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ORIGINAL ARTICLE

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Differences in symptoms and utility of MEWS score in geriatric patients with COVID-19

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ABSTRACT

Introduction: Rational resource management was key to avoiding overcrowding in Coronavirus Infectious Disease 2019 (COVID-19) dedicated wards. The study aimed to identify specific symptoms for aged patients with COVID-19 and assess the utility of the Modified Early Warning Score (MEWS) as a tool that may support decisions within an emergency department (ED).

Material and methods: This was a retrospective analysis of medical records. ED patients with positive antigen tests for COVID-19 infection were identified. Patients' history, length of stay (LOS) and vital signs were collected. MEWS score was calculated. Age groups were divided as follows: non-geriatric (NG) — aged under 60; geriatric groups (G): G1 — aged 60–74; G2 — aged 75–89; G3 — aged 90 and over.

Results: There were 777 individuals (261 NG and 510 G patients). Symptoms related to pain as well as anosmia and ageusia occurred more often in NG patients. The longest LOS was in G2 — 182 [101–295] minutes. A significantly shorter LOS (51 [24–156] minutes) was recorded in NG (NG *vs.* G1 $p < 0.0001$; NG *vs.* G2 $p < 0.0001$; NG *vs.* G3 $p = 0.0007$). Admission rate was as follow: NG: 17.24%, G1: 50.97%, G2: 61.43%, G3: 54.17. Accuracy parameters for MEWS score (NG vs G, [%]) were as follow: sensitivity (93.18 *vs.* 91.04), specificity (13.04 *vs.* 11.79), positive predictive value (18.55 *vs.* 52.88), negative predictive value (90.00 *vs.* 54.76).

Conclusions: Geriatric patients spent more time in ED and were admitted more often. Seniors were less likely to experience pain. MEWS is not a valuable tool for supporting decisions concerning the admission or discharge of geriatric patients with COVID-19.

Key words: emergency department; SARS-CoV-2; COVID-19; organization and administration; patient care management

Introduction

In December 2019 there were noticed many cases of pneumonia of unknown cause in the city of Wuhan, China. Research revealed it was caused by a novel coronavirus, that causes Coronavirus Infectious Disease 2019 (COVID-19). The insidious disease spread quickly and affected people all over the world. On the 11th of March COVID-19 was characterized as a pandemic [1]. Patients suffering from this disease presented a wide range of clinical conditions: an asymptomatic infection, a mild course of infection, or severe pneumonia leading to acute respiratory failure followed by death. The most severe course of the illness and the highest mortality rate were observed among elderly patients, especially those with underlying diseases [2–4].

Many people concerned about their symptoms seek help in hospitals. The places where they could always contact a medical professional were emergency departments (ED). The unpredictable nature of patients' attendance makes the work in an ED extremely challenging. The frontline medical staff needed to work more efficiently, admit more patients and prevent coronavirus transmission. This required early recognition and immediate isolation of the infected patients as well as adapting appropriate care to patients' conditions and the severity of their symptoms. The effectiveness of various scores and scales used in emergency

medicine to predict disease severity and outcome in COVID-19 patients have been analysed in prior studies [5–7]. Among these systems, Modified Early Warning Score (MEWS) has been proven to be an efficient tool for the rapid assessment of COVID-19 patients [8, 9].

Simultaneously, many studies have been performed to analyse the most specific and characteristic symptoms of SARS-CoV-2 infection to facilitate early recognition of the infected patients [10, 11]. It has been also defined that the most common symptoms of COVID-19 are cough, weakness, taste disorder, myalgia and fever. Other symptoms like taste and smell disorders or diarrhoea were determined as characteristic of COVID-19-positive patients [10].

It's a known fact that older adults have been reported to be a population with a high risk of death in the outbreak of COVID-19. Hence, the rapid detection of high-risk patients and appropriately assessed disease severity are crucial to reducing mortality in this population. All these scales work best in an in-hospital setting. Moreover, it has been reported that this scale is less functional in geriatric patients. Thus, the purpose of this study was to recognize the clinical features of elderly and non-elderly patients with COVID-19 and identify specific symptoms for aged patients with COVID-19 to evaluate the clinical relevance of MEWS calculated during the admission of hospitalized geriatric COVID-19 patients.

