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COVID-19 pneumonia; predictors of severity and outcome in Erbil city hospitals

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Halgurd Fathulla Ahmed [1*] Zahir Salih Hussein [2]

Abstract

Background and objective: Corona infections disease nowadays is one of the major burden on national health institutes. The aim of the study is to identify the parameters that can predict the mortality in moderate to severely ill COVID-19 infected patients.

Methods: A prospective cross sectional study was carried out in Erbil Hospitals, Kurdistan region/Iraq from December 2020 to December 2021 on a sample of 100patients with positive real-time polymerase chain reaction. The data of enrolled patients were collected by direct interview with patients or with their relatives and filled in a prepared questionnaire. The patients were followed up from their admission to hospital until their discharge alive or dead.

Results: The mortality rate of hospitalized patients was 44% for 100 patients. Budesonide nebulizer were given to all of the patients. The mortality rate was significantly higher in old COVID-19 patients. The COVID-19 patients presented with dyspnea, hypertension and renal failure were significantly associated with higher mortality rates. High respiratory rate, low oxygen saturation and high C-reactive protein level were accompanied with higher mortality rates of COVID-19 patients.

Conclusion: The early predictors of mortality in patients with moderate to severe COVID-19 infection were elderly age, clinical presentation of dyspnea, clinical co-morbidity with hypertension and renal failure, high respiratory rate, low oxygen saturation and elevated levels of C-reactive protein.

Keywords: Corona virus infection; Severity; Mortality; Dyspnea; Hypoxia

Introduction

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was firstly recorded in Wuhan/China in December, 2019 with unknown etiology and then declared as a pandemic coronavirus disease 2019 (COVID-19) disease by World Health Organization (WHO) affecting hundreds of millions and more than four million deaths globally.[1,2]

Budesonide nebulizer was used for asthmatic cases, and acute pulmonary inflammation, as steroid might reduce bronchial secretion and inflammatory cell infilteration.[3] The COVID-19 disease severity classification is important in prediction of the disease progression in regard to considerable variables. Some authors documented that clinical features at presentation like cough[4] and fever[5] were related to severe critical illness. The comorbidity factors such as cancer,[6] diabetes,[7] psychiatric disorders,[8] nephritis[9] and obesity[10] were found to be accompanied with severe COVID-19 disease and poor prognosis. Additionally, many literatures found that laboratory findings,[11] imaging characteristics,[12] exposure risks,[13] management variables,[14] environmental hazards,[15] social variables[16] and regional variables were related to severity of COVID-19 disease.

[1] Kurdistan Higher Council for Medical Specialties, Erbil, Iraq.
[2] Department of Medicine, College of Medicine, Hawler Medical University, Erbil, Iraq.
Correspondence: halgurd.ahmed@khcms.edu.krd

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The moderate COVID-19 disease is related to lower respiratory disorder detected by clinical examination or by laboratory and imaging findings with low blood oxygen saturation (SpO2 <94%). Severe COVID-19 disease is defined with signs of SpO2 <94%, 30 breaths/min, or lung infiltration>50%. Critically COVID-19 illness is accompanied by acute respiratory distress syndrome.[17] The global case fatality rate for COVID-19 disease as documented recently by WHO was 1.46%.[18] The overall pooled mortality rate from acute respiratory distress syndrome in COVID-19 patients is 39%.[19] Use of arterial blood gas analyses required for severely ill patients during hospital admission.[20] The aim of the study was to identify the parameters that can predict the mortality in moderate to severely ill COVID-19 patients .

