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Original Article

Which Biomarkers Help to Distinguish Between *Candida* and *Aspergillus* in Patients with Pulmonary Infections?

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Keywords: Aspergillosis, candidiasis; mean platelet volume; neutrophil-to-lymphocyte ratio; platelet count/mean platelet volume; pulmonary fungal infection.

ABSTRACT

Objective: This study was an evaluation of differences in the inflammatory markers of C-reactive protein (CRP) level, the neutrophil-to-lymphocyte ratio (NLR), the platelet count-to-mean platelet volume ratio (PLT/MPV), and the platelet-to-lymphocyte ratio (PLR) in patients with pulmonary candidiasis and pulmonary aspergillosis.

Methods: A retrospective, cross-sectional study was performed with the data of patients who were diagnosed with pulmonary candidiasis and pulmonary aspergillosis between 2016 and 2017 according to the records of the hospital information system. The results and date of hemograms, the biochemistry values, and C-reactive protein (CRP) levels were recorded. The NLR, PLT/MPV, and PLR were calculated. The documented parameters of the study groups were compared and analyzed.

Results: There were 44 patients (29 men) (candidiasis, n=19; aspergillosis, n=25), with a median age of 65 years. In both groups, the incidence of chronic obstructive pulmonary disease, level of CRP, and the NLR, PLR, MPV, and PLT/MPV were statistically similar. At discharge, the CRP, PLR, NLR, and PLT values were still similar in the 2 groups; however, the MPV was significantly lower in the pulmonary aspergillosis group when compared with the pulmonary candidiasis group (7.3 vs 8.4; p=0029).

Conclusion: Most biomarkers were similar in the pulmonary aspergillosis and the candidiasis groups; however, a PLT elevation and an MPV decrease were significant in the diagnosis of aspergillus. Similar findings in prospective, multicenter studies performed with patients who are suspected of having a fungal lung infection will add to the ultimate determination of the value to be given to PLT and MPV biomarkers in the initiation of empirical treatment.

INTRODUCTION

Fungal infections of the respiratory system are diseases with a high rate of mortality and morbidity. They often present in immunosuppressed patients.[1] Early diagnosis and early initiation of treatment in fungal infections markedly reduces morbidity and mortality.[2] *Candida spp.* and *Aspergillus spp.* are primary agents of fungal infection in patients with parenchymal disease and sequelae, such as chronic obstructive pulmonary disease (COPD), interstitial lung disease, tuberculosis, and bronchiectasis, and in patients with the chronic use of steroids or immunosuppressive drugs.[2] *Candida spp.* are endogenous in the mucosa and may become pathogenic with antibiotics used to fight infectious disease.[3]

In respiratory system infections, the most important way to reduce mortality is to initiate treatment as soon as possible. Treatment differs between *Candida* and *Aspergillus* infections: As first-line antifungals, fluconazole has been used in cases of candidiasis, and the varicosanol group of drugs in *Aspergillus* infections. As treatment options, the echinocandin group of drugs has been used for candidiasis

and amphotericin B for both *Candida* and *Aspergillus* infections.[2] Among the known biomarkers, C- reactive protein (CRP) and leukocyte counts do not aid the physician in the discrimination between *Candida* and *Aspergillus* infections, so new hemogram parameters, such as the neutrophil-to-lymphocyte ratio (NLR), platelet-to-mean platelet volume ratio (PLT/MPV), platelet-to-lymphocyte ratio (PLR), and procalcitonin level are being investigated for use in the discrimination between fungal and bacterial infections.[4–7]

At present, studies in the literature about the role of inflammatory markers in the fungal infections of *Candida albicans* and *Aspergillus fumigatus* are still insufficient. This study was an investigation of whether platelets, which are fragments of megakaryocytes, and NLR, PLR, MPV, and other hemogram subparameters could be used as an inflammatory biomarkers in *Aspergillus* and *Candida* infections.

MATERIAL AND METHODS

This study was constructed as a retrospective, cross-sectional observational trial and conducted in the chest diseases and thoracic surgery department of the education and research hospital of a university. The study was approved by the Scientific Committee of the Hospital (14.05.2018 / 035) and ethical approval was granted based on compliance with the Helsinki Declaration. All of the study data were collected retrospectively from the hospital electronic information management system. The need to obtain informed consent from the patients for the use of medical data for publication was waived by the scientific committee due to the retrospective nature of the study in accordance with local legislation. The identity information of all patients was strictly protected.

