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ORIGINAL ARTICLE

WHAT DID WE LEARN DURING CLASSIFICATIONS TO SEVERE AND NON-SEVERE COVID-19 PATIENTS IN AN EMERGENCY UNIT ON THE ADMISSION DAY?

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Abstract

Introduction: We aim with this study to present the lessons we've learned during the pandemic time and to demonstrate the methods that we used for the classification of the severity of the patient's condition. The most studies focus on derangement in vital signs including oxygen saturation when an infection like COVID-19 affects the body or before any clinical deterioration. On contrary, it has been found that low oxygen saturation can be monitored even if the patient is feeling well, and symptoms are absent in the phenomenon named silent hypoxemia. Many studies highlight the beneficial use of screening tools like NEWS 2 when silent hypoxemia is recognized.

Material and Methods: This is a retrospective study of 117 patients with confirmed COVID-19 disease from January 2021 and January 2022. Assessment of patients was performed at the Emergency Unit of City General Hospital "8th of September", Skopje, Macedonia, transformed into the main COVID-19 Center during the pandemic. We measured vital signs and NEWS 2 score in each patient on the admission day. Patients were classified according to Chinese diagnosis and treatment protocol for COVID-19 into two groups: severe and non-severe. We compared demographic factors (age, gender), comorbidities, shortness of breath, radiological findings, length of hospital, and homestay between the groups.

Results: 117 patients met the criteria for the study. 40% of the patients reported severe type. NEWS2, age, shortness of breath, severe general condition and radiological findings were significantly greater in the severe group, but the level of mean O2 saturation, length of hospital stay and incidence of comorbidities were higher in the non-severe group. The author concludes

that a high percentage of comorbidities in the severe group can be a cause for severity in younger patients.
Conclusion : The lesson we learned with this triage is that patient's feelings are not always related to his/ her medical condition. Besides he / she felled well, there might be a beginning of a storm of clinical deterioration. Therefore, using screening methods such as NEWS 2 score can be beneficial during practicing triage on admission day.

Key Words: *COVID-19, emergency admission, triage.*

Introduction

Beyond COVID-19, the lessons we learned during the pandemic time, motivated us to present the methods that we used for classification of the severity of the patient's condition in order to optimize his/her outcome. Once the patient arrives in the emergency unit, and later on during hospitalization, monitoring of vital signs such as blood pressure, heart rate, temperature, respiratory rate and oxygen saturation are commonly used for estimating patients' medical condition (1). Derangement in oxygen saturation is set in among these vital signs when an infection like COVID-19 affects the body or prior to any clinical deterioration (2). The strong linking of the coronavirus to respiratory cells is one of the reasons for impaired oxygen supply and derangement in oxygen saturation as a consequence of that (3). Thus, several studies have hallmarked the main manifestation of low oxygen saturation in patients with COVID-19 (4,5).

Additionally, changes in other vital signs: heart rate and breathing rate, followed by symptoms such as shortness of breath, blush coloring in face and lips, and chest pain was observed in patients when hypoxemia with low oxygen saturation developed (6).

Contrary, it has been found that low oxygen saturation could be monitored even if the patient was feeling well and didn't show any signs of disease (7). The explored phenomenon was named silent hypoxemia (8). Therefore, it is important to perform measurements of oxygen saturation in all patients with COVID-19 pneumonia regardless of the type of disease.

The World Health Organization recommends noninvasive measurement of oxygen saturation of COVID-19 patients with an electronic device such as pulse oximetry (9). In patients with silent hypoxemia, when symptoms are absent, screening tools like NEWS 2 can be beneficial in order to predict early clinical deterioration and risk for severity (10). We applied NEWS 2 among the present study's screening tools (11). Furthermore, patients' outcomes can be prognosis by applying clinical classifications (12). We used the definitions of the type of disease according to the Guidelines of diagnosis and treatment protocol for COVID-19 (trial version 7) issued by the National Health Commission of the People's Republic of China (13). This retrospective study aims to demonstrate the methods of the medical assessment for clinical deterioration and classification of the type of disease and to discuss the findings between severe and non-severe patients during practicing triage on admission day.

Material and Methods

The present study followed a retrospective analysis of 117 COVID-19 patients conducted at the Emergency unit of City General Hospital "8th of September", Skopje, Macedonia, after obtaining ethical approval from the institutional Ethics Committee according to the situations for emergency infected disease (14).

All patients had confirmed COVID-19 diagnosis by positive revere-transcription polymerase chain reaction assay of nasopharyngeal swabs.