Methods

The present study was a prospective cross sectional study carried out in Erbil hospitals including; Rizgary Teaching Hospital and West Emergency Hospital in Erbil city/ Kurdistan region/Iraq throughout the period of December, 2020 to December, 2021. Patients with positive real-time polymerase chain reaction (RT-PCR) test for COVID-19 admitted to Rizgary Teaching Hospital and West Emergency Hospital were the study population. The inclusion criteria were adult (age ≥18 years) patients with COVID-19 disease (positive RT-PCR) and moderate or severe Covid-19 disease according to Iraq Ministry of Health and World Health Organization guidelines plus arterial blood gas analyses.[2,9]

Exclusion criteria was patients who refuse to participate. The ethical considerations were implemented according to Helsinki Declaration regarding ethical approval of Health authorities; and ethical approval was taken from Kurdistan Higher Council of Medical Specialties Ethical Committee. Verbal informed consent of patients were also obtained. A convenience sample of one hundred patients with COVID-19 disease was selected after eligibility to inclusion and exclusion criteria.

The data of enrolled patients were collected by direct interview with patients or with their relatives filled in a prepared questionnaire. The questionnaire was designed by the researchers. The questionnaire included the following information: demographic characteristics of COVID-19 patients (age and gender), complaints at admission (shortness of breath, cough and fatigue), smoking history, clinical features of COVID-19 patients (cough, dyspnea, fatigue, myalgia loss of smell and loss of taste), co-morbidity with chronic diseases (hypertension, diabetes mellitus, coronary heart diseases, heart failure, asthma and renal failure) and outcome (alive or dead). The diagnosis of COVID-19 disease was achieved according to National Guidelines by RT-PCR, imaging and laboratory tests. The RT-PCR was performed through oropharyngeal and nasopharyngeal swapping. The patients were followed up from their admission to hospital until their discharge alive or dead. Local governmental guideline treatment include admission of intravenous antibiotics, Remdesivir vial intravenous infusion for five days, dexamethasone ampule six milligram daily, supportive treatment, treatment of underlying diseases, in spite of that all cases received budesonide ampule 0.5 mg nebulizer three times daily. The data collected were analyzed statistically using Statistical Package of Social Sciences software version 25. The chi-square and Fishers exact tests were applied for analyzing categorical variables. Level of significance (*P* value) was regarded statistically significant if it was 0.05 or less.

Results

This study involved one hundred COVID-19 cases. As shown in Table 1, most of the patients (60%) were male, majority had severe disease (71%), shortness of breath on admission (94%), non-smoker (71%),

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with no loss of taste (61%), no loss of smell (72%). Majority of them had cough during the course of the disease (76%), (dyspnea -subjective) (79%), myalgia (62%) but only minority of them felt being fatigue (22%). All patients received budesonide nebulizer, to reduce symptoms of cough or shortness of breath (SOB).

Table 1 Gender and presenting sign and symptoms of the participants.

Variables	Categories	Frequency and percent
Gender	Male	60
	Female	40
Severity	Moderate	29
	Severe	71
Complaint at admission	SOB	86
	Cough	4
	SOB and cough	8
	Fatigability	2
Smoking	Current smoker	6
	Ex-smoker	23
	Non-smoker	71
Loss of taste	Yes	39
	No	61
Loss of smell	Yes	28
	No	72
Cough	Yes	76
	No	24
Dyspnea	Yes	79
	No	21
Myalgia	Yes	62
	No	38
Fatigue	Yes	22
	No	78
Total		100

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Table 2 shows that 40% of them had hypertension, 31% were diagnosed with diabetes mellitus, 13% had coronary artery disease, only four patients had heart failure, 13% with history of asthma and six cases with renal failure. Among the total cases, 44% of them died.

The results show that there was non-significant statistical association between outcome and signs, symptoms and chronic diseases except for dyspnea, hypertension and renal failure. Pearson Chi square test was performed and *P* values were more than 0.05. There was a significant statistical relationship between outcome and dyspnea, hypertension and renal failure. Most of the patients with dyspnea (54.1%), hypertension (57.1%) and the six renal failure cases had died due to COVID-19 complications. Pearson Chi square test was done and *P* values were less than 0.05 (see Table 3).

Table 2 Outcome and chronic diseases of the study sample.

