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COVID-19 in end-stage renal disease: Does it differ?

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Abstract
Background: Since December 2019, the coronavirus disease-2019 (COVID-19) has spread throughout the world. The only methods for controlling this illness without appropriate medication and vaccine are ensuring hygiene habits, and isolation. The novel coronavirus (COVID-19), caused by SARS-CoV-2, showed various prevalence and case-fatality rates among patients with pre-existing chronic conditions. End-stage renal disease (ESRD) patients with renal replacement therapy (RRT) might have a higher prevalence and CFR due to reduced immune function from uremia and kidney tropismof SARS-CoV-2.
Methods: In this study, we compared the effect of infection and the health status of the patients with SARS-CoV-2 infection in ESRD patients on RRT with those infected with SARS-CoV-2 in the general population. The current study was carried out on 100 end-stage renal disease patients and 300 from the general population, where we did retrospective assessment from files, taking history from patients and the general population.
Results: High temperature, dry cough, general fatigue, loss of smell, and dizziness were significantly higher in non-ESRD COVID-19 patients than in ESRD COVID-19 patients. Mortality was significantly higher in ESRD COVID-19 patients compared to non-ESRD COVID-19 patients.
Conclusion: We concluded that morbidity and mortality were higher in ESRD patients than in the general population, and clinical presentation of COVID-19 differs in ESRD from the general population.

Keywords: COVID-19, renal replacement therapy, end-stage renal disease, hemodialysis

Introduction
The first coronavirus disease 2019 (COVID-19) cases occurred in China and quickly developed into an epidemic centered in Hubei province. At present, the pandemic has spread globally [1]. It is vital to use several different methods to stop the spread of diseases. Effective and prompt identification of potentially infected individuals is crucial to break the cycle of (COVID-19) spread with limited resources [2].
Early detection of COVID-19 is extremely difficult due to its diverse and non-specific clinical symptoms, which include fever, cough, nauseousness, vomiting, diarrhea, exhaustion, and loss of smell [3].
Although many infected people are asymptomatic, elderly patients with concomitant conditions are more likely to get acute respiratory distress syndrome and die [4].
End-stage renal disease (ESRD), also called end-stage kidney disease, occurs when chronic kidney disease-the gradual loss of kidney function - reaches an advanced state.
The kidneys filter wastes and excess fluids from blood, which are then excreted in urine. When kidneys lose their filtering capabilities, dangerous fluid, electrolytes, and waste levels can build up in the body [5].
In ESRD, patients need renal replacement therapy, dialysis, or kidney transplants to keep their life. The primary renal replacement therapy in most nations is center-based hemodialysis (HD). For HD patients, three times a week requires a 4-hour restriction in an indoor setting, and regular interaction with staff members and other patients increases the risk of cluster infection. In order to stop the spread of the COVID-19 pandemic, nephrologists and healthcare professionals must develop efficient prevention techniques [6].

Materials and Methods
Study population: This study is a retrospective cross-sectional study conducted on one hundred ESRD patients in Menofia University Hospitals' dialysis units and three hundred of the general population from February 2020 to May 2021.

Inclusion criteria: All general population and ESRD patients are above 18 years old.

Exclusion criteria: Age under 18 years and CKD patients were excluded from the general population.

Study groups

Group 1: the general population is classified according to their covid 19 infection into two subgroups:

- **Subgroup 1A:** Not infected by COVID-19.
- **Subgroup 1B:** Infected by COVID-19.

Group 2: Patient with ESRD in renal dialysis units of Menofia University hospitals are also classified according to their COVID-19 infection into two subgroups:

- **Subgroup 2A:** Patient with ESRD not infected by COVID-19.
- **Subgroup 2B:** Patient with ESRD infected by COVID-19.

Retrograde assessment of population from patients files and history taking and evaluation of previous investigations: age, sex, residence, marital status, occupation, COVID-19 infection, mask commitment, smoking, chronic disease (HTN-diabetes-heart disease-bronchial asthma or anything else).symptoms that the patients experienced during their covid infection: Fever, Dry cough, Exhaustion, Anosmia, Dizziness, Loss of concentration, Vomiting, Dyspnea, Diarrhea, Bone ache, wheezes, headache, sore throat, skin rash, period of feeling manifestation till disappeared, time of feeling good despite presence of manifestations.

We asked them if they felt manifestations that weren't present before or after recovery, then we asked them what these were. After recovery, we asked them if they felt (a loss of smell or taste – exhaustion- or fear from COVID-19). Place of treatment (home – hospital- ICU), oxygen needed at home or hospital, Treatment protocol; we asked if they knew the source of infection.

We know from hospital files and resident doctors The Cause of death in ESRD patients and the general population who are not CKD.

Investigations: determined that PCR and CT chest are the only diagnostic methods for COVID-19 patients.

