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Research Article

Diagnostic Efficiency of Inflammatory Prognostic Index on Pain Scoring for Degenerated Intervertebral Disc

Dejenere Intervertebral Disk için Ağrı Skorlamasında İnflamatuar Prognostik İndeksin Tanısal Etkinliği

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Abstract

Aim: Inflammatory Prognostic Index (IPI), calculated via Albumin, CRP and Neutrophil-Lymphocyte Ratio (NLR), is used in the inflammation related diseases. The study focused the efficacy and predictive effect of the IPI in terms of Visual Analog Scales (VAS) for interpretation of back and leg pain.

Materials and Methods: This multicenter retrospective clinical study was performed by the hospital records of the Degenerated Intervertebral Disc (DIVD) treated between January 2020 and February 2022. IPI value was calculated by the formula of "CRPxNLR/Albumin".

Results: There was a significant difference between VAS-B (2.38±1.74; p=0.0001) and VAS-L (7.09±1.44; p=0.00017) in the comparison of paired VAS values before and after the surgery. Similar change occurred within walking distance after surgery. According to the correlation analysis of the IPI index with DIVD pain scoring, VAS-B(r=0.391; p=0.00017) and delta VAS-B (r=0.422; p=0,00004) showed a positive correlation with the IPI. In the ROC analysis for the diagnostic value of the IPI, the cut-off value of VAS-L above 0.184 showed a diagnostic value as 78.9% sensitivity and 64.3% specificity (UAC:0.702; p:0.003; CI%95: 0.581-0.815).

Conclusion: We showed a strong relationship between IPI and pain scoring of DIVD. The diagnostic value of IPI with VAS-L was very important and can be used by physicians for pain follow-up of DIVD.

Keywords: Inflammatory prognostic index, pain scoring, disc hernia

Öz

Amaç: Albümin, CRP ve Nötrofil-Lenfosit Oranı (NLR) ile hesaplanan İnflamatuvar Prognostik İndeks (IPI), inflamasyona bağlı hastalıklarda kullanılmaktadır. Çalışmamız, sırt ve bacak ağrısının yorumlanması için Görsel Analog Ölçekler (VAS) açısından IPI'nin etkinliğine ve öngörücü etkisine odaklandı.

Materyal ve Metot: Bu çok merkezli retrospektif klinik çalışma, Ocak 2020 ile Şubat 2022 arasında tedavi edilen Dejenere Intervertebral Disk (DIVD) hastalarının hastane kayıtları üzerinden yürütülmüştür. IPI değeri "CRPxNLR/Albumin" formülü ile hesaplanmıştır.

Bulgular: Ameliyat öncesi ve sonrası ikili VAS değerleri karşılaştırıldığında, VAS-B (2.38±1.74; p=0.0001) ve VAS-L (7.09±1.44; p=0.00017) arasında anlamlı fark tespit edildi. Ameliyattan sonra yürüme mesafesinde de benzer bir değişiklik meydana geldi. IPI indeksinin DIVD ağrı skorlaması ile korelasyon analizine göre, VAS-B (r=0,391; p=0,00017) ve delta VAS-B (r=0,422; p=0,00004) ile IPI değeri pozitif korelasyon gösterdi. IPI'nin tanısal değeri için yapılan ROC analizinde, VAS-L'nin 0,184'ün üzerindeki kesim değeri, %78,9 duyarlılık ve %64,3 özgüllük olarak tanısal değer göstermiştir (UAC:0.702; s:0,003; CI %95: 0.581-0.815).

Sonuç: IPI ile DIVD'nin ağrı skorlaması arasında güçlü bir ilişki olduğunu gösterdik. VAS-L ile IPI'nin tanı değeri çok önemliydi ve doktorlar tarafından DIVD'nin ağrı takibinde kullanılabileceğini düşünmekteyiz.

