INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressive, chronic, and inflammatory disease of lungs and airways, which is caused by noxious particles and smoke.[1,2] Worldwide, COPD is one of the most common diseases that cause morbidity and mortality, and it is predicted that COPD will be the third-leading reason of death in 2020.[3] Exacerbations and frequent hospitalizations are the major risk factors for increased death due to COPD.[4]

Acute exacerbation of COPD (AECOPD) is characterized by worsened respiratory symptoms such as dyspnea, productive cough, and increased nonrespiratory symptoms such as fever, malaise, and fatigue with acute onset.[5]

Several recent studies have investigated the usefulness of various blood biomarkers for the prediction of prognosis and mortality of patients with AECOPD. Lactate clearance (LC) which is a measure of the change in the lactate levels during the therapy of critically ill patients, C-reactive protein/albumin ratio (CAR), procalcitonin, platelet/lymphocyte ratio, and neutrophil/lymphocyte ratio were the most useful predictors of the 30 day mortality for AECOPD in the ER. Materials and Methods: The study took place at Kars Harakani State Hospital. The files of patients were evaluated retrospectively. Results: The study included 243 patients and 15.6% of those died within 30 days. The mean systolic blood pressure (SBP) was lower in those who survived (P = 0.008). The hospitalization in intensive care unit (ICU) during the past 12 months (P < 0.001), CAR (P = 0.044), and procalcitonin (P = 0.002) was higher and forced-vital capacity (FVC) (P = 0.035) was lower in nonsurvivors. The age, ICU, and procalcitonin level correlated positively (r = 0.188, P = 0.003; r = 0.400, P < 0.001; r = 0.223, P = 0.001) and SBP, FVC correlated negatively with 30-day mortality, respectively (r = −0.197, P = 0.002; r = 0.400, P = 0.034). Conclusions: Age, SBP, CAR, procalcitonin, ICU, and FVC are predictors for 30-day mortality in patients who admit to ER with AECOPD.

Key words: Chronic obstructive pulmonary disease, emergency room, mortality

How to cite this article: Avci S, Perincek G. Prediction of 30-day mortality for acute chronic obstructive pulmonary disease exacerbation in the emergency room. Saudi J Health Sci 2020;9:17-21.
The main objectives of this study were to determine which clinical or laboratory results, including vital signs, number of hospitalizations, LC, CAR, procalcitonin, PLR, and NLR, were the most useful predictors of the 30-day mortality in patients with AECOPD who admitted to the emergency room (ER).

MATERIALS AND METHODS

Patients and study design
This retrospective study was conducted with the approval of Kafkas University Medical Faculty Ethics Committee between June 2018 and April 2019. The study included 243 patients (93 females and 150 males) with AECOPD who admitted to ER, Stages I–IV, for all. Patients were included in the study if they met the following criteria: (a) primary clinical diagnosis of AECOPD, characterized as an acute worsening of respiratory symptoms such as dyspnea, cough, or sputum purulence and (b) COPD diagnosis supported by spirometric data of airflow obstruction even with bronchodilator forced expiratory volume in 1 s (FEV1)/forced vital capacity (FVC) <0.7. For patients who were admitted to ER more than once during the study period, only the first admission data were recorded. Patients without all the laboratory results and vital signs or demographic profile were not evaluated. Patients who had primary diagnosis such as congestive heart failure, pneumonia, pleural effusion, pneumothorax, pulmonary embolism, cardiac ischemia, upper airway obstruction, asthma exacerbation, and any other reason of dyspnea were excluded from the study.

Data collection
Baseline characteristics, including age, gender, systolic blood pressure (SBP), fever, respiratory rate, peripheral oxygen saturation, smoking status, biomass exposure, and comorbidities such as hypertension, diabetes mellitus, congestive heart failure, prostate hyperplasia, obstructive sleep apnea, atrial fibrillation, chronic renal failure, coronary artery disease, hyperlipidemia, cancer, goiter; hospitalization rates due to AECOPD, including number of hospitalization in the intensive care unit during the past 12 months (NHICU), number of hospitalization in the respiratory diseases unit during the past 12 months, number of admission to the ER during the past 12 months, discharge time interval from the hospital, home support, including usage of BiPAP machine, portable oxygen concentrator and nebulizer, lung function tests, including FEV1 and FVC. The laboratory tests, including LC, CAR, procalcitonin, PLR, and NLR, were conducted within 24 h of ER admission. The primary outcome was 30-day all-cause mortality. The need for informed consent was waived given the retrospective design of the study.

