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Original article

A study on COVID-19 patients in a period from January 2022 to August 2022 in Assiut city

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ABSTRACT

Background: Coronavirus disease-2019 (COVID-19) mortality rates are increasing globally. Protection is especially important for those who are at risk for serious and fatal disease. Furthermore, factors increasing these risks are of interest in the search of potential treatments. The study's goal is to improve our understanding of how risk factors affect COVID-19 fatality rates. **Methods:** Data was collected for all 100 COVID- 19 adult patients who admitted to Chest Hospital, Assiut University Hospitals and other quarantine hospitals in Assiut, Egypt with confirmed COVID-19 by RT-PCR from January 2022 to August2022.The patient cohort was classified into severe group (n=32) cases developed as severe symptoms and needed critical care support (ICU). A total of 68 patients did not require intensive care (ICU) and were thus classified as non-severe. Follow-up was completed on October, 2022, at which time all patients either were discharged from the hospital as "cured" or had a fatal outcome of the disease. **Results:** 56.0% of patients were ≥60 years, 65 patients (65%) were of the male gender. The most prevalent symptoms among patients were dyspnea (98%), cough (93%) followed by fever (74%). The most prevalent comorbidities hypertension (37%), diabetes mellitus (34%), and followed by chronic obstructive pulmonary disease (19%).32.0% of patients with COVID-19 infection admitted ICU, and 18.0% of patients were died. **Conclusion:** In this study, the most common risk factors associated with COVID-19 among the studied population were age ≥60 years, male gender (65%) and comorbidities (hypertension (37.0%), diabetes mellitus (34.0%) and COPD (19.0%)). Also, age and comorbidities were significantly higher in died patients when compared with cured patients.

Introduction

The coronavirus disease 2019 (COVID-19), caused by the infection by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become a problem for global health [1].

Severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) is an enveloped, positive-sense, single-stranded RNA virus that is closely related to original SARS-CoV and Middle East respiratory syndrome (MERS) coronaviruses [2]. SARS-CoV-2 enters human cells with help of angiotensin-converting enzyme 2 (ACE-2) located

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on the cell surface of different organs such as the heart, lung, kidney, testis, and digestive tract [2].

The COVID-19 prevalence had spread to almost every country in the world. As of March 2023, more than 6.8 million confirmed COVID-19 deaths had occurred [3]. The total death rate is around 2%, and 23% of COVID-19 patients have severe disease, necessitating intensive care and mechanical ventilation in 11% and 7%, respectively [4]. Severe COVID-19 is associated with acute renal damage, liver failure, cardiomyopathy, and coagulation malfunction. Consequently, finding proteins and genetic factors associated with COVID-19 susceptibility and outcome is therefore crucial [5]. The primary symptoms of COVID-19 are fever, a dry cough, and exhaustion. Patients with more serious conditions frequently have dyspnea and/or hypoxemia, which can quickly lead to acute respiratory distress syndrome, septic shock, metabolic acidosis, coagulation issues, and multiple organ failure [6]. Epidemiological data revealed that the majority of COVID-19 infections were asymptomatic or displayed a mild illness, while a sizable number (up to 20%) develop either severe hypoxemic pneumonia or critical illness culminating in death [7,8]. The large variability in clinical expression and outcomes of COVID-19 was associated with host factors such as old age, gender, comorbidities, ethnicity, and lower economic status [7,9].

Due to the complexity of its transmission and lack of effective treatments, COVID-19 poses a significant challenge on a global scale.[10] Due to their high rates of illiteracy, inadequate healthcare systems, and scarcity of Intensive Care Units, middle- and low-income countries will be more severely affected. A series of studies have reported clinical characteristics of COVID-19 critical illness [11] and severe illness patients [7].

The clinical characteristics and risk factors taken into consideration aim to identify risk factors connected to fatal outcomes. Our current knowledge of patient's risk factors of death with COVID-19 is currently inadequate. As a result, not all potential risk factors may be thoroughly investigated. In every study, the different risk factors are taken into consideration.

Hypertension, diabetes, chronic obstructive pulmonary disease, dyspnea, history of substance use, gender, acute respiratory distress syndrome (ARDS), history of smoking, older age, are commonly reported risk factors [12,13].

The goal of the study is to consolidate and improve our knowledge of the precise impact of risk factors on the COVID-19 fatality rate.