The patients

Among patients receiving inpatient treatment between January 1and December 31, 2016, those whose diseases were coded as pulmonary candidiasis (IDC B 37) or pulmonary aspergillosis (ICD B 44) according to the International Classification of Diseases 10th Revision, and who underwent a hematological examination at admission and prior to discharge were enrolled in the study. Patients who were classified as cases of colonization of fungal infection as described below were excluded from the study. Patients with etiological factors for non-fungal infections that could cause changes in inflammatory biomarkers were also excluded. Adult patients with a pulmonary infection that was considered to be a pathogenic agent of *Candida* or *Aspergillus* were included in the study. The definition of *Candida* and *Aspergillus* infections is provided below.

Definitions

Fungal colonization: Samples were harvested from different regions of the body and if the ratio of areas with intense growth of *Candida spp.* to areas with only general growth of *Candida spp.* were detected was greater than 0.4 in semiquantitive culture media, these areas were considered to be colonized and these patients were excluded from the study.[8]

Patients hospitalized in the intensive care unit, immunosuppressed patients, surgical patients, those receiving total parenteral nutrition, with a central venous catheter, a history of diabetes mellitus, severe sepsis, or prolonged mechanical ventilation were considered to be at risk for fungal infection. Fungal growth was accepted as a pathogenic condition.[9]

Candidiasis: The presence of candidiasis was defined with *Candida spp.* detected in patients with clinical and radiological (plain pulmonary radiography and computed tomography) evidence of pulmonary infiltration and increased CRP and hemogram values, a microbiological examination that did not demonstrate growth of any pathogen other than *Candida spp*., immunosuppressed cases, patients who were using systemic steroids for more than 6 months, those who were hospitalized in the intensive care unit and using two or more antibiotics.[10,11]

Aspergillosis: The presence of clinical and radiological (pulmonary plain radiograph and computerized) evidence, infection parameters, and cases where no pathogenic organism other than *Aspergillus spp.* was detected in the sputum/bronchoscopy lavage/blood samples which could explain the infection was considered aspergillosis.[11–13]

Diagnostic methods

Flexible bronchoscopy

In our center, the presence of a whitish, sticky secretion and edematous hyperemic mucosa and/or mucosal plaque formation observed on bronchoscopy in patients with COPD, diabetes mellitus, or those using steroids is defined as a suspect tracheobronchial fungal infection (TBFI).[14] The results of bronchial lavage and bronchial mucosal biopsy were recorded in cases of a suspected TBFI.

Evaluation of microbiological material

Bronchoscopic lavage: Bronchial and tracheal lavage material was inoculated on Sabouraud dextrose agar and a microbiological culture analyzer (mini API; Biomerieux, Marcy l'Etoile, France) was used to identify molds and yeasts. The distinction between *Candida albicans* and *Candida* non-albicans was not recorded. *Aspergillus* was also identified by inoculating bronchial and tracheal lavage

material in Sabouraud's dextrose agar. Fast growing white, yellow, yellow-brown, brown-black, or green colonies were considered positive for aspergillosis. Bronchoscopic suspicion in patients based on clinical findings or the observance of growth of *Candida spp.* in deep tracheal aspirate or bronchoscopic lavage material was recorded as a diagnosis of pulmonary candidiasis, and galactomannan positivity seen in lavage material was used as a rapid method of diagnosis of pulmonary aspergillosis.

Calculations

Neutrophil-to-lymphocyte ratio (NLR): NLR as a marker of systemic inflammation was defined as the absolute number of neutrophils divided by the absolute lymphocyte count.[15,16]

Platelet-to-lymphocyte ratio (PLR): PLR was defined as the absolute platelet count divided by the absolute lymphocyte count.[16,17]

PLT-to-mean platelet volume ratio (PLT/MPV): The PLT/MPV was the calculated value of the ratio of the platelet volume to the mean platelet volume.[18]

C-reactive protein-to-serum albumin ratio (CAR): The CRP was divided by the serum albumin value to determine the CAR.[19]

Recorded data

Patient admission and discharge hemogram and subparameter data, as well as demographic characteristics, additional diseases, length of hospitalization, and hospital mortality details were recorded based on hospital records. CRP, NLR, PLT/MPV, and PLR values were calculated and recorded.