Material and methods

Legal considerations

According to Polish Law, retrospective analysis of medical records does not meet the criteria of a medical experiment and does not require the consent of the Institutional Review Board.

Study design

This study was designed as a retrospective analysis of medical records. The study population were COVID-19 patients, admitted to the Emergency Department at Hipolit Cegielski Medical Centre, Poznań, Poland between October 2020 and May 2021. Patients' data, symptom information, and test results were obtained from the electronic medical records. Inclusion criteria were as follow: 1) adults aged 18 or above, 2) patients confirmed as SARS-CoV-2 positive by Abbott's antigen test (Abbott Rapid Diagnostic Jena GmbH, Jena, Germany). In case of unclear results or high clinical suspicion of infection with a negative result of an antigen test, the RT-PCR method was used to detect viral mRNA.

Primary outcomes

The primary outcomes were patients' main symptoms; length of stay (LOS) in ED, defined as the length of time between the first examination made by an ED physician and discharge or admission to a hospital ward; endpoint: the patient was admitted to the hospital (Admission — non ICU), transferred to the intensive care unit (Admission — ICU), discharged home (ED — discharged) or died in ED (ED — deceased).

Secondary outcome

The secondary outcome was to assess the utility of the MEWS score for predicting the requirement for further hospitalisation in elderly adults admitted to ED with COVID-19 and comparing its predictions with the actual endpoint as indicated by the data. This allowed evaluation of the utility of this scale in emergency departments in geriatric patients diagnosed with COVID-19.

Clinical data collection

The data recorded in the hospital's system included: personal data, initial vital signs (e. g. heart rate, respiratory rate, oxygen saturation level, blood pressure), medical interview, physical examination as well as the time of admission and discharge/transfer. Based on the review performed by Grant et al., the most common symptoms were defined and divided into several groups: systemic, respiratory, gastrointestinal, ear–nose–throat, and psychiatric [12]. This breakdown was presented in Table 1. Other reported symptoms were not included in the further analysis.

Patients

Patients included in the analysis were aged 18 or above. The study group consisted of geriatric patients (G), and the control group contains non-geriatric patients (NG). To accurately analyse age groups of seniors, they

Table 1. Division of symptoms into groups according to Grant et al. [12]

Group	Symptoms
Systemic symptoms	Fever, fatigue, myalgia, arthralgia, near fever, headache
Respiratory symptoms	Dyspnea, cough, chest pain
Gastrointestinal symptoms	Diarrhea abdominal pain, vomits, nausea, chest pain, loss of appetite
Ear-nose-throat symptoms	Anomia, ageusia, sore throat, rhinitis
Psychiatric symptoms	Altered mental status, delirium

