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The clinical significance of neutrophil to lymphocyte ratio in incarcerated inguinal hernia in patients over 65

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Abstract
Aim: Morbidity and mortality rates increase in the presence of an incarcerated inguinal hernia in geriatric patients. The study aims to determine two parameters that can be used to predict ischemia in elderly patients.
Material and Methods: The records of patients over 65 years of age who were operated on in emergency conditions with the diagnosis of incarcerated inguinal hernia were retrospectively analyzed. The patients were divided into non-resection (Group 1) and resection (Group 2) groups. The groups were evaluated in terms of demographic features, American Society of Anesthesiology score, white blood cell numbers, neutrophil percentage, neutrophil/lymphocyte ratio, mean platelet volume, hernia sac content, hernia type, length of hospital stay, and complication rates.
Results: The study included 183 patients. One hundred fifty-six of the patients were male (85.3%), 27 patients were female (14.7%), and the mean age of the patients was 75.4 ± 5.3 years (66-90). The neutrophil/lymphocyte ratio value was determined as 3.1 (0.62-3.9) in the non-resection group and 3.2 (0.7-16.4) in the resection group. There was no statistically significant difference between the groups in terms of neutrophil/lymphocyte ratio values ($p > 0.05$). In Group 2, mean platelet volume, hospital stay, and complication rates were statistically higher.
Discussion: Although the preoperative neutrophil/lymphocyte ratio is not useful in predicting the presence of ischemia in incarcerated inguinal hernias in elderly patients, mean platelet volume may be useful in predicting the presence of ischemia and indication of resection.

Keywords
Hernia, Small Bowel, Mean Platelet Volume, Geriatric

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Introduction

Inguinal hernia is an essential component of the indications for emergency surgery due to the presence of incarceration [1]. In the presence of incarceration, the postoperative morbidity rate, hospital stay, and cost increase, following the width of the surgical intervention to be performed [2]. The time between the development of incarceration to ischemia is very critical, and surgical intervention during this period eliminates the need for resection and prevents negative postoperative outcomes [3].

The proportion of elderly patients presenting to emergency departments has increased in the last two decades. This patient population is more susceptible to poor postoperative outcomes for various reasons, such as comorbidity, poor immunity compared with younger age groups, and limited mobility [4,5]. Thus, in the presence of an incarcerated inguinal hernia, earlier surgical intervention after deciding whether the probability of strangulation development and perioperative resection is much more crucial. Several studies have examined the use of radiological and physical examination findings to identify ischemia in preoperative period [6,7]. However, no scoring system or set of laboratory parameters has been developed to demonstrate the presence or determine the severity of ischemia [8-10].

This study is aimed to investigate whether laboratory parameters reflecting changes in various inflammatory events are useful for the prediction of problems associated with inguinal hernia incarceration in elderly patients.

Material and Methods

The Ethics Committee of xxxx University Medical School approved this study. The records of patients diagnosed with incarcerated inguinal hernias who underwent surgery between January 2018 and November 2020 in the Department of General Surgery, xxx University Medical Faculty, were evaluated retrospectively. The study was conducted in accordance with the "Standards for Reporting Diagnostic accuracy studies" guidelines. An informed consent was obtained from the participants.

Patients with non-inguinal hernias, those aged < 65 years, those with active infection at the time of admission, and those who were diagnosed with malignancy, undergoing immunosuppressive therapy, or had histories of trauma or major surgery in the past month were excluded. The patients were divided into non-resection (Group 1) and resection (Group 2) groups. Demographic characteristics, American Society of Anesthesiologists (ASA) scores, White blood cell (WBC) counts, neutrophil percentages, the Neutrophil/lymphocyte ratio (NLR), Mean platelet volume (MPV), surgical findings, durations of hospitalization, and complication rates were examined.

