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ORIGINAL ARTICLES

Evaluation of epidemiological characteristics, treatments, and prognosis of patients with COVID-19 hospitalized in the Intensive Care Unit

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Abstract: *Introduction: Intensive care facilities may play an important role in reducing corona mortality. This study aimed to assess the epidemiological features, treatments, and prognosis of corona patients that admitted to the Intensive Care Unit (ICU) of Baqiyatallah Hospital.*

Methods: All patients with a corona that admitted to the ICU of Baqiyatallah Hospital from March 5 to May 20, 2020, were included. The epidemiological characteristics, pharmacological, non-pharmacological, and supportive therapies and prognosis were assessed. Underlying diseases, smoking, and severity of lung involvement based on CT scan findings (mild, moderate, severe) and length of hospital stay in the ICU were recorded in a questionnaire. Non-invasive ventilation (NIV) or tracheal intubation, ventilator ventilation, and duration of endotracheal intubation, if needed, were recorded in the questionnaire. Meanwhile, whether tracheostomy was performed, the time of the procedure, and its duration were also recorded.

Results: Overall, 82 patients were included in the study that 68 (82.9%) of them were males. The mean age was 57.96±14.08 years. The mortality rate was 53 cases (64.6%). There were 57 subjects (73.1%) at a severe lung involvement and 21 subjects (26.9%) at a moderate lung involvement. There was a significant relationship between severity of lung involvement and mortality (Odds ratio= 14.3, P<0.001).

There was a significant relationship between mortality and Armadile use (Odds ratio= 2.9, P=0.04). There was a significant relationship between mortality and tracheal intubation (Odds ratio= 27.2, P<0.001). There was no significant difference between mortality and discharge of patients regarding the intubation period (P=0.26). There was not a significant relationship between tracheostomy, NIV, and mortality status in the patients (P=0.14 and 0.33 respectively). Also, there was no significant difference between mortality and discharge of patients regarding tracheostomy and NIV period (P=0.51 and 0.17). There was no significant difference in age between severe and moderate lung involvement cases (P=0.63). There was a significant difference in the duration of ICU hospitalization between severe and moderate lung involvement cases (P=0.004).

Conclusion: The results showed none of the factors of age, sex, underlying diseases other than hypertension, pharmacological methods other than Armadile, and non-pharmacological methods such as hemoperfusion, plasmapheresis, IVIG, hyperimmune plasma injection, and stem cell as well as Ozone therapy does not affect corona patient's mortality. Only the severity of lung involvement leading to endotracheal intubation and mechanical ventilation is related to patients' mortality

Keywords: *Covid-19, Mortality, ICU*

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INTRODUCTION

In December 2019, the world faced a great challenge. A respiratory disease caused by the coronavirus that causes severe acute respiratory syndrome (SARS) in patients and endangers the health of people around the world [1].

Treatment of these patients is supportive and usually respiratory failure is the main cause of death [2]. The clinical features and CT scan images help in the early diagnosis and treatment of this disease [3].

This disease's mortality has been stated 3.6% in China and 1.2 to 1.7% outside of China. the difference between these statics is because of not considering patients with mild illness and taking diagnostic tests. The actual number of deaths is unknown [4].

Intensive care facilities may play an important role in reducing the risk of COVID-19 death [5].

In this retrospective study, we surveyed the epidemiological features, treatments, and prognosis of patients with coronavirus admitted to the ICU of Baqiyatallah Hospital, that we may identify preventable factors associated with the patient recovery and reduce mortality of these patients.

METHODS

In a retrospective study from March 5 to May 20, 2020, all patients with COVID-19admitted to ICU of Baqiyatallah Hospital were evaluated for their epidemiological characteristics, pharmacological, non-pharmacological, and supportive therapies, and prognosis. "Baqiyatallah Hospital is one of the important referral medical centers for corona patients in Iran."

The diagnostic criteria for Corona Patients are clinical symptoms, positive PCR test, and CT scan findings in this center. Hospitalized patients with respiratory distress or SPO2 with oxygen and storage bag below 90% in general wards and emergency departments were transferred to ICU.

Epidemiological characteristics of patients including age, sex, underlying diseases, smoking and Drug abuse, the severity of lung involvement based on CT scan findings (mild, moderate, severe), and length of hospital stay in the ICU were recorded in a questionnaire.

