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Associations between low back pain, disability, functional status, and serum interleukin-1 β level

Aim: In the past the role of biochemical mediators of inflammation in back pain received little attention. The purpose of the present study was to examine the association between serum IL-1 β level in patients with low back pain (LBP) and its effect on their functional status.

Methods: This cross-sectional study included 88 LBP patients with symptom duration of 6 months or longer and 65 healthy controls. Serum analysis was performed using ELISA. The LBP group completed the Roland-Morris Disability Questionnaire and Oswestry Disability Index in order to evaluate their functional status.

Results: Mean IL-1 β level was significantly higher in the LBP group than in the control group. As the duration of LBP and age increased, IL-1 β level also increased significantly. We observed a positive correlation between IL-1 β level and Oswestry Disability Index score.

Conclusion: Proinflammatory cytokine levels, including IL-l β, were elevated in LBP patients, which affected their functional status. Determination of the influence of cytokines in LBP may aid in improving diagnostic and therapeutic interventions for LBP.

Key words: Low back pain, interleukin-1 β, functional status

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Bel ağrılı olgularda, sakatlık, fonksiyonel durum ile Il-1 β düzeyinin karşılaştırılması

Amaç: Bel ağrısındaki inflamasyon ve bu inflamasyona yol açan mediatörlerin rolünün araştırılması güncelliğini korumaktadır. Bu çalışmada temel proinflamatuar mediatörlerden olan interlökin-1β'in bel ağrısı ve yaşam kalitesi ile olan ilişkisi araştırılmıştır.

Yöntemler: Altı aydan daha uzun süreli bel ağrısı yakınması olan 88 hasta ve sağlıklı 65 kontrol çalışmaya alındı. Çalışmaya katılan tüm bireylerin serum IL-1 β düzeyleri ELISA yöntemi kullanılarak ölçüldü. Bel ağrısı olan gruba Oswestry ve Roland-Morris disabilite ölçekleri uygulandı.

Bulgular: IL-1 β düzeyleri bel ağrılı olgularda anlamlı yüksek bulunmuştur. Bel ağrısın süresi ve hasta yaşı arttıkça serum IL-1 β düzeyi anlamlı olarak artmaktaydı. Serum IL-1 β düzeyi ile Oswestry Disabilite Indeksi arasında pozitif korelasyon saptandı.

Sonuç: Çalışmamızın sonuçlarına göre, bel ağrılı olgularda IL-1 β vb gibi proinflamatuar sitokinlerin serum düzeyi artmıştır ve bu durum hastanın fonksiyonel durumunu etkilemektedir. Sitokinlerin bel ağrısındaki yerinin belirlenmesi, bu hastalığın tanı ve tedavisinde yeni gelişmelere yol açacaktır.

Anahtar sözcükler: Bel ağrısı, interlökin 1 β, fonksiyonel durum

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Introduction

Low back pain (LBP) is a significant clinical entity that causes major disability. Although the etiology and the exact pathophysiology of LBP remain elusive, environmental and genetic factors may play significant roles (1,2).

The biochemical events that occur as a result of intervertebral disk degeneration and, in particular, the role of biochemical mediators of inflammation and tissue

degradation have received little attention in the literature (1-3).

Interleukin 1 beta (IL-1 β), a proinflammatory cytokine, contributes to joint degeneration by inducing enzymes that destroy proteoglycan and is involved in the mediation of pain (4-6). The production of IL-1 β might be influenced by the potential risk factors for LBP (2).

The purpose of the present study was to examine the association between serum IL-1 β level in LBP patients and its effect on their functional status.

Materials and methods

The study was conducted at the Department of Physical Medicine and Rehabilitation, Gaziantep University Medical School, and included 88 LBP patients (40 male, 48 female) with symptom duration of 6 months or longer. The control group included 65 age- and sex-matched healthy subjects.

The LBP patients were sub-grouped as mechanical back pain, spinal stenosis, lumbar disc herniation, and facet syndrome, on the basis of patient history, physical examination, laboratory investigation (whole blood count and erythrocyte sedimentation rate, calcium, phosphorus, and alkaline phosphatase levels, and urinary analysis), and imaging techniques, such as CT and/or MRI, when needed. Patients that experienced recent low back trauma, were pregnant, or had cauda equina symptoms and/or co-existent diseases, such as cancer, osteoporosis, and rheumatic disease, were excluded from the study.

