THE ATLANTIC Journal of Medical Science and Research

Atlantic J Med Sci Res 2022;2(4):72-8
DOI: 10.55358/atjmed.2022.10.016

Original Article

The use of the news in predicting the clinical status of copd patients presenting to the emergency department with a the complaint of dyspnea

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Received: 19 October, 2022
Accepted: 07 November, 2022
Published: 28 December, 2022

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CITATION
Ekmekyapar M, Yucel N, Gulbas G, Oguzturk H, Gurbuz S, Derya S. The use of the news in predicting the clinical status of copd patients presenting to the emergency department with the complaint of dyspnea. Atlantic J Med Sci Res. 2022;2(4):72-8. DOI: 10.55358/atjmed.2022.10.016

Abstract

Aim: COPD (Chronic Obstructive Pulmonary Disease) is a lung disease that causes impairment in quality of life. NEWS (National Early Warning Score) is a scoring system that evaluates patients' general condition and mortality. We examined the utility of NEWS in predicting the clinical status of COPD patients.
Materials and methods: COPD patients admitted to the emergency department were included in the study. Age, gender, comorbid diseases, occupational exposure status, smoking/tobacco intake, hematological and radiological examinations, vital values, and continuous drug use status of the patients were evaluated. The GCS (Glasgow Coma Scale), CCI (Charlson Comorbidity Index), and NEWS values of the patients were calculated. Chi-square, Fisher's exact, unpaired t-test, or Mann-Whitney U tests were applied according to the normal distribution. Values of $p<0.05$ were considered statistically significant.
Results: Of the patients, 82% (n=205) were male, and 18% (n=45) were female. Of the patients, 67% had comorbid diseases. Coronary artery disease was the most common comorbid disease (n=68, 27%). Low saturation, pH, mean blood pressure, low hemoglobin, high CO_2, creatinine, urea, CRP, and INR levels were associated with mortality. In non-survival patients, the GCS was low, whereas the CCI and NEWS were high.
Conclusions: The NEWS value should be considered in order to determine the clinical status of patients presenting with a COPD attack, to make the decision for hospitalization, and to predict their mortality.

Keywords: Emergency department, COPD exacerbation, NEWS, mortality

INTRODUCTION

COPD (Chronic Obstructive Pulmonary Disease) is a lung disease with respiratory problems caused by poor airflow. Dyspnea and cough are the main symptoms. In addition to progressive and worsening over time, it also causes deterioration in exercise performance and quality of life (1). Acute exacerbations are the most critical events in patients with COPD, and these exacerbations are vitally important in terms of clinical course and prognosis (1). Its mortality and incidence are increasing worldwide (2). This disease causes the death of nearly 3 million people a year. Considering the causes of death, it is thought that COPD-related deaths will take third place by 2030 (3,4).

There are many factors associated with COPD. Inflammation (systemic or local), a sedentary lifestyle, and air pollution are among these factors (4). Smoking, occupational dust or chemical exposure, genetic factors, and air pollution are risk factors for COPD (5). Comorbid diseases are at the forefront of the conditions that negatively affect COPD patients and closely affect the patients' clinical status (6). Cardiovascular diseases, endocrine-metabolic disorders, neuropsychiatric diseases,

anemia, neoplasms (especially lung cancer), and gastrointestinal diseases are the comorbid diseases that can be observed in patients with COPD (6).

Early Warning Scores (EWS) are used in healthcare centers around the world for a variety of reasons. In these scores, the main logic is their ability to facilitate the early detection of patients whose clinical condition worsens and thus improve the care quality, safety, and clinical outcomes of patients (7). NEWS (National Early Warning Score) has also taken its place among the scoring systems used in clinics. Here, the vital signs of the patient, the need for supplemental oxygen support, and the level of consciousness are checked (7). These values are recorded as an integral part of the patient's clinical process (7). NEWS was found to be more successful in recognizing the clinical status of patients compared to other scoring systems (8). We examined the utility of NEWS in predicting the clinical status of COPD patients.