All drugs used in the treatment of patients, as well as non-pharmacological methods including antibody therapy, plasmapheresis, hemofiltration with Jeffron filter, hyperimmune plasma, IVIG, CRRT with cytosorb filter, stem cell, and other methods, were recorded in the questionnaire.

NIV or tracheal intubation, ventilator ventilation, and duration of endotracheal intubation, if needed, were recorded in the questionnaire. Meanwhile, whether tracheostomy was performed, the time of the procedure, and its duration were also recorded.

The data were analyzed by SPSS-22 software. Quantitative data were analyzed using descriptive software and displayed as Mean ± SD. Chi-Square tests were used to compare percentages or frequencies. A P-value less than 0.05 was considered statistically significant.

RESULTS

Overall, 82 patients were included in the study that 68 (82.9%) of them were males. The mean age was 57.96±14.08 years. The mortality rate was 53 cases (64.6%). Table 1 showed the distribution of age, sex, duration of hospitalization in the ICU, and history of diabetes mellitus (DM), hypertension (HTN), kidney disease, liver disease, rheumatic disease, smoking, opium addiction, corticosteroid use, and ARBS regarding mortality of the patients.

The mean age was 59.59±13.85 years in mortality cases and 55.03±14.24 years in discharge patients. There was no significant difference in age between mortality and discharge of patients (P=0.16). Also, there was not a significant relationship between gender and mortality (P=0.76(.

There was not a significant relationship between mortality and DM, kidney disease, lung disease, liver disease, and rheumatic disease in the patients (Table 1). However, there was a significant relationship between mortality and HTN (Odds ratio= 2.99, P=0.04) (Table 1).

There was not a significant relationship between mortality and smoking, opium addiction, corticosteroids, and ARBS in the patients (Table 1).

Table 2 showed the distribution of pharmacological treatment regarding the mortality status of the patients. There was a significant relationship between mortality and Armadile use (Odds ratio= 2.9, P=0.04) (Table 2).

Table 3 showed the distribution of tracheal intubation, intubation period, tracheostomy, tracheostomy period, NIV, NIV period regarding the mortality status of the patients.

There was a significant relationship between mortality and tracheal intubation (Odds ratio= 27.2, P<0.001) (Table 3). The mean intubation period was 3.50±2.83 days in mortality cases and 2.81±2.22 days in discharge patients. There was no significant difference between mortality and discharge of patients regarding the intubation period (P=0.26).

Table 1: Distribution of age, sex, duration of hospitalization in the ICU, DM, HTN, kidney disease, liver disease, rheumatic disease, smoking, drug use, corticosteroids, and ARBS regarding mortality status of the patients

Mortality status		Death	Discharge	Total	P-value
Number (%)		53 (64.6%)	29 (35.4%)	82	---
Sex	male	43 (81.1%)	25 (86.2%)	68 (92.9%)	0.76
	female	10 (19.9%)	4 (13.8%)	14 (17.1%)	
Age, years, mean (±SD)		59.59±13.85	55.03±14.24	57.96±14.08	0.16
Duration of ICU hospitalization, days, mean (±SD)		13.28±8.72	14.17±1.30	13.59±10.06	0.83
DM	Yes	22 (41.5%)	9 (31.0%)	31 (37.8%)	0.35
	No	31 (58.5%)	20 (69.0%)	51 (62.2%)	
HTN	Yes	23 (43.4%)	6 (20.7%)	29 (35.4%)	0.04*
	No	30 (56.6%)	23 (79.3%)	53 (64.6%)	
kidney disease	Yes	5 (9.4%)	3 (10.3%)	8 (9.8%)	0.58
	No	48 (90.6%)	26 (89.7%)	74 (90.2%)	
Lung disease	Yes	4 (7.5%)	1 (3.4%)	5 (6.1%)	0.65
	No	49 (92.5%)	28 (96.6%)	77 (93.9%)	
Liver disease	Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)	---
	No	53 (100%)	29 (100%)	82 (100%)	
Rheumatic disease	Yes	0 (0.0%)	1 (3.4%)	1 (1.2%)	0.35
	No	53 (100%)	28 (96.6%)	81 (98.8%)	
Smoking	Yes	3 (5.7%)	0 (0.0%)	3 (3.7%)	0.54
	No	50 (94.3%	29 (100%)	79 (96.3%)	
Opium addiction	Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)	---
	No	53 (100%)	29 (100%)	82 (100%)	
Corticosteroids	Yes	3 (5.7%)	2 (6.9%)	5 (6.1%)	0.58
	No	50 (94.3%	27 (93.1%)	77 (93.9%)	
ARBS	Yes	13 (24.5%)	4 (13.8%)	17 (20.7%)	0.35
	No	40 (75.5%)	25 (86.2%)	65 (79.3%)	