LC is calculated as explained; LC = first lactate measured in ER admission-second lactate measured at 6 h × 100/First lactate measured in ER admission. A negative LC indicates increase of lactate after 6 h, whereas the positive LC shows decrease of lactate value.[8]

Statistical analysis
All statistical calculations were performed with SPSS software version 21.0 (SPSS for Windows, Chicago, IL, USA). All continuous variables were expressed as mean, standard deviation, median, minimum, and maximum; categorical variables were defined as percentages (%). The categorical parameters were compared with the Chi-square test and Fisher’s exact test. The normal distribution was determined by histogram and Kolmogorov–Smirnov test. In the comparison of two independent groups, $t$-test was used when the parametric conditions were provided, and the Mann–Whitney U-test was used when it was not provided. A nonparametric (distribution free) test known as Spearman’s rank correlation coefficients were used to measure the strength of the associations between two variables. All tests

| Table 1: Baseline profile and clinical features of patients who were admitted to the emergency room with chronic obstructive pulmonary disease exacerbation |
|---------------------------------|--|
| Age (years), mean (SD)           | 243, 71.35 (10.439) |
| Gender, n (%)                    |                          |
| Female                           | 93 (38.3)               |
| Male                             | 150 (61.7)              |
| SBP (mmHg), mean (SD)            | 118.42 (14.021)         |
| Fever (°C), mean (SD)            | 36.488 (0.2872)         |
| Respiratory rate (per min), mean (SD) | 21.69 (2.824) |
| Peripheral oxygen saturation (%), mean (SD) | 80.72 (9.133) |
| Smoking status, n (%)            |                          |
| Ex-smoker                        | 116 (47.7)              |
| Smoker                           | 29 (11.9)               |
| Never smoker                     | 66 (27.2)               |
| Exposure to passive smoke        | 32 (13.2)               |
| Biomass exposure, n (%)          |                          |
| Previously                       | 118 (48.6)              |
| Currently                        | 12 (4.9)                |
| Never                            | 113 (46.5)              |
| Comorbidity, n (%)               |                          |
| Hypertension                     | 112 (46.1)              |
| Diabetes mellitus                | 23 (9.5)                |
| Congestive heart failure         | 54 (22.2)               |
| Prostate hyperplasia             | 2 (0.8)                 |
| Hyperthyroidism                  | 2 (0.8)                 |
| Obstructive sleep apnea          | 2 (0.8)                 |
| Atrial fibrillation              | 5 (2.1)                 |
| Chronic renal failure            | 3 (1.2)                 |
| Coronary artery disease          | 4 (1.6)                 |
| Hyperlipidemia                   | 1 (0.4)                 |
| Cancer                           | 2 (0.8)                 |
| Goiter                           | 2 (0.8)                 |
| Usage of BiPAP machine at home, n (%) | 35 (14.4)    |
| Usage of portable oxygen concentrator at home, n (%) | 106 (43.6) |
| Usage of nebulizer machine at home, n (%) | 162 (66.7) |

SD: Standard deviation, BiPAP: Bi-Level positive airway pressure, SBP: Systolic blood pressure
were applied as two tailed; the statistical significance level was $P < 0.05$ and $P < 0.01$.

**RESULTS**

Between January 1, 2018 and April 30, 2019, the Emergency Department of Kars Harakani State Hospital had roundly 91,200 admissions, although 35 patients were excluded (27 patients with multiple admissions, eight patients did not have all the laboratory results, and four patients did not have all the vital signs). Thus, 243 patients were included in the final analysis. About 1.2% ($n = 3$) of the patients were discharged within 0–24 h after hospital admission, 74.1% ($n = 180$) were discharged within 1–7 days, and 24% ($n = 60$) were discharged 7< days. Thirty-eight patients (15.6%) died within 30 days after their ER admission [Schema 1].