Statistical Analysis

The Number Cruncher Statistical System 2007 (Kaysville, UT, USA) was used for the statistical analysis. Descriptive statistics (means, standard deviations, medians, frequencies, rates, and ranges) were calculated. For quantitative data, the normality of distribution was tested using the Shapiro–Wilk test and graphical evaluation. Student's t test was used to compare normally distributed variables and the Mann–Whitney U test was used to compare non-normally distributed variables between groups. Pearson's chi-squared test and the Fisher–Freeman–Halton test were used to compare qualitative data. Diagnostic screening tests (specificity and sensitivity) were used to determine the MPV cut-off point. P values < 0.05 were considered to be significant.

Results

Data from 302 patients who underwent emergency inguinal hernia surgery were examined. In total, 119 patients (62 patients aged < 65 years, 5 patients with active infection at admission, 3 patients with malignancies, 12 patients who received chronic steroid or immunosuppressive therapy with other agents for other reasons, and 37 patients who had experienced trauma or undergone major surgery in the previous month) were excluded. Thus, the analysis was performed with data from 183 patients (28 [15.3%] females and 155 [84.7%] males) with a mean age of 75.03 ± 6.83 (range, 65–94) years. All patients had unilateral inguinal hernias. The distribution of descriptive properties is shown in Table 1. The results of the statistical comparison of Groups 1 and 2 are shown in Table 2.

No significant difference in age, sex, ASA score, or WBC count was observed between groups (p > 0.05). No significant difference was observed in the percentage of neutrophils or the NLR (p > 0.05). The MPV was significantly greater in the resection group than in the non-resection group (p = 0.026; Figure 1).

The development of postoperative complications did not differ between groups (p > 0.05). The duration of hospitalization was greater in the resection group than in the non-resection group (p = 0.001; p < 0.01).

Table 1. Distribution of descriptive properties

		n (%)
Age (year)	Min-Max (Median)	65-94 (74)
	Mean±Sd	75,03±6,83
Sex	Female	28 (15,3)
	Male	155 (84,7)
ASA	ASA II	45 (24,6)
	ASA III	90 (49,2)
	ASA IV	48 (26,2)
WBC (mm3/l)	Min-Max (Median)	3,1-25,2 (10,2)
	Average±SS	10,82±3,88
MPV (fl)	Min-Max (Median)	5,4-10 (7,6)
	Average±SS	7,59±0,95
Neutrophils (%)	Min-Max (Median)	33,5-94,7 (69,4)
	Ort±Ss	68,59±12,77
NLR	Min-Max (Median)	0,5-16,4 (3,1)
	Average±SS	3,52±2,17
•Hernia Sac Content	Omentum	164 (89,6)
	İntestine	164 (89,6)
Type of Hernia	İndirect	140 (76,5)
	Direct	4 (2,2)
	Pantaloon	39 (21,3)
Resection	Yes	69 (37,7)
	No	114 (62,3)
Complication	No	167 (91,3)
	Yes	16 (8,7)
Hospitalization (Day)	Min-Max (Median)	1-16 (5)
	Mean±Sd	4,77±2,83

Table 2. Evaluations by groups

		Incarcerated inguinal hernia group (n=69)	Strangulated inguinal hernia group (n=114)	p
Age (year)	Min-Max (Median)	66-94 (75)	65-90 (73)	[a]0,095
	Mean±Sd	76,12±7,30	74,38±6,48	
Sex	Female	13 (18,8)	15 (13,2)	[c]0,301
	Male	56 (81,2)	99 (86,8)	
ASA	ASA II	18 (26,1)	27 (23,7)	[c]0,884
	ASA III	34 (49,3)	56 (49,1)	
	ASA IV	17 (24,6)	31 (27,2)	
WBC (mm3/l)	Min-Max (Median)	3,1-22,8 (10,7)	4,8-25,2 (9,7)	[a]0,403
	Mean±Sd	11,13±4,01	10,64±3,80	
MPV (fl)	Min-Max (Median)	5,4-10 (7,3)	5,4-9,6 (7,7)	[a]0,026*
	Mean±Sd	7,39±0,98	7,71±0,92	
Neutrophils (%)	Min-Max (Median)	33,5-94,7(69,4)	41,5-94,2 (69,5)	[a]0,854
	Mean±Sd	68,81±12,92	68,45±12,72	
NLR	Min-Max (Median)	0,5-10,1 (3,1)	0,7-16,4 (3,2)	[b]0,134
	Mean±Sd	3,28±2,07	3,67±2,22	
*Hernia Sac Content	Omentum	64 (92,8)	100 (87,7)	[c]0,279
	Intestine	51 (73,9)	113 (99,1)	[c]0,001**
Hernia Type	Indirect	50 (72,5)	90 (78,9)	[d]0,224
	Direct	3 (4,3)	1 (0,9)	
	Pantaloon	16 (23,2)	23 (20,2)	
Complication	No	65 (94,2)	102 (89,5)	[c]0,272
	Yes	4 (5,8)	12 (10,5)	
Hospitalization (Day)	Min-Max (Median)	1-8 (2)	4-16 (6)	[b]0,001**
	Mean±Sd	1,94±1,28	6,47±2,02	