Patients and methods

Study subjects

Patients: One hundred of COVID-19 patients who admitted in Chest Hospital, Assiut University Hospitals and other quarantine hospitals in Assiut, Egypt in the period from January 2022 to August 2022. SARS-CoV-2 RNA was detected in all enrolled patient's pharyngeal swab specimens by real-time reverse transcription polymerase chain reaction (RT-PCR). Patients must be adult (age ≥ 18 years). Exclusion criteria: a. Immunological disorders (e.g.: autoimmune or immune deficiency disorders). b. Radiotherapy and chemotherapy. c. Patients diagnosed with other viral infections, such as HIV, HCV, HBV, or another common respiratory virus, as well as solid organ or hematological transplantation patients.

Methods

Data was collected for all 100 COVID- 19 adult patients. The patient cohort was classified into severe group (n=32) cases developed as severe symptoms and needed critical care support (ICU), including high-flow oxygen, positive-pressure ventilation or vasoactive drugs. A total of 68 patients did not require intensive care (ICU) and were thus classified as non-severe. Follow-up was completed on October, 2022, at which time all patients either were discharged from the hospital as "cured" or had a fatal outcome of the disease.

Ethical approval

Ethical Approval for this study was obtained from Institutional review board (IRB) and approved by The Ethical Committee of the Faculty of Medicine - Assiut University prior to study execution (at a date of 3/11/2021 with IRB local approval number (04-2023-200342).

Statistical analysis

Data analysis performed using statistical package for the social science (IBM-SPSS) version 26.0 software. Categorical data presented in the form of frequencies and percentages. All numerical variables tested before evaluation to determine the normality of data by Shapiro–Wilk test and mean ± SD was used to express quantitative variables as age. Chi square test used to compare proportion

between different groups, *p* value significant if < 0.05.

Results

Overall, 100COVID-19 patients were admitted in Chest Hospital, Assiut University Hospitals and other quarantine hospitals in Assiut City, Egypt, from January 2022 to August 2022which were included in this study. The mean age ± standard deviation (SD) of covid 19 patients was 61.13±14.25, ranged from 22 to 97 years. 56.0% of patients were ≥60 years, 65 patients (65%) were of the male gender. The most prevalent symptoms among patients were dyspnea (98%), cough (93%) followed by fever (74%) **(Table 1).** Sixty one percent (61%) of patients had comorbidities of one or more types. The most prevalent comorbidities were hypertension (37%), diabetes mellitus (34%), and followed by chronic obstructive pulmonary disease (19%). 32.0% of patients with COVID-19 infection admitted ICU, and 18.0% of patients were died **(Table 1).**

Risk factors associated with mortality in COVID-19 patients

There was high statistically significant difference between the mean age of patients who, died compared to cured patients (74.00 ±12.84 vs 58.30 ±12.99 respectively), *p* value< 0.001.83.3% of patients aged ≥ 60 were died compared to 50.0% aged ≥60 was cured, *p* value=0.010. Moreover, there was total percent of died patients with comorbidities (100.0%) compared to 52.4% of patients with comorbidities were cured, *p* value <0.001. As regards comorbidities, there was higher percent of death among patients with hypertension (83.3%) compared to 26.8% of patients with hypertension were cured, *p* value <0.001. Similarly, there was higher percent of death among patients with diabetes mellitus (72.2%) compared to 25.6% of patients with diabetes were cured, *p* value <0.001. Also, there was a higher percent of deaths among patients with COPD (38.9%) compared to 14.6% of patients with COPD were cured, *p* value =0.018. On the other hand, admitted ICU group of died patients had a higher percent (50.0%) than admitted ICU group of cured patients with no significant differences. Also, the male gender of died patients were more the male gender of cured patients with no significant differences **(Table 2).**

Table 1. Baseline patients characteristics of the study groups.

Parameter	**Patients (N=100)(%)**
Age (years) Mean ± SD (Range)	61.13±14.25 (22-97)
• <60	44 (44.0%)
• ≥60	56 (56.0%)
Sex (male/female)	65/35 (65.0%/35.0%)
Clinical presentation	98 (98.0%)
• Dyspnea	93 (93.0%)
• Cough	23 (23.0%)
• Diarrhea	74 (74.0%)
• Fever	29 (29.0%)
• Sore throat	
Presence of comorbidities	61 (61.0%)
• HTN	
• DM	37 (37.0%)
• COPD	34 (34.0%)
• CKD	19 (19.0%)
• CLD	7 (7.0%)
• Pregnancy	4 (4.0%)
	3 (3.0%)
ICU	
• Admitted ICU	32 (32.0%)
• Not admitted ICU	68 (68.0%)
Outcome	18 (18.0%)
• Died	82 (82.0%)
• Cured	

Table 2. Factors associated with mortality among patients with COVID-19.