MATERIAL AND METHODS

With the decision dated 07.03.2017 and numbered 2017/6-6, ethical approval was obtained from the Scientific Research and Publication Ethics Committee of İnönü University. COPD patients admitted to the emergency department for one year were reviewed retrospectively. Patients with COPD over the age of 18 who presented to the emergency department with a the complaint of dyspnea were included in our study. COPD patients who presented with any complaint other than shortness of breath and patients who presented with shortness of breath but did not have COPD, and all patients under the age of 18 were excluded from the study. The patients' age, sex, comorbid diseases, medications used, smoking status, biomass exposure, pulmonary function tests, complaints at admission to the emergency department, vital signs, physical examination, laboratory tests, and radiological images were examined. From the laboratory tests, hemoglobin, white blood cell, platelet, C-reactive protein, arterial blood gases, activated partial thromboplastin time (aPTT), international normalized ratio (INR), blood urea nitrogen, and creatinine values were examined. Interventions, service or intensive care unit hospitalizations, discharge from the emergency department and discharge or death after hospitalization, number of admissions to the emergency department and hospitalization in the last year, duration of hospitalization in the intensive care unit, and duration of hospitalization in the ward were recorded for these patients. The GCS (Glasgow Coma Scale), CCI (Charlson Comorbidity Index), and NEWS values of the patients were calculated.

Statistical Analysis

SPSS (SPSS, Chicago, IL, USA) version 17.0 was used for analysis. Chi-square, Fisher's exact, unpaired t-test, or Mann-Whitney U tests were applied according to the normal distribution. Values of $p<0.05$ were considered statistically significant. ROC curve analysis was performed for CCI and NEWS cut-off values. The sensitivity of NEWS and CCI on survival was compared with MedCalc.

RESULTS

250 patients were included in the study. Of the patients, 82% (n=205) were male, and 18% (n=45) were female. Of all patients, 205 (82%) had a history of smoking, and 82 (33%) had a history of biomass exposure. Of the male patients, 196 (95%) had a history of smoking, and 71 (34.6%) had biomass exposure. These values were 9 (20%) and 11 (24.4%) (smoking and biomass exposure) in female patients, respectively. One hundred sixty-five (66%) out of 250 patients were hospitalized (intensive care or ward). 50 (20%) of the patients died. Coronary artery disease was seen in 68 (%27) patients and was the most common comorbid disease.

The mean hospital and intensive care hospital stays were 9.3±8.4 and 9.3±9.5 days, respectively. In patients who died, these values were 13.3±13 (hospital admission) days and 11.6±12 (intensive care admission) days, respectively. In the surviving group, the mean length of hospital stay was 10±6 days, and the mean length of intensive care stay was 7±5 days. The median GCS of the surviving group was 15 (min-max=3-15), and the median of the non-survival group was 12 (min-max=3-15). GCS median values of patients were examined, and it was found to be lower in patients who died *(p<0.0001)*. Median CCS values were 5 in living patients. It was 5.5 in patients who died *(p=0.004)*. The median NEWS was 6 in the surviving group and 9 in the non-survival group *(p<0.0001)* (Table-1).

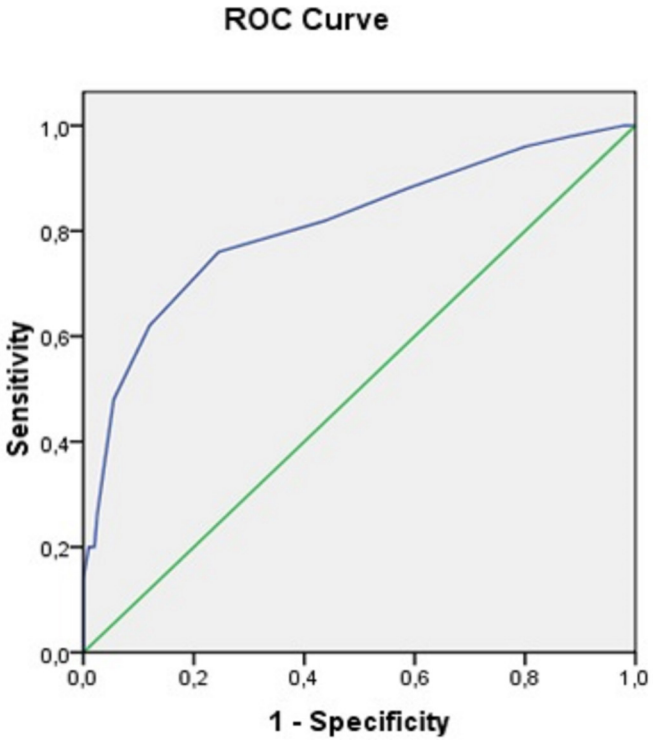

Figure 1. ROC curve of the NEWS

Table 1. Patient characteristics of the surviving, non-survival, and all patients

