Are Transitional Vertebra and Spina Bifida Occulta Related with Lumbar Disc Herniation and Clinical Parameters in Young Patients with Chronic Low Back Pain?

Kronik Bel Ağrılı Genç Hastalarda Lomber Disk Herniasyonu ve Klinik Parametreler Transizyonel Vertebra ve Spina Bifida Okülta ile İlgili midir?

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ABSTRACT

Objective: Lumbosacral transitional vertebra (LSTV) and spina bifida occulta (SBO) are widespread within the lumbosacral spine. Their connection to lumbar disc herniation (LDH) and/or lower back pain has been debated in the current literature; however, there is no consensus. The purpose of this study is to evaluate the relationship between the frequency of LSTV and SBO with that of LDH among young patients with chronic lower back pain.

Study Design: Cross-sectional.

Materials and Methods: A total of 1094 patients with lower back pain, aged between 20 and 40 years, with lower back pain history persisting for longer than 12 weeks were studied. All the patients in the study were evaluated with standard pelvic radiographs and lumbar vertebra magnetic resonance imaging. The severity of pain was measured using the visual analog scale, and the effect of lower back pain on daily life activities was measured using the Oswestry disability index. The patients were separated into two groups: Group 1 consisted of patients without LDH, and Group 2 consisted of patients with LDH. Additionally, these two groups were separated into three subgroups: Non-LSTV-SBO, LSTV, and SBO.

Results: It was determined that LSTV frequency was significantly higher (p=0.004) in the lumbar disc herniation group 2. In addition, the existence of LSTV increased the risk of lower back pain (p<0.001, p<0.001) and disability (p<0.001, p<0.001) in young patients with and without LDH or not. However, the presence of SBO did not increase lower back pain (p=0.251, p=0.200) and disability (p=0.134, p=0.161) in both groups.

Conclusion: A relationship was detected between the frequency of LDH and LSTV in young patients with chronic lower back pain between the ages of 20 and 40 years. Also, the presence of LSTV was found to increase the risk of lower back pain and disability.

Keywords: Chronic lower back pain, lumbar discopathy, transitional vertebra, spina bifida occulta

ÖZ

Amaç: Lumbosakral transizyonel vertebra (LSTV) ve spina bifida okülta (SBO) lumbosacral omurgada sıklıkla görülür. Lomber disk herniasyonu (LDH) ve / veya bel ağrısı ile ilişkisinin varlığı mevcut literatürde tartışılmıştır ancak bir fikir birliği yoktur. Bu çalışmanın amacı, kronik bel ağrısı olan genç hastalarda LSTV ve SBO sıklığı ile LDH sıklığı arasındaki ilişkiyi değerlendirmektir.

Çalışma tasarımı: Kesitsel.

Gereç ve Yöntemler: 20 - 40 yaş arası bel ağrısı olan ve ağrısı 12 haftadan uzun süre devam eden toplam 1094 hasta çalışmaya alındı. Çalışmaya katılan tüm hastalar standart pelvis grafisi ve lomber vertebra manyetik rezonans görüntülemesi ile değerlendirildi. Ağrının şiddeti görsel analog skala ile ve bel ağrısının günlük yaşam aktivitelerine etkisi Oswestry dizabilite indeksi ile ölçülmüştür. Hastalar iki gruba ayrıldı: Grup 1, LDH'si olmayan hastalardan oluşuyordu ve Grup 2, LDH'li hastalardan oluşuyordu. Ek olarak, bu iki grup, üç alt gruba ayrılmıştır: Non-LSTV-SBO, LSTV ve SBO.

Bulgular: Lomber disk herniasyon grubu grup 2'de LSTV sıklığının anlamlı olarak yüksek (p=0.004) olduğu görüldü. Buna ek olarak LDH'lı olan ve olmayan grupta da LSVT varlığının bel ağrısı (p<0.001, p<0.001) ve dizabilite (p<0.001, p<0.001) riskini arttırmaktaydı. Bununla birlikte SBO varlığı, her iki grupta da bel ağrısını (p=0.251, p=0.200) ve dizabiliteyi (p=0.134, p=0.161) arttırmamaktadır.

