

The Epidemiological Characteristics and Outcome of COVID-19 in Patients Undergoing Peritoneal Dialysis: A Multi-center Study in Iran

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The pandemic of COVID-19 emerged in December 2019. Although numerous features of the illness have been investigated, the impact of disease on those patients with underlying diseases, is still a major problem. The aim of this multicenter, cohort study, was to determine the clinical manifestations of COVID-19 in peritoneal dialysis (PD) patients. Five hundred and five patients, receiving PD, were enrolled in this study, out of which 3.7% had coronavirus infection. Fever was the most common symptom (63.2%). The hospitalization rate was 10.5, 21.1% required admission to intensive care units (ICU) and the mortality rate was 21%. The most common cause of infection included close contact with the infected individuals and lower rates of protective equipment use. Although the incidence of COVID-19 among PD patients is low, the severity of the disease and the mortality rate are quite high. Vaccination and adherence to preventive measures are strongly recommended in PD patients.

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INTRODUCTION

In the last days of December 2019, a new coronavirus with predominant respiratory involvement was discovered in China. The disease was known as COVID-19 which rapidly spread around the world.^{1,2} During this period, many

features of the disease were identified. One of the most important effects of the severe form of COVID-19 is kidney damage in patients with no prior history of kidney diseases.^{3,4} In addition, serious kidney damage, requiring dialysis, was reported in about 30% of patients who were

admitted to the hospital, due to the severe form of the illness.⁵ Patients with COVID and kidney failure appear to have a poor prognosis; however, there is a lack of evidence which have described the clinical characteristics of this population. This study aimed to evaluate the clinical manifestations and outcomes of patients receiving peritoneal dialysis, who had been diagnosed with COVID-19.

CLINICAL TRIAL FINDINGS

This multicenter cohort trial included patients with kidney failure under peritoneal dialysis between 20th January and 20th February 2020. Data were collected from 14 dialysis centers, in different cities and towns of Iran. The information was compiled through a combination of phone calls to patients and reviews of dialysis center records. The patients were divided into two categories: those suspected to have COVID-19 and those who had no symptoms of illness. The presence of clinical symptoms, in addition to a positive coronavirus polymerase chain reaction (PCR) and/or obvious

lung involvement, in a computerized tomography (CT) scan, were required for the diagnosis of COVID-19. Additionally, the clinical outcomes, including disease recovery, need for ICU admission or mortality were assessed. SPSS software, version 23 was used for statistical analysis.

Five hundred and five patients, receiving peritoneal dialysis, were enrolled in the current study. As mentioned before, they were divided into two categories according to the presence ($n = 19$) or absence ($n = 486$) of COVID-19. The most common reported symptoms were fever (63.2%), gastrointestinal symptoms (52.6%), cough (42.1%), dyspnea (42.1%), sore throat (10.5%), and neurological symptoms (10.5%). The rate of hospitalization was significantly higher in the patients with COVID-19 (57.9 vs. 19.5%, $P < .001$). Most of the affected patients reported a history of close contact with infected individuals (57.9 vs. 10.9%, $P < .001$) as well as lower rates of adherence to protective measures (78.9 vs. 95.1%, $P = .02$) (Table 1). There was no significant difference

Table 1. Baseline Characteristics of Study Subjects

Characteristics	Non-COVID-19 Patients (n = 486)	COVID-19 Patients (n = 19)	P	Total (n = 505)
Age, y (mean \pm SD)	53.1 \pm 16.5	58.1 \pm 14.5	> .05	53.3 \pm 16.4
Dialysis Duration, d (mean \pm SD)	38.4 \pm 31.8	45.6 \pm 35.0	> .05	38.6 \pm 32.0
KT/V, (median 25 th to 75 th)	1.9 (1.6 to 2.1)	2.0 (1.7 to 2.3)	> .05	1.9 (1.6 to 1.9)
Sex, Women, n (%)	212 (43.6)	7 (36.8)	> .05	219 (43.4)
Hospitalization, n (%)	95 (19.5)	11 (57.9)	< .001	106 (21.0)
PD Complication, n (%)	135 (27.8)	4 (21.1)	> .05	139 (27.5)
Travelling, n (%)	95 (19.5)	0 (0.0)	< .05	95 (18.8)
Living in An Infected Area, n (%)	417 (85.8)	19 (100.0)	> .05	436 (86.3)
Self-isolation, n (%)	387 (79.6)	13 (68.4)	> .05	400 (79.2)
Contact With An Infected Person, n (%)	53 (10.9)	11 (57.9)	< .001	64 (12.7)
Using Safety Equipment, n (%)	461 (95.1)	15 (78.9)	< .05	467 (94.4)
Smoking, n (%)	43 (8.8)	0 (0.0)	> .05	43 (8.5)
Opium, n (%)	41 (8.4)	0 (0.0)	> .05	41 (8.1)
Comorbidities				
Diabetes Mellitus, n (%)	170 (35.0)	10 (52.6)	> .05	180 (35.6)
Hypertension, n (%)	338 (69.5)	12 (63.2)	> .05	350 (69.3)
Kidney Transplantation, n (%)	60 (12.3)	2 (10.5)	> .05	62 (12.3)
Using Immunotherapy, n (%)	24 (4.9)	2 (10.5)	> .05	26 (5.1)
Clinical Symptoms				
Fever, n (%)	30 (6.2)	12 (63.2)	< .001	42 (8.3)
Cough, n (%)	25 (5.2)	8 (42.1)	< .001	33 (6.5)
Sore Throat, n (%)	8 (1.6)	2 (10.5)	.05	10 (2.0)
Gastrointestinal, n (%)	31 (6.4)	10 (52.6)	< .001	41 (8.1)
Loss of Sense of Smell, n (%)	4 (0.8)	0 (0.0)	> .05	4 (0.8)
Skin, n (%)	2 (0.4)	0 (0.0)	> .05	2 (0.4)
Neurologic, n (%)	7 (1.4)	2 (10.5)	< .05	9 (1.8)
Dyspnea, n (%)	0 (0.0)	8 (42.1)	> .05	8 (1.6)