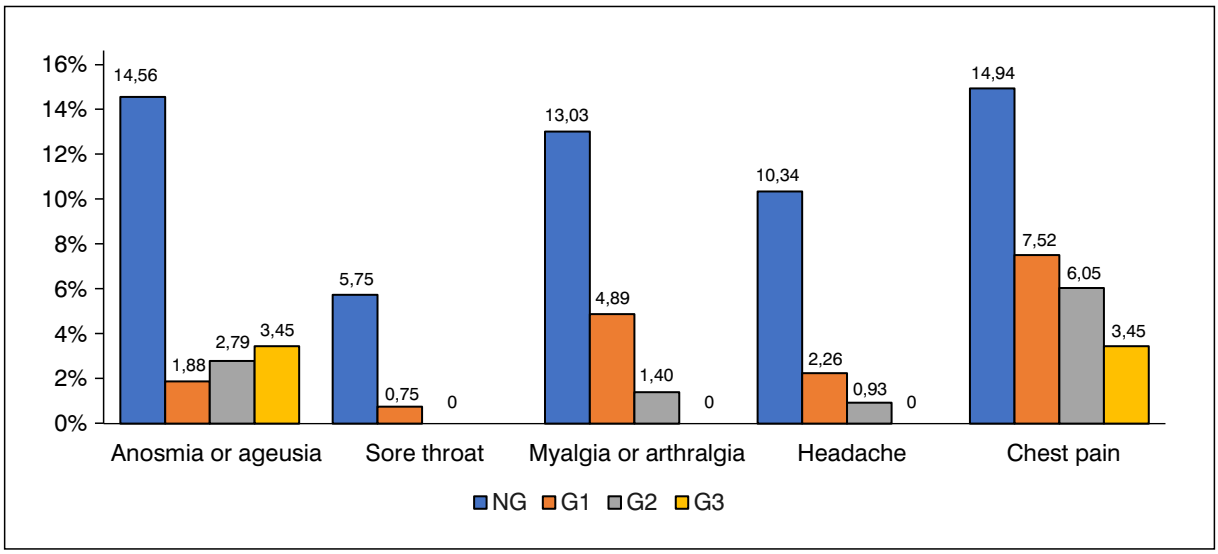

Figure 1. The percentage frequency of symptoms in four age groups. G1 — elderly age; G2 — senile age; G3 — long-livers; NG — non-geriatric

were divided into 4 subgroups by the WHO guidelines described in the work by Dyussenbayev [13]: 1) non-geriatric — aged under 60; 2) youngest-old (elderly age, G1) — aged 60–74; 3) middle-old (senile age, G2) — aged 75–89; 4) oldest-old (long-livers, G3) — aged 90 and over

There were 777 individuals concerned for analysis. Six patients were excluded due to the inability to perform medical interviews. Therefore, the group of all patients tested for symptoms was 771 individuals. The control group consisted of 261 patients. The study group consisted of 510 patients.(G1: n = 266 patients, G2: n = 215, G3: n = 29).

In the second part of the study, the calculation of the MEWS score was possible for 658 patients. Two deceased individuals were excluded. All admissions were counted together (ICU + non-ICU). Therefore the control group was made of 251 non-geriatric patients and the study group consisted of all geriatric subgroups and accounted for 407 geriatric patients (G1: n = 228, G2: n = 165, G3: n = 14).

Modified early warning score

Modified early warning score is a tool designed to identify patients with declining clinical conditions. It consists of 5 physiological parameters: systolic blood pressure, heart rate, respiratory rate, temperature, and level of consciousness (based on the AVPU score). The score is based on the principle that clinical deterioration can be seen through subtle changes in several parameters as well as large changes within a single variable. The score helps to determine the patient's chances of being admitted to the intensive care unit or dying within the next 60 days, a score of 5 or more is associated with a higher likelihood of these incidents. The patient's condition is described appropriately:

- 0 points — stable asymptomatic (can be discharged and recover at home),
- 1–2 points — stable with symptoms (should be admitted to non-ICU),
- 3–4 points — clinically unstable (should be treated in ICU),
- > 5 points — critical condition.

MEWS, according to the guidelines of the Polish Association of Epidemiologists and Infectiologists, can be used on patients with SARS-CoV-2 infection to assess their clinical condition and to allow for early detection of clinical deterioration and the potential need for a higher level of care [14].

Statistical analysis

The analysis was performed using the Statistica 12 software (Tibco Inc., Tulsa, OK, USA). Descriptive statistics of measurable variables were performed. The categorical variables were expressed as numbers (n) with percentages (%), whereas quantitative data as median [interquartile range] as they did not present normal distribution (confirmed in the Wilk-Shapiro W test). To evaluate the significance of differences chi-square test and Mann-Whitney test were used as appropriate. A value of $p<0.05$ was considered statistically significant.

Table 2. Comparison of the percentage frequency of occurrence of COVID-19 by gender and age in the given age groups

Group	Women	Men	Age*
Total	47.75%	52.25%	68 [49–78]
NG	45.21%	54.79%	40 [30–50]
G1	45.11%	54.89%	69 [65–72]
G2	51.36%	48.64%	81 [78–84]
G3	66.67%	33.33%	92 [90–96]

G1 — elderly age; G2 — senile age; G3 — long-livers; NG — non-geriatric; *Data are presented as median [IQR]

Results

Study group

During the months of the study, data from 777 individuals were collected. The youngest patient was 18 years old whereas the oldest was 99 years old. Table 2 presented a comparison of gender and age according to age groups.

