

Outcomes of Patients on Maintenance Haemodialysis Admitted to a Tertiary Care Hospital with COVID-19

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^{1,2,3} Conception of study

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¹ Analysis/Interpretation/Discussion

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Abstract

Introduction: The coronavirus disease-2019 pandemic has caused a disastrous world health crisis. The patients with renal disease, particularly those who are receiving regular dialysis therapy have an elevated risk of COVID-19 infection-associated complications as well as poor prognosis including enhanced risk of hospital admission, mechanical ventilation, and mortality.

Objective: The objective of the study is to assess the outcomes of patients on maintenance dialysis admitted to a tertiary care hospital with COVID-19.

Materials and Methods: This retrospective study was performed in a Tertiary Care Hospital from March 2020 to August 2020. A total of 44 patients were included in the study. Data collected through a questionnaire was analyzed using the computer software SPSS 24.0. Frequencies and percentages were calculated for categorical data while mean+SD was calculated for quantitative data.

Results: Among 44 patients, 63.6% were males and the mean age was 46.86+12.413 years. The mean number of dialysis during hospital stays was 3.57+2.214. The mean ferritin level was 2067.05+788.412 ng/ml and the mean C-reactive protein level was 111.59+32.998 mg/L. Among these patients, 65.9% were discharged and 34.1% of patients expired.

Conclusion: The study concluded that elevated levels of inflammatory markers such as ferritin and CRP are found among patients on maintenance dialysis with COVID-19.

Keywords: Outcomes, dialysis, COVID-19, patients, expired.

Introduction

The recent COVID-19 (Coronavirus disease-2019) pandemic due to SARS-CoV-2 (Severe Acute Respiratory Syndrome-Corona Virus 2)¹, initially emerged during December 2019 in Wuhan city of China² and as per WHO (World Health Organization) it has spread to 2012 areas of world countries including Pakistan³; finally acquired the status as "Global Pandemic" on March 11, 2020, by WHO.⁴

The COVID-19 has had detrimental effects worldwide⁵ as above 38 million cases infected with the SARS-CoV-2 were reported globally.⁶ In Pakistan, the Coronavirus pandemic outbreak occurred in February 2020.⁷ As per the Ministry of Health, Pakistan, there were 564,824 confirmed COVID-19 cases. Among these cases, 527,061 recovered, 1,648 were critical and 12,380 died till February 16, 2021. The highest number of COVID-19 cases have been reported in the Province of Sindh (254,016) followed by Punjab (164,696), Khyber Pakhtunkhwa (69,885), Islamabad (42,808), Balochistan (18,946), Azad Jammu & Kashmir (9,532), and Gilgit Baltistan (4,941).⁸

Almost after a 5 to 6 days incubation period, COVID-19 symptoms start to appear.⁹ The disease clinical presentation is greatly variable, from symptom-free/mild disease (≤ 80 percent), to acute with unilateral/bilateral pneumonia (about 15 percent).¹⁰ The routes of transmission comprise droplet inhalation, person-to-person direct transmission during sneezing, coughing, and with the contact of nasal, oral, as well as mucous membranes of the eye.¹¹ The disease identification is based upon real-time RT-PCR (reverse transcriptase polymerase-chain-reaction) assay on the nasopharyngeal swabs. Most of the COVID-19 patients present with elevated to normal leukocyte counts, lymphopenia, elevated plasma pro-inflammatory cytokines such as CRP (C-reactive protein), serum ferritin, procalcitonin, abnormal test results of liver and kidney function.⁹ The COVID-19 patient's largest series reported co-morbidities for example, hypertension, obesity, diabetes, immunodeficiency, and cardiovascular diseases were associated with enhanced mortality.¹²

Coronavirus disease-2019 is an important threat to patients undergoing maintenance dialysis.¹³ Severe infection of COVID-19 could cause AKI (acute kidney injury) that is linked with enhanced mortality.¹⁴ However, the maintenance dialysis patients (MDPs) seem to be at higher risk of infectivity because of the viral transmission besides an increased risk of death when compared with the general populace, even

despite mild medical presentation.^{14,15} Adaptive resistant systems and derangements in innate could be accountable for a decreased antiviral reaction,¹⁶ while innate resistant system chronic activation, as well as endothelial malfunction, offer a background regarding the more acute course. The presence of acute co-morbidities for example, diabetes mellitus, cardiovascular disease, increased age, and hypertension could cause a rapid worsening of the patient's clinical situation in case of acute infectivity.^{14,17}

As the world continues to rage a war against the pandemic of COVID-19, the evidence about dismal diagnosis among patients on maintenance dialysis is worrisome. Though, apart from the infection itself, the significant challenges in underdeveloped and developing countries add insult to enhanced morbidity and mortality among this populace.¹⁸ No much data is available regarding the impact of COVID-19 on the clinical outcomes of *patients on maintenance dialysis*.¹⁹ So, the objective of the study is to assess the outcomes of patients on maintenance dialysis admitted to a tertiary care hospital with COVID-19.