*Multipl Choices Made; [a]Student t Test; [b]Mann Whitney U Test; [c]Pearson Chi-Square Test; [d]Fisher Freeman Halton Test; *p<0,05; **p<0,01

Table 3. Diagnostic screening tests and ROC curve results for MPV

		MPV (fl)
Diagnostic scanning	cut off	≥8,2
ROC curve	sensitivity	39,47
	specificity	84,06
	Positive predictive value	45,67
p	Negative predictive value	0,609
	area	0,525-0,693
	%95 confidence interval	0,014*

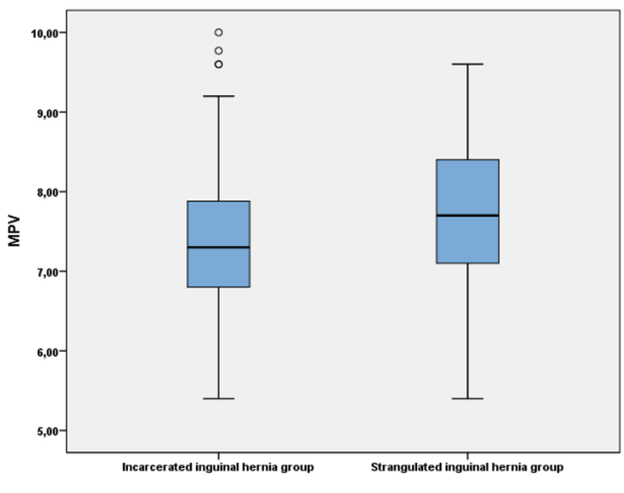


Figure 1. Distribution of MPV measurements by groups.

Determination of the MPV Cut-off Value for Group Measurements; The MPV was greater in the resection group than in the non-resection group (p = 0.026; p < 0.05; Table 3). Receiver operating characteristic (ROC) curve analysis and diagnostic screening tests were used to determine the MPV cut-off value.

According to the group-level analysis, the MPV cut-off value was ≥8.2, with a sensitivity of 39.47%, specificity of 84.06%, positive predictive value of 80.36%, negative predictive value of 45.67%, and accuracy of 56.28%. The area under the ROC curve was 60.9% and the standard error was 4.3%. The MPV threshold (≥8.2) was related significantly to group allocation (p = 0.001; p < 0.01). The risk of ischemia in incarcerated inguinal hernias was 3,439 times greater in cases with MPVs ≥ 8.2 (odds ratio, 3,439; 95% confidence interval, 1,631–7,251; Figure 2).

Discussion

Inguinal hernia surgery continues to be among the most frequently performed emergency surgical procedures due to the development of incarceration [11]. Clinical experience shows that severe problems can be encountered during emergent inguinal hernia repair, rendering this easily treated pathology fatal [12]. Elderly subjects have more limited tolerance for the metabolic disorders and stress that may develop, and functional disorders develop more commonly under emergent conditions. Thus, it is becoming increasingly important to determine the need for surgical intervention in elderly patients and the ability to predict the problems that may encounter [13]. The diagnosis of an incarcerated inguinal hernia is made based on the patient's clinical history, physical examination findings with laboratory and radiological evaluations. The identification of markers to help predict the presence of ischemia in the hernia sac, which can make the postoperative course more problematic, is essential [14]. Studies on the predictive value of the NLR and MPV, which are routine blood count parameters used to assess various inflammatory conditions have shown that the MPV has predictive value in mesenteric ischemia, myocardial infarction, and stroke, whereas the NLR has predictive value in mesenteric ischemia, acute appendicitis, acute pancreatitis, and sepsis; both measures can be used to predict the clinical course [15-18]. Nevertheless, studies on the