Statistical analysis

Statistical analyses were performed using the portable SPSS Statistics for Windows, Version 20.0 program (IBM Corp., Armonk, NY, USA). Patient demographics and clinical data were summarized using descriptive analysis. The Student's t-test was used for continuous variables, such

Table 1. Demographic characteristics of pulmonary candidiasis and pulmonary aspergillosis groups

	Pulmonary candidiasis (n=19)		Pulmonary aspergillosis (n=25)		p
	n	%	n	%	
Age median, years (IQR)	19	66 (54–79)	25	61 (55–73)	0.39
Male	11	58	18	72	0.020
Additional diseases					
COPD	8	42	10	40	0.89
Asthma	1	5	1	4	0.84
Immune deficiency	1	5	3	12	0.44
Hypertension	3	16	0	0	0.040
Heart failure	1	5	0	0	0.25
Malignancy	1	5	2	8	0.72
Indications for hospitalization					
Pneumonia	20	80.0	15	78.9	0.93
COPD/Asthmatic episodes	3	12.0	3	15.8	0.72
Bronchiectasis	1	4.0	0	0.0	0.38
Hospital stay, median, days (IQR)	19	8 (7–12)	25	5 (2–6)	0.009
Diagnostic methods					
Bronchoscopic appearance, lavage/culture	17	89.5	17	68.0	0.11
Surgical biopsy	0	0.0	5	20.0	
Medical history and physical examination*	2	10.5	3	12.0	
Hospitalization					
In the service	17	68.0	8	42.1	0.09
In the intensive care unit	8	32.0	11	57.9	
Mortality	2	11	2	8	0.77

COPD: Chronic obstructive pulmonary disease, chi-square test; IQR: Interquartile range, Mann-Whitney U test; *: Findings of oral candida mucositis, thrush on the epiglottis and surrounding area, history of respiratory fungal infection, ambulatory treatment follow-up in polyclinics with galactomannan positivity.

as age, hemogram values, biochemistry values, NLR, PLR, PLT/MPV, and CRP when the distribution was normal. Values obtained using the Student's t-test were presented as mean±SD. The non-parametric Mann-Whitney U test was used for non-normally distributed numerical values and the results were expressed as median value and interquartile range (IQR: 25% and 75%). Dichotomic values, such as sex and the presence of additional disease, were tested with a chi-square test. A p value <0.05 was considered statistically significant.

RESULTS

A total of 44 (men: n=29, 66%) patients with a median age of 65 years (IQR: 55–74 years) who were diagnosed with pulmonary aspergillosis (n=25) or pulmonary candidiasis (n=19), who had the appropriate hemogram values accessible in the hospital records, and who met the eligiblility criteria were included in the study.

The demographic characteristics of the participants, additional diseases present, and causes of hospitalization and mortality are summarized in Table 1. A statistically significantly greater number of male patients were found in the pulmonary aspergillosis group, and the hospital stay was statistically significantly longer in the pulmonary candidiasis group.

Table 2 provides a comparison of hemogram values at hospital admission and discharge between patients with pulmonary candidiasis and those with pulmonary aspergillosis. Comparisons of leukocyte, erythrocyte, and other hemogram values between the 2 groups yielded similar results.

Biochemical values of glucose, creatinine, blood urea nitrogen, protein, albumin, electrolytes, lactate dehydrogenase (LDH), serum glutamic oxaloacetic transaminase, and serum glutamic pyruvic transaminase were also compared (Table 3). The LDH value measured at admission was significantly higher in patients with pulmonary candidiasis; however, the overall biochemical values measured at admission and discharge were similar between groups.

Inflammatory biomarkers were also analyzed at hospital admission and discharge (Table 4). The admission values were similar in both groups, while the discharge MPV value was significantly higher in the pulmonary aspergillosis group.

Figure 1 illustrates the MPV values of the patient groups compared with the normal range (MPV <7.4 fL), and the platelet counts (PLT >440.000/mm^3) recorded at admission and discharge.