Ethical Consideration

The data that were obtained from participants are confidential. The study participants were not identified by name in any report or publication concerning this study. Before the participants were admitted to this study, the purpose and nature of the study and the risk-benefit assessment were explained to them. A written consent from each subject was taken. Online approval for this research was taken from the Internal Medicine Department section council, and we are waiting for the IRB number from the ethics committee of the Faculty of Medicine, Menoufia University, as a result of measures taken due to COVID-19.

Statistical analysis

Statistical analysis was performed with the Statistical Package for the Social Sciences version 28.0 (SPSS Inc., Chicago, IL, US). Discrete data are given as absolute values and percentages. We used the Chi-square test to analyze the categorical variables. To define potential confounders, we compared baseline characteristics between Non-ESRD and ESRD COVID-19 patients. A p value of 0.05 was determined as significant.

Results

Table 1 shows no significant difference in baseline characteristics between the studied groups.

Table 1: Baseline characteristics of the studied groups

	Non-ESRD COVID-19 patients (n =136)	ESRD COVID-19 Patients (n =16)	P value
Age			
<18	4 (2.9%)	0 (0.0%)	0.307
18-60	79 (58.1%)	12 (75%)	
>60	53 (39.0%)	4 (25%)	
Sex			
Male	52 (38.2%)	6 (37.5%)	1.000
Female	84 (61.8%)	10 (62.5%)	
Residence			
Rural	51 (37.5%)	6 (37.5%)	1.000
Urban	85 (62.5%)	10 (62.5%)	
Marital status			
Married	71 (52.2%)	9 (56.3%)	0.775
Single	63 (46.3%)	7 (43.8%)	
Widower	2 (1.5%)	0 (0.0%)	
Work status			
Yes	74 (54.4%)	8 (50.0%)	0.738
No	62 (45.6%)	8 (50.0%)	
Clinical data			
Hypertension	43 (31.6%)	6 (37.5%)	0.634
Diabetes mellites	27 (19.9%)	3 (18.8%)	1.000
Chest diseases	10 (7.4%)	0 (0%)	0.601
Heart diseases	9 (6.6%)	3 (18.8%)	0.117
Smoking	42 (30.9%)	5 (31.3%)	1.000

Data is represented as n (%), ESRD: End-stage renal disease.

Table 2: Symptoms in the studied groups

	Non-ESRD COVID-19 patients (n =136)	ESRD COVID-19 patients (n =16)	P value
High temperature	97 (71.3%)	6 (37.5%)	0.006*
Dry cough	84 (61.8%)	2 (12.5%)	<0.001*
General fatigue	74 (54.4%)	3 (18.8%)	0.007*
Loss of smell	71 (52.2%)	2 (12.5%)	0.003*
Lack of concentration	75 (55.1%)	6 (37.5%)	0.181
Dizziness	73 (53.7%)	3 (18.8%)	0.008*
Diarrhea	42 (30.9%)	4 (25%)	0.628
Bone pain	69 (50.7%)	4 (25%)	0.051
Difficulty in breathing	57 (41.9%)	3 (18.8%)	0.073
Headache	81 (59.6%)	6 (37.5%)	0.092
Sore throat	58 (42.6%)	3 (18.8%)	0.065
Joint pain	63 (46.3%)	7 (43.8%)	0.845

Data is represented as n (%), ESRD: End-stage renal disease, *statistically significant as p-value <0.05.

Table 3: Post-COVID-19 syndrome in the studied groups

	Non-ESRD COVID-19 Patients (n =136)	ESRD COVID-19 Patients (n =16)	P value
Difficulty in breathing	11 (8.1%)	0 (0%)	0.607
Digestive problems	2 (1.5%)	0 (0%)	1.000
Dizziness	1 (0.7%)	0 (0%)	1.000
Fatigue	14 (10.3%)	0 (0%)	0.364
Irregular blood sugar	1 (0.7%)	0 (0%)	1.000
Loss of smell	4 (2.9%)	0 (0%)	1.000
Memory impairment	1 (0.7%)	0 (0%)	1.000
Severe headache	2 (1.5%)	0 (0%)	1.000
Thrombosis	0 (0%)	1 (6.25%)	1.000

Data is represented as n (%), ESRD: End-stage renal disease, *statistically significant as p-value <0.05.

Regarding the symptoms in the study participants, table 2 shows that high temperature, dry cough, general fatigue, loss of smell, and dizziness were significantly higher in non-ESRD COVID-19 patients than ESRD COVID-19 patients. There was no significant difference in the rest of the symptoms between the studied groups.

Table 3 showed that there was no significant difference in post-COVID-19 syndrome between the studied groups.

Regarding clinical outcomes of the study participants, table 4 shows that the number of patients treated at home was significantly higher in non-ESRD COVID-19 compared to ESRD COVID-19 patients. There was no significant difference in oxygen needs between the studied groups. Mortality was significantly higher in ESRD COVID-19 patients compared to non-ESRD COVID-19 patients.

