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European Journal of Medical Research (2023) 28:4
https://doi.org/10.1186/s40001-022-00908-4

European Journal of Medical Research

RESEARCH

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A novel scoring system for early assessment of the risk of the COVID-19-associated mortality in hospitalized patients: COVID-19 BURDEN

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Abstract

Background: Corona Virus Disease 2019 (COVID-19) presentations range from those similar to the common flu to severe pneumonia resulting in hospitalization with significant morbidity and/or mortality. In this study, we made an attempt to develop a predictive scoring model to improve the early detection of high risk COVID-19 patients by analyzing the clinical features and laboratory data available on admission.

Methods: We retrospectively included 480 consecutive adult patients, aged 21–95, who were admitted to Faghihi Teaching Hospital. Clinical and laboratory features were collected from the medical records and analyzed using multiple logistic regression analysis. The final data analysis was utilized to develop a simple scoring model for the early prediction of mortality in COVID-19 patients. The score given to each associated factor was based on the coefficients of the regression analyses.

Results: A novel mortality risk score (COVID-19 BURDEN) was derived, incorporating risk factors identified in this cohort. CRP (> 73.1 mg/L), O_2 saturation variation (greater than 90%, 84–90%, and less than 84%), increased PT (> 16.2 s), diastolic blood pressure (≤ 75 mmHg), BUN (> 23 mg/dL), and raised LDH (> 731 U/L) were the features constituting the scoring system. The patients are triaged to the groups of low- (score < 4) and high-risk (score ≥ 4) groups. The area under the curve, sensitivity, and specificity for predicting mortality in patients with a score of ≥ 4 were 0.831, 78.12%, and 70.95%, respectively.

Conclusions: Using this scoring system in COVID-19 patients, the patients with a higher risk of mortality can be identified which will help to reduce hospital care costs and improve its quality and outcome.

Keywords: COVID-19, SARS-CoV-2, Mortality, Prognosis, Risk assessment

Introduction

Corona Virus Disease 2019 (COVID-19) caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) is highly a contagious disease, with symptoms ranging from those of common flu including fever, cough, and congestion of the nasal cavity to very severe respiratory symptoms [1]. As the pandemic spread, other symptoms such as loss of taste and smell (anosmia) have also emerged [2, 3]. Patients with the severe form of the

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study is not concerned with this issue and this hypothesis requires further investigation on the effect of applying prediction models on the burden imposed on various units in hospitals.

CRP, Oxygen saturation variation, increased PT, DBP, and BUN, and raised LDH (COVID-19 BURDEN) were detected as six factors for COVID-19 infection severity. Using this prediction model, the severity of the disease in the early stages of the disease can be estimated and helps to reduce health costs and improve the quality of patient care in the health care units. The great utility of clinical prediction models have been demonstrated previously in several instances (e.g., CURB65, MELD, etc.) [27, 28].

The present survey was mainly limited by studying COVID-19 patients in a single center retrospectively. The management of the patients included in the present study was based on the most recent version of the WHO guideline for COVID-19 management at the time (https://www.who.int/publications/i/item/WHO-2019-nCoV-Clinical-2022.2) [29]. Furthermore, our model did not make use of viral load in predicting the mortality in COVID-19 patients. Viral load is among the most important parameters in the setting of COVID-19 infection; however, it is mostly limited to experimental settings and not implemented in the real-world clinical setting. Moreover, it is not easy-to-obtain and not available early in the admission of the patients, if at all. As a result, incorporating it into a screening model will defeat its purpose and make triage based on the model impossible. It is quite common for patients to receive non-invasive ventilation or high-flow nasal cannula before their screen either in the emergency department or during transportation with emergency medical service. In our study, although the clinicians conducting the primary screening abided by the recommendations for cessation of therapy before recording O_2 saturation, it is plausible to assume that the O_2 saturation was falsely recorded in a set of patients, inclining toward a higher O2 saturation. Undoubtedly, further studies with larger sample sizes are needed in settings with diverse backgrounds to validate the COVID-19 BURDEN model. Moreover, many more studies are still required to better understand the disease itself. Finally, simple models similar to that outlined in the present paper can be beneficial in other aspects of the care for COVID-19 patients and their needs including ICU admission requirements, unplanned readmission, its long-lasting health effects, etc.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40001-022-00908-4.

Additional file 1: Table S1. Demographic, clinical, and laboratory characteristics of COVID-19 patients, stratified by the outcome of hospitalization.

Acknowledgements

The authors would like to thank Shiraz University of Medical Sciences, Shiraz, Iran and also Center for Development of Clinical Research of Nemazee Hospital and Dr. Nasrin Shokrpour for editorial assistance.

Author contributions

FA: conceptualization MHI: writing—reviewing and editing, conceptualization. SZ: conceptualization, writing—original draft, supervision. FS: writing—original draft. PJ: statistical analysis, supervision. HH: investigation. MF: investigation. MM: investigation. PB: investigation SM: supervision, conceptualization. RD: investigation. AF: investigation, writing—original draft. All authors read approved the final manuscript.

Funding

The authors received no financial support for the research, authorship, or publication of this article.

Availability of data and materials

All data generated or analyzed during this study are included in the final published article.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the local ethics committee of Shiraz University of Medical Sciences (IR.SUMS.MED.REC.1400.382). Written informed consents were obtained from all participants on admission.

Competing interests

The authors declare no competing interests.

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Received: 23 August 2022 Accepted: 21 November 2022
Published online: 03 January 2023

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