In this study, we included all patients who arrived in the emergency unit between January 2021 and January 2022. Medical data collected for each patient were: demographic factors (age, gender), medical history (with or without comorbidities), clinical symptoms (shortness of breath defined as clinical evidence of altered breathing), radiological findings (normal, pattern, opacity). The patients underwent monitoring of the level of oxygen saturation and assessment for clinical deterioration.

The blood's oxygen saturation level was measured using a pulse oximeter placed over the patients' fingers.

Clinical deterioration was assessed with the NEWS 2 score calculation using an online calculator (https://www.mdcalc.com/calc/10083/national-early-warning-score-news-2). NEWS2 score is calculated by adding the scores of the following physiological parameters: systolic blood pressure, heart rate, temperature, respiratory rate, oxygen saturation, need for supplemental oxygen and level of consciousness.

According to the definition of the type of disease in the Chinese diagnosis and treatment protocol for COVID-19, we divided the patients into two groups: non-severe (a disease with mild symptoms and pneumonia can be seen on the imaging findings) and severe (severe and critical illness, respiratory rate >30 times/min, in resting state oxygen saturation <93%, respiratory failure requiring mechanical ventilation).

Oxygen saturation, NEWS 2 score and clinical outcomes: length of hospital stay (LOS) and length of home stay (LHS) were compared between the two groups. LOS and LHS were expressed as absolute numbers. LOS was counted from the day of admission till the day of discharge. LHS represents the number of days from the beginning of the symptoms to the day of admission to the hospital.

Results

117 results with confirmed COVID-19 pneumonia were retrospectively compared. According to the type of disease 40% (n=47) of the patients had a severe type. The study population consisted of 43 (59.7%) men and 27 (60%) women in the non-severe group and 29 (40%) men and 18

(40%) women in the severe group at the mean age of 60.19 ± 14.39 for non-severe group and 54.47 ± 13.41 for severe group retrospectively. We identified that 50 (71.4%) non-severe and 31 (66%) severe patients had comorbidities. The participants with severe disease were significantly younger than the participants with non-severe disease (54.47 ± 13.41 *vs*. 60.19 ± 14.39) (t=2.165, p=0.032).

A severe type of disease was significantly associated with shortness of breath (p=0.003), severe general condition (p=0.001) and radiological finding (p<0.001).

LOS and LHS were not associated with the type of disease (p=0.658 and p=0.357).

The frequency of patients with severe COVID-19 was significantly higher in the sub-group with opacities (62.3%) than in the sub-groups with pattern (10.3%) and normal radiological findings (n=0) (χ^2=34.647, p<0.001).

The mean NEWS score was significantly higher in patients with severe COVID-19 (6.7 ± 1.65) than in patients with non-severe disease (4.21 ± 2.36) (t=-6.71, p<0.001).

On the contrary, the mean O_2 saturation was higher in patients with non-severe COVID-19 (89.66 ± 5.3 *vs*. 53.68 ± 20.35) (t=11.85, p<0.001) (Table 1.)

Table 1. Demographic and clinical characteristics of the patients.

	Non-severe (N=70)	**Severe (N=47)**	**Statistic, *p* value**
Age (years) (mean ± SD)	**60.19 ± 14.39**	**54.47 ± 13.41**	***t*=2.165 *p*=0.032**
Gender - n (%) Male (n=72) Female (n=45)	 43 (59.7) 27 (60)	 29 (40.3) 18 (40)	χ^2=0.001, p=0.976
With co-morbidities - n (%)	50 (71.4)	31 (66)	χ^2=0.395, p=0.53
Length of hospital stay (days) (mean ± SD)	13.31 ± 8.66	12.6 ± 8.45	t=0.444, p=0.658
Length of home stay before hospitalization (days) (mean ± SD)	5.43 ± 7.85	4.34 ± 2.18	t=0.926, p=0.357
Shortness of breath - n (%)	2 (2.9)	9 (19.1)	χ^2=8.762, p=0.003
Severe general condition - n (%)	8 (11.4)	17 (36.2)	χ^2=10.245, p=0.001
Radiological findings - n (%)			χ^2=34.647,

1 Normal (n=9) 2 Pattern (n=39) 3 Opacity (n=69)	9 (100) 35 (89.7) 26 (37.7)	0 4 (10.3) 43 (62.3)	$p<0.001$
NEWS score (mean ± SD)	4.21 ± 2.36	6.7 ± 1.65	t=-6.71 $p<0.001$
O_2 Saturation (mean ± SD) (%)	89.66 ± 5.3	53.68 ± 20.35	t=11.85 $p<0.001$

Discussion

After we had summarized our results, we wrote the findings between the two groups of patients and discussed them in order to present our work during the triage of the patients.

