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Assessment of Risk Factors for Severe Coronavirus Disease -19 in Taif Province, Saudi Arabia

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ABSTRACT

Coronavirus 2019 (COVID 19) is one of the pandemics registered for 2020, with the entire world affected. COVID 19 disease is diagnosed based on symptoms and risk factors, and both swab and RT-PCR tests are available to confirm the disease. The aim of this study was to the underlying health issues which might be connected to development of severe COVID19.A retrospective study was carried out in a tertiary hospital (Corona center) in Saudi Arabia from August 2020 to December 2020 to identify the risk factors of mortality in ICU admitted COVID-19 patients and to assess the underlining sociodemographic and medical conditions that may lead to the development of severe COVID-19. Data was collected from patients' medical records. In this study, 174 subjects were recruited and 71.3% of the population is male and 28.7% as female. Survival was 52%, whereas non-survivors was 48%. The average age was 57.7±16.0 years old. The most common clinical manifestations were shortness of breath (75.9%), cough (67.8%), and fever (64.9%). T2DM was one of the highest co-morbidities was documented. Binary logistic regression analysis confirmed both the age and fever showed the positive association ($p<0.05$) and the serum parameters such as CRP, d dimer, neutrophils and lymphocytes showed the elevated levels and positive association ($p<0.05$). In conclusion, the current study results confirmed HTN, CKD, and heart disease comorbidities all played a substantial impact in the development of COVID-19, and that older age (>60 years) also played a role in COVID 19 patients. Saudi Arabia is one of the nations that has successfully managed the COVID 19.

KEY WORDS: COVID 19, COMORBIDITIES, SERUM PARAMETERS, SURVIVORS AND NON-SURVIVORS.

INTRODUCTION

The story of the coronavirus begins at the end of 2019 in China, in a well-known location known as the Wuhan market (Farasani, 2021). Because of the threat to the entire human population, the World Health Organization (WHO) has declared coronavirus 2019 (COVID19) a pandemic (Daniel, 2020). Severe acute respiratory syndrome Coronavirus 2 (SARSCoV-2), the seventh human coronavirus, has been discovered. As a result of this, the virus has spread throughout the entire world (Ciotti et al., 2020). Coronaviruses (also known as Coronavirinae/CoV) are enclosed, single-stranded, positive-sense RNA viruses. It's likely that the CoVs genome, which ranges from 26 to 32 kilobases in length, is the biggest viral RNA yet discovered. CoVs have historically been recognized to cause disease in humans, and there are currently six identified CoVs of which two falls into the low pathogenic and two falls into the highly pathogenic category.

Between 10-30% of all upper respiratory tract infections are caused by CoVs that have a low pathogenicity, including 229E, HKU1, OC43, and NL63. In contrast, CoVs with high pathogenicity, such SARS and MERS, primarily infect the

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lower respiratory system and produce deadly pneumonia (Han et al., 2020). SARS-CoVs has a diameter of ~50–200 nm, ranging from 26-32 kb. SARS-CoV-2 is a β-coronavirus that contains a single positive RNA strand. Its 60-140 nm diameter envelope provides it with a square, elliptical form. In its genome, there are special parts derived from 9 Wuhan patients that consist of a close-knit 29,903 basis pair of single stranded RNA pairs (88%) of β-coronavirus isolated bats. The untranslated area (UTR) of the SARS-CoV-2 genome is composed of 50 leader sequence, 1a/b free reading frame genes, spike protein, the protein envelope, protein membrane/ matrix and auxiliary protein, nucleoprotein and sequenced 3´UTR (Farasani, 2020).

The most typical symptoms of COVID 19 are fever, cough, and weariness. One of the first signs is a loss of taste or scent. Shortness of breath, muscle aches, headache, runny nose, nausea, vomiting, diarrhea, and rashes are the remaining symptoms. These factors, such crowding, literacy levels, and health care employees, are all involved in increasing the likelihood of infection and infection is often a problem in the elderly, men, and those with preexisting conditions (Rashedi et al., 2020). Because of community transmission, the risk of COVID 19 in the general population is currently very high. COVID-19 harm to the population with established risk factors for severe illness outcome and COVID-19 can cause serious disease in people of any age who have specific underlying medical issues. COVID-19 is a newly discovered disease. COVID-19 can affect anyone, and the disease can cause mild to severe symptoms. Some persons may be more likely than others to suffer from severe disease because they have qualities or medical conditions that put them at risk.

