Objective: The aim of this study was to elucidate the relationship between atrial fibrillation (AF) and chronic obstructive pulmonary disease (COPD) classification based on clinical severity determined in current guidelines. AF is the most common chronic arrhythmia that requires treatment. COPD is one of the risk factors for AF, but this relationship was only explored through respiratory function test results. Methods: Patients who received inpatient treatment for COPD between November 2019 and January 2017 were screened. Patients with coronary artery disease, heart failure, valvular heart disease, diabetes, chronic kidney disease, hypertension, thyroid dysfunction, and sleep apnea syndrome were excluded. According to the 2019 Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines, patients with COPD were divided into groups A, B, C, and D, and the relationship between AF and these groups was investigated. Results: There was no difference between the two groups (depending on the presence of AF) in terms of sex and body mass index. There was a significant difference between the two groups in terms of age, left ventricular ejection fraction (LVEF), left atrium, right atrium, right ventricle, and systolic pulmonary artery pressure. When patients with COPD were classified according to clinical and symptomatic severity, the frequency of AF increased as the clinical severity increased. Conclusion: Regardless of the forced expiratory volume – first second (FEV\textsubscript{1}) value in the respiratory test, the incidence of AF is higher in patients with COPD with a clinically more severe picture.

Atrial fibrillation (AF) is the most common type of chronic arrhythmia that requires treatment in clinical practice. Coronary artery disease, heart failure, valvular heart diseases, hypertension, diabetes, hyperthyroidism, chronic renal failure, obesity are predisposing factors for AF.\textsuperscript{[1-3]} In addition, chronic obstructive pulmonary disease (COPD) is one of the most common diseases of the respiratory system and is a predisposing factor for AF.\textsuperscript{[4]} In a previous study that guided the European Society of Cardiology (ESC) guideline, the relationship between COPD severity and AF was demonstrated with forced expiratory volume – first second (FEV\textsubscript{1}) value. The diagnosis and treatment of COPD is made with the recommendations in the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines.\textsuperscript{[5]}

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Correspondence: Ekrem Şahan, M.D., Department of Cardiology, Atatürk Chest Disease and Thoracic Surgery Training and Research Hospital, Ankara, Turkey
Tel: +90 533 353 88 32 e-mail: ekremshan@hotmail.com
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In the GOLD guidelines, determining the severity of COPD disease and treating COPD is performed with A-B-C-D classification as well as FEV\textsubscript{1} values. In ABCD classification, in addition to hospitalization for COPD attacks the patient’s symptomatic condition was also assessed. Our aim in this study was to elucidate the relationship between AF and the severity of COPD disease (using the ABCD classification in the GOLD guidelines) by excluding the predisposing factors mentioned above.

**METHODS**

In this retrospective study, the files of 1454 patients hospitalized with COPD between January 2017 and November 2019 were scanned. Patients who did not have an electrocardiogram (ECG) in their file were excluded from the study. Patients with coronary artery disease, heart failure, valvular heart disease, diabetes, hypertension, obstructive sleep apnea syndrome, thyroid dysfunction, and chronic kidney disease, which are predisposing to AF, were excluded from the study. The study population was evaluated under two groups as those with AF and those without AF.

The Modified Medical Research Council Dyspnea Score and the ABCD classification (Table 1) calculated on the number of COPD exacerbations and hospitalizations were used to assess the severity of the COPD clinical condition. When calculating the Modified Medical Research Council Dyspnea Score, values used were 0=dyspnea only in a severe strenuous exercise; 1=dyspnea when walking fast or climbing uphill; 2=walking slower than a healthy individual in his age, needing rest due to dyspnea; 3=resting due to dyspnea with 100-m walking need; 4=significant dyspnea in daily movements such as dressing. Later, patients were divided into four groups, A, B, C, and D, according to disease attacks, hospitalization, and dyspnea score (Table 1). Based on the number of COPD attacks and hospitalizations, groups A and B were considered as patients with mild COPD, and groups C and D were accepted as patients with severe COPD (Table 2).

| Table 1. Classification of patients with COPD according to COPD attack, hospitalization, and dyspnea score |
|---------------------------------------------------------------|
| mMRC 0-1 | mMRC ≥2 |
| ≥2 moderate exacerbations or ≥1 (leading to hospitalization) | C | D |
| 0 or 1 moderate exacerbations (not leading to hospitalization) | A | B |

COPD: chronic obstructive pulmonary disease; mMRC: modified Medical Research Council dyspnea questionnaire.
multiple logistic regression analysis was used with all of the prespecified factors with p<0.25 in the univariate analysis. Statistical significance in the multivariate analysis was accepted at p<0.05.