Table 2. Comparison of admission and discharge hemogram values of patients with pulmonary candidiasis and pulmonary aspergillosis

	On admission							At discharge						
	Pulmonary candidiasis (n=19)			Pulmonary aspergillosis (n=25)			p	Pulmonary candidiasis (n=19)			Pulmonary aspergillosis (n=25)			p
	Md.	25%	75%	Md.	25%	75%		Md.	25%	75%	Md.	25%	75%	
White blood cell count (x10^9/mL)	9.7	7.4	15.8	10	8.5	13.4	13.8	11.1	8.7	13.6	10.8	8.4	13.8	0.89
Neutrophil count (x10^9/mL)	8.8	5.7	12.1	7.8	5.9	10.5	1.0	8.2	6.2	11.8	8.8	5.5	11.5	0.92
Monocyte count (x10^9/mL)	0.5	0.3	0.7	0.5	0.42	0.8	0.21	0.5	0.3	0.8	0.7	0.5	0.8	0.12
Lymphocyte count (x10^9/mL)	1.0	0.7	1.9	1.5	0.8	1.8	0.43	1.2	0.8	2	1.1	0.94	2	0.82
Neutrophil (%)	79	71.7	86.9	75.55	66.15	87.9	0.34	80	73.02	88.4	81.8	66	87.8	0.90
Monocyte (%)	5.23	2.3	7.6	5.4	3.7	7.7	0.51	5.2	2.8	7.3	6	4.8	6.8	0.30
Lymphocyte (%)	10.9	5.7	17.2	13.1	5.7	21.5	0.69	13.2	7.2	19.8	9.36	7.7	22.3	0.91
Eosinophil (%)	0.57	0.1	1.9	0.9	0.2	1.4	0.38	0.7	0.1	1.42	0.4	0.1	1.2	0.97
Basophil (%)	0.3	0.1	1.1	0.3	0.2	0.7	0.89	0.2	0	0.4	0.2	0.1	0.5	0.81
Erythrocyte count (x10^9/mL)	4.22	3.56	4.73	4.04	3.54	4.54	1.0	4.21	3.37	4.8	4	3.53	4.59	0.73
Hemoglobin cell count (x10^9/mL)	11.1	10	13.4	12.4	9.6	13.6	0.78	11.4	9.4	13	11.6	9.3	13	0.93
Hematocrit cell count (x10^9/mL)	34.7	29.7	39.4	38	29.1	40.5	0.62	34.3	28.9	38.9	34.5	30.2	38.9	0.90
Mean corpuscular volume	83.7	78.7	89.2	86.2	84	88.8	0.33	83.7	79	88.9	86.7	83.9	89.3	0.18
Platelet distribution width	17	16.7	17.8	17.2	16.98	17.5	0.85	17	16.5	17.5	17	16.8	17.5	0.72
RDW-CV	17.67	15.4	19.4	15.8	14.7	17.5	0.16	17.77	15.3	19.5	15.5	15.1	17.9	0.14

Md.: Median; RDW: Red cell distribution width; RDW-CV: Stands for coefficient variation of RDW.

Table 3. Comparison of admission and discharge biochemical values of patients with pulmonary candidiasis and pulmonary aspergillosis

	On admission									At discharge								
	Pulmonary candidiasis				Pulmonary aspergillosis				P*	Pulmonary candidiasis				Pulmonary aspergillosis				p*
	n	Md.	25%	75%	n	Md.	25%	75%		n	Md.	25%	75%	n	Md.	25%	75%	
Fasting blood glucose (mg/dL)	11	112	92	192	12	107	83	142	0.28	19	131	91	162	23	103	86	148	0.62
BUN (mg/dL)	17	44	25	81	16	33	22	47	0.28	19	36	23	71	23	33	25	64	0.82
Creatinine (mg/dL)	17	0.58	0.44	0.99	17	0.63	0.55	0.76	0.84	19	0.66	0.55	0.9	23	0.62	0.51	1	0.92
Protein (mg/dL)	5	6.2	6	6.2	5	7.5	6.8	7.6	0.08	13	5.8	5	6.4	14	6.6	5.5	7.2	0.29
Albumin (mg/dL)	9	3.5	3.1	3.6	14	3.1	2.5	3.7	0.73	18	3.3	2.3	3.6	22	3	2.6	3.5	0.49
Sodium (mg/dL)	17	138	134	140	16	136	131	139	0.33	19	137	134	142	23	137	133	140	0.65
Potassium (mg/dL)	17	4.5	3.9	4.8	15	4.6	4	4.9	0.42	19	4.2	3.9	4.9	22	4.3	4.1	4.6	0.65
Calcium (mg/dL)	12	9.1	8.6	9.3	13	8.9	8.2	9.3	0.46	18	8.8	8.2	9.4	21	8.6	8.4	9.1	0.70
LDH (mg/dL)	4	266	258	401	3	141	122	200	0.034	12	318	214	394	12	231	170	304	0.11
SGOT (mg/dL)	10	29	15	78	11	34	17	50	0.78	19	22	15	56	22	25	17	41	0.92
SGPT (mg/dL)	10	31	14	46	11	22	11	29	0.10	19	28	14	61	23	23	13	31	0.29