	Surviving (n=200)	Non-survival (n=50)	Total (n=250)	p
Age (years)				**0.008**
Median (min-max)	66 (30-86)	71 (46-93)	69 (30-93)	
Sex (n,%)				0.015
Female	30 (15%)	15 (30%)	45 (18%)	
Male	170 (85%)	35 (70%)	205 (82%)	
Smoker (n,%)	171 (86%)	34 (68%)	205 (82%)	0.005
Smoking cessation (n,%)	115 (58%)	27 (54%)	142 (57%)	0.137
Biomass exposure (n,%)	79 (40%)	3 (6%)	82 (33%)	0.001
Comorbidity (n,%)	133 (65%)	34 (71%)	167 (67%)	0.491
Coronary artery disease	61 (31%)	7 (14%)	68 (27%)	0.012
Hypertension	40 (20%)	8 (16%)	48 (19%)	0.337
Heart failure	22 (11%)	14 (28%)	36 (14%)	0.004
Diabetes mellitus	29 (15%)	5 (10%)	34 (14%)	0.282
Lung malignancy	12 (6%)	5 (10%)	17 (7%)	0.236
Cerebrovascular event	10 (5%)	0 (0%)	10 (4%)	0.103
Solid tumor	6 (3%)	3 (6%)	9 (4%)	0.260
Chronic renal failure	6 (3%)	2 (4%)	8 (3%)	0.499
Hematological malignancy	5 (3%)	2 (4%)	7 (3%)	0.424
Previous tuberculosis	4 (2%)	1 (2%)	5 (2%)	0.676
Other	14 (7%)	3 (6%)	17 (7%)	0.547
Hospitalization (n,%)	112 (56%)	50 (100%)	162 (65%)	0.0001
Intensive care admission (n,%)	32 (16%)	34 (68%)	66 (26%)	0.0001
Length of hospital stay (days)				0.016
Median (min-max)	7 (1-35)	8.5 (1-57)	7 (1-57)	
Length of intensive care stay (days)				0.0001
Median (min-max)	5 (1-18)	7 (1-57)	6.5 (1-57)	
Presenting to the emergency department in the last 1 year (mean±SD)	2.4±3.4	2.1±3	2.4±3.5	0.248
Hospitalization in the last 1 year (mean±SD)	1.2±1.6	1.3±1.6	1.2±1.6	0.609
GCS				0.0001
Median (min-max)	15 (3-15)	12 (3-15)	15 (3-15)	
CCI				0.004
Median (min-max)	5 (1-9)	5.5 (2-11)	5 (1-11)	
NEWS				0.0001
Median (min-max)	6 (1-13)	9 (3-17)	7 (1-17)	

min-max: minimum-maximum, SD: Standart deviation

Mean respiratory rate (min), mean heart rate (beat/min), and mean body temperature (Co) were examined. No statistically significant difference was detected between the groups (p=0.481, p=0.756, and p=0.936, respectively). The mean arterial pressure was 83±28 mmHg in the non-survival group and 97±9 mmHg in the surviving group *(p<0.0001)*. The mean oxygen saturations of the patients who died were lower *(p<0.0001)*. The mean pH, hemoglobin, and oxygen saturation (oxygen saturation values in arterial blood gas) values of the non-survival patients were lower *(p<0.001, p<0.001,* and *p=0.015,* respectively). Partial CO_2, creatinine, urea, CRP, and INR values were significantly higher in patients with mortality *(p=0.002, p<0.0001, p<0.0001, p<0.001,* and *p<0.0001*, respectively). The vital signs, laboratory values, and analysis results of the surviving, non-survival, and all patients are shown in Table 2.

The ROC curve of the NEWS is presented in Figure 1, and the analysis result is shown in Table 3. Looking at the cut-off value, it was seen that this value was >7 in NEWS (sensitivity 76%, specificity 75.5%, *p<0.0001)*. The mean survival time of patients with the NEWS >7 at the time of admission to the emergency department was 9.9 months *(p<0.0001, X^2=41.3)*. The mean survival time of patients with NEWS ≤7 was found to be 16.6 months. The ROC curve of the CCI is presented in Figure 2, and the analysis result is shown in Table 3. According to the analysis results, the CCI cut-off value of the patients was calculated and found to be >4 (sensitivity 84%, specificity 37%, *p=0.002)*. The mean survival time was 13.9 months in patients with CCS >4 *(p=0.003)*. We observed that the NEWS was more sensitive than the CCI in predicting survival *(p=0.002)*.