in gender, mean age, duration of dialysis, the prevalence of diabetes mellitus, hypertension, smoking, kidney transplantation or immunotherapy between the two groups. A high C-reactive protein (CRP) level was reported in 68.4% and elevated liver enzymes in 36.8% of those affected by COVID-19. Antiviral medications were prescribed in 57.9% and corticosteroids in 63.2% of COVID-19 patients. Hemodialysis was performed in about 10.5% of patients. Regarding the clinical outcome, 47.4% of the patients recovered in outpatient settings, while 10.5% were hospitalized, 21.1% required admission to intensive care units (ICU) and 21.1% passed away. Higher rates of dyspnea, cough, elevated liver enzymes, erythrocyte sedimentation rate (ESR), leukocytosis and lower hemoglobin level were found in those who did not survive (Table 2).

In this study, 3.7% of the patients on PD were infected with coronavirus with a mortality rate of approximately 21%. History of recent travel and close contact with infected individuals, were the main risk factors for COVID-19. Patients receiving dialysis have compromised immune systems as

compared to the normal population, and are more susceptible to a wide range of infections, especially when corticosteroids are also prescribed.

One of the important findings in PD patients is coronavirus-associated peritonitis.⁶ Patients with end-stage kidney disease (ESKD), affected by COVID-19, have been the subject of various investigations, but the exact relationship between the two conditions is still unclear. Researchers have found that between 2.5 and 18.8% of hemodialysis patients are infected with the coronavirus.^{7,8}

In the current study, we did not find any significant difference between the two groups regarding the underlying comorbidities, including diabetes mellitus, hypertension, and smoking. Furthermore, the duration of dialysis had little effect on the likelihood of COVID-19. However, the role of exposure to infected individuals was more noticeable in these groups of patients, and therefore adherence to preventive measures, by the patients and dialysis wards staff, is strongly recommended. Approximately, half of our patients recovered from the disease, without the need for

Table 2. Clinical Characteristics of Survived and Non-survived COVID-19 Patients

Characteristics	Non-survived Patients (n = 4)	Survived Patients (n = 15)	P
Age, y (mean ± SD)	67.00 ± 10.80	55.67 ± 14.74	> .05
Dialysis Duration, d (mean ± SD)	31.50 ± 21.06	49.40 ± 38.69	> .05
Sex, Male, n (%)	3 (75.0)	9 (60.0)	> .05
Hospitalization, n (%)	4 (100)	7 (46.7)	> .05
PD Complication, n (%)	1 (25.0)	3 (20.0)	> .05
Living in An Infected Area, n (%)	4 (100)	4 (100)	> .05
Self-isolation, n (%)	3 (75.0)	10 (66.7)	> .05
Contact With An Infected Person, n (%)	2 (50.0)	9 (60.0)	> .05
Using Safety Equipment, n (%)	3 (75.0)	12 (80.0)	> .05
Diabetes Mellitus, n (%)	2 (50.0)	8 (53.3)	> .05
Hypertension, n (%)	4 (100)	8 (53.3)	> .05
Kidney Transplantation, n (%)	0 (0.0)	2 (13.3)	> .05
Using Immunotherapy, n (%)	1 (25.0)	1 (6.7)	> .05
Fever, n (%)	4 (100)	8 (53.3)	> .05
Cough, n (%)	4 (100)	4 (26.7)	< .05
Sore Throat, n (%)	0 (0.0)	2 (13.3)	> .05
Gastrointestinal, n (%)	2 (50.0)	8 (53.3)	> .05
Neurologic, n (%)	1 (25.0)	1 (6.7)	> .05
Dyspnea, n (%)	4 (100)	4 (26.7)	< .05
WBC, mm ³	18600.00 ± 5817.21	6623.33 ± 2098.20	< .05
ESR	47.50 ± 16.58	26.40 ± 9.03	< .05
Hb, mg/dL	8.77 ± 0.22	11.50 ± 1.37	< .05
Antiviral Use, n (%)	4 (100)	7 (46.7)	> .05
Corticosteroid Use, n (%)	4 (100)	8 (53.3)	> .05
Change to HD, n (%)	1 (25.0)	1 (6.7)	> .05
CRP, Positive, n (%)	4 (100)	9 (60.0)	> .05

admission, whereas, one-fifth passed away during hospitalization. In other words, less than half of the individuals identified, had a favorable outcome, following recovery from COVID-19. In addition, leukocytosis, elevated inflammatory biomarkers and decreased hemoglobin levels were the poor prognostic factors in our patients.

DISCUSSION

In a study by Sachdeva *et al.*, 27.2% of PD patients and COVID-19, required mechanical ventilation, out of which, 66.7% passed away.⁹ In another study by Jiang *et al.* in PD patients, 1.7% were admitted to the hospital due to respiratory tract infection, catheter-related complications, peritonitis, and gastrointestinal bleeding, while only 0.9% of them, had a positive PCR for coronavirus. In their study, 25% of patients passed away from myocardial infarction (MI) and cerebrovascular hemorrhage. The duration of hospitalization was also longer in their study group, compared with the normal population, with the same type of infection.¹⁰

CONCLUSION

PD patients have relatively poor outcomes, despite having a lower incidence of COVID-19. In conclusion, this study demonstrated the importance of intensive adherence to preventive protocols, such as wearing masks, vaccination, hand hygiene and avoiding close contact with infected individuals, especially in ESKD patients, receiving PD.

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