Anahtar Kelimeler: İnflamatuvar prognostik indeks, ağrı skorlaması, disk hernisi

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INTRODUCTION

Low back pain is accepted as a derivative of multi-origin somatic pain with its physical, psychogenic and social aspects, and the problem of degenerated intervertebral disc (DIVD) emerges as the most important source of this pain in the lumbar spine (1). Although clinical results vary, the difficulty of diagnosing objects such as spinal fusion, spondylodesis or arthrodesis, the problematic disc area according to the source and degree of pain is the biggest challenge to be solved today (2). Analyzing the inflammation in the painful area and evaluating the correlation with the pain will be explanatory in the detection and grading of the pain.

The pathophysiology of disc anatomical deterioration is a set of symptoms that develop as a result of inflammatory developments and remodeling of facet joint processes (3). These cytokines and enzymes that break down the matrix disrupt chondrocyte metabolism and thus lead to cartilage transformation (4). In a vicious circle, these changes in cartilage cause extensive pathological remodeling of subchondral bone and stimulate a recurrent inflammatory process (5). In addition to prostaglandins, numerous cytokines such as TNF and IL-6 worsen this picture by causing osteoarthritic alterations. These cytokines and matrix-degrading enzymes disrupt chondrocyte metabolism and thus lead to cartilage transformation (6). In a vicious circle, these changes in cartilage cause intense pathological remodeling in the subchondral bone, stimulating a recurrent inflammatory process (7, 8). Surgeons need novel cheap and practical indexes to maintain and follow pain scoring in DIVD (9). It may be easier to follow these processes clinically to investigate their relevance to pain using indirectly influenced platelet association indices such as neutrophil/lymphocyte ratio (NLR), rather than expensive and difficult-to-measure tests.

Albumin, CRP and NLR, used in routine analyze for inflammatory conditions, are easy to measure, inexpensive, and widely available in clinical practice. Today, the Inflammatory Prognostic Index (IPI), calculated via Albumin, CRP and NLR, is used in the investigation of cancer cases known to be closely related to inflammation and some rheumatological disease. The present study investigated the efficacy and predictive effect of IPI, which has separate effects on DIVD in terms of Visual Analog Scale (VAS) for interpretation of back and leg pain.

MATERIAL AND METHOD

This retrospective clinical study was conducted in the Department of Neurosurgery. Siirt University Faculty of Medicine's Local Ethics Comittee approved the study protochol.(2022/05.06).

Study Design

The patients were treated between June 2021 and February 2022 and were selected from patients undergoing follow-up evaluations. Clinicopathological variables such as age, gender and pain score were recorded with the electronic medical record system. As inclusion criteria, volunteer participants with defined DIVD and complete hospital data were included in the study with their retrospective data. Exclusion criteria included: patients with missing data, who had infection/inflammation, haematological disorder, embolism or infarction, who had a history of active bleeding/ transfusion recently, who had a major drug therapy such as steroid. After assessment of inclusion/ exclusion criteria, 88 of 215 participants were eligible for the present analysis.

Laboratory Data Collection

All laboratory data of the patients were evaluated. The following formula was used to find the IPI value: "CRPxNLR/ Albumin". According to the definition of the World Health Organization (10), anemic, platelet deficiency or disorders in calcium metabolism were evaluated and those with inappropriate results were excluded from the study.

Statistical Analysis

Data analyze was done using SPSS-25.0 software (Chicago,IL,USA). As categorical parameters were presented as number of patients and percentage, mean and standard deviation values were shared in data with normal distribution. Spearmen' correlation test was used to measure the relationships of IPI index with pain scores and outputs of DIVD. The receiver operating characteristic(ROC) curve was used to determine the predictive ability for VAS-L and cut-off value for IPI (Figure-1, Table-3).