RESULTS

Of 1454 inpatients with a diagnosis of COPD, 170 patients who were in compliance with the methodology of the study were included in the study. The average age of the entire study population was 70.11±10.37 years. The number of female patients in the whole study population was 50 (29.4%). There was no statistically significant difference between mild COPD (A + B group) and severe COPD (C + D group) groups in terms of age, sex, body mass index, LVEF, RA enlargement, RV enlargement, RA enlargement, and FEV<sub>1</sub> (L) (Table 2). In terms of disease severity, there was a significant difference in systolic pulmonary artery pressure (p=0.005) and FEV<sub>1</sub> (%) (p=0.017) between mild COPD (A + B group) and severe COPD (C + D group) groups (Table 2). When the patients were evaluated as groups with and without AF, a statistically significant difference was found between the two groups in terms of age (p=0.002), and there was no significant difference between the two groups in terms of sex and body mass index (Table 2). In terms of echocardiographic findings, LVEF (p<0.001), systolic pulmonary artery pressure (p=0.001), LA enlargement (p<0.001), RA enlargement (p<0.001), and RV enlargement (p<0.001), there was a significant difference between the two groups. For FEV1 values, there was no statistically significant difference between the two groups (Table 2). When the diagnosis of AF was examined in the mild COPD (A + B group) and severe COPD (C + D) groups, AF was more common in the group with a higher number of disease attacks and/or hospitalization (p=0.009) (Table 3).

In the study population, the effects of variables included in the study on the diagnosis of AF were examined. When multivariate regression analysis is done; LVEF (Odds ratio: 0.842, 95% CI: 0.758-0.936; p≤0.001), LA enlargement (Odds ratio: 4.690, 95% CI: 1.359-16.185; p=0.014), and COPD disease severity (Odds ratio: 2.697, 95% CI: 1.046-6.951; p=0.040) were associated with AF (Table 4).
In this study, we investigated the possible effect of the clinical severity of COPD on the frequency of AF and found that the frequency of AF increases as the disease severity increases. COPD severity was previously determined from the FEV\textsubscript{1} value obtained from the pulmonary function test. The GOLD guidelines used in the diagnosis and treatment of COPD included not only the FEV\textsubscript{1} value but also the clinical status and symptomatic severity of the disease. The study on COPD-AF based on the ESC guidelines has been conducted on the FEV\textsubscript{1} value, and it has been shown that the frequency of AF increases as the FEV\textsubscript{1} value decreases. When the study population was grouped according to the clinical and symptomatic severity of COPD, there was no difference in FEV\textsubscript{1} (L) value between the AB and CD groups, but there was a difference between the two groups in terms of FEV\textsubscript{1} (%). In our study, when FEV\textsubscript{1} values were taken into consideration, no statistically significant difference was found between patients with and without AF. However, there was a relationship between the clinical and symptomatic severity of COPD and the frequency of AF. The frequency of AF was higher in the group with a more severe COPD clinic.\textsuperscript{[6]} As COPD disease progresses, an increase in hypoxia, pulmonary hypertension, and an adaptation process in the right cavities occurs due to these conditions.\textsuperscript{[7,8]} These physio-pathological conditions also increase the frequency of AF in COPD patients. In addition, β-agonist bronchodilators and anticholinergic agents used in the treatment of COPD increase the risk of AF and tachyarrhythmias.\textsuperscript{[9,10]} As these agents were used in all patients in the study group, their effect on the results of this study was considered neutral.

Although many predisposing factors affecting the incidence of AF were excluded in the study plan, age and structural changes in the heart may also have affected the incidence of AF. In multivariate regression analysis, it was revealed that advanced age, LA enlargement, and the severity of COPD disease affect the presence of AF in the study population. The relationship between age and increased frequency of AF and structural changes in the heart and the presence of AF is known.\textsuperscript{[11]} Age and LA growth may have affected the frequency of AF in the study population in this respect. When the AB and CD groups were compared according to the severity of COPD, the absence of a significant difference in age and LA enlargement between the two groups may suggest that this effect may be less.

**Limitations**

The retrospective nature of the study is one of the limitations. Another limitation is the number of patients included in the study. Had the number of patients included in the study been higher, it could have increased the statistical power of the study.
Conclusion

The frequency of AF is higher in patients with COPD with clinically more severe presentations, independent of the FEV₁ value in the respiratory test. It may be recommended that patients with severe COPD should be followed more closely in terms of AF.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Keçiören Training and Research Hospital (Approval Date: December 22, 2020; Approval Number: 2012-KAEK-15/2207).

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