Symptoms

Among analysed symptoms, four can be distinguished, which occurred much more often than the others. These were: fever (339 patients, 43.97%), dyspnoea (314 patients, 40.73%), cough (270 patients, 35.02%) and fatigue (250 patients, 32.43%). Symptoms related to pain: sore throat, myalgia, arthralgia, headache and chest pain as well as anosmia and ageusia occurred much more often in the group of NG patients. This relation was shown in Figure 1. The symptom that showed the opposite tendency was altered mental status/delirium. It occurred in 1.92% of NG patients, whereas in G subgroups were as follows: G1: 16.17%, G2: 24.65%, G3: 37.93%.

Length of stay

For the entire group of patients, LOS was 133 [47–248] minutes. The longest LOS was in the G2 group — 182 [101–295] minutes, then in G3 — 164 [98–327] minutes, and G1 — 155 [78–277] minutes. The shortest LOS — 51 [24–156] minutes, was recorded in the NG group. This difference was statistically significant (NG vs G1 $p < 0.0001$; NG *vs.* G2 $p < 0.0001$; NG *vs.* G3 $p = 0.0007$). Figure 2 presented the comparison of the LOS median on ED between the age groups.

Treatment endpoint

Four hundred and thirty seven out of 777 patients were discharged home, 329 were admitted to the hospital (non-ICU), 4 patients were transferred to the intensive care unit and 7 patients died, all of them were geriatric patients.

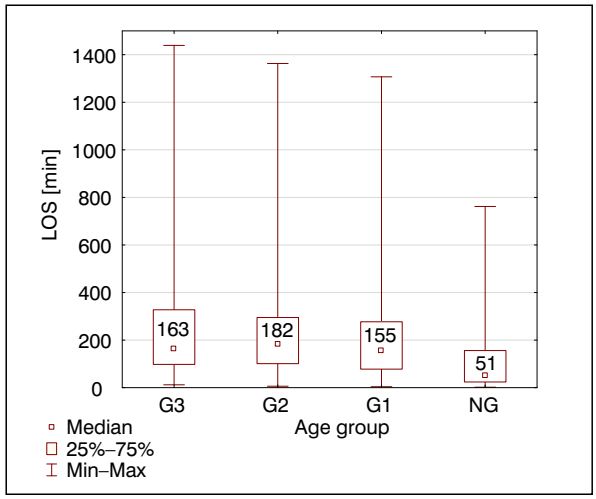

Figure 2. Comparison of the LOS median on ED between the age groups. ED — emergency department; G1 — elderly age; G2 — senile age; G3 — long-livers; LOS — length of stay; NG — non-geriatric. Numbers represent median LOS

Due to the negligible number of patients who died or were admitted to the ICU, the comparison in the age groups was made only for the patients who were discharged home and admitted to departments other than the intensive care unit. Details were presented in Table 3.

MEWS score

There were no differences in median MEWS scores for admitted (3 [1–4] points) as well as discharged (3 [1–5] points) patients. The median MEWS score for the NG group was 2 [1–5] and for the G group was 3 [1–5]. This difference was not statistically significant ($p = 0.7453$). According to the real and counted endpoint, specificity, sensitivity, PPV and NPV were calculated. Results were presented in Table 4 and details were presented in Suppl. Table 1.

Discussion

The conducted analysis was aimed at drawing attention to the characteristic features of the COVID-19 dis-

Table 3. Comparison of the endpoint in age groups

	Admission	Discharged	P-value
NG	17.24% (n = 48)	82.76% (n = 216)	
G1	50.97% (n = 133)	49.03% (n = 128)	NG *vs.* G1 < 0.0001
G2	61.43% (n = 130)	38.57% (n = 81)	NG *vs.* G2 < 0.0001
G3	54.17% (n = 18)	42.86% (n = 12)	NG *vs.* G3 = 0.0031

G1 — elderly age; G2 — senile age; G3 — long-livers; NG — non-geriatric

ease in geriatric patients. The analysis aimed to emphasise what symptoms should be looked for in elderly patients presenting to an ED.

