



COVID-19 and emergency departments: need for a validated severity illness score. The history of emerging CovHos score

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Received: 4 July 2022 / Accepted: 26 July 2022 / Published online: 13 August 2022
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In the last years, the COVID-19 pandemic has profoundly challenged the world healthcare systems. All medical services have struggled against the burden of this rapidly spreading pandemic, while they were far to be prepared to face it. In particular, the Emergency Departments (ED) have been in a frontline position, having little if any knowledge on the management of this unparalleled condition. In this setting, the lack of a decisional score has been a major issue and several attempts have been made to create such scores, with controversial results. The recent study by Salvatore et al. provides a valuable tool to help decision making in the ED [1]. In this study the authors analyzed the performance of the CovHos score, previously developed to evaluate the need for hospitalization [2], in predicting severe respiratory failure (SRF) in patients with COVID-19 admitted to ED.

During the first wave (conventionally February–May 2020), an overwhelming number of patients with suspected SARS-CoV-2 infection clogged the ED, flooding the available resources world widely. In this context, the available beds were immediately saturated with a great delay in treatments. The prompt response of the governments allowed successively having more hospital beds and facilities available. However, being this disease new and as such unpredictable, a great issue remained: which patient was to be discharged and who to be admitted? Where to admit? Patients required different intensities of care, from the general ward to ICU. So, how to decide? How to predict if a patient

admitted in a general medical ward will get worse soon? Were there validated tools or score to help physicians in ED? The answer was “no” until now, but we think the CovHos score could fill the gap.

Soon after the pandemic onset, several studies tried to use already validated scores to assess severity and final disposition in patients with COVID-19. An “ideal” score has to correctly assess the severity of the disease and/or predict a close worsening. In this way, this score could help the physicians to make the best choice for each patient. Several scores, predictive of acute respiratory failure, have been taken into account among published papers. The NEWS score is one of most studied. It is a tool validated by the Royal College of Physicians in UK to determine the degree of illness of a patient and to prompt critical care intervention [3]. Included items are respiratory rate, oxygen saturation, temperature, heart rate, systolic blood pressure, and consciousness evaluated by the AVPU scale. The NEWS2 score was an attempt to improve the prior score including factors such as the presence of hypercapnic respiratory failure and the FiO_2 , with a better performance on acute respiratory failure [4]. The ROX index (combining respiratory rate and SaO_2) has been first proposed to predict endotracheal intubation after a trial with high-flow nasal cannula treatment in acute respiratory failure and a score of 4.87 has been indicated as a threshold for intubation need [5]. The SOFA [6] (Sequential Organ Failure Assessment) and the quick SOFA scores, first intended for the managing of sepsis, have been also widely studied. SOFA takes into account PaO_2 , FiO_2 , use of mechanical ventilation (including CPAP), platelets count, Glasgow Coma Scale (GCS) and bilirubin, while the quick SOFA (simpler) includes GCS, respiratory rate (RR) and systolic blood pressure.

All these scores try to assess patients' condition using both respiratory and hemodynamic parameters. They have been validated to predict rapid worsening of patients' health conditions in different scenarios. Furthermore, not all these scores include arterial blood gas analysis (ABG) data, while

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there is consensus that ABG is important for a correct evaluation of a patient with COVID-19 [7]. As an example, the presence of respiratory alkalosis is predictive of a worsening [8].

In the confusing climate following this pandemic, it is important for physicians, especially for those operating in ED, to have a tool that could help them to quickly and safely decide the appropriate setting where the patient will receive the best care.

Several scientists in the world met this challenge. Martín-Rodríguez et al. [9], for example, tried to assess the power of the NEWS2 score to early recognize clinical deterioration of patients with COVID-19 as compared to the qSOFA, MREMS and RPAS scores. The authors showed that the NEWS2 presented the best predictive power (AUC of the ROC 0.80), but they emphasized the need of a new score to discriminate high-risk patients.

In patients presenting with initial mild disease it is particularly challenging to predict deterioration. Piombi-Adanza et al. [10] compared the predictive values of NEWS2, qSOFA and ROX index in a population evaluated for mild COVID-19. While the qSOFA poorly performed, the AUC for ROX and NEWS2 were 0.72 and 0.75.