Materials and Methods

This retrospective study was carried out in a Tertiary Care Hospital from March 2020 to August 2020. A total of 44 patients were included in the study.¹³ During the study only hospitalized patients on twice-weekly maintenance hemodialysis with COVID-19 were included. The patients aged <18 years and those who were hospitalized due to other reasons were not included in the study.

A COVID-19 case was defined by a positive result on RT-PCR assay based upon WHO standard and targeting the SARS-CoV-2 E gene and RdRp gene of a specimen collected on a nasopharyngeal swab.

Dataset included age, gender, number of dialysis during the hospital stay, medications (heparin prophylaxis, dexamethasone), and inflammatory markers (ferritin, C-reactive protein). Patients' need for oxygen dependency and mechanical ventilation were also noted. The main study outcome was defined as in-hospital mortality.

Data collected through a questionnaire was analyzed using computer software SPSS 24.0. Frequencies and percentages were calculated for categorical data, while mean \pm SD was calculated for quantitative data. Chi-square test was applied to find out the association between the outcome of patients with age, gender,

number of dialysis, medications, and mechanical ventilation. A P-value ≤ 0.05 was considered statistically significant. Confidentiality of the data was ensured and proper consent was obtained before data collection.

Results

Table 1 describes that among 44 patients, 27 (61.4%) were up to 50 years old and 17 (38.6%) were more than 50 years old while the mean age of the patients was 46.86 ± 12.413 years.

Out of 44 patients, 28 (63.6%) were male and 16 (36.4%) were females.

Among these patients, the mean number of dialysis done during hospital stay was 3.57 ± 2.214 while the range was 1-9.

The result shows that among 44 patients, the majority 35 (79.5%) was given heparin prophylaxis while only 9 (20.5%) patients were not given heparin prophylaxis.

Table highlights that among 44 patients, more than half 26 (59.1%) were given dexamethasone while 18 (40.9%) patients were not given dexamethasone.

Among 44 patients, the mean ferritin level was 2067.05 ± 788.412 ng/ml and the range was 800-4008 ng/ml. Similarly among male patients, the mean ferritin level was 2109.61 ± 729.125 ng/ml and the range was 864-3455 ng/ml while among female patients, the mean ferritin level was 1992.56 ± 903.151 ng/ml and the range was 800-4008 ng/ml.

The result indicates that among patients the mean C-reactive protein level was 111.59 ± 32.998 while the range was 68-210.

Table 1 depicts that all (100.0%) patients were oxygen-dependent.

Out of 44 patients, only 10 (22.7%) were on a mechanical ventilator while the majority 34 (77.3%) did not require mechanical ventilation.

When the outcomes were evaluated, the result demonstrates that 29 (65.9%) patients were discharged from the hospital and 15 (34.1%) patients expired.

Table 2 depicts that among 27 patients who were up to 50 years old, 21 (47.7%) were discharged and 6 (13.7%) expired. Among 17 patients who were above 50 years old, 8 (18.2%) were discharged and 9 (20.4%) expired. The result was found statistically insignificant ($P=0.444$).

Among 28 patients who were males, 19 (43.2%) were discharged and 9 (20.4%) expired. Among 16 patients who were females, 10 (22.7%) were discharged and 6 (13.7%) expired. The result was found statistically insignificant ($P=0.718$).

Among 33 patients who had up to 5 dialyses, 21 (47.7%) were discharged and 12 (27.3%) expired. Among 11 patients who had more than 5 dialyses, 8 (18.2%) were discharged and 3 (6.8%) expired. The result was found statistically insignificant ($P=0.630$).

Among 35 patients who were given heparin prophylaxis, 23 (52.2%) were discharged and 12 (27.3%) expired. Among 9 patients who were not given heparin prophylaxis, 6 (13.6%) were discharged and 3 (6.8%) expired. The result was found statistically insignificant ($P=0.957$).

Among 26 patients who were given dexamethasone, 16 (36.4%) were discharged and 10 (22.7%) expired. Among 18 patients who were not given dexamethasone, 13 (29.5%) were discharged and 5 (11.4%) expired. The result was found statistically insignificant ($P=0.462$).

Among 10 patients who were on mechanical ventilation, all (22.7%) were expired. Among 34 patients who were not on mechanical ventilation, 29 (65.9%) were discharged and 5 (11.4%) expired. The result was found statistically significant ($P=0.000$).