Parameter	Died (n=18)	Cured(n=82)	*P*-value
Age (years): Mean ± SD	74.00±12.84	58.30±12.99	<0.001
• **<60**	3 (16.7%)	41 (50.0%)	
• **≥60**	15 (83.3%)	41 (50.0%)	0.010
Sex (male/female)	11/7(61.1%/38.9%)	54/28(65.9%/34.1%)	0.702
Presence of any comorbidities	18 (100.0%)	43 (52.4%)	<0.001
• HTN	15 (83.3%)	22 (26.8%)	<0.001
• DM	13 (72.2%)	21 (25.6%)	<0.001
• COPD	7 (38.9%)	12 (14.6%)	0.018
• CKD	2 (11.1%)	5 (6.1%)	0.606
ICU	9 (50.0%)	23 (28.0%)	0.071
• Admitted ICU	9 (50.0%)	59 (72.0%)	
• Not admitted ICU			

Discussion

In the current study, the mean age ± SD of COVID-19 patients was 61.13 ±14.25, ranged from (22 to 97 years). Fifty six percent of patients were ≥ 60 years. These results matched with those obtained by **Schönfelder et al. [**14] who found that the median age of covid -19 patients was 59 years ranged from (18 to 99 years).

In addition, **Cuesta - Llavona et al.** [15] reported that the mean age ± SD of covid-19 patients was 66 ±16, ranging from (55 to 75 years). Furthermore, **Gómez et al.** [16] reported that the mean age ± SD of covid-19 patients 65.23±15[16], ranged from 56 to 75 years. Elderly people frequently have more comorbid conditions, and aging-related chronic pro-inflammatory immune status with persistent low-grade innate immune activation may increase tissue damage caused by infections in the elderly. This evidence demonstrated that age may be a risk factor in the epidemiology of this infection [17].

In all regions, the age dependence of COVID-19 susceptibility was significantly lower in younger age groups, ranging from 21% in those aged 10 to 19 to 69% in those over 70 [18]. Similarly, in China, compared to the susceptibility in individuals aged 60–69 years, the relative susceptibility was 0.34 in adults aged 20–29 years, 0.57 in adults aged 30–39 years, 0.69 in those aged 40–49 years, 0.79 in individuals aged 50–59 years, 0.94 in elderly individuals aged 70–79 years, and 0.88 in individuals aged ≥80 years [19].

In the current study, susceptibility to SARS-CoV-2 had different distribution among males (65.0%) and females (35.0%). Males were more predisposed to COVID-19 infection. Initial pandemic reports from China indicated that men accounted for ~ 60% of COVID-19 patients. [20] Men were found to have a higher risk of infection, disease severity, intensive care unit (ICU) admission, and death than women in a meta-analysis of 59 studies involving 36,470 patients [21].

According to some theories, males are more likely to contract COVID-19 infection than females due to differences in how hormones affect inflammatory processes, variations in the concentrations of molecules that help SARS-CoV-2 enter cells by fusing with them (such as transmembrane protease serine 2, or TMPRSS2) and cell receptors (such as angiotensin-converting enzyme, or ACE2) and lifestyle choices (such as smoking) [22].

In the current study, the most common risk factors associated with Covid-19 among the studied population were hypertension (37.0%), diabetes mellitus (34.0%) and COPD (19.0%). This finding goes along with **Ng et al.** [23] who revealed that hypertension and diabetes mellitus were the most prevalent comorbidities in COVID-19 patients and were associated with a higher risk of fatality.

The key regulator of blood pressure is the ACE receptor which is the binding site of SARS-CoV, making hypertension the most focused comorbidity [24]. Also, diabetic patients are frequently prescribed by thiazolidinedione, a type of

oral hypoglycemic used to lower blood glucose levels which is reported to increase the expression of ACE2 [25], (that, is connected with spike protein of the virus on human cells and used as a mechanism of cell entry) [2].

Patients in this study were categorized according to their severity into admitted to ICU (32.0%) and not admitted to ICU (68.0%). This result was similar to that reported by **Gómez et al.** [16] who found that (26%) of covid-19 patients admitted to ICU and (74%) not admitted to ICU. Also, **Cuesta - Llavona et al.** [15] found that (31.4%) of covid-19 patients admitted ICU and (68.6%) not admitted to ICU.

Regarding to the mortality in the current study, 18% of patients were died (non-survivors) and 82% of patients were cured (survivors). This result was similar to that reported by **Cuesta - Llavona et al.** [15] who found (9%) of 484 patients were died. However, **Guan et al.** [20] found that the mortality of Covid-19 was 1.4%. And **Huyut et al.** [26] found that the mortality of the treated patients was 5.07% (233/4597). The different sample sizes and case inclusion criteria used in the studies may be the reason of these different mortality results.