Variables	Categories	Frequency and percent
Hypertension	Yes	40
	No	60
Diabetes mellitus	Yes	31
	No	69
Coronary artery disease	Yes	13
	No	87
Heart failure	Yes	4
	No	96
Asthma	Yes	13
	No	87
Renal failure	Yes	6
	No	94
Outcome	Alive	56
	Dead	44
Total		100

Table 3 Association between outcome and signs, symptoms and chronic diseases.

Variable	Outcome		
	Alive	**Dead**	***P*-value**
Loss of smell	15 (53.8%)	13 (46.2%)	0.797
Loss of taste	18 (44.4%)	21 (55.6%)	0.275
Cough	40 (54.8%)	36 (45.2%)	0.765
Dyspnea	35 (45.9%)	44 (54.1%)	***P* <0.001**
Myalgia	34 (55.9%)	28 (44.1%)	0.972
Fatigue	12 (55.6%)	10 (44.4%)	0.967
Hypertension	17 (42.9%)	23 (57.1%)	**0.024**
Diabetes mellitus	14 (46.7%)	17 (53.3%)	0.218
Coronary artery disease	5 (37.5%)	8 (62.5%)	0.104
Heart failure	2 (33.3%)	2 (66.7%)	0.249
Asthma	5 (40%)	8 (60%)	0.328
Renal failure	0 (0%)	6 (100%)	**0.035**

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Table 4 illustrates that there was a statistically significant difference in age, respiratory rate, pulse oximetry and C-reactive protein measures between alive and dead cases. On average, those who survived were younger (mean age 58.11 years) than who passed away (mean age 68.32 years), with lower respiratory rate (mean rate 21 breaths per minute), and C-reactive protein measure (mean=20.30) than dead cases who had higher respiratory rate (mean rate of 26.36 breaths per minute), and C-reactive protein measure (mean=60.11). in addition, the mean pulse oximetry for the survivors was higher (91.61%) in comparison to the mean pulse oximetry for dead COVID-19 cases (86.14%). T-test was performed to compare between the averages of the two groups and p-values were less than 0.05. The difference between dead and alive cases regarding other numeric measures was not statistically significant, t- test was performed and p-values were more than 0.05.

Discussion

Early prediction of mortality of COVID-19 disease in emergency department is very important in triage of patients, monitoring of patients, planning of treatment and preventing complications.

Table 4 Difference in parameters between dead and alive cases in numeric measures.

Variables	Outcome	N	Mean	S.D	*P*-value
Age (years)	alive	56	58.11	12.29	**0.004**
	dead	44	68.32	15.23	
SBP	alive	56	126.07	12.35	0.427
	dead	44	129.93	17.38	
DBP	alive	56	72.21	6.77	0.305
	dead	44	83.00	9.26	
pulse rate in bpm	alive	56	91.25	14.98	0.934
	dead	44	98.95	20.54	
respiratory rate	alive	56	21.00	5.30	**0.006**
	dead	44	26.36	6.67	
pulse oximetry %	alive	56	91.61	6.11	**0.029**
	dead	44	86.14	5.16	
WBC count	alive	56	11.21	6.42	0.568
	dead	44	16.52	4.18	
Neutrophil count	alive	56	9.66	4.67	0.334
	dead	44	8.31	3.18	
C-reactive protein	alive	56	20.30	46.86	**0.001**
	dead	44	60.11	52.15	
patient weight in kg	alive	56	85.46	17.412	0.119
	dead	44	82.02	14.23	

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Different predictive models were used in emergency departments which all dependable on clinical symptoms, clinical co-morbidity and SPO_2 of patients. The present study showed predominance of male gender patients with hospitalized COVID-19 disease. This finding is similar to results of Naguyen et al [21] study in USA which reported predominant male gender for COVID-19 patients admitted to hospital and revealed that male gender was a predictable of mortality in COVID-19 disease. Our study reported that severity of COVID-19 diseases in hospitalized patients was distributed into; moderate (24%) and severe (76%).