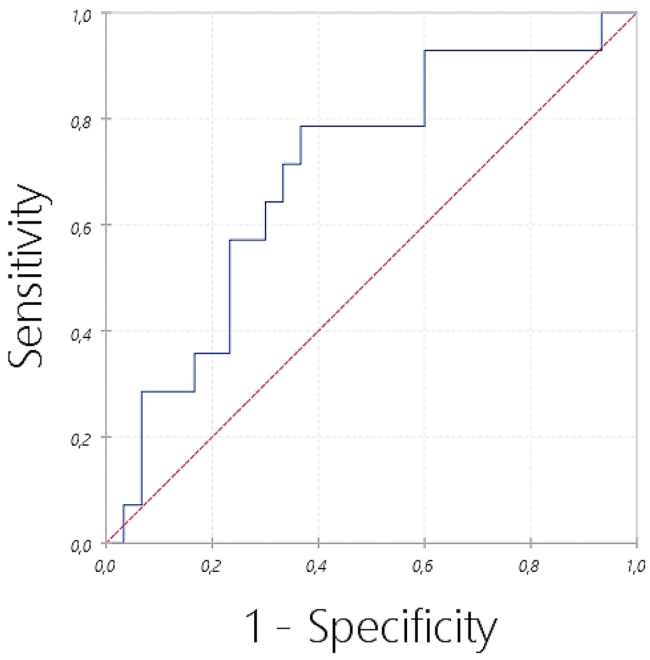

Figure-1. The receiver operating characteristic determining the predictive of IPI for VAS-L

RESULTS

Patient Characteristics

Of the 88 patients included in the study, 54 (61.4%) were

female. The spine levels affected by DIVD were mostly L1 (n:54) and L2 (n:14) spines. Twenty-eight (31.8%) of the patients had high VAS-L values. In terms of VAS-B, it was high in 36 patients (41%). There was a significant difference between VAS-B (2.38±1.74; p=0.0001) and VAS-L (7.09±1.44; p=0.00017) in the comparison of paired VAS values before and after the surgery (Table-1). A similar change occurred within walking distance after surgery (p<0.0001).

Correlations

According to the correlation analysis of the IPI index with DIVD pain scoring, VAS-B (r=0.391; p=0.00017) and delta VAS-B (r=0.422; p=0.00004) showed a positive significant correlation with the IPI value, as given in Table-2. Similarly, follow-up (r=0.308; p=0.003) and hospital stay period (r=0.854; p=0.0001) took longer time when the IPI value increased. Walking distance showed a negative correlation with the IPI (r=-0.355, p=0.001). VAS-B and delta VAS-B values did not show any correlation with the IPI (p>0.05).

ROC Analysis

In the ROC analysis for the diagnostic values of the IPI value in the presence of Leg VAS (Figure-1 and Table-3), the cut-off value above 0.184 showed a diagnostic value of 78.9% sensitivity and 64.3% specificity [UAC:0.702; p:0.003; CI%95: 0.581-0.815). When looking for the Back-VAS values of the IPI value, we did not find a significant cut-off such as Leg-VAS (UAC: 0.529, p:0.647, CI: 0.402-0.656).

Table 1. Paired scale results by before and after the surgery

Variables	Mean	SD	SE	95% CI		Df	P-value
				Lower	Upper		
VAS-L	7.09	1.44	0.19	6.01	7.17	87	0.00017
VAS-B	2.38	1.74	0.22	1.69	2.85	87	0.00011
W-D	-333.5	101.4	14.2	-408.6	-319	87	0.00003

Abbreviations. Leg pain visual analog scale (VAS-L), Back pain scoring (VAS-B), Walking distance (W-D), SE: Standard Error, SD: Standard Deviation, CI: Confidence Interval, Df: Degrees of Freedom

Table 2. Correlation analysis of the IPI index vwith DIVD pain scoring

IPI Comparison	VAS-L	VAS-B	Delta VAS-L	Delta VAS-B	W-D	Stay (day)	Follow-up (month)
Pearson Correlation	0.089	0.391	0.092	0.422	-0.355	0.854	0.308
Sig. (2-tailed)	0.406	0.00017	0.394	0.00004	0.001	0.0001	0.003

Abbreviations. Leg pain visual analog scale (VAS-L), Back pain scoring (VAS-B), Walking distance (W-D)

Table 3. Details of the ROC analyze performed for the prediction of VAS-LEG

Variables	Area	Std. Error	P value	95% Confidence Interval	
				Lower	Upper
IPI	0.702	0.077	0.003	0.581	0.815
NLR	0.430	0.071	0.355	0.292	0.568
CRP	0.511	0.068	0.013	0.577	0.845
Albumin	0.413	0.073	0.253	0.275	0.551

Abbreviations. IPI: Inflammatory Prognostic Index, CRP: C-reactive protein, NLR: neutrophil/lymphocyte ratio

DISCUSSION

As a result of the increase in diagnostic costs in health systems of pandemics worldwide, the need for inexpensive diagnostic parameters in public and private institutions has increased more than ever. Since the IPI index we investigated in the present study is a strong indicator of inflammation and can be used very conveniently and cost-effectively in pain scoring, the results of the study will help us to score pain practically and inexpensively for use in the pre- and postoperative routines of DIVD patients.