COVID patients are exposed to clinical deterioration and progression of illness disease (15). For each patient, after he/she arrives in the emergency department, a medical examination starts with measuring his/her vital signs.

Several reports have shown that derangement in admission vital signs, such as low oxygen saturation and elevated respiratory rate, have been observed when the patient is at risk for clinical deterioration (16,17). Another way to assess disease progression at arrival time in the emergency unit is to apply surveillance systems such as screening tools (17,18). Among them, in this study, we applied the screening tool NEWS 2. The NEWS 2 score is calculated as the sum of individual scores for these physiological parameters: systolic blood pressure, heart rate, temperature, respiratory rate, oxygen saturation, need for supplemental oxygen and level of consciousness. This study found that the NEWS 2 score was significantly higher in patients with severe COVID (6.7 ± 1.65), than (4.21 ± 2.36) in patients with non-severe disease (t=-6.71, $p<0.001$). We also tried to identify the factors for a high NEWS 2 score. The need for supplement oxygen and oxygen saturation are the maximum scored parameters in NEWS 2's score calculation with points 5. The results of our study showed a strong correlation between mean low oxygen saturation and severe type of disease ($p<0.001$). One of the reasons for hypoxemia and low oxygen saturation as a consequence of that, is the existence of comorbidities. Patients with comorbidities may have reduced hypoxic response even before the beginning of COVID-19 pneumonia (20). Reported incidence of severe patients with comorbidities in our study was 31%, compared to 50% in the non-severe group of patients. Furthermore, comorbidities such as obesity, hypertension, diabetes Mellitus, kidney failure cancer and heart disease are recognized as risk factor for the severity of disease (20). The fact that comorbidities are more prevalent as the patient gets older, can explain the relationship between age and the severity of COVID-19 (22). However, in our study, patients from the severe group were

significantly younger than non-severe patients. A high percentage of comorbidities in the severe group can answer why our younger patients had a severe type of disease instead of a non-severe type. In reviewing the literature, no data was found for a clear cut-off for hypoxemia, but 90% saturation was used by a previous study (23,7). Concerning this data in our study, the patients with a non-severe type of disease also developed hypoxemia and had low oxygen saturation as a repercussion of that. The most obvious explanation for low oxygen saturation is that COVID patients regardless the type of disease, might not complain of dyspnea or other symptoms when hypoxemia was set, and this condition is named silent hypoxemia. Analyzing this data, we noticed that shortness of breath as one of the symptoms of COVID-19 pneumonia was not significantly related to the type of disease. In this study, the Chinese diagnosis and treatment protocol for COVID-19 was applied. According to it, non-severe patients might be with or without pneumonia on imaging findings. Positive chest X-ray findings, such as ground glass opacities, are another reason for hypoxemia even if the patient is without subjective dyspnea (24). We also found a significant correlation between imaging findings and the type of disease $p<0.001$. Compared between the two groups, large number of patients with a non-severe type of disease also had opacity on imaging findings and low oxygen saturation during measurements of vital signs as a result of that.

Previous studies evaluating the relationship between severity with length of hospital stay and mortality found a strong association (25). The finding in our study was contrary to studies related to length of hospital stay. This study has been unable to demonstrate the correlation between severity and length of hospital stay. Our analysis stratified all patients who arrived in the emergency unit. Among them were patients coming from their homes and patients transferred from another hospital. We did not have exact data for the length of hospital stay for patients who arrived from another hospital. So, in our study, the calculation of the length of hospital stay includes only the days of hospital stay in our hospital. This data is also one of the limitations of our study.

Another limitation is the time of measurement of admission vital signs. Because we included all patients as mentioned above, the day of admission and the day of the beginning of symptoms were different and could not be matched. We measured NEWS 2 score at the time of admission but evaluating the NEWS 2 score at regular intervals during the hospital stay would be beneficial.

Conclusion

COVID-19 patients may present with disruption in vital signs without symptoms. Therefore, initial assessment with screening tools is needed for better hospital management, especially in hospital limits like beds and personnel. We also can confirm that the use of screening tools helped us in deciding which patients should be hospitalized for further treatment. The lesson we learned with this triage is that his/ her feelings were not always related to his/ her medical

condition. Although the patient felt well, there might be a beginning of a storm of clinical deterioration.

Screening methods can help in that state of mismatch between symptoms and the clinical picture.

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