Sonuç: Yaşları 20 - 40 arasında değişen kronik bel ağrısı olan genç hastalarda, LDH ve LSTV sıklığı arasında bir ilişki saptanmıştır. Ayrıca, LSTV varlığının bel ağrısı ve sakatlık riskini arttırdığı görülmüştür.

Anahtar Kelimeler: Kronik bel ağrısı, Lomber diskopati, transizyonel vertebra, spina bifida okülta

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Introduction

Lower back pain is a common problem. Approximately 60% to 85% of all individuals experience lower back pain at least once in their lives [1]. Multiple factors are involved in the development of lower back pain. Although congenital vertebral anomalies are often found, there is no consensus in the literature on the association between lower back pain and congenital vertebra malformation [2, 3].

Spina bifida occulta (SBO) and lumbosacral transitional vertebra (LSTV) are the most common congenital lumbosacral malformations [4, 5]; both generally involve the 5th lumbar vertebra. SBO is caused by a failed fusion between the posterior vertebral elements that does not affect the spinal cord or meninges. This malformation is generally observed at the 5th lumbar vertebra and/or 1 or 2 vertebrae above or below the 5th lumbar vertebra [6, 7]. The prevalence of SBO varies between 0.6% and 25% [4].

Bertolloti syndrome was described in 1917 and has been identified in detail in all vertebra located within the transitional areas in the respective parts of the spine [8]. Castellvi also classified LSTV in 1985 [9]. According to Castellvi's classification, there are four types of lumbosacral transitional vertebrae: type I, dysplastic transverse process with height >90 mm; type II, incomplete lumbarization/sacralization; type III, complete lumbarization/sacralization with complete fusion with the neighboring sacral basis; and type IV, mixed [9]. In most of the literature that supports Bertolotti syndrome, the implicated transitional segments are Castellvi types II to IV. Castellvi states that type I LSTVs are of no clinical significance and are a "forme fruste." Therefore, they have no relationship to what was initially described as Bertolotti syndrome. However, Aihara et al. [10, 11] determined that both short and broad iliolumbar ligaments provide a protective effect on the L5-S1 disk space and potentially destabilize the L4-L5 level. There may be an association of this iliolumbar ligament morphology with broadened long transverse processes (Castellvi type I). LSTV is common in the general population, with a reported prevalence of 4% to 35% [12]. This wide range may be explained by the investigation of different populations. In Turkey, LSTV prevalence was represented as 18.9% of the general population by Uçar et al. [13].

The aim of this study was to evaluate LSTV and SBO frequency in young patients with chronic lower back pain and their relationship with LDH.

Materials and Methods

Patients:

A total of 1094 patients, 609 (55.7%) female and 485 (44.3%) male, aged between 20 and 40 years, with lower back pain persisting longer than 12 weeks were included in the study. SBO and LSTV anomalies were detected in this study. Patients with LSTV were classified according to the Castellvi classification of LSTV [9]. The patients were separated into two groups: Group 1 consisted of patients without LDH, and Group 2 consisted of patients with LDH. Additionally, these two groups were separated into three subgroups: Non-LSTV-SBO, LSVT, and SBO. All patients have confirmed to use images and medical information in a study and an article.

Exclusion Criteria:

Patients who had cancer, trauma history, facet tropism, vertebral problems such as scoliosis and kyphosis, inflammatory diseases, osteoporosis, or who had undergone spinal surgery were excluded from the study. Patients who were found to have sacroiliitis or who had high levels of acute phase reactants (ESR, CRP) were also excluded. In addition, patients with both spina bifida and LSTV were excluded from the study to avoid distortion of the statistical homogeneity.

Evaluation:

All patients were evaluated with standardized pelvis radiographs and lumbar vertebra magnetic resonance imaging (MRI) with 1.5 T (Siemens Symphony, Erlangen, Germany). The radiographs and MRI films were assessed by a radiologist with 11 years of experience according to the 2001 standard of the North American Spine Society definitions of lumbar disc pathology [14]. Then, the patients who had discopathy at the L3-L4, L4-L5, and L5-S1 levels were recorded.

