



May The Delta Neutrophil Index Be Used As A Marker To Predict The Need For Bowel Resection In Incarcerated Hernias?

Delta Nötrofil İndeksi, İnkarsere İnguinal Fıtıklarda Barsak Rezeksiyonu Gereğini Öngörmeye Bir Belirteç Olarak Kullanılabilir Mi?

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Abstract

Aim Delta neutrophil index is a parameter that shows the ratio of immature granulocytes to the neutrophil count. This study aims to determine the power of DNI in predicting the presence of strangulation in incarcerated inguinal hernias.

Material and Method The files of the patients who were admitted to our clinic and operated due to incarcerated inguinal hernia between May 2021 and May 2022 were reviewed retrospectively. The patients' age, gender, hernia type, leukocyte, lymphocyte, neutrophil, platelet, monocyte values, delta neutrophil index, the surgical method applied, and whether bowel resection was performed were extracted from the patient files. The patients were divided into two groups patients who underwent bowel resection because of bowel ischemia (group 1) and those who did not (group 2).

Results Eighty-one patients were included in the study. It was determined that 70 (86.4%) patients did not undergo bowel resection, and 11 (13.6%) underwent bowel resection. The median DNI value of the patients in Group 1 was 0.30 (0.10 - 1.20), and the median DNI value of the patients in Group 2 was 0.30 (0.10 - 1.30), and the difference was not statistically significant (p=0.77)

Conclusion Delta neutrophil index may not be an accurate predictive value to predict the presence of ischemia in the incarcerated bowel segment in patients with incarcerated inguinal hernia.

Keywords Delta neutrophil index, Incarcerated inguinal hernia, strangulation

Özet

Amaç Delta nötrofil indeksi, immatür granulositlerin nötrofil sayısına oranını gösteren bir parametredir. Bu çalışma, DNI'nin inkarsere inguinal herni hastalarında strangülasyon varlığını öngörmedeki gücünü belirlemeyi amaçlamaktadır.

Gereç ve Yöntem Mayıs 2021-Mayıs 2022 tarihleri arasında inkarsere kasık fıtığı nedeniyle kliniğimize başvuran ve opere edilen hastaların dosyaları geriye dönük olarak incelendi. Hastaların dosyalarından yaş, cinsiyet, fıtık tipi, lökosit, lenfosit, nötrofil, trombosit, monosit değerleri, delta nötrofil indeksi, uygulanan cerrahi yöntem ve barsak rezeksiyonu yapıp yapılmadığı öğrenildi. Hastalar barsak iskemisi nedeniyle barsak rezeksiyonu yapılanlar (grup 1) ve yapılmayanlar (grup 2) olarak iki gruba ayrıldı.

Bulgular Seksen bir hasta çalışmaya dahil edildi. 70 (%86,4) hastaya barsak rezeksiyonu yapılmadığı, 11 (%13,6) hastaya barsak rezeksiyonu yapıldığı belirlendi. Grup 1'deki hastaların ortanca DNI değeri 0,30 (0,10 - 1,20), Grup 2'deki hastaların ortanca DNI değeri 0,30 (0,10 - 1,30) idi ve aradaki fark istatistiksel olarak anlamlı değildi (p=0,77).

Sonuç İnkarsere inguinal hernisi olan hastalarda inkarsere barsak segmentinde iskemi varlığını öngörmek için delta nötrofil indeksi güçlü bir prediktif değer olmayabilir.

Anahtar Kelimeler Delta nötrofil indeksi, İnkarsere inguinal herni

INTRODUCTION

Inguinal hernia is one of the most common diseases in general surgery practice. Inguinal hernia occurs in 3-6% of women and 27-43% of men in their lifetime¹. Risk factors for developing an inguinal hernia include heredity, male gender, advanced age, previous surgeries (prostate, etc.), and collagen tissue disorders². The only treatment method for inguinal hernia is surgery. Although surgical treatment of inguinal hernias is often performed electively, it has been reported that incarceration can develop at a rate of 2.5% in patients followed for two years³. When the incarcerated bowel segment cannot be reduced, emergency surgical intervention may be required due to ischemia in the bowel segments, especially in patients with a femoral hernia. Urgent surgical intervention is needed in 5-15% of all patients diagnosed with inguinal hernia due to incarceration^{4,5}. This rate can go up to 38% in femoral hernia patients⁶. However, elective surgery is possible without emergency surgery when the incarcerated bowel segment can be reduced into the abdomen before ischemia develops or in cases where only the omentum is incarcerated⁷. The morbidity and mortality of elective hernia surgery are much lower when compared to emergency surgery in patients with comorbidities⁷⁻⁹.