** P-value is significant at the 0.05 level, SD=Standard deviation*

Table 2: Distribution of pharmacological treatment regarding the mortality status of the patients

Mortality status		Death	Discharge	Total	P-value
Tamiflu	Yes	28 (52.8%)	16 (55.2%)	44 (53.7%)	0.51
	No	25 (47.2%)	13 (44.8%)	38 (46.3%)	
Interferon beta	Yes	12 (22.6%)	8 (27.6%)	20 (24.4%)	0.61
	No	41 (77.4%)	21 (72.4%)	62 (75.6%)	
Hydroxychloroquine	Yes	48 (90.6%)	27 (93.1%)	75 (91.5%)	0.52
	No	5 (9.4%)	2 (6.9%)	7 (8.5%)	
Remdesivir	Yes	6 (11.3%)	3 (10.3%)	9 (11%)	0.60
	No	47 (88.7%)	26 (89.7%)	73 (89%)	
Ribavirin	Yes	35 (66%)	18 (62.1%)	53 (64.6%)	0.71
	No	18 (34%)	11 (37.9%)	29 (35.4%)	
Favipiravir	Yes	20 (37.7%)	11 (37.9%)	31 (37.8%)	0.98
	No	33 (62.3%)	18 (62.1%)	51 (62.2%)	
Kaletra	Yes	51 (96.2%)	28 (96.4%)	79 (96.3%)	0.71
	No	2 (3.8%)	1 (3.4%)	3 (3.7%)	
Anticoagulant	Yes	47 (88.7%)	24 (82.8%)	71 (86.6%)	0.45
	No	6 (11.3%)	5 (17.2%)	11 (13.4%)	
Azithromycin	Yes	49 (92.5%)	28 (96.6%)	77 (93.9%)	0.41
	No	4 (7.5%)	1 (3.4%)	5 (6.1%)	

Mortality status		Death	Discharge	Total	P-value
Plasmapheresis	Yes	6 (11.3%)	4 (13.8%)	10 (12.2%)	0.73
	No	47 (88.7%)	25 (86.2%)	72 (87.8%)	
Corticosteroids therapy	Yes	47 (88.7%)	27 (93.1%)	74 (90.2%)	0.70
	No	6 (11.3%)	2 (6.9%)	8 (9.8%)	
Hemoperfusion	Yes	29 (54.7%)	25 (51.7%)	44 (53.7%)	0.79
	No	24 (45.3%)	14 (48.3%)	38 (46.3%)	
Naproxen	Yes	45 (84.9%)	25 (86.2%)	70 (85.4%)	0.57
	No	8 (15.1%)	4 (13.8%)	12 (14.6%)	
CRRT	Yes	0 (0.0%)	1 (3.4%)	1 (1.2%)	0.35
	No	53 (100%)	28 (96.6%)	81 (98.8%)	
Cinnora	Yes	3 (5.7%)	2 (6.9%)	5 (6.1%)	0.58
	No	50 (94.3%)	27 (93.1%)	77 (93.9%)	
IVIG	Yes	26 (49.1%)	9 (31.0%)	5 (42.7%)	0.11
	No	27 (50.9%)	20 (69.0%)	47 (57.3%)	
Armadile	Yes	20 (37.7%)	5 (17.2%)	25 (30.5%)	0.04*
	No	33 (62.3%)	24 (82.8%)	75 (69.5%)	
Actemra	Yes	14 (26.4%)	5 (17.2%)	19 (23.2%)	0.34
	No	39 (73.6%)	24 (82.8%)	63 (76.8%)	
AB therapy	Yes	45 (84.9%)	24 (82.8%)	69 (84.1%)	0.79
	No	8 (15.1%)	5 (17.2%)	13 (15.9%)	
Plasma hyper immune	Yes	20 (37.7%)	12 (41.4%)	32 (39.0%)	0.74
	No	33 (62.3%)	17 (58.6%)	50 (61.0%)	
Stem cell	Yes	6 (11.3%)	2 (6.9%)	8 (9.8%)	0.70
	No	47 (88.7%)	27 (93.1%)	74 (90.2%)	
Ozone therapy	Yes	2 (3.8%)	0 (0.0%)	2 (2.4%)	0.53
	No	51 (96.2%)	29 (100%)	80 (97.6%)	