The severity of the pain was measured using the visual analog scale (VAS), and the effect of lower back pain on daily life activities was measured using the Oswestry Disability Index (ODI).

VAS. This test measures the pain threshold of a patient based on a scale from 0 to 10 on a 10 cm line. The absence of pain is indicated by 0, while the most severe pain is scored as 10. The patient is asked to mark his/her pain on the line [15].

ODI. This scale was approved at the International First Level Health Research Meeting to measure the disability caused by lower back pain [16]; it was developed to analyze the extent of the effect of lower back pain on life activities. The ODI is

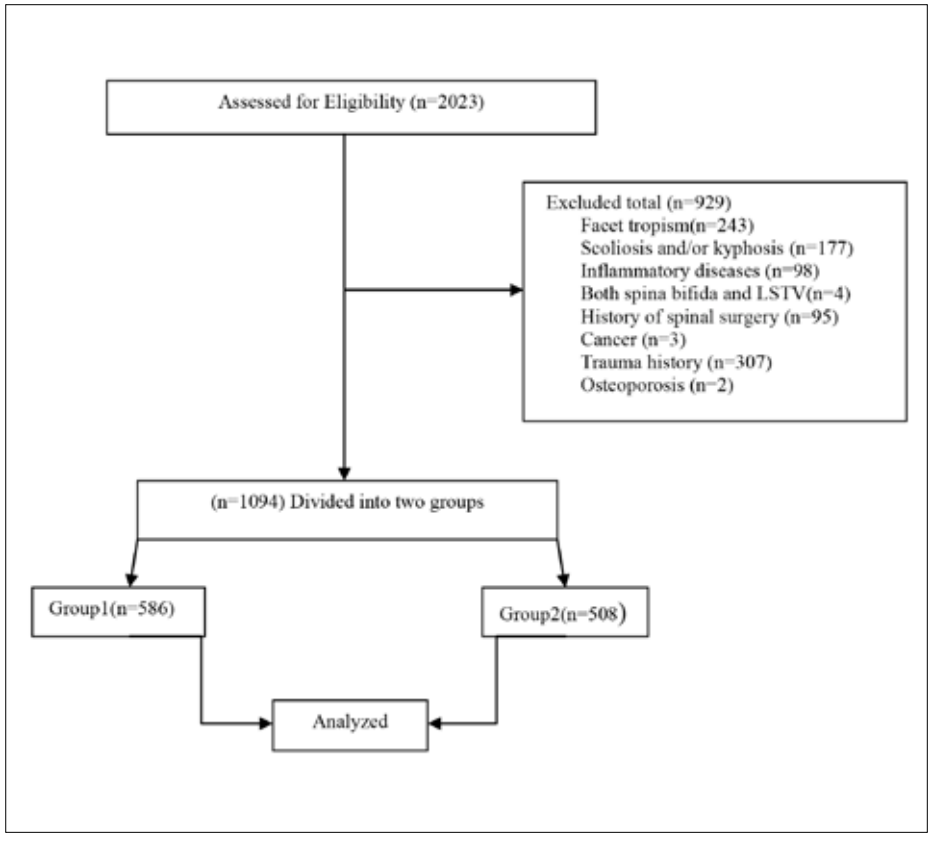

Figure 1. Flowchart of study

Table 1. Results of patient evaluations according to group, with p values

		Group 1 (n=586)	Group 2 (n=508)	p
Age (mean±SD (min-max))		31.19±6.4 (20–40)	34.10±6.9 (20–40)	0.120
Non-LSVT-SBO		425 (%72.5)	352 (%69.3)	*0.004
LSTV (%)	LSTV 1	47 (%8)	64 (%12.6)	
	LSTV 2	25 (%4.3)	34 (%6.7)	
	LSTV 3	13 (%2.2)	17 (%3.3)	
	LSTV 4	11 (%1.9)	9 (%1.8)	
SBO (%)		65 (%11.1)	32 (%6.3)	
VAS (mean±SD (min-max))		5.82±1.27 (2–9)	7.66±2.42 (3–10)	*<0.001
ODI (mean±SD (min-max))		13.45±5.69 (2–40)	23.58±8.81 (4–45)	*<0.001