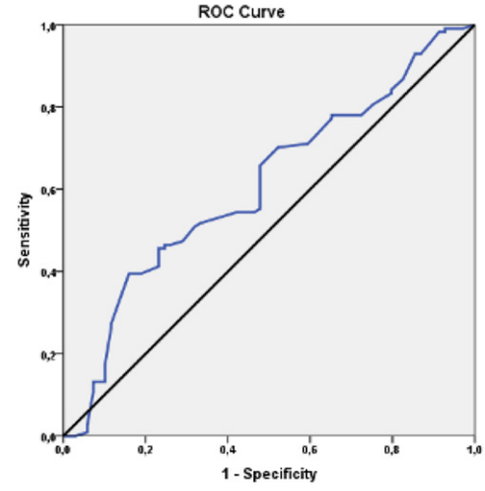


Figure 2. ROC curve for MPV level by groups

use of specific parameters for elderly patients are limited, and their results cannot be standardized due to factors such as the variability of the bone marrow response in elderly patients, the presence of multiple comorbidities, and chronic drug use due to various disorders. Cigsar et al. [10] reported NLR cut-off values of 4.9 for geriatric patients and 5.35 for non-geriatric patients with acute appendicitis; they examined the ability of the NLR to predict acute appendicitis and found that it was not a determinant in the geriatric patient group. The usefulness of the NLR for the preliminary diagnosis of acute cholecystitis has also been examined; a threshold of >3 was found to be related significantly to severe cholecystitis [19]. Zhou et al. [9] reported an NLR cut-off value of 6.5 for inguinal hernia incarceration in adult patients, with higher values indicating urgent surgical intervention. They reported that the optimal preoperative NLR has 75% sensitivity and 69% specificity for inguinal hernias in adults, according to a ROC curve analysis. In the present study, NLR did not differ between geriatric patients with incarcerated inguinal hernias. Thus, the neutrophil/lymphocyte levels are not determinants of the presence of inflammatory events or predictors of the clinical course in elderly patients, as they are related to the immune response capacity and vary among individuals, regardless of the clinical situation.

MPV is a marker of platelet volume and activation, which are critical for the regulation of blood flow. Large MPVs indicate increased platelet production and activation. Large platelets are metabolically and enzymatically active, which is associated clinically with increased thrombogenic potential [20]. Large MPVs are associated with increased vascular inflammation and acute thrombogenic events, such as acute myocardial infarction and stroke [21,22]. Kim et al. [23] examined 28-day mortality in 345 patients, and found that a severe increase in the MPV during the first 72 hours was an independent risk factor for adverse outcomes in patients with sepsis and septic shock. MPV has also been related to small bowel (mesenteric) ischemia; large MPVs have been associated with high mortality rates among patients with mesenteric ischemia at admission [24]. Albayrak et al. [25] reported that the MPV is diagnostic for acute appendicitis, with 73% sensitivity and 84% specificity. For some patients with natural disease courses, clinicians are unsure whether to perform resection or reduction due to comorbidities. In this study, the MPV was related to the presence of ischemic organs in the hernia sac (and thus a lengthy a problematic subsequent course) in such patients. MPVs above the cut-off of 8.2 were associated with a considerably (3.4 times) greater probability of bowel ischemia. Accordingly, clinical monitoring of the MPV after reduction may guide the surgeon's decision making.

Study Limitations

The limitations of this study include its retrospective design and inclusion of patients only from a single center.

Conclusion

In the presence of inguinal hernia incarceration in elderly patients, large MPVs may indicate the presence of ischemia and may help to predict the clinical course.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of interest

The authors certify that there is no conflict of interest.

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