Table 1: Demographic features and outcomes of maintenance dialysis patients with COVID-19

Demographic features	
Age	n (%)
≤ 50 years	27 (61.4%)
> 50 years	17 (38.6%)
mean \pm SD [min - max]	46.86 ± 12.413 [23 - 74]
Gender	n (%)
Male	28 (63.6%)
Female	16 (36.4%)
Dialysis, mean \pm SD [min - max]	3.57 ± 2.214 [1 - 9]
Heparin prophylaxis	n (%)
Yes	35 (79.5%)
No	9 (20.5%)
Dexamethasone	n (%)
Yes	26 (59.1%)
No	18 (40.9%)
Ferritin (ng/ml), mean \pm SD [min - max]	2067.05 ± 788.412 [800 - 4008]
Male	2109.61 ± 729.125 [864 - 3455]
Female	1992.56 ± 903.151 [800 - 4008]
C-reactive protein (mg/L), mean \pm SD [min - max]	111.59 ± 32.998 [68 - 210]
Oxygen dependency, n (%)	44 (100.0%)
Mechanical ventilation	n (%)

Yes	10 (22.7%)
No	34 (77.3%)
Outcome	n (%)
Discharged	29 (65.9%)
Expired	15 (34.1%)

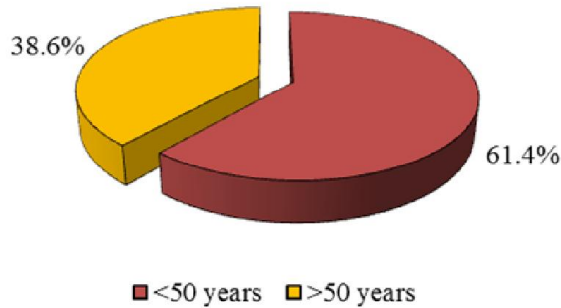


Figure-1: Age of patients

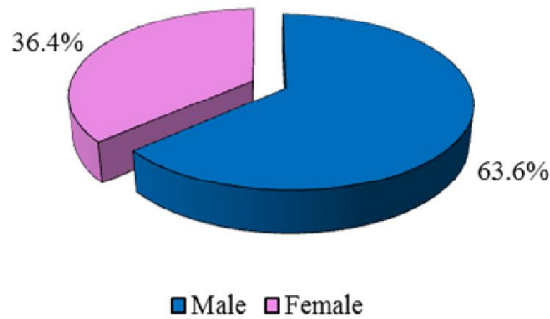


Figure-2: Gender of patients

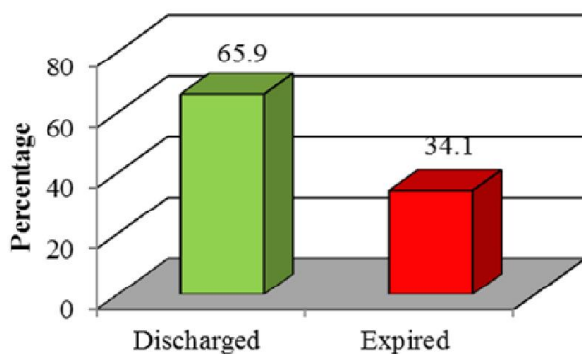


Figure-3: Outcomes in maintenance dialysis patients with COVID-19

Table-2: Factors associated with outcomes of maintenance dialysis patients with COVID-19

	Outcome		p-value
	Discharged	Expired	
Age, n (%)			
≤50 years	21 (47.7%)	6 (13.7%)	0.444
>50 years	8 (18.2%)	9 (20.4%)	
Gender, n (%)			
Male	19 (43.2%)	9 (20.4%)	0.718
Female	10 (22.7%)	6 (13.7%)	
Dialysis, n (%)			
≤5	21 (47.7%)	12 (27.3%)	0.630
>5	8 (18.2%)	3 (6.8%)	
Heparin prophylaxis, n (%)			
Yes	23 (52.3%)	12 (27.3%)	0.957
No	6 (13.6%)	3 (6.8%)	
Dexamethasone, n (%)			
Yes	16 (36.4%)	10 (22.7%)	0.462
No	13 (29.5%)	5 (11.4%)	
Mechanical ventilation, n (%)			
Yes	0 (0.0%)	10 (22.7%)	0.000
No	29 (65.9%)	5 (11.4%)	