Low back pain is accepted as a derivative of multi-origin somatic pain with its physical, psychogenic and social aspects, and the problem of DIVD emerges as the most important source of this pain in the lumbar spine (11, 12). An inflammatory condition in DIVD is a kind of anti-injury response to injury in the skeleton, and it plays a crucial efficiency in the development and worsening of DIVD (13). Platelet generates reactive oxygen species and interleukins. Recently, the inflammatory response was accepted to be a parameter in the weak prognosis of cases with some diseases through hematological indexes (14,15). Under the inflammatory condition, the increased neutrophil count can produce nitric oxide, resulting in worsening the immediate clinical condition (16).

In DIVD patients, we need to assess the inflammation process in terms of pain that radiates to the extremities and beck (17). CRP, which is accepted as a better indicator of inflammation than erythrocyte sedimentation rate (18), responds more quickly to changes in a more sensitive clinical situation than many parameters (18). Albumin, on the other hand, is a negative acute-phase protein, unlike CRP, and its level decreases during sepsis or injuries (19). In addition, albumin reduction is not only closely related to inflammation (20). In this sense, we cannot specifically accept CRP and Albumin. The CRP/Albumin ratio, which is another inflammatory scale examined in combination with CRP, was first studied in some inflammatory-related diseases (21). Patients with a higher CRP/Alb ratio showed a worse overall survival than patients with a lower rate. We think that the NLR parameter, which is obtained by

the ratio of neutrophil and lymphocyte parameters and which has attracted attention recently, can help us in this sense. Some orthopedic studies have presented NLR as a potential marker with prognostic and predictive values in inflammatory conditions (22). In a study performed by Ethemoglu et al., among patients with neck pain, those with non-elevated NLR and CRP levels may have normal neck MR imaging, and in patients with elevated NLR and CRP levels, early protective approaches may play a preventive role in disc degeneration and cervical disc hernia development (23). In our study, we evaluated lumbar disc hernia for the first time, the effect of the IPI value, consisting of NLR, CRP, and albumin, on pain in DIVD patients.

In our study, we found a significant efficiency for IPI in pain scoring of DIVD. There was a significant difference between VAS-B and VAS-L in the comparison of paired VAS values before and after the surgery. Similar change occurred within walking distance after surgery. According to the correlation analysis of the IPI index with DIVD pain scoring, VAS-B and delta VAS-B showed a positive significant correlation with the IPI value. Similarly, follow-up and hospital stay period took longer time when the IPI value increased. Walking distance showed a negative correlation with the IPI. VAS-B and delta VAS-B value did not show any correlation with the IPI. In the ROC analysis for the diagnostic values of the IPI value in the presence of VAS-L, the cut-off value above 0.184 showed a diagnostic value as 78.9% sensitivity and 64.3% specificity.

The present study had some limitations. We collected all the data by retrospective way; therefore, case comparison may be affected by selection bias. Second, the present research included a non-homogenous group, and so we had no restrictions according to some variables such as age. We think that the coefficient of significance evaluation can be increased by reducing the BIAS in studies that will be conducted by creating a higher participation and control group in terms of the number of patients.

CONCLUSION

In the present study, we showed a correlation between IPI and pain scoring of DIVD. We concluded that this correlation is due to the relationship between IPI and inflammation, and it increases in correlation with pain. In particular, the diagnostic correlation between VAS-L values and IPI was very important and can be used by physicians for follow-up of DIVD.

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Conflict of Interest: *The authors declare that they have no competing interest.*

Ethical approval: *Siirt University Faculty of Medicine's Local Ethics Comittee approved the study protochol.(2022/05.06).*

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