	
Spondylolisthesis	23 (20.9)	7 (14)	
L1 Fracture	5 (4.5)	5 (10)	
L2 Fracture	4 (3.6)	4 (8)	
L3 Fracture	1 (0.9)	3 (6)	
T11 Fracture	1 (0.9)	2 (4)	
T12 Fracture	1 (0.9)	1 (2)	
Lumbar Disc Herniation	1 (0.9)	-	
T10 Fracture	-	1 (2)	
T5 Fracture	-	1 (2)	
T7 Fracture	1 (0.9)	-	
<b>Operation</b>			-
L1-2-3-4-5 TPS	1 (0.9)	-	
L2-3 TPS	1 (0.9)	-	
L2-3-4 TPS	1 (0.9)	3 (6)	
L2-3-4-5 TPS	12 (10.9)	5 (10)	
L2-3-4-5 TPS and PLIF	4 (3.6)	3 (6)	
L2-3-4-5-S1 TPS	4 (3.6)	1 (2)	
L3-4 TPS	2 (1.8)	-	
L3-4-5 and PLIF	1 (0.9)	-	
L3-4-5 TPS	18 (16.4)	10 (20)	
L3-4-5 TPS and PLIF	11 (10)	4 (8)	
L3-4-5-S1 TPS	9 (8.2)	3 (6)	
L3-4-5-S1 TPS and PLIF	1 (0.9)	-	
L4-5 TPS	7 (6.4)	2 (4)	
L4-5 TPS and PLIF	3 (2.7)	-	
L4-5-S1 TPS	13 (11.8)	2 (4)	
L4-5-S1 TPS and PLIF	1 (0.9)	-	
L4-5-TPS and XLIF	1 (0.9)	-	
L5-S1 TPS	4 (3.6)	2 (4)	
L5-S1 TPS and XLIF	-	1 (2)	
T10-11-12-L1 TPS	-	1 (2)	
T10-11-12-L1-2 TPS	1 (0.9)	-	
T10-11-12-L1-2-3 TPS	1 (0.9)	-	
T11-12-L1-2 TPS	3 (2.7)	4 (8)	
T11-12-L1-2-3 TPS	1 (0.9)	1 (2)	
T11-12-L1-2-3-4 TPS	2 (1.8)	-	
T11-12-L1-2-3-4-5-S1 TPS	2 (1.8)	-	
T11-12-L2-3 TPS	1 (0.9)	1 (2)	
T12-L1-2 TPS	-	1 (2)	
T12-L1-2-3 TPS	2 (1.8)	2 (4)	
T12-L1-2-3-4 TPS	-	1 (2)	
T12-L1-2-3-4-5 TPS	1 (0.9)	-	
T4-5-6 TPS	-	1 (2)	
T5-6-7-8 TPS	1 (0.9)	-	
T8-9-10-11-12-L1 TPS	-	1 (2)	
T9-10-11-12-L1 TPS	1 (0.9)	1 (2)	

## DISCUSSION:

Spinal stenosis is the most common diagnosis that was made for our operations. The clinical entity lumbar spinal stenosis is the most common reason for spinal surgery in patients 65 years of age and older<sup>4</sup>. includes Lower extremity pain which may occur with or without low back pain is the clinical definition<sup>23</sup>. Neurogenic claudication is the main complaint of patients that caused by compression of intraforaminal nervous structures<sup>10</sup>. The management of spinal stenosis is still controversial. Conservative treatment seems to be the natural choice although controlled clinical studies comparing conservative and surgical treatments<sup>2</sup>.

When symptoms are severe and conservative treatment has failed, surgery is suggested<sup>3</sup>. Decompression which is defined as the relief of pressure on one or many pinched nerves of the spinal column seems to be the logical procedure that has the potential to give the patient immediate relief<sup>2,5</sup>.

White and Panjabi defined criteria for diagnosing instability from flexion-extension radiographs as sagittal plane translation greater than 4.5 mm or greater than 15 % of the vertebral body width, or sagittal plane rotation of greater than 15° at L1/L2, L2/L3 or L3/L4, greater than 20° at L4/L5, or greater than 25° at L5/S1<sup>7,24</sup>.

However, instability of the spine is a potential consequence that needs to be considered. The additional value of decompression and arthrodesis compared to decompression is debated<sup>3</sup>. Toracal and lumbar anatomy must be evaluated well before the surgery<sup>13,19-20</sup>. Fusion is defined as a surgical technique used to join two or more vertebrae. Bone graft, either from the patient, a donor or bone substitute is used in conjunction with the body's natural bone growth processes to fuse the vertebrae. Fusion with instrumentation utilizes stainless steel, titanium or non-metallic devices to stabilize the spine.

Spinal instrumentation is the most common surgical technique used for spinal instability. Spinal stenosis, fractures and spondylolisthesis are the most common diagnosis for the causes of spinal instability.