There is currently little evidence and information available about the impact of underlying medical disorders and if they raise the risk of severe disease from COVID-19. Based on what we know at this time, it is extremely vital to recognize the persons at high risk of serious disease from COVID-19, as well as those who live with them, in order to protect yourself from obtaining COVID-19. If you have COVID-19, you are more likely to be admitted to the hospital or ICU if you have certain risk factors. Knowing the risk factors connected with COVID-19 is important because it can help people who are at high risk take further precautions. Almost 98% of COVID-19 cases from Saudi Arabia has recovered and 1% of the mortality cases was documented and only <1% of active cases were listed. Limited studies in the Saudi Arabia has performed with the risk of developing with severe form. Therefore, the current study was aimed to investigate the underlying health issues which might be connected to development of severe COVID-19.

METHODOLOGY

This is a retrospective and hospital-based study that was conducted at King Faisal Medical Complex hospital in Taif Province from August to December 2020. Following authorization from the Ministry of Health, clinical details, personal and family history data were gathered from medical records of patients admitted to Intensive Care Unit. This rationale study will address one of the most important questions to address the currently unfolding pandemic: "what are the risk factors for severe illness or death and will allow us to understand the risk factors for disease severity providing a comprehensive picture of the characteristics of COVID-19 patients." The inclusion criteria of the cases were patients diagnosed with COVID 19 in any nationality and the patients without COVID-19 infection can be considered as exclusion criteria of the enrolled subjects. In this study, we have selected 174 cases in which 50 females and 124 males were involved. In this study, 77 non-Saudi and 97 Saudi subjects were involved. Both the symptoms and comorbidities details were recorded in all the enrolled patients.

Table 1. Clinical and sociodemographic characteristics of COVID 19 patients hospitalized to the ICU

Sociodemographic			
Gender			
		Frequency	**Percent**
	Female	50	28.7
	Male	124	71.3
Age (Mean ± SD)	57.7 ± 16		
Age group	< 35	15	8.6
	36 - 59 Y	76	43.7
	≥ 60	83	47.7
Nationality	Non-Saudi	77	44.3
	Saudi	97	55.7
Symptoms			
SOB	No	42	24.1
	Yes	132	75.9
Cough	No	56	32.2
	Yes	118	67.8
Fever	No	61	35.1
	Yes	113	64.9
Diarrhea	No	151	86.8
	Yes	23	13.2
Myalgia or fatigue	No	159	91.4
	Yes	15	8.6
Headache	No	160	92
	Yes	14	8
Comorbidity			
Type 2 DM	No	91	52.3
	Yes	83	47.7
Hypertension	No	105	60.3
	Yes	69	39.7
Heart disease	No	147	84.5
	Yes	27	15.5
Chronic kidney disease	No	153	87.9
	Yes	21	12.1
Asthma, Bronchial Asthma (BA)	No	159	91.4
	Yes	15	8.6

Biochemical parameters: In this study, serum blood was collected from all the patients who have involved and used for c-reactive protein (CRP), lymphocytes, neutrophils and d dimer tests.

Statistical analysis: Statistical analysis was performed with SPSS software and we have analyzed both the numerical and categorical variables with frequency and percentages. Binary logistic regression analysis was performed with the obtained data. P values less than 0.05 is considered as statistically significant ($p<0.05$) (Khan et al., 2019).

Table 2. Shows the survival and non-survival rates of COVID 19 patients hospitalized to the ICU.

Variable	Survivor	Non- Survivor	Total	P-value
Sociodemographic				
Gender N (%)				
Female	21(23.3%)	29(34.5%)	50 (28.7%)	0.131
Male	69(76.7%)	55(65.5%)	124(71.3%)	
Age N (MIN - MAX)	90(14 - 82)	84(23 - 92)	174(14 - 92)	
Age (mean ±SD)	51 ±14	65 ±14	57.7 ± 16	
Age group				
≤ 35	13(14.4%)	2(2.4%)	15(8.6%)	
36 - 59 Y	51(56.7%)	25(29.8%)	76(43.7%)	0.00
≥ 60	26(28.9%)	57(67.9%(	83(47.7%)	
Symptom				
Dyspnea SOB	61(67.8%)	71(84.5%)	132(75.9%)	0.013
Cough	54(60%)	64(76.2%)	118(67.8%)	0.02
Fever	49(54.4%)	64(76.2%)	113(64.9%)	0.004
Diarrhea	14(15.6%)	9(10.7%)	23(13.2%)	0.37
Myalgia or fatigue	6(6.7%)	9(10.7%)	15(8.6%)	0.4
Headache	8(8.9%)	6(7.1%)	14(8%)	0.7
Comorbidities				
Type 2 DM	38(42.2%)	45(53.6%)	83(47.7%)	0.17
Hypertension	26(28.9%)	43(51.2%)	69(39.7%)	0.003
Bronchial Asthma, (BA)	9(10%)	6(7.1%)	15(8.6%)	0.5
Chronic kidney disease	5(5.6%)	16(19%)	21(12.1%)	0.006
Heart disease	7(7.8%)	20(23.8%)	27(15.5%)	0.003

