

Assessing COVID-19 Prognostic Indicators in the Kingdom of Bahrain

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Abstract

Background: Assessing the COVID-19 prognostic indicators is crucial to identify high risk group and is vital in order to establish admission ground basis and identify the level of care required as well as prevention of rapid progression and deterioration by providing the proper care level at the time of presentation. This study has been designed to assess the outcome of hospitalized COVID-19 patients across government medical institutions in the Kingdom of Bahrain to delineate any bad clinical representations based on demographic prognostic indicators and laboratory parameters.

Method: A prospective observational analysis of all patients that were admitted with confirmed COVID-19 disease at different COVID governmental treating institutions throughout the Kingdom of Bahrain over a period of nine (9) consecutive months (February to October 2020).

Results: During the months of February and October 2020, it was estimated that 490 patients were admitted at the governmental COVID-19 isolation and treatment centers. Male predominance as well as old age was the most common risk factors. However, the latter was noticed to show no significant difference between ICU and non-ICU group. Among the comorbidities, diabetes was the commonest, although immuno-compromised state; respiratory diseases and hypertension were associated with higher risk of ICU admissions. Added to that, the clinical presentation had an impact on the outcome, as higher rates of ICU admissions were reported with fever, cough, and shortness of breath. (p value of 0.003, 0.001 and 0.001 respectively). Moreover, high inflammatory markers reflecting the presence of a cytokine storm were noticed among ICU patients.

Conclusion: It was found out that both the male gender as well as the comorbidities such as immuno-compromised status of admitted patients, respiratory diseases and/or hypertension reflected an independent risk factor for the severity of COVID-19 disease amidst adults. That, while clinical and laboratory indicators for the disease progression to a severe one included fever, cough and shortness of breath with presence of leukocytosis and elevated inflammatory markers such as D-Dimer, LDH, Ferritin and ESR..

Keywords: Kingdom of Bahrain, Middle east, COVID-19, Symptoms, Treatment

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Introduction

Over the past year, the Coronavirus Disease-2019 pandemic (COVID-19) has spread around the world at an unprecedented rate leading to over two (2) million deaths. That and the greatest risk were attributed to the severe illnesses in elder adults and the ones with comorbidities [1-3]. As time lapses and we gain deeper insight, it is becoming ever more evident that the primary risk factor for severe outcomes is associated with age (i.e.) elderly citizens of the world possessed the highest COVID-19 risks.

In a report produced by the Chinese Center for Disease Control and Prevention, the observed fatality rates of the overall cohort was 2.3% [4-6] whilst an estimated 8%-15% fatality rate was recorded amongst the age groups of 70-79 and 80 years respectively. In a separate analysis that was undertaken in the United Kingdom, the risk of death among individuals who were of 80 years of age or elder was established to be of twenty folds (twenty times greater) than that found amidst individuals of were 50-59 years respectively.

Numerous gender based global studies have concluded that male individuals with known history of comorbidities were found to be a vital aspect for the prediction of the disease severity and mortality [7-8].

Those studies have illustrated that not only comorbidities were a vital prediction mechanism but also other underlying severe medical ailments such as cardiovascular diseases, Diabetes Mellitus (DM), chronic obstructive pulmonary disease, lung diseases, cancers (in particular hematologic malignancies, lung cancer and metastatic disease), chronic kidney disease, solid organ and/or hematopoietic stem cell transplantation, obesity and smoking were all important prediction indicators [9-11].

Earlier retrospective studies of critically ill patients have suggested that two important predictors of death in clinical presentations were dyspnea and high fever ($\geq 39^{\circ}\text{C}$). Although, certain laboratory abnormalities such as neutrophilia, high lactate dehydrogenase, D-Dimer, admission oxygen saturation of $<88\%$, C reactive protein level >200 and D-Dimer level >2500 were recorded in association with poor outcomes.

Identifying COVID-19 high risk groups with rapid progression to critical illness and ICU admission is vital in order to establish admission ground basis and identify the level of care required. The thorough study of demographics and medical predictors of severe diseases can contribute enormously to the earlier prevention mechanism used and to aid the decision makers in mitigating occupational exposure as well as in directing the vaccines towards such vulnerable groups.