Table 4: Clinical outcomes in the studied groups

	Non-ESRD COVID-19 Patients (n =136)	ESRD COVID-19 Patients (n =16)	P value
Difficulty in breathing	11 (8.1%)	0 (0%)	0.607
Digestive problems	2 (1.5%)	0 (0%)	1.000
Dizziness	1 (0.7%)	0 (0%)	1.000
Fatigue	14 (10.3%)	0 (0%)	0.364
Irregular blood sugar	1 (0.7%)	0 (0%)	1.000
Loss of smell	4 (2.9%)	0 (0%)	1.000
Memory impairment	1 (0.7%)	0 (0%)	1.000
Severe headache	2 (1.5%)	0 (0%)	1.000
Thrombosis	0 (0%)	1 (6.25%)	1.000

Discussion

In ESRD, patients need renal replacement therapy, either dialysis or kidney replacement, to keep their life. Those patients are immunocompromised, so they can easily be infected by COVID-19, which has a more harmful effect on their lungs. This creates a challenge in front of medicine regarding prevention and treatment protocols. This study aims to see if COVID-19 in ESRD patients in Menoufia University hospitals' dialysis units differs from the general population.

The prevalence of COVID-19 in patients with ESRD is 20% more than in the general population, which is 11.5%. This is consistent with Corbett and coworkers [7], which also had a higher prevalence of COVID-19 in ESRD (19.6%). At the same time, the lowest COVID-19 prevalence was reported in Turkey; Kemeç and coworkers [8] reported that it was 0.2%, which was against our results.

In ESRD, high temperature (71.3%), dry cough (61.8%), general fatigue (54.4%), loss of smell (52.2%), and dizziness (53.7%) were significantly higher in non-ESRD COVID-19 patients compared to ESRD COVID-19 patients. There was no significant difference between the studied groups in the rest of the assessed symptoms. Valeri and coworkers [9] said that fever was the most common presenting symptom, followed by cough, dyspnea, and fatigue/malaise. They also said that altered mentation was the most common presenting symptom versus those in the general population who suffer from headache, joint pain, difficulty breathing, sore throat and dizziness, high temperature, bone pain, lack of concentration and diarrhea,

tiredness, smell loss, loss of ability to speak or move and joint pain and chest sounds with breathing difficulties and cough.

According to post-COVID-19 syndrome, there was no significant difference in post-COVID-19 syndrome between the studied groups. There was no significant difference in post-COVID-19 syndrome between the studied groups.

Post-COVID syndrome in the infected general population is about 14% versus nearly 0% in ESRD patients. This is consistent with Arifa Akram and coworkers [10] from Bangladesh, who reported that 45.6% had a loss of sense of smell and taste, which was about 1% in the infected general population in our study. In comparison, Jerome and coworkers [11] were about 82% versus 10% in those with ESRD.

Regarding the clinical outcomes of the study participants, the number of patients treated at home was significantly higher in non-ESRD COVID-19 compared to ESRD COVID-19 patients. There was no significant difference in oxygen needs between the studied groups. Mortality was significantly higher in ESRD COVID-19 patients compared to non-ESRD COVID-19 patients.

Management of covid infection in the general population took place in the home (82.4%), at the hospital (11.8%), ICU (5.9%) in our study. In comparison, Management of COVID-19 infection in end-stage renal disease patients took place at home (56.3%), at the hospital (25%), and in the ICU (18.8%) in our study. Ashleigh R. Tuite and coworkers [12] said that management of COVID-19 in the general population took place (75.5%) at the hospital and about (28.6%) in the ICU.

Compared to 50% at home, 20% in hospital, and 30% in ICU in those with ESRD in our study. This is against Molly Fisher and coworkers [13], which said that management of covid infection in those with ESRD is about (30%) at home, (57,6%) at hospital and (13,2%) in ICU.

The need for oxygen was about (23.5%) in our infected general population. In comparison, the need for oxygen in ESRD patients was (37.5%) while Sylvia Garry and coworkers [14] were about (15%) in the general population (60%) in those with ESRD. In contrast, Molly Fisher and coworkers [15] said only (16.7%) of infected ESRD patients required mechanical ventilation.

Mortality in the infected general population is about (10.3%) while in ESRD patients, it was (31.3%) while Christian Karagiannidis and coworkers [16] said that mortality in the infected general population is about (5%).

VS (10%) in those with ESRD, while Molly Fisher and coworkers [15] said that mortality in infected ESRD patients is about (28%).

Conclusion

End-stage renal disease patients with COVID-19 infection differ significantly from the general population with COVID-19 infection in needing Management at the hospital and mortality. High temperature, dry cough, general fatigue, loss of smell, and dizziness were significantly higher in non-ESRD COVID-19 patients than in ESRD COVID-19 patients.

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