Table 2. Vital signs and laboratory values of the surviving, non-survival, and all patients

	Surviving (n=200)	Non-survival (n=50)	Total (n=250)	p
Vital signs (±SD)				
Body temperature (Co)	36.4±0.3	36.4±0.4	36.3±0.4	0.481
Pulse (pulse/min)	82±13	81±32	81±18	0.936
Respiratory rate (min)	21±4	19±7	20±4	0.756
Mean arterial pressure (mmHg)	97±9	83±28	95±16	0.0001
Oxygen saturation (%)	87±9	77±20	85±12	0.0001
Laboratory data (±SD)				
Hemoglobin (mg/dL)	14.2±2.3	13.4±4.4	14±3	0.001
White blood cell (mm^3/dL)	11.1±4	13.5±7.2	11.5±5	0.037
Platelet (mm^3/dL)	251±78	254±105	252±83	0.897
aPTT (seconds)	31±21	31±8	31±19	0.039
International normalized ratio	1±0.6	1.3±0.6	1.2±0.4	0.0001
Blood urea nitrogen (mg/dL)	20±11	32±19	22±14	0.0001
Creatinine (mg/dl)	1±0.6	1.3±0.7	1±0.6	0.0001
C-reactive protein (mg/dL)	4±6	9±11	5±8	0.0001
pH	7.413±0.064	7.345±0.147	7.398±0.1	0.001
$PaCO_2$ (mmHg)	42±13	54±25	44±17	0.002
PaO_2 (mmHg)	66±18	63±21	66±19	0.281
HCO_3 (mmol/L)	26±5	27±9	26±7	0.360
Oxygen saturation (%)	88±10	81±16	86±12	0.015

SD: Standart deviation

Table 3. ROC curve analysis results of the NEWS and CCI

				95% Confidence Interval	
	The area under the curve	Standard Error	p	Lower Limit	Upper Limit
NEWS	0.810	0.0378	0.000	0.735	0.884
CCI	0.628	0.043	0.005	0.545	0.711

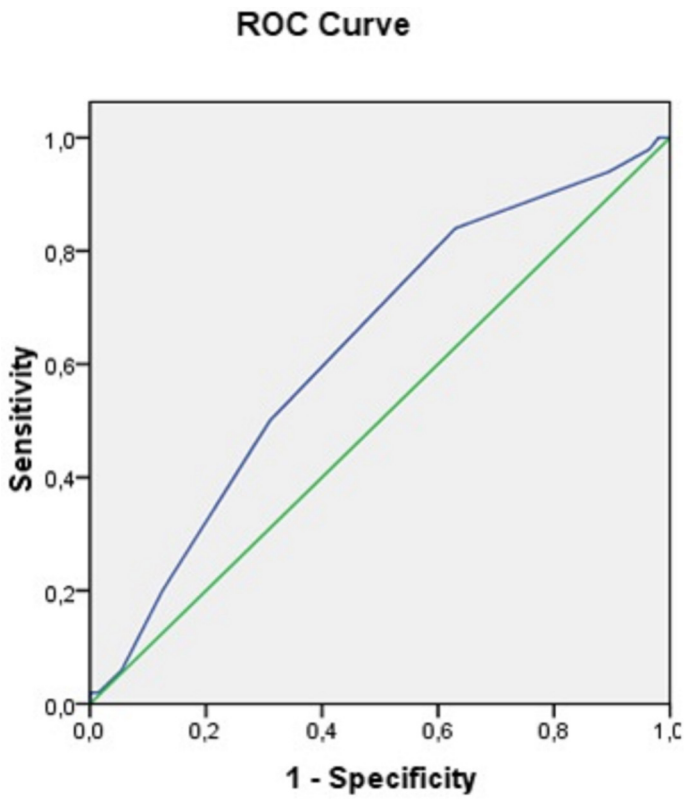

Figure 2. ROC curve of the CCI

DISCUSSION

COPD is one of the most serious public health problems in the world, characterized by irreversible and progressive airway limitation, including chronic bronchitis and emphysema (9,10). As an inflammatory disease, inflammation of the airways and lung parenchyma has been defined as one of the main pathogenic mechanisms of COPD (11). The inflammation here is activated by a series of inflammatory signals, including various cells and molecules (4).

Studies on the mortality of COPD have always been important in the medical literature. One of these studies included a total of 140 patients, 118 males, and 22 females, who were hospitalized with a COPD exacerbation (12). Out of 140 patients, 87 (62%) survived, and 53 (38%) died. Considering the patients who died, 8 (15.1%) female and 45 (84.9%) male patients died. The mean age was 71.2±9.4 years in non-survival patients and 68.7±8.7 years in surviving patients (12). In our study, 162 out of 250 COPD patients were hospitalized. Of the 162 hospitalized patients, 50 (30%) died, 35 (70%) of the non-survival patients were male and 15 (30%) were female. We saw that the median age was 71 in patients who died. This value was 66 in survivors. These values supported the literature.