VAS: visual analog scale; ODI: oswestry disability index; LSTV: lumbosacral transitional vertebra; SBO: spina bifida occulta; *significance was defined as p<0.05

Table 2. Arithmetic means of ODI and VAS with p values of Group 1, Group 2, and the subgroups

	Group 1				Group 2			
	Non-LSTV and SBO (n=425)	LSTV (n=96)	SBO (n=65)	p	Non-LSTV and SBO (n=352)	LSTV (n=124)	SBO (n=32)	p
ODI	12.76±4.84	15.9±4.36	14.26±9.96	p<0.001	22.15±8.19	27.73±9.46	23.19±7.97	*p<0.001
VAS	5.71±1.24	6.27±1.24	5.78±1.42	p<0.001	7.92±1.25	8.79±4.15	7.31±1.82	*p<0.001

VAS: visual analog scale; ODI: oswestry disability index; LSTV: lumbosacral transitional vertebra; SBO: spina bifida occulta; *significance was defined as p<0.05

Table 3. P values of subgroups in terms of ODI and VAS

		Group 1	Group 2
ODI	Non-LSVT-SBO and SBO	p=0.134	p=0.161
	LSTV and SBO	*p<0.001	*p=0.015
	LSTV and Non-LSVT-SBO	*p<0.001	*p<0.001
VAS	Non-LSVT-SBO and SBO	p=0.251	p=0.200
	LSTV and SBO	*p=0.001	p=0.041
	LSTV and Non-LSVT-SBO	*p<0.001	*p<0.001

VAS: visual analog scale; ODI: oswestry disability index; LSTV: lumbosacral transitional vertebra; SBO: spina bifida occulta; *significance was defined as p<0.017

composed of 10 questions. Each question has 6 choices, numbered from 0 to 5. The lowest score is 0, and the highest score is 50 [16, 17].

The validity of the scale in Turkey was confirmed by Yakut et al. [17].

Local ethical committee approval was obtained for this study. The flowchart is depicted in Figure 1.

Statistical analysis

SPSS 21 (IBM Corp.; Armonk, NY, USA) software was used for the statistical analyses and p<0.05 was considered statistically significant.

Descriptive statistics were used. The patients were separated into two groups: Group 1 consisted of patients with normal lumbosacral MRIs and bulging, and Group 2 consisted of patients with protruded, extruded, and sequestered LDH. The Mann-Whitney U test was used to evaluate the differences between the two groups in terms of VAS and ODI.

The chi-square test was used to evaluate the relationship between the presence of lumbar discopathy and congenital malformations.

The Kruskal-Wallis analysis was used to evaluate the differences between the VAS and ODI in relation to the Non-LSTV-SBO, LSTV, and SBO groups. The Mann-Whitney U test was used for post hoc analyses with the Bonferroni correction.

Results

No difference was detected between Group 1 and Group 2 with respect to age. However, a statistically significant difference was shown between these two groups in terms of VAS and ODI. In addition, a total of 96 (16.4%) patients had LSTV in Group 1 and 156 (24.4%) patients had LSTV in Group 2. A relationship was detected between the frequency of LDH and LSTV in young patients with chronic lower back pain. The results of the patient evaluations according to group and the p values are depicted in Table 1.

Group 1 and Group 2 were separated into three subgroups: LSVT, SBO, and Non-LSTV-SBO. Statistically significant differences were detected between the three subgroups in terms of VAS and ODI. These differences were found in both Group 1 and Group 2. Table 2 shows the arithmetic means of ODI with VAS and the p values of Group 1, Group 2, and the subgroups.