** P-value is significant at the 0.05 level.*

Table 3: Distribution of tracheal intubation, intubation period, tracheostomy, tracheostomy period, NIV, NIV period regarding mortality status of the patients

Mortality status		Death	Discharge	Total	P-value
Tracheal intubation	Yes	50 (94.3%)	11 (37.9%)	61 (74.4%)	<0.001*
	No	3 (5.7%)	18 (62.1%)	21 (25.6%)	
Intubation period, days, mean (±SD)		3.50±2.83	2.81±2.22	3.37±2.72	0.26
Tracheostomy	Yes	29 (54.7%)	11 (37.9%)	40 (48.8%)	0.14
	No	24 (45.3%)	18 (62.1)	42 (51.2)	
Tracheostomy period, days, mean (±SD)		11.29±7.26	12.81±5.82	11.69±7.19	0.51
NIV	Yes	13 (24.5%)	10 (34.5%)	23 (28.0%)	0.33
	No	40 (75.5%)	19 (65.5%)	59 (72.0%)	
NIV period, days, mean (±SD)		3.63±2.20	2.54±1.43	3.09±1.90	0.17

** P-value is significant at the 0.05 level.*

There was not a significant relationship between tracheostomy, NIV, and mortality status in the patients (P=0.14 and 0.33 respectively). Also, there was no significant difference between mortality and discharge of patients regarding tracheostomy and NIV period (P=0.51 and 0.17) (Table 3).

Table 4 showed the distribution of mortality, age, tracheostomy, duration of ICU hospitalization, tracheal intubation, intubation period, tracheostomy, tracheostomy period, NIV, NIV period regarding the severity of the disease of the patients.

There were 57 subjects (73.1%) at a severe lung involvement and 21 subjects (26.9%) at a moderate lung involvement (Table 4). There was a significant relationship between

severity of lung involvement and mortality (Odds ratio= 14.3, P<0.001).

The mean age was 58.05±13.43 years in severe lung involvement cases and 55.19±15.15 years in moderate lung involvement cases. There was no significant difference in age between severe and moderate lung involvement cases (P=0.63).

The mean duration of ICU hospitalization was 15.59±10.61 days in severe lung involvement cases and 8.85±5.78 days in moderate lung involvement cases. There was a significant difference in the duration of ICU hospitalization between severe and moderate lung involvement cases (P=0.004).

49 cases (86.0%) in severe lung involvement had tracheal intubation There was a significant relationship between the severity of diseases and tracheal intubation (P<0.001). The mean intubation period was 3.30±2.32 days in severe cases and 4.12±4.96 days in moderate cases. There was not a significant difference in the intubation period between severe and moderate lung involvement cases (P=0.86).

Also, 34 cases (59.6%) in severe lung involvement had a tracheostomy. There was a significant relationship between the severity of diseases and tracheostomy (P<0.001). There was not a significant difference in the tracheostomy period between severe and moderate lung involvement cases (P=0.74).

There was not a significant relationship between NIV and the severity of disease in the patients (P=0.15). The mean NIV period was 3.44±1.91 days in severe lung involvement cases and 1.50±0.57 days in moderate lung involvement cases. There was a significant difference in the NIV period between severe and moderate lung involvement cases (P=0.026) (Table 4).

Table 4: Distribution of morality, age, duration of ICU hospitalization, tracheal intubation, intubation period, tracheostomy, tracheostomy period, NIV, NIV period regarding the severity of lung involvement of the patients