RESULTS

In this hospital-based study, we have opted 28.7% of women and 71.3% of men. The mean age of the 174 participants were found to be 57.7±16.0. The age was categorized into <35 (8.6%), between 36-59 (43.7%) and >60 (47.7%) years of age. Saudi subjects (44.3%) were found to be higher than non-Saudi participants in this study (55.7%). Table 1 presents information on sociodemographic, symptoms, and comorbidities. The general COVID 19 symptoms such as high in SOB (75.9%), cough (67.8%), fever (64.9%), diarrhea (13.2%), fatigue (8.6%) and headache (8%). Type 2 diabetes mellitus (T2DM; 47.7%), hypertension (HTN; 39.7%), heart disease (15.5%), chronic kidney disease (CKD, 12.1%) and bronchial asthma (BA, 8.6%) were among the comorbidities revealed in this studied participant. According to Figure 1, 48% of hospitalized patients were determined to be alive, while the remaining 52% were confirmed to be dead. Table 2 shows the survival and non-survival rates of participants infected with COVID-19 who were admitted to the Taif hospital in the ICU.

Table-2 shows the list of COVID-19 survivors and non-survivors admitted to the ICU. Males were found to be higher than females in both categories among survivors and non-survivors ($p=0.13$). The survivors' minimum and maximum ages were determined to be 14-82 years old, whereas the non-survivors' minimum and maximum ages were found to be 23-92 years old. The mean ages of survivors and non-survivors were reported to be 51±14 and 65±14, respectively, with a non-significant association ($p>0.05$). Among survivors, the majority of the age groups was found to be high in between 36-59 years of age with 56.7%, followed by 28.9% in 60 and above years of age and 14.4% in below 30 years of age, while in non-survivors, 67.9% was found to be high in below 60 years of age, followed by 29.8% in between 36-59 years of age, and only 2.4% in above 35 years of age with the statistical association ($p<0.05$).

Among the symptoms, dyspnea SOB, cough, and fever were found to be more prevalent in non-survivors when compared to survivors and showed a significant association

(p<0.05), whereas in survivors, both diarrhea and headache were found to be more prevalent when compared to non-survivors with a non-significant association (p>0.05), and fatigue prevalence was found to be more prevalent in non-survivors when compared to survivors (p=0.7). T2DM and BA were shown to have a non-significant association when compared between survivors and non-survivors (p>0.05) in the comorbidities. Other comorbidities, such as HTN, CKD, and heart disease, were found to be substantially associated when comparing survivors to non-survivors (p<0.05).

Binary logistic regression analysis among the survival subjects of independent factors was defined in Table-3. In this study, numerous variables such as age, gender, fever, cough, fatigue, dyspnea, diarrhea, headache, T2DM, HTN, BA, CKD and heart disease were involved in the survivor subjects and only the age (OR-5.48 [95%CI:2.54-11.81]; p=0.001) and fever (OR-3.15 [95%CI:1.10-8.97]; p=0.03) variables was associated. The other variables were found to be non-significant when performed the logistic regression analysis (p>0.05).