## REFERENCES:

1. Akan B, Benli T, Karagüven D, Köken M, Bülbül Ö, Yıldırım T, Özdoğan S. Taze dana torakal ve lomber omurgasında serbest el tekniği ile transpediküler vida uygulamasında açılabilir güvenli zonun araştırılması. *JTSS* 2009; 20 (3): 11-22.
2. Amundsen T, Weber H, Nordal HJ, Magnaes B, Abdelnoor M, Lilleas F. Lumbar spinal stenosis: conservative or surgical management?: a prospective 10-year study. *Spine* 2000; 25: 1424-35. Discussion: 1435-1426.
3. Carragee EJ. Single-level posterolateral arthrodesis, with or without posterior decompression, for the treatment of isthmic spondylolisthesis in adults. A prospective, randomized study. *J Bone Joint Surg* 1997;79-A: 1175-1180.
4. Ciol MA, Deyo RA, Howell E, Kreif S. An assessment of surgery for spinal stenosis: time trends, geographic variations, complications, and reoperations. *J Am Geriatr Soc* 1996; 44: 285-90.
5. Dictionary AH. *The American Heritage Medical Dictionary*. Mifflin Company, Houghton 2007; p:700-750.
6. Düzkalır AH, Özdoğan S, İstemem İ. Radyofrekans termokoagülasyon ile faset eklem denervasyonu. *JTSS* 2014; 25(1): 33-37.
7. Fritz JM, Piva SR, Childs JD. Accuracy of the clinical examination to predict radiographic instability of the lumbar spine. *Eur Spine J* 2005; 14: 743-50.
8. Hadra BE. The classic: wiring of the vertebrae as a means of immobilization in fracture and Potts'disease. Berthold E. Hadra. *Med Times and Register* 22, May 23, 1891. *Clin Orthop Relat Res* 1975; 112: 4-8.
9. Hibbs R. An operation for progressive spinal deformities. *NY Med J* 1911; 93: 1013-1016.
10. Kalichman L, Cole R, Kim DH, Li L, Suri P, Guermazi A, Hunter DJ. Spinal stenosis prevalence and association with symptoms: the Framingham study. *Spine J* 2009; 9: 545-550.
11. Kış N, Kapmaz M, Düzkalır AH, Özdoğan S. Brucellar and tuberculous spondylodiscitis: comparison of magnetic resonance imaging findings. *JTSS* 2015; 26(4): 285-290.
12. Ozdogan S, Gergin YE, Senol O, Tiryaki M, Suslu HT, Tatarlı N, Hicdonmez T. Thoracic disk herniation mimicking spinal mass lesion: An illustrative case and review of the literature. *Neurosurg Q* 2016 (In press).
13. Özdoğan S, Gergin YE, Düzkalır AH, Demirel N, Köken M. Measurement of lumbar vertebral disc heights by computed tomography: Morphometric study. *JTSS* 2015; 26(4): 291-294.
14. Özdoğan S, Gür E, Süslü H, Tiryaki M, Düzkalır AH, Yalırık CK. Failed back surgery syndrome. *JTSS* 2015; 26(3): 249-254.
15. Özdoğan S, Yalırık CK, Atalay B, Tiryaki M, Düzkalır AH, Süslü H. Unilateral approach for bilateral spinal microdecompression in lumbar spinal stenosis: short term results. *JTSS* 2015; 26(3): 205-209.

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16. Özdoğan S, Gergin YE, Şenol Ö, Tiryaki M, Düzkalır AH, Hiçdönmez T. Torakal disk hernilerine pratik yaklaşım. *JTSS* 2014; 25(4): 309-312.
  17. Özdoğan S, Düzkalır AH, İştmen İ. Lomber diskojenik ağrı tedavisinde alternatif yöntem: Disk içi elektrotermal tedavi (IDET - Intradiscal electrothermal therapy. *JTSS* 2013; 24(2): 131-134.
  18. Özdoğan S, Düzkalır AH, İştmen İ. Kronik bel ağrısı tedavisinde faset eklem denervasyonu ile faset eklem enjeksiyonunun karşılaştırılması. *JTSS* 2013; 24(3): 219-222.
  19. Şerifoğlu L, Gül A, Gergin S, Düzkalır HG, Başaran R, Düzkalır AH, Özdoğan S. Lumbar intervertebral foraminal morphometry. *JTSS* 2016; 27(1): 19-22.
  20. Şerifoğlu L, Erol AT, Gergin S, Düzkalır HG, Başaran R, Düzkalır AH, Aydoğmuş E, Özdoğan S. Lumbar spinal canal morphometry. *JTSS* 2016; 27(1): 23-27.
  21. Süslü H, Köken M, Özdoğan S, Tiryaki M, Düzkalır AH. Coccydina: pain management with radiofrequency thermoablation of ganglion impar. *JTSS* 2015; 26(3):229-236.
  22. Süslü H, Yalırık CK, Özdoğan S, Şenol Ö, Tatarlı N, Düzkalır AH, Düzkalır HG. Epiduroscopy usage for pain management of failed back surgery syndrome. *JTSS* 2015; 26(2):127-133.
  23. Watters W, Baisden J, Gilbert T, Kreiner D, Resnick D, Bono C, et al. *Evidence Based Clinical Guidelines for Multidisciplinary Spine Care: Diagnosis and Treatment of Degenerative Lumbar Spinal Stenosis*. North American Spine Society, Burr Ridge 2007; pp:19-121.
  24. White AA, Panjabi MMA. *Clinical Biomechanics of the Spine*. 2nd ed. Lippincott Williams & Wilkins, Philadelphia 1990; p: 1-115.