Table 2 demonstrates the relationship between 30-day mortality and results of patients in the ER. The mean age of patients who died within 30 days was greater than those who survived ($P = 0.002$). The mean SBP was lower in those with who survived ($P = 0.008$). The NHICU ($P < 0.001$), CAR ($P = 0.044$), and procalcitonin ($P = 0.002$) were higher and FVC ($P = 0.035$) was lower in patients who died within 30 days than those who survived.

The age, NHICU, and procalcitonin level correlated with 30-day mortality, respectively ($r = 0.188$, $P = 0.003$; $r = 0.400$, $P < 0.001$; $r = 0.223$, $P = 0.001$). SBP and FVC correlated negatively with 30-day mortality, respectively ($r = −0.197$, $P = 0.002$; $r = 0.400$, $P = 0.034$).

One hundred and forty-eight (60.9%) had negative LC and 94 (38.7%) had positive LC.

Discharge time from hospital (<7 days or >7 days) and hospitalization unit (renal dialysis unit [RDU] or intensive

Schema 1: Illustration of patients evaluation stages
avci and perincek: mortality in copd exacerbation

20

Saudi Journal for Health Sciences - Volume 9, Issue 1, January-April 2020

Table 2: The relationship between 30-day mortality and results of patients’ in the emergency room

|                  | Nonsurvivor | Survivor | P     |
|------------------|-------------|----------|-------|
| Age (years)      | 76.13 (8.845) | 70.47 (10.491) | 0.002 |
| SBP (mmHg)       | 111.24 (18.128) | 119.76 (12.736) | 0.008 |
| Fever (°C)       | 36.547 (0.4336) | 36.477 (0.2507) | 0.679 |
| Respiratory rate (per min) | 22.18 (3.660) | 21.60 (2.637) | 0.243 |
| Peripheral oxygen saturation (%) | 77.21 (15.763) | 81.34 (7.260) | 0.148 |
| NHICU            | 0.55 (0.555) | 0.14 (0) | <0.001 |
| NHRDU            | 1.76 (1.651) | 1.97 (1.450) | 0.137 |
| NAER             | 9.13 (6.393) | 12.64 (16.846) | 0.260 |
| FEV1 (%)         | 30.26 (15.726) | 37.21 (18.685) | 0.106 |
| FVC              | 25.47 (17.677) | 31.69 (15.458) | 0.035 |
| LC               | -29.3137 (72.45429) | -46.8613 (87.20637) | 0.254 |
| CAR              | 3.1284 (6.03328) | 1.3472 (2.02568) | 0.044 |
| Procalcitonin    | 6.39343 (21.960247) | 0.42789 (1.629850) | 0.002 |
| PLR              | 231.4578 (197.25723) | 217.8070 (149.60831) | 0.851 |
| NLR              | 10.5765 (12.39863) | 7.4509 (7.74996) | 0.244 |

SD: Standard deviation, SBP: Systolic blood pressure, NHICU: Number of hospitalization in the intensive care unit during the past 12 months, NHRDU: Number of hospitalization in the respiratory diseases unit during the past 12 months, FEV1: Forced expiratory volume in 1 s, FVC: Forced vital capacity, LC: Lactate clearance, CAR: C-reactive protein/albumin ratio, PLR: Platelet/lymphocyte ratio, NLR: Neutrophil/lymphocyte ratio

Table 3: The relationship between gender, hospitalization time unit, lactate clearance, and 30-day mortality

|                  | 30-day mortality, n (%)* | P     |
|------------------|--------------------------|-------|
| Gender           |                          |       |
| Female           | 77 (37.6)                | 16 (42.1) | 0.597 |
| Male             | 128 (62.4)               | 22 (57.9) |
| Discharge time (days) |                      |       |
| <7               | 164 (80)                 | 19 (50) | <0.001 |
| >7               | 41 (20)                  | 19 (50) |
| Hospitalization  |                          |       |
| RDU              | 196 (95.6)               | 25 (65.8) | <0.001 |
| ICU              | 9 (4.4)                  | 13 (34.2) |
| LC               |                          |       |
| Negative         | 128 (62.7)               | 20 (52.6) | 0.240 |
| Positive         | 76 (37.3)                | 18 (47.4) |

RDU: Respiratory disease unit, ICU: Intensive care unit, LC: Lactate clearance.