These findings are different from results of Mohammed et al [22] study in Iraq who reported that 74.8% of COVID-19 patients had mild severity. This difference might be due to discrepancy in study aims and inclusion criteria between two studies. The shortness of breath was the common presenting complaint at admission in our study, while other common clinical features were dyspnea, myalgia, cough and loss of taste. This finding is consistent with results of Perotte et al[23] retrospective study in USA which revealed that fever and shortness of breath were the initial presenting complaints at admission of COVID-19 patients to emergency department. Our study found that patients with moderate to severe COVID-19 disease had clinical co-morbidity with hypertension (42%), diabetes mellitus (30%), asthma (10%), heart failure (6%) and renal failure (4%). These findings are close to results of Htun et al [24] study in Myanmar which reported that patients with moderate to severe COVID-19 disease were associated with clinical co-morbidities like hypertension, diabetes mellitus and cardiac diseases. Current study revealed mortality rate of (44%) for hospitalized patients with moderate to severe COVID-19 disease. This mortality rate is higher than rate of 14.4% for mortality of hospitalized patients with moderate to severe COVID-19 disease reported by Mammen et al [25] study in India. This difference might be due to differences in risk factors and clinical co-morbidities prevalence between study populations in addition to differences in study methodology. Current study found a significant association between COVID-19 patients presented clinically with dyspnea and mortality (P = 0.001). This finding coincides with results of Aksel et al [26] prospective observational study in Turkey, in which it was found that dyspnea, the clinical co-morbidity, high CRP levels and SPO_2 are early predictors of mortality in moderate to severely ill Covid-19 patients. Our study showed a significant association between COVID-19 patients with hypertension and mortality (P = 0.02). Similarly, in a comparative study in China conducted by Chen et al [27], it was found that clinical co-morbidity with hypertension was an independent risk factor for severity and mortality of COVID-19 disease.

Our study also showed a significant association between COVID-19 patients with renal failure and mortality (P = 0.03). This finding is agreed with results of Pua et al[28] retrospective cohort study in Kazakhstan which was conducted on 293 hospitalized patients with COVID-19 disease that showed a statistically significant association between COVID-19 patients with renal failure and mortality. In present study, older age patients with moderate to severe COVID-19 disease were significantly related to mortality. Consistently, Sepandi et al [29] systematic review and meta-analysis study in Iran revealed that elderly, male gender and clinical co-morbidity were early predictors of mortality in COVID-19 disease.

Our study revealed that a higher mean respiratory rate patient with moderate to severe COVID-19 disease was significantly related to mortality (P = 0.006). This finding is in agreement with results of Nlandu et al [30]retrospective study in Democratic Republic of the Congo which reported the respiratory rate of hospitalized COVID-19 patients as early predictor of mortality. Our study found that low SPO_2 of patients

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with moderate to severe COVID-19 disease was significantly related to mortality (P = 0.02). This finding is similar to results of many literatures such as Mukhtar et al [31] study in Egypt and Xie et al [32] study in China which all documented that low SPO_2 was an independent predictor of mortality in hospitalized patients with COVID-19 disease. Daval et al[33] showed that budesonide nebulizer improves hypoxia. Ramakrishnan et al[35] found that budesonide nebulizer reduce pulmonary inflammation which in agreement with this study. Our study showed that high C-reactive protein level in patients with moderate to severe COVID-19 disease was significantly related to mortality (P = 0.001). This finding is parallel with results of Timpau et al[34] retrospective study in Romania that revealed that C-reactive protein and D-dimer levels had better performance in prediction of mortality in patients with moderate to severe COVID-19 disease.

Conclusion

The early predictors of mortality in patients with moderate to severe COVID-19 disease were elderly age, clinical presentation of dyspnea, clinical co-morbidity with hypertension and renal failure, high respiratory rate, low SPO2 and elevated levels of C-reactive protein. This study recommended physicians in emergency department to implement the prediction model in assessment of patients with moderate to severe COVID-19 disease which help in triage and better in planning of management for COVID-19 disease.

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Competing interests

The authors declare that they have no competing interests.

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