In the current study, the mean age ± SD of died patients (non-survivors) were significantly older (74.00 ± 12.84) when compared with survivors (58.30 ±12.99) years (<0.001). Similarly, **Salinas-Escudero et al.** [27] reported that the risk of dying was significantly high older (59.42±14.29) when compared with survivors (45.22±15.06) years (p<0.001).Moreover, **Ahmadi et al.** [28] reported that (57.7 ±11.3) years were died when compared with cured patients (49.6±13.1) years (p<0.001).in our study , (83.3%) were died and were ≥60 years . Similarly, **Ahmadi et al.** [28] reported that78.3% were died and were ≥51 years.

Moreover, according to data from 79394 confirmed cases that reported by **Wu et al.** [29] Chinese study, compared to patients aged 30−59 years, those aged below 30 and above 59 years were 0.6 and 5.1 times more likely to die after developing symptoms, respectively.

Regarding to the mortality and gender in the current study, 61.1% of male patients were died and 38.9% of females were died. In accordance with our finding, **Ahmadi et al.** [28] found that 53.6% of males were died. As well as **Peckham et al.** [30] found that males were at a higher risk of severe disease and death than females. It is generally believed that women have stronger innate and adaptive immune responses to infection than men [31].

In the current study, hypertension had significantly higher in died patients (n=15, 83.3%), (p<0.001) than survivors (n=22, 26.8%). In accordance with our finding, **Cuesta - Llavona et al.** [15] and **Gopalan et al.** [32] who reported that 66%, 42% of patients died had hypertension, respectively. However, **Huang et al. [**33] found that 24.8% of patients with hypertension were died. These different mortality results may have been due to the different sample sizes and case inclusion criteria used in the studies.

In the current study, diabetes mellitus had significantly higher incidence of death (n=13, 72.2%), (p<0.001) when compared with survivors. In accordance with our finding **Gopalan et al.** [32] reported that 57.3% of dead patients had diabetes mellitus. Similarly, **Ng et al.** [23] revealed that hypertension and diabetes mellitus were among the most prevalent comorbidities in Covid-19 patients and were associated with a higher risk of fatality.

Regarding to the mortality and COPD in the present study, (38.9%) of died patients with COPD, (p=0.018). In accordance with our finding **Zhang et al.** [34] found that 6.1% of non-surviving patients had COPD comorbidity, which was remarkably higher than COPD prevalence 0.6% of non-severe patients. Also, **Zhou et al.** [13] found that non survivors had higher COPD prevalence (7%) compared to survivors (1%). Moreover, **Guan et al.** [35] demonstrated that COPD (hazard ratio [HR]: 2.681) was a risk factor for ICU admission, invasive ventilation, and death after adjustment for age and smoking in a Chinese nationwide Covid-19 analysis. **Assal et al.** [36] reported a significant association between mortality rate and COVID-19 severity and the associated comorbidities.

Regarding to the mortality and ICU admission (poor healthy state) in the current study, nine patients (50%) of died patients and had ICU admitted. However, **Cuesta Llavona et al.** [15] found that the frequency of deaths was significantly higher in the ICU patients (24%), as Cuesta Llavona calculated the frequency of deaths according to total number of ICU admitted patients not according to total number of death patients.

The main host risk factors for severe COVID-19 are older age (>60 years), unvaccinated, associated comorbidities (such as cardiovascular disease, hypertension, chronic pulmonary disease, diabetes, chronic liver disease, and malignancy),

immunodeficiency, obesity, and heavy smoking [37]. Apart from these factors, studies have shown that host genetics may also be key in the development of severe COVID-19 and should be considered in COVID-19 prognosis [38].

Emerging studies suggested that host-genetic factors may also contribute to the difference in COVID-19 phenotypes [39]. Early identification of risk factors would be of great value, not only to identify the defining clinical and epidemiological characteristics with greater precision, but also to make it easier to get the right supportive care and, if needed, quick access to the ICU [9]. Studies investigating the role of host genetic factors in COVID-19 pathogenesis are rapidly growing, revealing several gene susceptibility variants, although with different levels of evidence [40].

Conclusion

In this study, the most common risk factors associated with COVID-19 among the studied population were age ≥60 years, male gender (65%), comorbidities (hypertension (37.0%), diabetes mellitus (34.0%) and COPD (19.0%)). Also, age and comorbidities were significantly higher in died patients when compared with cured patients.

Limitations

There are some limitations on our study that should be considered. Small sample size (as it only confined to 100 patients of Assiut city hospitals, Egypt). Furthermore, there was no information on the patients' prior vaccinations.

Conflict of interest

The authors report no conflicts of interest in this work.

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