The motive of this clinical study is to assess the outcome of hospitalized COVID-19 patients across government medical institutions in the Kingdom of Bahrain to delineate any bad clinical representations based on demographic prognostic indicators and laboratory parameters of patients with COVID-19 illness.

Materials and Method

Study design and setting

The study was undertaken based on a prospective observational analysis of all patients that were admitted with confirmed COVID-19 disease at different COVID governmental treating institutions throughout the Kingdom of Bahrain over a period of nine (9) consecutive months (February to October 2020). That and the data that was accumulated during the in-patient stay at the treating facilities were via electronic health records and direct interactive queries with the patients themselves.

Study population

All COVID-19 disease confirmed patients through positive testing using real-time reverse transcriptase PCR for nasopharyngeal, sputum, endotracheal aspiration and/or Broncho alveolar lavage samples that has required admission to any given government COVID treatment centers across the Kingdom of Bahrain.

Outcome

The progression of the COVID-19 disease to a critical illness that requires ICU admission.

Data analysis

Statistical analyses were conducted using SPSS 23 software and were initially based on patient baseline characteristics such as age, gender, comorbidities and clinical features that were collected for the entire sample. Later, the data was further segregated into two main groups (i.e.) a group with patients who had developed a critical illness trait and needed ICU admission (the first group) whilst the second group was for patients that didn't exhibit such traits and didn't need ICU admission.

Computation was relied on for establishing the categorical measures, frequencies and percentages. That, while the mean and standard deviation values were calculated for continuous measures. Descriptive comparisons were made where ever possible using χ^2 or Fisher's exact test for categorical variables and T-test for continuous variables. A P-value of less than 0.01 was considered to indicate statistically significant difference.

Ethical approval

This study has no ethical consideration as it followed a non-interventional nature with no requirement to disclose any patient data. Hence, the study was approved by the National COVID Research Committee as well as the Secondary Care Research Committee of Salmaniya Medical Complex, Ministry of Health, Kingdom of Bahrain.

Results

During the months of February and October 2020, it was estimated that 490 patients were admitted at the governmental COVID-19 isolation and treatment centers whereby only 14 patients out of them required ICU admission (2.86%).

In (**Table 1**) below presents a detailed breakdown of baseline characteristics including demographic and comorbidity traits. A male predominance was found to exist in nearly the overall sample (81.8%) and was more pronounced significantly among patients who need ICU admission (92.8% male) with a grave difference (p value: 0.03).

The mean age of the overall sample was 41.0 ± 14.0 respectively. In contrast, the patients that required ICU admission were older than the patients who didn't need ICU admission. However, no significant difference between the age groups was recorded (p value of 0.07).

Diabetes was the most common comorbidity encountered among all patients. None the less, no difference was observed between ICU and non-ICU groups. That, and clinical study of the cohort illustrated that the most significant morbidities associated with ICU admissions were that of immuno-compromised state, respiratory diseases and hypertension as detailed in (**Table 1**) below.

The statistical data representation the follows (**Table 2**) illustrates the common clinical presentation amongst the admitted COVID-19 patients where the history of fever (11%) and cough (12%) were the most common symptoms within the admitted patients respectively. Noticeably, both criterions were associated with ICU admission risk significantly (p value of 0.003 and 0.001

Table 1: Demographic and risk contributors in COVID-19 patients in the Kingdom of Bahrain.