When an incarcerated inguinal hernia is detected, it should be ensured that there is no strangulation in the intestinal segment before the hernia content is reduced. Complaints of nausea, vomiting, tachycardia, hypotension or peritonitis findings in physical examination, tenderness in the hernia area, redness of the skin, and increased temperature should raise strong suspicion in terms of strangulation^{10,11}. Computed tomography and ultrasonography can provide information about the viability of the incarcerated bowel segment¹²⁻¹⁴. In addition to physical examination findings and imaging methods, blood parameters (increase in white blood cell (WBC), serum D-Dimer >300 ng/ml, serum phosphokinase value >140 IU/U, elevated serum lactate, amylase, and C-reactive protein (CRP) levels) and other markers of the increased systemic inflammatory response

may suggest the presence of intestinal ischemia.^{7,11,15,16}

Delta neutrophil index (DNI) is a parameter that shows the ratio of immature granulocytes to the neutrophil count¹⁷. There are studies showing that the DNI is superior to WBC and CRP in demonstrating inflammation and determining disease prognosis in many diseases¹⁸⁻²⁰. However, there is no study in the literature on the use of DNI in the prediction of bowel ischemia in incarcerated inguinal hernias. This study aims to determine the power of DNI in predicting the presence of strangulation in incarcerated inguinal hernias.

MATERIAL and METHOD

The ethics committee approval was obtained (E-71522473-04-128370-129) subsequently the study was started. The files of the patients who were admitted to our clinic and operated due to incarcerated inguinal hernia between May 2021 and May 2022 were reviewed retrospectively. Patients over the age of eighteen were included in the study, while patients under the age of eighteen were excluded. The patients' age, gender, hernia type, WBC, Leukocyte, lymphocyte, neutrophil, platelet, monocyte values, DNI, the surgical method applied, and whether bowel resection was performed were extracted from the patient files. The patients were divided into two groups patients who underwent bowel resection because of bowel ischemia (group 1) and those who did not (group 2). Statistical analyzes were performed to determine whether there was a significant difference between the two groups in terms of age, gender, hernia type, WBC, Leukocyte, lymphocyte, neutrophil, platelet, monocyte values, and DNI.

Statistical analysis

Descriptive analyses were performed to provide information on the general characteristics of the study population. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to evaluate whether the distributions of numerical variables were normal. Accordingly, the independent sample t-test and Mann-Whitney U tests were used to compare the nu-

meric variables between groups. The numeric variables were presented as mean \pm standard deviation or median (minimum-maximum). Categorical variables were compared by the Chi-Square test. Categorical variables were presented as a count and percentage. A p-value <0.05 was considered significant. Analyses were performed using SPSS statistical software (IBM SPSS Statistics, Version 25.0. Armonk, NY: IBM Corp.)

RESULTS

Eighty-one patients were included in the study. It was determined that 70 (86.4%) patients did not undergo bowel resection, and 11 (13.6%) underwent bowel resection. Forty-Six (56.8%) were male, and thirty-five (43.2%) were female, of patients included in the study. Minimally invasive surgical interventions were not preferred because the patients were operated on for incarcerated inguinal hernia. Two patients who underwent bowel resection died due to multiple organ failure before being discharged in the post-operative period. No 30-day hospital mortality was detected in any of the patients who did not undergo bowel resection. Intestinal resection was performed in three (6.5%) male patients, and forty-three (93.5%) male patients did not undergo resection. It was determined that 8 (22.9%) of the female patients underwent bowel resection, and 27 (77.1%) of them did not. The rate of bowel resection in male patients was higher than in female patients, and this difference was statistically significant ($p=0.03$).