*Mann-Whitney U Test. Md.: Median; BUN: Blood urea nitrogen; LDH: Lactate dehydrogenase; SGOT: Serum glutamic oxaloacetic transaminase; SGPT: Serum glutamic pyruvic transaminase.

Table 4. Comparison of admission and discharge inflammatory biomarkers of patients with pulmonary candidiasis and pulmonary aspergillosis

	On admission									At discharge								
	Pulmonary candidiasis (n=19)				Pulmonary aspergillosis (n=25)				p*	Pulmonary candidiasis (n=19)				Pulmonary aspergillosis (n=25)				p*
	n	Md.	25%	75%	n	Md.	25%	75%		n	Md.	25%	75%	n	Md.	25%	75%	
CRP (mg/dL)	11	70.8	1.8	140	7	30.3	7.8	74.1	0.56	19	15.3	8.5	113	20	19.6	3.1	48.7	0.51
PLR	19	198.57	114.35	410	21	257.5	216	330	0.49	19	220.45	104.33	413.75	25	362.73	153.7	528	0.40
IQR	7	20.17	6.55	40.67	6	18.38	4.43	29.64	0.89	18	6.03	2.18	47.92	19	5.21	1.03	17	0.40
NLR	19	7.11	4.38	1.13	21	5.83	3.17	15.56	0.62	19	5.9	3.75	11.45	25	9	2.93	11	0.90
PLT/MPV	19	28.73	16.17	4.78	21	48.59	22.58	60.72	0.11	19	39.13	16.5	54.26	25	52.38	31.34	64.26	0.12
PLT	19	259	152.6	394	21	324	210	424	0.19	19	279	170	355	25	399	257	47.2	0.19
MPV	19	8.7	7.8	9.5	21	7.4	6.93	9.1	0.07	19	8.3	7.5	9.8	25	7.3	6.9	8.2	0.029

*Mann-Whitney U Test. Md.: Median; CRP: C-reactive protein; IQR :CRP/albumin ratio; MPV: Mean platelet volume; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio; PLT/MPV: Platelet-mean platelet volume ratio.

DISCUSSION

The NLR, PLR, and CRP values of patients with pulmonary candidiasis and pulmonary aspergillosis were similar; however, the MPV of the patients with pulmonary aspergillosis was significantly lower than the normal value (<7.4 fL), and platelet counts were higher relative to pulmonary candidiasis patients.

Inflammatory biomarkers in fungal infections

MPV, PLT/MPV

Ates et al.[20] reported that there was a significant difference in the MPV and MPV/PLT values between healthy subjects and patients with systemic inflammatory response syndrome (SIRS). In their study, they reported that there

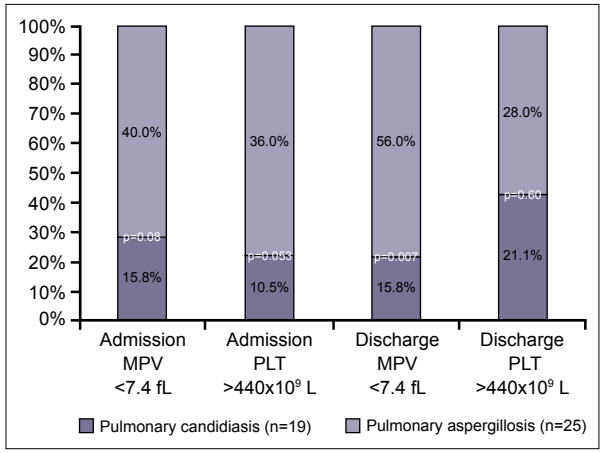

Figure 1. A comparison of the mean platelet volume (MPV) and platelet count (PLT) at admission and discharge in pulmonary candidiasis and pulmonary aspergillosis groups.