The severity of lung involvement		Moderate	Severe	Total	P-value
Number (%)		21 (26.9%)	57 (73.1%)	82	---
Mortality	Yes	6 (28.6%)	43 (75.4%)	49 (62.8%)	<0.001*
	No	15 (71.4%)	14 (24.6%)	29 (37.2%)	
Age, Years, mean (±SD)		55.19±15.15	58.05±13.43	57.27±13.87	0.63
Duration of ICU hospitalization, days, mean (±SD)		8.85±5.78	15.59±10.61	13.78±9.98	0.004*
Tracheal intubation	Yes	8 (38.1%)	49 (86.0%)	57 (73.1%)	<0.001*
	No	13 (61.9%)	8 (14.0%)	21 (26.9%)	
Intubation period, days, mean (±SD)		4.12±4.96	3.30±2.32	3.42±2.79	0.86
Tracheostomy	Yes	4 (19.0%)	34 (59.6%)	38 (48.7%)	0.001*
	No	17 (81.0%)	23 (40.4%)	40 (51.3%)	
Tracheostomy period, days, mean (±SD)		10.50±4.79	11.75±7.08	11.62±6.84	0.74
NIV	Yes	3 (14.3%)	19 (33.3%)	22 (28.2%)	0.15
	No	18 (85.7%)	38 (66.7%)	58 (71.8%)	
NIV period, days, mean (±SD)		1.50±0.57	3.44±1.91	3.09±1.90	0.026*

** P-value is significant at the 0.05 level*

DISCUSSION

Overall, 82 patients were included in this study that 68 (82.9%) of them were males. The mean age was 57.96±14.08 years. The mortality rate was 53 cases (64.6%).

There was a significant relationship between mortality and history of HTN, Ardamadil use for treatment, the severity of lung involvement, and tracheal intubation. There was no significant relationship between NIV and the severity of lung involvement in the patients. There was a significant difference in the NIV period between severe and moderate lung involvement cases.

The mean duration of ICU hospitalization was 15.59±10.61 days in severe cases and 8.85±5.78 days in moderate cases. There was a significant difference in the duration of ICU hospitalization between severe and moderate cases

Daniel E L Promislow and colleagues concluded that aging is associated with increased complications of corona and that men of all ages have more serious complications than women [6].

Qiurong Ruan and colleagues in a study of hospitalized

corona patients concluded that age had a significant effect on mortality and gender had no significant effect. Underlying diseases, secondary infections, and high levels of inflammatory factors in the blood are predictors of high mortality [7].

However, in this study, patient's age and sex did not have a significant relationship with mortality. Maybe the reason that gender didn't have a significant relationship with mortality in this study was that this study included patients admitted to the ICU and patients with critical situations were being transferred to this sector., and this statistic is different from the general mortality statistics in the society.

As in previous studies, Mandeep R. et al. Concluded heart diseases were associated with increased mortality in hospitalized corona patients. In their study, the use of ACEIs and ARBs was not associated with an increase in mortality [8].

In a meta-analysis of 1576 patients with COVID 19, JingYang and colleagues concluded that underlying diseases such as hypertension, heart disease, and respiratory disease were more common in critically ill patients than in less critically ill patients [9].

Marcello Covino et al. concluded that the use of ACEIs or ARBs in corona hypertensive patients was not associated with increased mortality [10].

In this study, in line with Mandeep R. and JingYang studies, blood pressure had a significant relationship with mortality. Also, in line with the study of Mandeep R. and Marcello Covino, the use of ACEIs and ARBs had no significant relationship with mortality.

Thomas C. Hanff and colleagues stated that corona hypertensive patients treated with ACEIs should not change their treatment regimen [11].

While Lei Fang and colleagues found that diabetes, heart disease, and hypertension were factors associated with corona disease severity, they suggested replacing calcium channel blockers with ACEIs or ARBs [12].

Li-Lin Liang and colleagues found that higher mortality rates could be due to fewer testers. Also, an older population, weak government, and a small number of beds can increase mortality [13].

A study by YUNPENG JI et al. In China concluded that the reason for the high mortality rate in HUBEI (2.9%) compared to other Chinese provinces (0.7%) was probably due to the rapid increase in the number of infections around the outbreak center. Which has led to insufficient health resources [14].

CONCLUSION

According to the results of this study, none of the factors of age, sex, underlying diseases other than hypertension, pharmacological methods other than Armadile, and non-pharmacological methods such as hemoperfusion, plasmapheresis, IVIG, hyperimmune plasma injection, and stem cell as well as Ozone therapy does not affect corona patient's mortality. Only the severity of lung involvement leading to endotracheal intubation and mechanical ventilation is related to patients' mortality, so according to studies by Li-Lin Liang and YUNPENG JI, it can be concluded that The most important factor in reducing patient mortality is the management of the disease epidemic, which makes adequate treatment resources available to patients and no patient dies due to lack of facilities in severe epidemics. And in epidemics, special attention should be paid to hypertensive patients.

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