Analysing the symptoms, it can be seen that, according to the typical course of COVID-19, patients considered in this study reported symptoms such as fever, cough and dyspnoea. These are typical symptoms of this disease, which are frequent irrespectively of age [15].

According to the literature, loss of smell and taste was a common symptom of SARS-CoV-2 infection [16]. However, the analysis showed that this symptom was typical only for patients who were under 60 years old, and occurred less often among older ones. A similar tendency has been noticed for pain symptoms such as a sore throat, headache, and joint pains — typically reported by younger patients. This result was similar to that obtained in other publications [17], while in the geriatric group it was usually lower.

The group of symptoms that were mostly observed among older patients — were psychiatric symptoms. According to studies by Kennedy et al., these symptoms were common in the group of geriatric patients and often occurred without any other typical symptoms of COVID-19. They also concluded, that delirium was associated with poor hospital outcomes and death [17]. In the present study, the highest percentage of mental symptoms was recorded in the G3 group, which may confirm their thesis. The observations emphasise that geriatric patients presented less typical symptoms than younger patients, and often the only symptom may be delirium, the development of which may adversely affect the treatment process. This is confirmed by the work of Rebora et al. They found that delirium occurs in 1 in 7 patients hospitalized for COVID-19 after the age of 65. Moreover, this symptom is considered to be associated with increased in-hospital mortality showing the clinical significance of neurological symptoms in elderly patients infected with SARS-CoV-2 [18].

Looking at the endpoint, there was a defined trend correlated to age. Most discharged patients belonged to the NG group. Furthermore, most of the admitted patients were those from geriatric groups, and only a small percentage of the total number of patients admitted was in the NG group. Longer LOS might be explained by two factors. Firstly, these patients required additional laboratory or imaging diagnostics. Secondly, there was a need to transport patients to COVID-19-dedicated hospitals or wards, which were also located outside the facility. Furthermore, patients admitted to the hospital required more resources than those discharged home [19].

Table 4. Accuracy and precision factors for MEWS score in relation to age group

Analysed factor [%]	NG	G
Sensitivity	93,18	91,04
Specificity	13,04	11,79
PPV	18,55	52,88
NPV	90,00	54,76
ACC	27,09	53,07

ACC — accuracy; G — geriatric group; MEWS — modified early warning score; NG — non-geriatric group; NPV — negative predictive value; PPV — positive predictive value

MEWS score has been proven to be the less burdensome scoring system, that should be considered a method to monitor patients for deterioration and admission to a higher level of care [20]. In another study, the MEWS score measured on ED arrival was the most sensitive predictor of 7-day ICU admission or death [21]. The accuracy and precision values found in the present study did not allow the authors to conclude that the MEWS score can be a useful tool for decision support for hospital admissions in the ED setting. Elevated body temperature is one of the parameters that are assessed in this scale. Fever is present in 89% of COVID-19 patients [22]. A patient with minor symptoms, not requiring oxygen supply, may have a fever and this will not be a reason for admission to the hospital. The authors claim that this parameter may falsify the study results the most. According to the recommendations, any patient with saturation below 94% should be admitted to the hospital [23]. However, as is well known, especially in seniors, health conditions can change dynamically and symptoms may be less typical. It is, therefore, necessary to continue identifying tools to support decision-making at the ED level.

It is important to consider the limitations of this retrospective study. First, groups were not equally

represented. In addition, the MEWS scale as well as the occurrence of particular symptoms were calculated for an incomplete group due to lack of data. Furthermore, patients were not examined only by one physician, therefore the decision about the endpoint could be person-dependent. Also, it is necessary to consider comorbidities which could influence patients' general condition and prognosis. Nevertheless, the authors believe that the results of this study may enhance existing knowledge and lead to more efficient organisation of patient flow in EDs.

Conclusions

Our study confirmed that geriatric patients were significantly more likely to require hospital treatment and spent more time in ED. Seniors were less likely to experience pain but other typical symptoms of the disease were the same. It has been proven that MEWS is not a valuable tool for emergency clinicians to support decisions concerning the admission or discharge of geriatric patients with COVID-19. Further research on prognostic scales in the ED is strongly recommended.

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