While inguinal hernia was present in 67 (82.7%) of 81 patients, the femoral hernia was detected in 14 (17.3%). Bowel resection was not performed in 60 (89.6%) of the patients with inguinal hernia, whereas bowel resection was performed in 7 (10.4%) patients. Bowel resection was not performed in 10 (71.4%) patients with a femoral hernia, while bowel resection was performed in 4 (28.6%) patients. The difference was found not to be statistically significant ($p=0.091$).

The mean age of the patients included in the study was

66.05 \pm 11.1. The mean age of the patients in Group 1 was 69.09 \pm 10.79, and the mean age of the patients in Group 2 was 65.57 \pm 11.14. The difference was not statistically significant ($p=0.33$).

The median WBC value of the patients included in the study was 8.48 10⁹/L (3.09-23.75). The WBC value of the patients in Group 1 was 10.47 10⁹/L (3.30-16.74), and the WBC value of the patients in Group 2 was 8.34 10⁹/L (3.09 - 23.75). The difference was not statistically significant ($p=0.23$).

The neutrophil median value of the patients included in the study was 6.76 K/ μ L (1.6-19.82). The neutrophil median value of the patients in group 1 was 8.52 K/ μ L (2.91-14.72), and the neutrophil median value of the patients in group 2 was 6.46 K/ μ L (1.6-19.82). The difference was not statistically significant ($p=0.87$).

The mean lymphocyte values of the patients included in the study were found to be 1.51 \pm 0.79 K/ μ L. The mean lymphocyte values of the patients in Group 1 were 1.11 \pm 0.69 K/ μ L, the mean lymphocyte values of the patients in Group 2 were 1.58 \pm 0.79 K/ μ L, and the difference was not statistically significant ($p=0.06$).

The median monocyte value of the patients included in the study was 0.515 K/ μ L (0.06-1.68). The median monocyte value of the patients in Group 1 was 0.51 K/ μ L (0.06 - 1.68), the median monocyte value of the patients in Group 2 was 0.52 K/ μ L (0.06 - 1.58), and the difference was not statistically significant ($p=0.36$).

The median platelet value of the patients included in the study was 236000 (80000-535000). The median platelet value of the patients in Group 1 was 229.000 (98.000 - 304.000), the median platelet value of the patients in Group 2 was 240.500 (80.000 - 535.000), and the difference was not statistically significant ($p=0.32$).

The median neutrophil-lymphocyte ratio of the patients in Group 1 was 6.14 (3.81 - 42.18), the median neutrophil-lymphocyte ratio of the patients in Group 2 was 4.13 (1.09 - 42.0), and the difference was statistically significant (p=0.01).

Table 1: Demographic analysis of variables regarding intestine resection

		Group 1 (Intestine resection performed) n=11	Group 2 (Intestine resection not performed) n=70	p Value
Gender	Male	3 (6.5%)	43 (93.5)	0.03*
	Female	8 (22.9%)	27 (77.1%)	
Age		69.09 ± 10.79	65.57 ± 11.14	0.33**
White blood cell		10.47 109/L (3.30 - 16.74)	8.34 109/L (3.09 - 23.75)	0.23***
Neutrophil		8.52 K/μL (2.91 - 14.72)	6.46 K/μL (1.6 - 19.82)	0.87***
Lymphocyte		1.11 ± 0.69 K/μL	1.58 ± 0.79 K/μL	0.068**
Monocyte		0.51 K/μL (0.06 - 1.68)	0.52 K/μL (0.06 - 1.58)	0.36***
Platelet		229.00 K/μL (98.00 - 304.00)	240.5 K/μL (80.00 - 535.00)	0.32***
Delta Neutrophil Index		0.30 (0.10 - 1.20)	0.3 (0.10 - 1.30)	0.77**
Neutrophil-Lymphocyte ratio		6.14 (3.81 - 42.18)	4.13 (1.09 - 42.0)	0.01***

* The Chi-Square test, ** The Independent Samples t test, *** The Mann-Whitney U test

The median DNI value of the patients included in the study was 0.30 (0.10-1.30). The median DNI value of the patients in Group 1 was 0.30 (0.10 - 1.20), and the median DNI value of the patients in Group 2 was 0.30 (0.10 - 1.30), and the difference was not statistically significant (p=0.77) (Figure 1).