Characteristic	All Patients n=490	ICU n=14	Non-ICU n=476	p-Value
Age	41.0 ± 14.0	47.6 ± 11.9	40.5 ± 14.5	0.07
Gender (Male)	401 (81.8%)	13 (92.8%)	388 (81.5%)	0.03
Smoking	-	-	-	-
Bahraini	146 (30.7%)	2 (14.3%)	144 (30.3%)	0.19
History of Travel	53 (10.8%)	0 (0.0%)	53 (11.2%)	0.18
History of Contact	102 (20.8%)	4 (28.6%)	98 (20.6%)	0.47
History of Hospitalization	68 (13.9%)	2 (14.3%)	66 (13.9%)	0.96
Body Mass Index (BMI) ≥ 40	1 (0.2%)	0 (0.0%)	1 (0.2%)	-
Hypertension (HTN)	34 (6.9%)	3 (21.4%)	31 (6.5%)	0.03
Diabetes Mellitus (DM)	42 (8.6%)	2 (14.2%)	40 (8.4%)	0.43
Respiratory Diseases	5 (1.0%)	1 (7.1%)	4 (0.8%)	0.02
Renal Diseases	7 (1.4%)	1 (7.1%)	6 (1.3%)	0.07
Liver Diseases	-	-	-	-
CNS Diseases	1 (0.2%)	0 (0.0%)	1 (0.2%)	0.86
CVS Diseases	3 (0.6%)	0 (0.0%)	3 (0.6%)	0.76
Immuno-compromised	7 (1.4%)	2 (14.3%)	5 (1.1%)	0.001

Table 2: Clinical presentation of COVID-19 patients in the Kingdom of Bahrain.

Characteristic	All Patients n=490	ICU n=14	Non-ICU n=476	p-Value
History of Fever	54 (11.0%)	5 (35.7%)	49 (10.3%)	0.003
Runny Nose	4 (0.8%)	0 (0.0%)	4 (0.8%)	0.730
Sore Throat	20 (4.1%)	1 (7.1%)	19 (4.00%)	0.550
Headache	14 (2.9%)	0 (0.0%)	14 (2.9%)	0.510
Fatigue	7 (1.4%)	0 (0.0%)	7 (1.5%)	0.640
Anosmia/Dysgeusia	1 (0.2%)	0 (0.0%)	1 (0.2%)	0.860
Myalgia	10 (2.0%)	0 (0.0%)	10 (2.1%)	0.580
Chest Pain	3 (0.6%)	0 (0.0%)	3 (0.6%)	0.770
Cough	59 (12.0%)	9 (64.3%)	50 (10.5%)	0.001
SOB	20 (4.1%)	5 (35.7%)	15 (3.2%)	0.001
Diarrhea	1 (0.2%)	0 (0.0%)	1 (0.2%)	0.860
Nausea/ Vomiting	4 (0.8%)	0 (0.0%)	4 (0.8%)	0.020
Tachycardia	10 (2.0%)	1 (7.1%)	9 (1.9%)	0.170
Documented Temp ≥38.3	5 (1.0%)	2 (14.3%)	3 (0.6%)	0.001
Altered Mental Status	-	-	-	-
Arthralgia	-	-	-	-
Ear Pain	-	-	-	-
Eye Symptoms	-	-	-	-

respectively). Shortness of breath upon patient admission was recorded to be present only among 41% (i.e.) 20 patients out of the total cohort of 490 patients. However, the same was significantly associated with ICU admissions (p value=0.001). Documented fever upon the patient admission was documented as a significant associated factor with ICU admissions at p value=0.001. That, and the presence of GI symptoms (nausea and vomiting) were found in relatively a fewer number of patients (n=4, 0.8) but found to be substantially lower amongst patients who needed ICU admission.

Further abnormal laboratory findings amongst admitted COVID-19 patients and their associated critical illness/ICU admission can be observed in (Table 3) refer below. Leukocytosis and the elevation of inflammatory markers such as D-Dimer, LDH, Ferritin and/or ESR were drastically recorded in association

with ICU admission (p value of 0.001, 0.001, 0.001, 0.001, and 0.02 respectively)

Discussion

Examining our study cohort closely, we notice that a minor portion of the patients had required ICU admission (2.86%) which in contrast remains quiet lower that most of the earlier published studies worldwide [1,2]. This is further elaborated upon in our clinical study that included a wide spectrum range that involved all categories of admitted COVID-19 patients (from mild illnesses that merely requires isolation to the largely critical cases that mandates the administration of the complete ICU admission protocols).

Other significantly associated risk factors encountered were

Table 3: Investigation findings of COVID-19 patients in the Kingdom of Bahrain.