Table 3. Binary logistic regression survival status and independent factors

Variables	OR	95% C. I		P-value
		Lower	Upper	
Age	5.48	2.541	11.815	0
Gender	0.675	0.3	1.517	0.341
Fever	3.15	1.105	8.979	0.032
Cough	1.22	0.418	3.562	0.717
Myalgia or fatigue	3.676	0.888	15.212	0.072
Dyspnea	1.426	0.534	3.809	0.479
Diarrhea	0.569	0.194	1.669	0.304
Headache	0.506	0.13	1.973	0.326
Type2DM	0.504	0.212	1.194	0.119
Hypertension	1.654	0.701	3.905	0.251
Bronchial Asthma (BA)	1.195	0.3	4.759	0.8
Chronic kidney disease	3.195	0.865	11.799	0.081
Heart disease	1.977	0.676	5.781	0.213

Table 4. Lab abnormalities of COVID 19 patients admitted to ICU

Variables	Survivor	Non- Survivor	Total*	P-value
C Reactive Protein				
Elevated	60(83.3%)	70(98.6%)	130(90.9%)	0.001
Normal	12(16.7%)	1(1.4%)	13(9.1%)	
Lymphocyte				
Lymphopenia	35(58.3%)	45(73.8%)	80(66.1%)	0.05
Normal	25(41.7%)	16(26.2%)	41(33.9%)	
Neutrophils				
Elevated	19(31.7%)	35(57.4%)	54(44.6%)	0.004
Normal	41(68.3%)	26(42.6%)	67(55.4%)	
D dimer				
Elevated	57(80.3%)	55(93.2%)	112(86.2%)	0.001
Normal	14(19.7%)	4(6.8%)	18(13.8%)	

*Total is differing for each test according to number of patients tested

Table 4 shows the biochemical parameters such as CRP, lymphocytes, neutrophils, and d dimer in COVID-19 survivors admitted to the ICU. When compared to survivors, the elevated levels were found to be higher in non-survivors, indicating a positive association. CRP levels were found to be increased in non-survivors at 98.6% and survivors at 83.3% (p=0.001). The aberrant lymphocyte counts were 73.8% and 58.3% in non-survivors and survivors, respectively (p=0.05). The number of increased neutrophils was 44.6% in non-survivors and 57.4% in survivors (p=0.004). The enlarged levels of d dimer in non-survivors were 93.2% and 80.3% in survivors (p=0.001).

Figure 1: Status of COVID 19 patients admitted into ICU

DISCUSSION

The purpose of this study was to investigate at the underlying health issues associated with demographic information, symptoms, and comorbidities among hospitalized patients in the ICU with COVID-19 in the Taif city of Saudi Arabia. The current study results confirmed the significant association with age group, documented symptoms such as Dyspnea SOB, cough, fever and other comorbidities such as HTN, CKD and heart disease ($p<0.05$). Binary logistic regression analysis revealed the positive association with age and fever ($p<0.05$) and all the biochemical parameters such as CRP, lymphocytes, neutrophils and d dimer showed the statistical association ($p<0.05$).

There have been no studies conducted in Saudi Arabia among COVID-19 patients admitted to the ICU, and this is the first research study was carried out in the Saudi population from Taif city. T2DM, HTN, BA, CKD, and heart disease were among the comorbidities studied in our study.

Unfortunately, due to the pandemic crisis, we did not record body mass index values to categorize obesity levels, despite the fact that obesity is one of the known risk factors for COVID-19. One of the meta-analysis and systematic reviews discovered that HTN, DM, and cardiovascular disease (CVD), along with age and being male, are all highly connected to severe COVID-19 and can provide a better estimate of risk for severe COVID-19 (Matsushita et al., 2020). Another systematic reviews and meta-analysis studies found that those over the age of 65, men, HTN, CVD, diabetes, and cancer were all more likely to die from COVID-19 infection. Patients with a poor prognosis could be identified based on these data (Parohan et al., 2020).

The immune system varies with age in a similar manner to the differences in immunological response related to sex. It is thought that as people age, their immune systems become chronically inflamed, which makes them more vulnerable to infection and tissue damage. Aging is related with comorbidities and a lower reserve capacity in essential organs, resulting in greater frailty and increased risk of mortality and infection with COVID-19 when infected. In this study, age was divided into three categories: (a) <35 years, (b) 36-59 years, and (c) >60 years, with 47.7% being >60 years, 43.7% being 36-59 years, and 8.6% being <35 years of age. A positive association was observed among the three age groups compared between the survivors and non-survivors ($p=0.001$). Our study was found to be in association with the previous studied results (Pijls et al., 2021). Similar studies have been conducted in different regions of Saudi Arabia based on our current study.