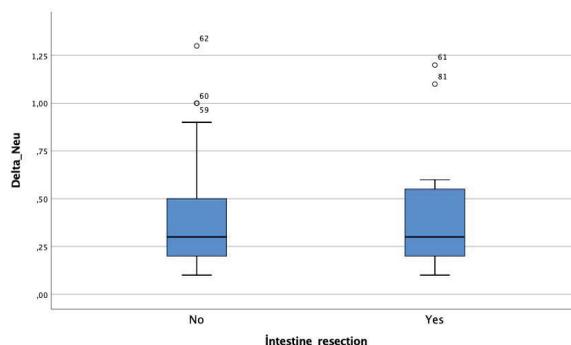


Figure 1: Box Plot graphic of Delta Neutrophil

DISCUSSION

Inguinal hernias are the most common inguinal hernia in both men and women. While femoral hernia repairs are performed more frequently in women, inguinal hernia surgeries are performed more frequently in men². Inheritance, male gender, collagen metabolism, and obesity are risk factors for developing groin hernia²¹⁻²³. In our recent study, we found that the ratio of male-female patients was higher in the patient population, in line with the literature. Bowel resection may be required due to bowel ischemia in 15 of the patients who were operated on for a strangulated inguinal hernia²⁴. In our study, we found that the rate of bowel resection in female patients was statistically significantly higher than in the literature, and lower in male patients. There is a consultant on duty every evening in our general surgery clinic to evaluate the patients consulted from the emergency department. We think that in male patients, bowel resection is required at a lower rate compared to the literature since inguinal hernias can be intervened in the early period before bowel ischemia develops. Making a differential diagnosis, especially in obese female patients, causes the patient to be evaluated longer. For this reason, the delay in the diagnosis of strangulated hernia in our female patient group may be the reason for the higher rate of bowel resection compared to the literature.

Age is another important risk factor for the development of an inguinal hernia. Its incidence increases especially at the age of 0-5 and at the age of 70-80 years^{2,25}. The rate of

femoral hernia surgeries among hernia surgeries increases proportionally with increasing age. Femoral hernia is an independent risk factor for strangulated bowel and bowel resection²⁶. In our recent study, we did not find a statistically significant difference in age between our patient groups with and without bowel resection. We think there is no statistically significant difference among the patients included in our study due to the low number of patients with femoral hernias.

White blood cell increases in inflammatory diseases. It has been shown in various articles in the literature that white blood cells and neutrophils should be expected to increase due to increased inflammation in inguinal hernias with a strangulated bowel segment²⁷⁻²⁹. However, in our recent study, we did not find a significant difference between the groups with and without bowel resection in terms of white blood cell and neutrophil counts.

Alvarez et al., determined that bowel resection due to strangulated inguinal hernia could lead to 33% morbidity and 7% mortality³⁰. The morbidity of elective hernia surgery is seen to be lower when compared to emergency hernia surgery. However, if bowel strangulation cannot be detected before the deterioration of the patient's physiological condition, delayed intervention increases mortality and morbidity³⁰. There are numerous studies on the use of biologic markers to predict the presence of strangulated bowel loops in inguinal hernias in the early period²⁹. Among these biological markers, the effectiveness of the neutrophil-lymphocyte ratio in predicting inflammation has been shown in many studies³¹. Delta neutrophil index is a biological marker used in estimating the prognosis of gastrointestinal system diseases, as well as in many areas of use.¹⁹. Although we determined that the neutrophil-lymphocyte ratio accurately predicts the existence of ischemic bowel loops in inguinal hernias, we did not find a statistically significant difference in delta neutrophil index between patient groups with and without bowel ischemia in our recent study.

The relatively small number of our study group is the limitation of our study.

Delta neutrophil index may not be an accurate predictive value to predict the presence of ischemia in the incarcerated bowel segment in patients with incarcerated inguinal hernia.

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