The detection of the subgroups that led to the related differences was performed by comparing the subgroups within the groups. The Bonferroni correction was calculated, and p<0.017 was accepted as being statistically significant. There was no statistical significance between the Non-LSVT-SBO and SBO groups in terms of ODI (Group 1: p=0.134; Group 2: p=0.161). There were statistically significant differences in Group 1 (p<0.001) and Group 2 (p=0.015) between LSTV and SBO in terms of ODI. Additionally, statistically significant differences were found in Group 1 and Group 2 between the LSTV (p<0.001) and Non-LSVT-SBO subgroups (p<0.001).

When the subgroups were compared to each other in terms of VAS, there were no statistically significant differences between the Non LSTV-SBO and SBO subgroups in Group 1 (p=0.134) and Group 2 (p=0.161). In both groups, significant differences were detected between LSTV and SBO (p=0.001), although this difference was not observed in Group 2 (p=0.041). Also, a significant difference emerged between the LSTV and Non-LSVT-SBO subgroups in both Group 1 (p<0.001) and Group 2 (p<0.001).

Table 3 shows the p values and means of the subgroups in terms of ODI and VAS.

Discussion

Statistical differences in the ODI and VAS values were found between patients with normal lumbosacral MRI and lumbar discopathy. In addition, the ODI and VAS values were found to be higher in patients with LSTV than in the Non-LSTV-SBO and SBO subgroups. There were also significant statistical differences between the SBO and LSTV subgroups, although there were no significant statistical differences between the Non-LSVT-SBO and SBO groups. These results show that LSTV may increase lower back pain and limit daily activity regardless of whether lumbar discopathy is present. Tini et al. [18] reported no correlation between LSTV and

LDH. Elster [9] also found that the incidence of structural pathology (disc pathology and spinal and foraminal stenosis) did not differ in patients with LSTV compared with those without LSTV. However, the results of a current study support our study [19].

There are various reports regarding the histopathological and radiological changes occurring at the structures adjacent to the LTSV. It has been suggested that the LSTV decreases annulus fibrosis degeneration of the disc below but does not have the same effect on the endplates and nuclear complex (20). An association has been found between the LSTV and disc herniation [9, 21]. Otani et al. [2] stated that an LSTV was found more often in patients with disc herniation (17%) than in a control group (11%). We also detected that in patients with LDH, the frequency of LSTV was statistically higher than in patients without LDH, whereas even in patients in the non-LDH, ODI, and VAS groups, the arithmetic means were significantly statistically higher in patients with LSVT. Only the frequency of patients in the LSTV 4 subgroup was lower than in the Non-LDH group. However, the total numbers of patients with LSTV were statistically higher than those without LDH. Aihara et al. [11] conducted a study on 70 cadavers; they concluded that upper segment hypermobility of the transitional vertebrae may cause abnormal torque moments, which could cause lower back pain as a result of axial compression.

In our study, the frequency of SBO was not higher in the LDH group than in the Non-LDH group. Additionally, there were no significant differences between the SBO and Non-LSVT-SBO subgroups in terms of ODI and VAS. However, there were statistical differences between the SBO and LSTV subgroups. Avrahami et al. [20] reported that a higher incidence of posterior disc herniation was showed in patients with SBO-S1, which increased with age. This can be explained by instability of the base of the lumbar spine caused by SBO-S1, which produces a predispostion to posterior disc herniation. The results were statistically significant.

Our study population was young, and the range of the patients' ages was between 20 and 40 years. Thus, these clinical cases may be seen in later years. Milic et al. also conducted a study on children; they reported that LSTV and/or SBO were related to disc degeneration in children. However, they statistically evaluated LSTV and SBO together as an anomaly [21]. They explained that the cause of the anomaly, disc degeneration, may lead to lower back pain.

Conclusion

A relationship was found between the frequency of LDH and LSTV in patients between the ages of 20 and 40 years with chronic lower back pain. However, the presence of SBO was not shown to increase the risk of lower back pain and LDH. Although current research supported our results of the study [19, 21-24]. New histopathological studies are required in order to determine whether SBO and LSTV have an impact on the mechanics of lower back.

Ethics Committee Approval: Ethics committee approval was received for this study from local ethic committee.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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