*Table 3 presents the relationship between gender, hospitalization time unit, LC, and 30-day mortality

care unit (ICU)) were associated with 30-day mortality. About 80% of the survivor patients discharged from hospital <7 days and 20% of nonsurvivor patients discharged from hospital >7 days (P < 0.001). Nonsurvivor of patients was hospitalized in RDU and ICU, respectively (65.8% and 34.2%) [Table 3].

DISCUSSION

AECOPD is an acute manifestation during the clinical course of COPD, and this presentation is related to decrease of lung function and increase of mortality in COPD patients.[46] Prediction of mortality with a basic and safe biomarker method or clinical finding that can evaluate the survival during AECOPD admission to ER is important for the management of patients. In this study, the age correlated expectedly with 30-day mortality and nonsurvivor patients were older than survivors. FVC of nonsurvivor patients was inversely correlated with mortality. Pulmonary functions known as FEV1 and FVC, which is measured by spirometry is a significant indicator of morbidity and mortality in elderly age groups. As people get older, their total lung capacity decreases and the higher frequency of comorbidities making elderly patients more vulnerable to death.[3,11,12]

In this study, we observed that SBP measured at admission to ER was lower for nonsurvivor patients, and it was correlated inversely with mortality. It is known that the SBP increases with age, but a decrease occurs after the age of 70–80 years.[13] High blood pressure is a well-known risk factor for mortality from vascular diseases, but several studies have reported and suggested that lower SBP may also increase the mortality and morbidity from vascular diseases, primarily among elderly patients with vascular diseases or any other comorbidity. Nowadays, the relationship between low SBP and vascular diseases remain ill-defined.[13‑16] Low‑SBP may cause inadequate perfusion to vital organs such as the brain and heart so that low pressure can increase the risk of mortality.

Our study confirms that CAR and procalcitonin were higher in nonsurvivors and procalcitonin correlated with 30-day mortality. C-reactive protein, albumin, CAR, and procalcitonin are biomarkers used for measure and predict of mortality, morbidity, and prognosis in systemic inflammatory diseases such as COPD.[9,10] Atalay et al., Lotfy et al., Ergan et al., and Oh et al. also reported that CAR and procalcitonin can
estimate the severity and mortality rate of patients suffer from COPD.[9,10,17,18]

Most of the survivors (80%) discharged from hospital <7 days and NHICU were higher in nonsurvivors. Some other studies suggest that the duration of hospitalization and hospitalization during the past several months were associated with patients who died after exacerbation of COPD.[19,20]

Severity of COPD, older age, severity of dyspnea, increased number of comorbidities, and inadequate home support for geriatric patients may cause prolongation of hospitalization duration in the ICU.

Retrospective design of the study, use of all-cause mortality, as opposed to specific causes and single center are limitations of this study.