Among the 88 LBP patients, 30 had musculotendinous strain findings in the lumbar region based on physical examination, but no radiculopathy. Patients whose radiographs revealed mechanical disorders, such as summarization, sacralization, and reduction in the lumbosacral angle, were diagnosed with mechanical LBP. In all, 13 patients were diagnosed with facet syndrome, 22 patients with spinal stenosis, and 23 with lumbar disk herniation, based on physical examination, and MRI or CT findings.

Serum IL-1 β level in the patient and control groups was measured using KHC0011C ELISA kits obtained from Biosource International, Inc. The range of these kits is 3.9-250 pg/mL and the sensitivity is 1 pg/mL (7).

Functional health status of the patients was evaluated with the Roland-Morris Disability Questionnaire, a disease-specific instrument, and their psychosocial variables were measured using the Oswestry Disability Index, a questionnaire with 10 sections, including pain intensity, self-care, and the ability to sit, stand, sleep, walk, lift, travel, or participate in social events (8,9). The Roland-Morris score was calculated by simply summing the scores.

The Oswestry disability questionnaire consists of 10 items that focus on different aspects of functioning. Each item is scored from 0 to 5, with higher values indicating greater disability. Total score is multiplied by 2 and expressed as a percentage. A score of 0%-20% indicates a baseline level or minimal disability, 21%-40% indicates moderate disability, 41%-60% indicates severe disability, 61%-80% indicates crippled, and 81%-100% indicates bedridden or exaggeration of symptoms (10). Evaluations were performed using the criteria described above.

Statistical analyses were performed using SPSS v.13.0. The chi-square test was used to analyze demographic data, diagnoses, questionnaires, and IL-l β levels. An ANOVA model was used to compare age, disease duration, and questionnaire scores with IL-1 β levels. To assess IL-l β levels between groups, Student's t-test was used.

Results

Demographic data of the participants are shown in Table 1. Roland-Morris Disability Questionnaire and Oswestry Disability Index scores, and serum IL-1 β levels are shown in Table 2. There were no significant differences between groups in terms of age,

Table 1. Patient demographic data.

	LBP group	Control group	P
Age	43.5 (23-69)	41.2 (24-62)	0.350
Gender	40 men 48 women	32 men 39 women	0.90
BMI	28.4	26.6	0.089

Table 2. Mean (range) Roland-Morris Disability Questionnaire and Oswestry Disability Index scores, and serum IL-1 β levels.

	LBP group	Control group	P
IL-1β level	77.3 (57-160)	34.5 (18-74)	0.001
Roland-Morris score	14.2 (9-22)	-----	
Oswestry score	66.8 (48-78)	-----	

gender, or BMI. The difference between serum IL-1 β levels in the patient and control groups was significant (P = 0.001). In the patient group a significant positive correlation was observed between IL-l β level, and both LBP duration and age (r = 0.480 and r = 0.340, respectively). We also observed a positive correlation between serum IL-1 β level and Oswestry Disability Index score (P = 0.024; r = 0.241) in the LBP group; however, there was no relationship between serum IL-1 β level and Roland-Morris Disability Questionnaire score (P = 0.069; r = 0.195). A significant relationship between age, and both Roland-Morris and Oswestry Disability scores (P = 0.767 and P = 0.970, respectively) was not observed in the LBP group. Moreover, a significant relationship was not observed between gender of the LBP patients, and LBP syndromes and IL-l β level (P = 0.341). There was no relationship between the duration of back pain, and Roland-Morris Disability Questionnaire or Oswestry Disability Index scores (P = 0.248 and P = 0.506, respectively).

There were positive correlations between serum IL-1 β level and the following sub-groups of LBP patients: spinal stenosis, facet syndrome, disk hernia, and mechanical back pain (P = 0.012). When the patients with spinal stenosis, facet syndrome, and disk hernia were excluded one by one from the comparison the statistical significance remained (P = 0.014, 0.017, and 0.016, respectively), whereas when mechanical back pain patients were excluded from the comparison statistical significance disappeared (P = 0.18).

Serum IL-l β levels in the LBP patient and control groups are presented in Figure 1. The relationships between diagnostic parameters and serum IL-1 β level are shown in Figure 2.