From the beginning of the pandemic crisis to current scenario, WHO has strongly recommended to follow three rules to avoid the COVID-19 infections: social distance, sanitization and wearing a mask. All countries have rigorously enforced and extra lockdown was performed to stop the infection rate, and Saudi Arabia is one of the countries that has successfully controlled the COVID-19. Until September 5th, 2021, the overall number of infected cases was 545,243, the number of recovered cases was 534062, and the total mortality was 8579, with 2602 active cases. Apart from Saudi Arabia, there are other countries which have been successfully managed the infection. Ministry of Health from Saudi Arabia has played a pivotal role in controlling the infections and proper measures have been taken, as well as residents of the kingdom received a couple of doses of free vaccines.

Aside from RT-PCR, biochemical markers were important in COVID-19 patients. A recent review supported the importance of CRP and d dimer levels in identifying COVID-19 patients (Farasani, 2021). In our study, additionally with CRP and d dimer, we have screened lymphocytes and neutrophils levels in the COVID-19 patients and unfortunately, all the elevated levels were confirmed in the non-survivors and all the parameters showed the significant association ($p<0.05$). Strong evidence suggests that neutrophils play a crucial role in pathogenesis, particularly in COVID 19 patients (Reusch et al., 2021).

One of the limitations of this study was not incorporating the RT-PCR details. Additionally, clinical details were not incorporated. The other limitations of our study were to skip the severe forms of diagnosis which is mandatory, but due to COVID-19, we couldn't document the data. The strength of this study was to involve the 174 subjects who were infected with COVID-19. Although the sample size was small but we have managed to enroll the limited subjects during the pandemic situations.

CONCLUSION

The current study shows that HTN, CKD, and heart disease comorbidities all played a substantial impact in the development of COVID-19, and that older age (>60 years) also played a role in COVID-19 patients. Developing a unique multi-item scale method to predict COVID-19 patients is indicated as a future proposed study.

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Abbreviations: ICU, Intensive Care Unit, DM, Diabetes Mellitus, T2DM, Type 2 Diabetes Mellitus, CRP, C Reactive Protein, CVD, Cardiovascular disease, HTN, Hypertension, CKD, chronic kidney disease, RT-PCR, Real Time polymerase Chain Reaction, RNA, Ribonucleic Acid, SOB, Shortness of Breath, BA, Bronchial Asthma, SPSS, Statistical Package for the Social Sciences.

REFERENCES

Ciotti M., Ciccozzi M., Terrinoni A., Jiang W.-C., Wang C.-B., Bernardini S. (2020) The COVID-19 pandemic. Critical reviews in clinical laboratory sciences 57:365-388.

Daniel J. (2020) Education and the COVID-19 pandemic. Prospects 49:91-96.

Farasani A. (2020) Genetic analysis of the 2019 coronavirus pandemic with from Real-time reverse transcriptase polymerase chain reaction. Saudi Journal of Biological Sciences.

Farasani A. (2021) Biochemical role of serum ferratin and d-dimer parameters in COVID 19 diagnosis. Saudi Journal of Biological Sciences.

Han Q., Lin Q., Jin S., You L. (2020) Coronavirus 2019-nCoV: A brief perspective from the front line. Journal of Infection 80:373-377.

Khan I.A., Jahan P., Hasan Q., Rao P. (2019) Genetic confirmation of T2DM meta-analysis variants studied in gestational diabetes mellitus in an Indian population. Diabetes Metab Syndr 13:688-694. doi: 10.1016/j.dsx.2018.11.035

Matsushita K., Ding N., Kou M., Hu X., Chen M., Gao Y., et al. (2020) The relationship of COVID-19 severity with cardiovascular disease and its traditional risk factors: a systematic review and meta-analysis. Global heart 15.

Parohan M., Yaghoubi S., Seraji A., Javanbakht M.H., Sarraf P., Djalali M. (2020) Risk factors for mortality in patients with Coronavirus disease 2019 (COVID-19) infection: a systematic review and meta-analysis of observational studies. The Aging Male 23:1416-1424.

Pijls B.G., Jolani S., Atherley A., Derckx R.T., Dijkstra J.I., Franssen G.H., et al. (2021) Demographic risk factors for COVID-19 infection, severity, ICU admission and death: a meta-analysis of 59 studies. BMJ open 11:e044640.

Rashedi J., Mahdavi Poor B., Asgharzadeh V., Pourostadi M., Samadi Kafil H., Vegari A., et al. (2020) Risk factors for COVID-19. Infez Med 28:469-474.

Reusch N., De Domenico E., Bonaguro L., Schulte-Schrepping J., Baßler K., Schultze J.L., et al. (2021) Neutrophils in COVID-19. Frontiers in Immunology 12:952.