



A Retrospective Study of End-Stage Renal Disease Patients on Maintenance Hemodialysis with COVID-19

Dear Editor,

On March 11, 2020, the World Health Organization recognized a new highly infectious-contagious SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) infection for humans as a pandemic.¹ Our tertiary care hospital of a medical university in South India started to function as hospital for COVID-19 patients on March 13, 2020. The aim of this article is to describe the clinical profile and outcomes of the end-stage renal disease patients on maintenance hemodialysis with COVID-19 disease at our center.

Till December 31, 2021, we had admitted and managed 15,719 COVID-19 disease patients. The overall mortality rate in all COVID-19 patients was 18.3% (2,878 deaths in 15,719 patients).

We admitted all patients with end-stage renal disease (ESRD) on maintenance hemodialysis (MHD) who were – positive for SARS-CoV-2 by RT-PCR (reverse transcription polymerase chain reaction). These patients were both from our institute's dialysis unit and patients referred to us from other dialysis centers.

From March 2020 to March 1, 2021, we admitted 269 MHD patients, out of whom the patient files were available for 210 patients. From March 1, 2021 to till December 31, 2021, we admitted MHD 445 patients, out of whom the patient files were available for 385 patients. The total number of patients was 714. The patient files were available for 595 patients (83.3%). The minimum and maximum ages of the patients were 10 and 89 years, respectively [Supplementary Table 1]. The number of males was 435 (60.9%).

The etiology of ESRD comprised diabetes mellitus in 229 (38.4%) patients, hypertension in 126 (21.1%) patients, and other etiologies accounted for 240 (40.3%) patients. However hypertension was documented either at admission or during hospital stay in 392 patients. At admission, the mean systolic and diastolic blood pressures were 133.8 and 81.5 mm Hg. Majority of patients (606 out of 714/84.8%) were on MHD with an arteriovenous fistula. For 108 patients (out of 714/15.1%), femoral

vein catheters were placed for these patients required initiation of MHD for the first time. In no patient, internal jugular vein catheterization was done.

Out of 595 patients, noninvasive ventilation at admission was necessitated in 68 (11.4%) patients, and 253 (42.5%) patients required oxygen. However, 145 (out of 595/24.3%) patients required NIV in hospital stay (NIVh). This group included the patients transferred onto NIV from oxygen or admitted without oxygen requirement.

The number of patients of ESRD on MHD with COVID-19 disease who expired in the hospital was 203 (34.1%). The age-wise mortality was compared in Supplementary Table 1. The data of the analysis of the mortality risk factors are described in Tables 1 to 2 and in Supplementary Tables 2–6. A table of comparison between the patients admitted in 2020 and 2021 is given in Supplementary Table 7.

The number of deaths reported was 2,878 (18.3%) out of the total 15,719 COVID-19 disease patients managed. As of December 31, 2021, the mortality percentage worldwide 1.9% and in our country was 1.38%. The mortality rate in ESRD patients on MHD with COVID-19 disease at our institution was 34.1%. We identified age, SpO₂ at admission, number of dialysis sessions, total leucocyte count, neutrophils, lymphocytes, blood urea, aspartate aminotransferase (AST), alanine aminotransferase (ALT), C-reactive protein (CRP), serum ferritin, serum lactate dehydrogenase (LDH), male, diabetes mellitus, oxygen requirement at admission, NIV at admission, and NIV in hospital are significant risk factors for mortality. On multivariate analysis age, NIV in hospital stay and serum LDH remained significantly associated with mortality. We also identified that oxygen-requiring patients by non rebreather masks or simple masks, not by NIV, were 6.51 times more at risk of mortality than patients not requiring oxygen, NIV patients were 9.78 times more at risk of mortality than others, and NIV and oxygen-requiring patients were 8.621 times more at risk of mortality than patients not requiring oxygen. Non oxygen requirement at admission had a significant favorable impact on the

Table 1: NIV patients only versus non-NIV patients

NIV patients only versus non-NIV patients	Definition	Mortality		Total	P, OR (95% CI)
		Yes	No		
Yes	On NIV at admission	54	14	68	<0.001
No	No NIV at admission, Included oxygen requiring and oxygen not requiring patients	149	378	527	9.785 (5.276–18.15)
Total		203	392	595	

NIV: noninvasive ventilation; CI: confidence interval; OR: odds ratio.

Table 2: Risk factors for mortality: Multivariate regression analysis (variables in the equation)

	Parameter	B	S.E.	Wald	df	Sig.	Exp (B)
Step 1	Age	0.038	0.016	5.817	1	0.016	1.038
	Sex (1)	0.418	0.465	0.807	1	0.369	1.519
	Diabetes mellitus (1)	0.292	0.387	0.569	1	0.451	1.339
	SPO ₂ at admission	-0.002	0.024	0.005	1	0.941	0.998
	NIV at admission (1)	0.834	0.910	0.839	1	0.360	2.301
	NIV in hospitalstay (1)	1.082	0.533	4.120	1	0.042	2.951
	Oxygen at admission (1)	0.786	0.819	0.922	1	0.337	2.196
	Non oxygen (1)	-0.093	0.867	0.011	1	0.915	0.912
	Total leucocyte count	0.000	0.000	0.464	1	0.496	1.000
	Neutrophils	0.046	0.043	1.129	1	0.288	1.047
	Lymphocytes	0.007	0.052	0.018	1	0.894	1.007
	Bloodurea	0.006	0.003	3.318	1	0.069	1.006
	AST	-0.004	0.002	2.174	1	0.140	0.996
	ALT	-0.004	0.002	2.374	1	0.145	0.916
	CRP	0.003	0.002	1.537	1	0.215	1.003
	Serumferritin	0.000	0.000	1.593	1	0.207	1.000
	LDH	0.003	0.001	10.001	1	0.002	1.003
	Constant	-10.135	5.076	3.986	1	0.046	0.000

SpO₂Oxygen saturation of blood, AST: aspartate aminotransferase, LDH: lactate dehydrogenase, NIV: noninvasive ventilation, CRP: C-reactive protein, ALT: Alanine aminotransferase

outcome, $P < 0.001$ OR: 0.116 (0.07–0.178).

The admission of ESRD patients on MHD was universal at our institute so as to isolate them from the non-COVID-19 ESRD patients. Therefore, the admission happened within few hours of diagnosis or onset of symptoms. The mean duration of hospital stay was 8.5 days. The median length of stay before death was six days. The length of hospital stay was reported as 11.4 days after admission by Goicoechea *et al.*² and as 12 days by Alberici *et al.*³ Goicoechea *et al.*² reported that the median length of stay before death was 9.3 days.

The mortality rate of hospitalized ESRD patients on MHD with COVID-19 disease in the study from Turkey was six times higher than the general population.⁴ The mortality rate of COVID-19 MHD patients in a few more published studies was higher than the non dialysis COVID-19 patients. The significant risk factors for the higher mortality in the studies of our nation and the international studies are listed in Supplementary Tables 8 and 9.^{S1-S12}

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Aiswharya LP, Sunnesh A, Mathini S, Kumar PN, Gurupriya M, Vishwaeswar Rao G, *et al.* A Retrospective Study of End-Stage Renal Disease Patients on Maintenance Hemodialysis with COVID-19. *Indian J Nephrol.* 2024;34:252-3. doi: 10.4103/ijn.ijn_230_23

Received: 30-05-2023; Accepted: 07-08-2023;
Online First: 06-11-2023; Published: 28-05-2024

DOI: 10.4103/ijn.ijn_230_23

Supplementary available on: https://doi.org/10.4103/ijn.ijn_230_23