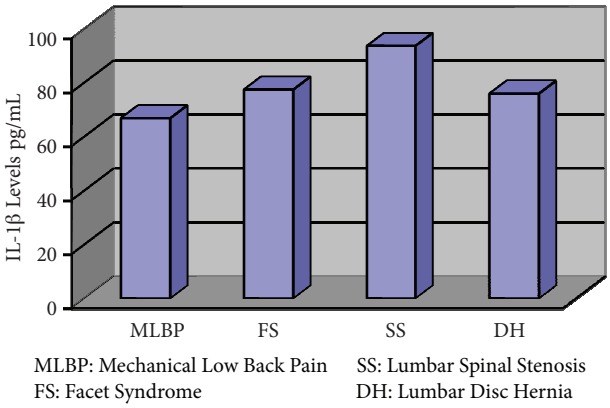

Figure 2. Mean IL-1ß levels in LBP patients.

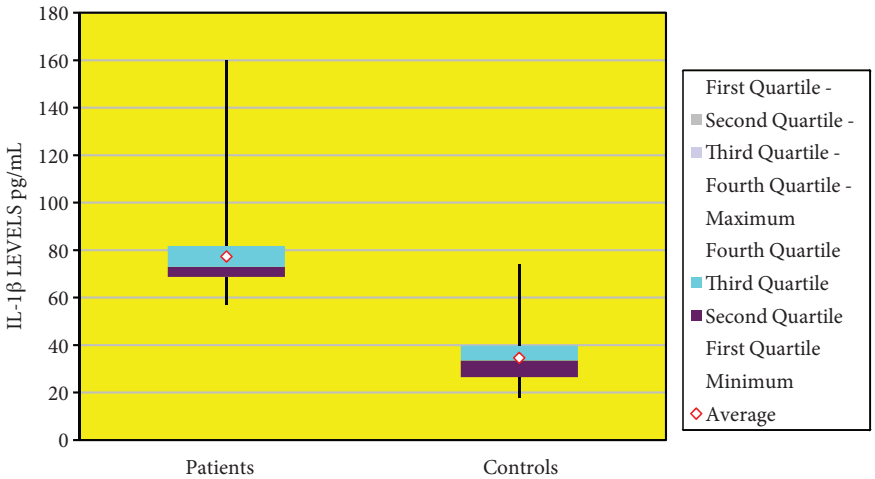

Figure 1. Mean serum IL-1ß levels in patients and controls.

Discussion

LBP is a common condition and researchers suggest that long-term patients continue to have significant activity limitations and diminished functional status (7,11,12). There is increasing evidence implicating cytokines, growth factors, and inflammatory mediators in the pathogenesis of LBP. The cytokines IL-1 β and TNF-α are overexpressed in degenerated intervertebral disks (IVDs), and this leads to matrix degradation and, subsequently, LBP (13-16). Le Maitre et al. reported that IL-1 and its receptor are significantly up-regulated in IVD degeneration and are, therefore, more likely to be major mediators in the processes of IVD degeneration (17). Kang et al. reported that herniated lumbar disks that spontaneously release MMP, NO, IL-6, and prostaglandin E2 increase their production further in response to IL-1 β (18). They concluded that IL-1 could be a target for therapeutic approaches to inhibit IVD degeneration and subsequent LBP. Most previous studies measured increased levels of IL-1 β in facet syndrome, spinal stenosis, and disk herniation (2,3), and the present study's results are similar. In addition to the above-mentioned low back pain subgroups, we also observed a significant difference in IL-1B levels between the mechanical LBP subgroup and control subjects.

Mean Oswestry Index (66.8) score in the LBP group was higher than the baseline level, which might have been due to a lower threshold of pain perception, cultural determinants, and genetic factors in Turkey. Furthermore, the observed positive correlation between IL-1 β level and Oswestry Index score might have been due to functional status being affected by IL-1 β levels. Additionally, some other factors, such as age and duration of disease, may have affected the functional status of the LBP patients.

In conclusion, the relationship between serum IL-1 β and LBP deserves more attention when determining the prognosis and therapeutic approach for LBP patients. To the best of our knowledge the present study is the first to examine IL-1 β and its effect on the functional status of LBP patients. Additional research is needed in order to better elucidate the relationship between inflammatory cytokines, LBP, and the functional status of LBP patients.

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