was no significant difference between the MPV values of SIRS and sepsis patients and that MPV values increased in sepsis patients. Zampieri et al.[21] have demonstrated that the increase in MPV was proportional to the mortality rate in sepsis patients. Eser et al.[22] found that platelet counts in sepsis patients were similar to the control group, suggesting that a reduction in the MPV value might be a diagnostic marker for pneumonia. In their study, infection among intensive care patients was markedly more severe. Though not statistically significant, a larger number of patients were hospitalized in the intensive care unit in the pulmonary aspergillosis group. The MPV values at admission and discharge were lower, but platelet counts were higher in the pulmonary aspergillosis group compared with the pulmonary candidiasis group, which was interpreted as the possible result of a bone marrow response due to an exogenous etiological infection agent.

There are studies showing that platelets are sensitive to stress, ischemia, obesity, hypoxia, and that smoking increases the activation of platelets.[23] It has been also reported that chemokines and cytokines are secreted from the membranes of platelets and that they have a role in the immune response like that of acute phase reactants and thus exert antimicrobial activities.[22,24]

In their studies, Redlant[25] and Speth[26] demonstrated that *Aspergillus spp.* activate platelets, and that platelets act as antimicrobial and antifungal agents. An increased platelet count and a decreasing MPV may be considered an important finding in the differential diagnosis of fungal infections that suggests the diagnosis of aspergillosis rather than candidiasis.

CRP, NLR, PLR

The role of the inflammatory markers of CRP, NLR, leukocytes, and platelets have been investigated in the differential diagnosis between bacterial infections, Gram-positive and Gram-negative infections, and fungal infections.[27–29] Ljungström et al.[27] analyzed the levels of procalcitonin, CRP, NLR, and LDH in 1572 patients evaluated in the emergency service with the suspicion of sepsis, and reported that though these parameters were not significant markers, especially in the early diagnosis of sepsis, the NLR-procalcitonin and LDH-CRP combination could identify bacterial sepsis. In a recent, similar study, Miglietta et al.[28] did not investigate fungi other than *Candida*, but studied the biomarkers of CRP, procalcitonin, platelet count, and LDH to differentiate between sepsis patients, patients with SIRS and systemic *Candida* infections among intensive care patients. Seventy patients with sepsis, 42 patients with SIRS, and 33 patients with systemic candidiasis were retrospectively enrolled in the study. The biomarkers were measured at intensive care admission and 2 days later. They found slightly lower CRP values (60.5 mg/L) in candidiasis patients when compared with those with Gram-negative (112 mg/L), and Gram-positive (184 mg/L) bacterial infections, while platelet counts were higher in patients with candidiasis. Pan et al.[29] retrospectively investigated the use of the inflammatory markers of procalcitonin; leukocyte, neutrophil, and lymphocyte counts; NLR; CRP level; and platelet count in 1807 patients with chronic bacterial and fungal blood-borne infections. They reported that among 230 patients with bacterial growth in their blood cultures, higher procalcitonin, NLR, and neutrophil values were detected only in patients with Gram-negative infections when compared with those with Gram-positive, and that fungal infections were reliable biomarkers. In our study, in addition to other studies, higher platelet counts were seen in patients with aspergillosis relative to those with candidiasis. Unlike other studies, we also studied the PLR and CAR in the differential diagnosis between *Candida* and *Aspergillus* diagnoses, and no significant difference was found.