CONCLUSIONS

To sum up, older age, lower SBP, increased CAR and procalcitonin, HICU, and FVC may predict 30-day mortality in patients who admit to ER with AECOPD.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Shavelle RM, Paculdo DR, Kush SJ, Mannino DM, Strauss DJ. Life expectancy and years of life lost in chronic obstructive pulmonary disease: Findings from the NHANES III follow-up study. Int J Chron Obstruct Pulmon Dis 2009;4:137-48.
2. Perincek G, Avci S. Statistical evaluation of COPD patients with respect to gender: A cross sectional study. Baqai J Health Sci 2018;2:18-27.
3. Flattet Y, Garin N, Serratrice J, Perrier A, Stinemann J, Carballo S. Determining prognosis in acute exacerbation of COPD. Int J Chron Obstruct Pulmon Dis 2017;12:467-75.
4. Cardoso J, Coelho R, Rocha C, Coelho C, Semedo L, Bugalho Almeida A. Prediction of severe exacerbations and mortalities in COPD: The role of exacerbation history and inspiratory capacity/total lung capacity ratio. Int J Chron Obstruct Pulmon Dis 2018;13:1105-13.
5. Pavord ID, Jones PW, Burgel PR, Rabe KF. Exacerbations of COPD. Int J Chron Obstruct Pulmon Dis 2016;11:21-30.
6. Yao C, Liu X, Tang Z. Prognostic role of neutrophil-lymphocyte ratio and platelet-lymphocyte ratio for hospital mortality in patients with AECOPD. Int J Chron Obstruct Pulmon Dis 2017;12:2285-90.
7. Kumar P, Law S, Sriram KB. Evaluation of platelet-lymphocyte ratio and 90-day mortality in patients with acute exacerbation of chronic obstructive pulmonary disease. J Thorac Dis 2017;9:1509-16.
8. Kurt NG, Ustundag M, Orak M. The role of lactate clearance on deciding discharge in exacerbation of chronic obstructive pulmonary disease: Retrospective cohort study. J Surg Med 2018;2:96-8.
9. Atalay E, Ergodengu D, Tur BK, Balyen LS, Karabay Y, Ardic S. The relationship between c reactive protein/albumin ratio and 1-year mortality in hospitalized elderly COPD patients with acute exacerbation. Turk J Geriatr 2019;1:9-17.
10. Oh TK, Song IA, Lee JH. Clinical usefulness of C-reactive protein to albumin ratio in predicting 30-day mortality in critically ill patients: A retrospective analysis. Sci Rep 2018;8:14977.
11. Bustamante-Fermedos A, De Miguel-Vanes JM, Duffort-Falcó M, Muñoz J. Mortality-related factors after hospitalization for acute exacerbation of chronic obstructive pulmonary disease: The burden of clinical features. Am J Emerg Med 2007;25:515-22.
12. Miller MR, Thinggaard M, Christensen K, Pedersen OF, Sigsgaard T. Best lung function equations for the very elderly selected by survival analysis. Eur Respir J 2014;43:1338-46.
13. Sørensen KH, Hilden T. Increased total mortality and decreased functional capacity are associated with low systolic blood pressure among elderly women. Scand J Prim Health Care 1988;6:105-10.
14. Yi SW, Hong S, Ohrr H. Low systolic blood pressure and mortality from all-cause and vascular diseases among the rural elderly in Korea; Kangwha cohort study. Medicine (Baltimore) 2015;94:e245.
15. Satish S, Freeman DH Jr., Ray L, Goodwin JS. The relationship between blood pressure and mortality in the oldest old. J Am Geriatr Soc 2001;49:367-74.
16. Venkatesan S, Myles PR, Manning HJ, Mozid AM, Andersson C, Jørgensen ME, et al. Cohort study of preoperative blood pressure and risk of 30-day mortality after elective non-cardiac surgery. Br J Anaesth 2017;119:65-77.
17. Ergan B, Şahin AA, Topeli A. Serum procalcitonin as a biomarker for the prediction of bacterial exacerbation and mortality in severe COPD exacerbations requiring mechanical ventilation. Respiration 2016;91:316-24.
18. Lotfy SM, Zayed NE, Mohghawri MW, Fouad RA. Serum procalcitonin level as a predictor of NIPPV and mortality in patients with COPD at Zagazig University Hospitals. Egypt J Chest Dis Tuberc 2019;68:170-74.
19. Roche N, Zureik M, Soussan D, Neukirch F, Perrotin D; Urgence BPCO (COPD Emergency) Scientific Committee. Predictors of outcomes in COPD exacerbation cases presenting to the emergency department. Eur Respir J 2008;32:953-61.
20. Patil SP, Krishnan JA, Lechtzin N, Diette GB. In-hospital mortality following acute exacerbations of chronic obstructive pulmonary disease. Arch Intern Med 2003;163:1180-6.