Investigation	All Patients n=490	ICU n=14	Non-ICU n=476	p-Value
Hb<12	3 (0.6%)	0 (0.00%)	3 (0.6%)	0.770
D-Dimer>1	9 (1.8%)	2 (14.3%)	7 (1.5%)	0.001
LDH>250	9 (1.8%)	5 (35.7%)	4 (0.8%)	0.001
Ferritin>500	9 (1.8%)	4 (28.6%)	5 (1.1%)	0.001
ESR>20	5 (1.0%)	1 (7.1%)	4 (0.8%)	0.020
CRP>100	4 (0.8%)	4 (28.6%)	0 (0.0%)	0.360
Mg>1	2 (0.4%)	0 (0.00%)	2 (0.4%)	0.810
WBC≥12k	3 (0.6%)	2 (14.3%)	1 (0.2%)	0.001
PMN>75	10 (2.0%)	2 (14.3%)	8 (1.7%)	0.730
Na>146	1 (0.2%)	-	1 (0.3%)	0.860
K>5.5	4 (0.8%)	2 (14.3%)	2 (0.4%)	0.001
Mg<0.7	1 (0.2%)	0 (0.00%)	1 (0.2%)	0.860
HCO3<24	2 (0.4%)	0 (0.00%)	2 (0.4%)	0.800
Platelets<150	8 (1.6%)	1 (7.1%)	7 (1.5%)	0.090
High Platelets	2 (0.4%)	0 (0.00%)	2 (0.4%)	0.800
High INR	2 (0.4%)	0 (0.00%)	2 (0.4%)	0.800
High Cr	7 (1.4%)	0 (0.00%)	7 (1.5%)	0.640
High AST	-	-	-	-
High ALT	67 (13.7%)	2 (14.3%)	65 (13.7%)	0.950
Normal/Low AST	-	-	-	-

that of male genders and comorbidities that included immunocompromised status, respiratory diseases and hypertension. This trend appears to be in synergy with earlier published global studies [7, 8] whereby male gender patients with presence of comorbidities were found to possess an important predictor of disease severity and mortality.

Severe illnesses were found to be in association with other conditions and comorbidities such as Cardiovascular Disease, Diabetes Mellitus (DM), Chronic Obstructive Pulmonary Disease (and other lung diseases), Cancer (in particular hematologic malignancies, lung cancer and metastatic disease), Chronic Kidney Disease, Solid Organ/ Hematopoietic Stem Cell Transplantation, Obesity and Smoking [9-13].

Meanwhile, clinical and laboratory indicators of progression to severe COVID-19 disease that requires ICU administration within our study cohort included fever, cough and shortness of breath with presence of leukocytosis and elevated inflammatory markers such as D-Dimer, LDH, Ferritin as well as ESR.

That, and our overall study results was all in alignment with other previously published studies from across the world which have established that the important death predictors with respect to clinical presentation were namely dyspnea and high fever ($\geq 39^{\circ}\text{C}$). It's also worth highlighting that other reported laboratory abnormalities that have been associated with poor outcomes were neutrophilia, high lactate dehydrogenase, D-Dimer, admission oxygen saturation of $<88\%$, C reactive protein level >200 and D-Dimer level >2500 .

The main strength of this study lies with the inclusion of all patients admitted to the governmental assigned treating facilities during the study period to cover the widest possible spectrum of COVID-19 hospitalized patients across the Kingdom with their respectively associated detailed clinical information.

None the less, the undertaken study does possess multiple challenges. Starting with, there were a few numbers of patients that mandated critical care administration. Furthermore, neither information regarding the duration of the chronic diseases was available nor out-of-hospital deaths nor records of re-admitted patients during the recovery period. Hence, we are not in a position to rule out this missing information and its likelihood to impact the end study result(s).

Conclusion

In conclusion, we can state that our study has found out that both the male gender as well as the comorbidities such as immunocompromised status of admitted patients, respiratory diseases and/or hypertension reflected an independent risk factor for the severity of COVID-19 disease amidst adults.

That, while clinical and laboratory indicators for the disease progression to a severe one included fever, cough and shortness of breath with presence of leukocytosis and elevated inflammatory markers such as D-Dimer, LDH, Ferritin and ESR.

Therefore, the presence of any of those stated parameters above should act in the capacity of an immediate alert the treating physician.

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