As with many diseases, comorbid diseases can be seen in COPD. A multicenter study involving 514 COPD patients reported that 279 (54.3%) of the patients had at least one other disease. The most common additional disease was cardiovascular disease (30.4%) (13). In our study, 167 patients had one or more comorbid diseases. Coronary artery disease (27%) was the most common among them. As is seen, in our study, the most common comorbid diseases of COPD patients were cardiovascular diseases, which was consistent with the literature.

COPD, which has high mortality and morbidity, also leads to long-term hospitalizations In a study investigating the costs of patients, patients admitted to the chest diseases service were examined. It was observed that COPD patients caused the highest cost with 12.1 days of hospitalization (14). In another study, the mean length of hospital stay of patients hospitalized in the intensive care unit due to COPD was determined as 6.2±0.4 days (15). The mean hospital stay was 9.3±9.5 days in our study, and the mean intensive care unit stay was 9.3±8.4 days, which is close to the literature.

Studies have reported that the incidence of low hemoglobin levels in COPD patients, especially those with advanced disease, varies between 15-30% (16,17). In addition, a determinant of mortality was found to be low hemoglobin (17). We also found that an indicator of mortality is a low hemoglobin value.

A large study involving 6574 people with COPD revealed that the risk of having an attack within 1 year was 4 times higher in people with high CRP, leukocyte, and fibrinogen levels evaluated in a stable period compared to people with normal values (18). The study by Weiss et al. reported age, FEV1, and leukocyte count in the blood as extremely important three determinants of increased mortality (19). CRP and white blood cell values were found to be high in our patients with mortality, as expected.

Worldwide, various early warning scoring systems, such as early warning score and patient risk score, are developed and used to identify patients who are at risk of clinical worsening among the patients presenting to the emergency department or hospital and to review the clinical picture (20). However, the success of many of these scoring systems in predicting mortality is variable due to various limitations (21,22). Early warning scores (EWS), which were first introduced in 1997, were developed in response to concerns about the inability to detect the worsening physiological parameters (vital signs of patients and monitoring of these findings) of inpatients in wards (23).

Positive results have been obtained by using various EWS systems in health centers designed to predict the condition of patients in clinics (24). NEWS is just one of these systems and was created in 2012 (25). Seven variables are examined, including the patient's vital signs (fever, pulse, systolic blood pressure, respiratory rate, oxygen saturation), need for supplemental oxygen support, and level of consciousness (Alert, Verbal, Pain, Unresponsive) (25). The NEWS performed better than 33 released systems that had been tested more strictly and used widely (21). In the results obtained from the studies, the NEWS was stated to be superior to other systems in predicting cardiac arrest, unexpected intensive care unit admission, or 24-hour mortality (21,26). Similar

findings have been reported in patients hospitalized in oncology clinics and in septic patients in emergency departments (27,28). In our study, we compared the NEWS with the CCI, another scoring system, and observed that the NEWS was more sensitive than the CCI in predicting survival.

In the prospective observational cohort study by Abbott et al., physiological data and early warning scores recorded in the hospitalization charts of the patients were collected. Compared to other scoring systems, NEWS was found to be superior for identifying poor patients. In other words, it was suggested that the NEWS at the time of hospital admission could be used for death or critical care admission within the first 2 days of hospital stay (29). Alam et al. carried out a prospective study to evaluate the performance of the NEWS in an emergency department in the Netherlands (30). In this study, they determined a significant relationship between the NEWS and 30-day mortality, admission to hospital and intensive care unit, and length of hospital stay (30). Furthermore, there are several studies in the literature using early warning scoring systems in COPD attacks (31-33). We investigated the effect of NEWS on mortality in COPD patients admitted to the emergency department. We found that NEWS is useful in predicting mortality during the COPD attack.

CONCLUSION

In COPD patients, low saturation, pH, mean blood pressure, low hemoglobin, high CO_2, creatinine, urea, CRP, and INR levels were associated with mortality. Moreover, low GCS, high CCI, and high NEWS values are also associated with mortality. In conclusion, the NEWS can also be used as a predictor of mortality in patients presenting to emergency departments with COPD attacks. In addition, NEWS value should be considered in order to determine the status of patients presenting with a COPD attack, to make the decision for hospitalization, and to predict their mortality.

Conflict of interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical approval

With the decision dated 07.03.2017 and numbered 2017/6-6, ethical approval was obtained from the Scientific Research and Publication Ethics Committee of İnönü University.

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