Other authors (see Table 1) performed similar studies leaving us with no certainty on the best score to use.

As mentioned before, the numerous attempts to find an accurate predicting score have been unsuccessful; however, the CovHos score seems to be promising [1]. This score was developed in a monocentric observational study conducted in a large ED in the city of Bologna (Italy) in October 2020. The CovHos score, applied to all adults

referring to this ED with a positive SARS-CoV-2 RT-PCR, is based on five variables easily obtainable in the ED. These include male sex, age > 65 years, Alveolar-to-arterial Oxygen Gradient percentage increase compared to that expected for age (AaDO₂%), Neutrophils/Lymphocytes ratio and C-reactive protein. Therefore, this score is a mix of data easily obtained from ABG, widely used in ED, and blood tests. This is a pivotal aspect of this score: it is easy to calculate. The main issue this score is required to address is the correct screening of those patients who are likely to develop SRF and those with a high probability of death. This should be the core of the initial evaluation of patients with COVID-19. Early prediction of outcomes after admission to ED not only can improve the quality of care, but can also allow to manage more patients at home, freeing public health resources.

Perhaps for a better performance in the ED setting, the CovHos or other similar scores could be also associated with the extension of lung involvement as evaluated by the Brixia score, which assess chest X-ray severity [21].

Another parameter of simple acquisition to include in the screening process could be the patient's BMI, already known as a risk factor for SARS-CoV-2 disease [22].

Another aspect further assessed by Salvatore et al. [1] is the predictive role of the CovHos score of 30 days mortality. In their statistical analysis, they calculate a NPV of 95.4% with 28 points cut off. To better highlight their findings, the authors compare the CovHos to the NEWS2 to predict 30 days mortality. In this sample, the NEWS2 showed 35.3% of sensitivity vs 69% sensitivity of the CoVHos, proving to be poorly reliable.

Table 1 List of studies on COVID 19 disease and severity scores

Study	Country	Score	Outcomes	Patients numbers
Haimovich [11]	USA	Quick COVID-19 Severity Index	Deterioration requiring O ₂ > 10 L/min, NIV/ ETI; death within 24 h	1172
Liu [12]	China	NEWS2	In-hospital death	673
Covino [13]	Italy	NEWS, REMS	Admission to ICU, death at 2–7 days	334
Carr [14]	UK	NEWS2	Severe infection at 14 days	6237
Richardson [15]	UK	NEWS, NEWS 2	Early mortality	620
Kostakis [16]	UK	NEWS, NEWS 2	Death or ICU within 24 h	405
Martín-Rodríguez [9]	Spain	NEWS2	Mortality within 48 h	663
Salvatore [2]	Italy	CovHos	Hospitalization need	667
Piombi-Adanza [10]	Argentina	sat/RR index	Prolonged hospital stay in mild disease	271
Valencia [17]	Colombia	ROX, HACOR	ETI, mortality	245
Giamarellos-Bourboulis [18]	Greece	SCOPE	Severe respiratory failure, death	1060
Fridman [19]	Italy	LOT	Conventional O ₂ therapy failure	101
Guarino [20]	Italy	MqSOFA	30-days mortality	437

NEWS National Early Warning Score; REMS Rapid Emergency Medicine Score; CovHos COVID-19 score for hospitalization prediction; sat/RR index oxygen saturation/respiratory rate index; ROX ratio of SaO₂/FIO₂ to respiratory rate; HACOR Heart rate, Acidosis, Consciousness Oxygenation, Respiratory rate; LOT Lactate, Oxygenation, Temperature; SCOPE Prediction Estimate score; MqSOFA Modified quick sequential Organ Failure Assessment; ETI endotracheal intubation; NIV non-invasive ventilation; ICU intensive care unit

Indeed, data on mortality provide a valuable information and a starting point for future investigation.

Of course, the next step is to validate this score on a larger scale so that multicentre studies should be granted.

Declarations

Conflict of interests The authors declare that they have no conflict of interests.

Human and animal rights statement and Informed consent Not applicable for this paper.

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