Limitations

There are some limitations to the study. Firstly, it was a single-center, retrospective study. However, patients data were retrieved from the hospital electronic system and data entry errors were minimized. The second limitation was the absence of fungal growth in tissue biopsy specimen in every case in order to identify the fungi. Although the diagnosis of fungal infection and fungal pneumonia is primarily made by demonstrating growth of fungi in the tissue culture material,[30] due to difficulties encountered in diagnosing fungal infections, beta-D glucan was used for rapid diagnosis and the identification of *Candida*, and galactomannan was used for *Aspergillus*,[31] in addition to clinical and microbiological results. In this study, we also indicated that the appearance of bronchoscopic material can be used in conjunction with microbiological results as a diagnostic tool in the identification of possible tracheo-

bronchial fungal infections.[14] As a third limitation, the results of the study cannot be generalized for any infection other than pulmonary candidiasis or aspergillosis.

CONCLUSION

Pulmonary candidiasis and pulmonary aspergillosis are common opportunistic fungal infections in COPD patients. The platelet count, MPV, and PLT/MPV estimated in pulmonary aspergillosis patients differ from those found in patients with pulmonary candidiasis. In patients with pulmonary aspergillosis, the platelet count and PLT/MPV were higher, but the MPV value was lower relative to patients with pulmonary candidiasis. These findings may aid chest disease specialists in the discrimination between pulmonary candidiasis and pulmonary aspergillosis. Platelet count, MPV, and PLT/MPV values can be assessed with advanced diagnostic tests in patients at risk for pulmonary aspergillosis and their diagnostic values may be investigated in further studies.

Ethics Committee Approval

The study was approved by the Scientific Committee of the Hospital (14.05.2018 / 035) and ethical approval was granted based on compliance with the Helsinki Declaration.

Informed Consent

Retrospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: F.A.H, H.T.; Design: F.A.H, H.T.; Data collection &/or processing: F.A.H., H.T.; Analysis and/or interpretation: F.A.H., H.T.; Literature search: F.A.H., H.T.; Writing: F.A.H., H.T.; Critical review: F.A.H., H.T.

Conflict of Interest

None declared.

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Pulmoner Enfeksiyonu Olan Hastalarda Kandida ve Aspergillus Etken Ayrımında Hangi Biyobelirteçler Yardımcı Olur?

Amaç: Çalışmada pulmoner kandidiaziz ve aspergilloziz enfeksiyonunda enflamatuvar belirteçlerden C-reaktif protein (CRP), nötrofil lenfosit oranı (NLO), platelet ve ortalama platelet hacmi (PLT/MPV), platelet lenfosit oranı (PLO) farklı olup olmadığı araştırıldı.

Gereç ve Yöntem: Çalışma 2016–2017 yıllarında geriye dönük kesitsel olarak yapıldı. Hastalar hastane bilgi yönetim sisteminden (HBYS) pulmoner kandidiaziz (ICD tanı kodu B 37), pulmoner aspergilloziz (ICD tanı kodu B44) kodu ile tarandı. Yatış, çıkış hemogramları, ek hastalıkları, yatış günü, hastane mortaliteleri kaydedildi. CRP, NLO, PLT/MPV, PLO hesaplandı. Grupların kayıt edilen değerleri, enflamatuvar biyobelirteçleri karşılaştırıldı.

Bulgular: Çalışmaya 44 (kandida n=19, aspergillus n=25) hasta alındı. Ortanca yaşları 65 ve 29 erkekdi (%66). Pulmoner kandidiazis ve aspergilloziz hastalarında KOAH, hastaların yatış CRP, NLO, PLO, MPV, PLT/MPV değerleri benzer idi; taburculuk sırasında CRP, PLO, NLO, PLT benzer iken taburculukta MPV pulmoner aspergillozizde, pulmoner kandidiaziz hastalarından anlamlı düşük (7.3 ve 8.4, p=0.029) idi.

Sonuç: Pulmoner aspergilloziz ve kandidiaziz enfeksiyonlarında çoğu biyobelirteç benzerdi. Aspergillus tanısında PLT yüksekliği ve MPV düşüklüğü anlamlıdır. Fungal akciğer enfeksiyonu düşünülen hastalarda yapılacak olan ileriye yönelik, çok merkezli çalışmalarda benzer bulgular olması amprik tedavi başlanmasında platelet ve MPV biyobelirteçlerinin önemini artıracaktır.

Anahtar Sözcükler: Aspergillus; kandidiaziz; nötrofil lenfosit oranı; ortalama platelet hacmi; platelet; platelet ortalama platelet hacmi; pulmoner fungal enfeksiyonlar.