Discussion

The Coronavirus disease 2019 is an emerging public health problem that represents a significant threat to maintenance dialysis patients. The current study was carried out to assess the outcomes of patients on maintenance dialysis admitted to a Tertiary Care Hospital of Rawalpindi with COVID-19. To acquire appropriate outcomes, a group of 44 patients was included in the study and found that most of the patients (61.4%) were up to 50 years old and 38.6% were above 50 years old (age range 23-74 years) while the mean age of the patients was 46.86 ± 12.413 years. But the findings of a study performed by Javaid and coworkers (2020) showed that the mean age of the patients on maintenance dialysis was 59.92 years.² In another study carried out by Ahmed and associates (2020) reported that the mean age of the patients was 52 ± 12 years while the age range was 20 to 85 years.¹⁰ A similar study conducted by Jung and collaborators

(2020) confirmed that the mean age of the patients was 63.5 ± 14.5 years and the range was 40–88 years.¹⁶

When the gender of patients was assessed, the study disclosed that the majority (63.6%) of the patients were male while 36.4% were female patients. The findings of our study are comparable with a study undertaken by Trivedi and partners (2020) who demonstrated that male patients were in majority (64.8%).¹⁸ A study was done by Turgutalp and coworkers (2020) also confirmed that among patients, more than half (52.2%) were males and 47.8% were female patients.¹⁹ The findings of our study further revealed that the mean number of inpatient dialysis was 3.57 ± 2.214 (range 1-9) and most of the patients were given heparin prophylaxis and dexamethasone.

Ferritin is an inflammatory marker; its elevated level could be detrimental for the survival of patients on maintenance dialysis and are linked with elevated mortality risk. *It was very discouraging that elevated ferritin levels were found among both male and female patients on maintenance dialysis with COVID-19.* The mean ferritin level of patients was 2067.05 ± 788.412 ng/ml and the range was 800-4008 ng/ml. The findings of a most recent study carried out by Chan and fellows (2021) exhibited a better scenario than our study results who confirmed that the mean ferritin level of patients was 1041 ng/ml while the range was 464-2556 ng/ml.⁵ The results of another study conducted by Islam and comrades (2021) are much better than our study results who reported that the mean ferritin level of patients was 950 ± 548 .¹¹

Likewise, it is also observed that elevated levels of CRP are associated with mortality risk among patients on maintenance dialysis. *During the study elevated level of this inflammatory marker (CRP) was also found among patients on maintenance dialysis with COVID-19.* The mean CRP level of patients was 111.59 ± 32.998 mg/L while the range was 68-210 mg/L. The findings of our study are comparable but demonstrated a more devastating situation than the study done by Tortonese and colleagues (2020) who asserted that the mean CRP level of patients was 65 mg/L while the range was 6-123 mg/L.¹³ Another study performed by Stefan et al. (2021) highlighted that among patients mean CRP was 96 mg/L while the range was 23-192 mg/L. But Chan and fellows (2021) reported more CRP values than our study and confirmed that the mean CRP of patients was 153 mg/L and the range was 80-250 mg/L.⁵

It is pertinent to mention that in our study only 22.7% of patients required mechanical ventilation while a study carried out by Turgutalp and coworkers (2020)

elucidated that a significant majority (69.5%) of the patients required mechanical ventilation.

The mortality rate is observed high among patients on maintenance dialysis with COVID-19. *In our study 15 patients expired in the hospital (mortality rate 34.1%). The findings of our study are almost comparable with a study conducted by Javaid and coworkers (2020) who asserted that the in-hospital mortality rate was 35.7%.² Several studies carried out in different parts of the world by Islam et al. (2021)¹¹, Trivedi et al. (2020)¹⁸ Tortonese et al. (2020),¹³ Jung et al. (2020),¹⁶ and Luo et al., (2020)²⁰ reported that mortality rates were 17.6%, 37.8%, 27.3%, 14.3%, and 18.5%, respectively.*

During the study association of outcome (discharged/expired) with patients' age, gender, dialysis, heparin prophylaxis, dexamethasone, and mechanical ventilation was evaluated. A study showed significant association ($P < 0.05$) only with mechanical ventilation while other variables had an insignificant association ($P > 0.05$). A study carried out by Stefan and coworkers (2021) found a significant association ($P = 0.04$) between outcome and age but an insignificant association ($P = 0.06$) between outcome and gender.⁶ Chan and fellows (2021) showed insignificant association ($P = 0.96$) between outcome and heparin. Another study conducted by Turgutalp and coworkers (2020) demonstrated a significant association ($P < 0.001$) between outcome and mechanical ventilation.¹⁹

Conclusion

The study concluded that elevated levels of inflammatory markers such as ferritin and CRP are found among patients on maintenance dialysis with COVID-19 and have no significant association with outcomes. Further large-scale studies are required to be conducted among patients on maintenance dialysis with COVID-19.

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