Factors related to mortality in patients with stage 5 chronic kidney disease on dialysis with COVID-19: An exploratory case series analysis

Yanissa Venegas Justiniano[a, b]*, César Loza Munarriz[b, c], Abdías Hurtado Aréstegui[a, b]

[a] Servicio de Nefrología, Hospital Nacional Arzobispo Loayza, Lima, Perú
[b] Facultad de Medicina, Universidad Peruana Cayetano Heredia, Lima, Perú
[c] Servicio de Nefrología, Hospital Nacional Cayetano Heredia, Lima, Peru
[2] Servicio de Nefrología, Hospital Nacional Cayetano Heredia, Lima, Perú

*** Corresponding author**
joanna.venegas.j@upch.pe

Citation
Venegas Justiniano Y, Loza Munarriz C, Hurtado Aréstegui A. Factors related to mortality in patients with stage 5 chronic kidney disease on dialysis with COVID-19: An exploratory case series analysis. *Medwave* 2022;22(11):e2562

DOI
10.5867/medwave.2022.11.2562

Submission date
Jan 19, 2022
Acceptance date
Dec 19, 2022
Publication date
Dec 29, 2022

Keywords
Renal insufficiency, renal dialysis, coronavirus infections, COVID-19, survival. (MeSH)

Postal address
Av Horacio Urteaga 722Dpto 804, Jesús María, Lima, Peru

Abstract

Introduction

Different studies describe the clinical profile and factors that could explain the evolution and outcome of patients with chronic kidney disease and COVID-19. This study aims to evaluate the factors related to the mortality of patients with stage-5 chronic kidney disease on chronic dialysis hospitalized for COVID-19 at the Hospital Nacional Arzobispo Loayza from April to December 2020.

Methods

Retrospective case series and exploratory analysis were performed. Patients with stage-5 chronic kidney disease on dialysis, older than 18 years, and hospitalized for COVID-19 disease were included. Hospital medical records were the primary data source.

Results

A total of 105 medical records were reviewed. 57 were male (54.3%), with a mean age of 58.6 years (standard deviation: 14.3). Eighty-four patients survived (80%), and 21 died (20%). The main cause of hospital admission, present in 80 patients (76.2%), was respiratory failure; the mean hospital stay was of 11.8 days (SD: 7.8). In the bivariate analysis: patients with moderate to severe COVID-19, overweight and obesity, increased levels of leukocytes, D-dimer, ferritin, C-reactive protein, lactate dehydrogenase, as well as, decreased levels of lymphocytes, bicarbonate and arterial oxygen pressure/inspired oxygen fraction were related to mortality risk. In multivariate analysis, only severe COVID-19 disease (OR 1.48; 95% CI 2.24 to 7.77), C-reactive protein > 10 mg/dL (OR: 9.72; 95% CI: 1.41 to 18.58), and arterial oxygen pressure/inspired oxygen fraction ≤ 150 millimeters of mercury (OR: 10.23; 95% CI: 5.87 to 36.06) were factors associated with poor survival.

Conclusions

In patients with stage-5 chronic kidney disease hospitalized for COVID-19, severe COVID-19 disease, C-protein reactive levels > 10 milligrams per deciliter, arterial oxygen pressure / inspired oxygen fraction ≤ 150 millimeters of mercury and severe COVID-19 disease were the main factors related to mortality.

Main messages

- The study explores factors related to mortality in patients with stage-5 chronic kidney disease on dialysis with COVID-19.
- Inflammatory response and oxygen were the most important factors related to the survival of hospitalized patients.
- The study's main limitation is the type of design: it is a retrospective study in which the primary data source is the hospital's medical records.

Introduction

The World Health Organization (WHO) declared the coronavirus-19 disease (COVID-19) pandemic in March 2020. This was initially identified in a group of patients with respiratory compromise in December 2019 in Wuhan. The infection spread rapidly throughout Asia, Europe, and other continents; in Peru, the first case was identified on March 6th, 2020, and to date, several cases and high mortality rates have been reported, ranking as the fifth most affected country in Latin America [1–7].

Infection is more frequent in older adults and males, with comorbidities such as diabetes mellitus and other immunosuppressive conditions. The clinical presentation is characterized by persistent fever, lymphopenia, high ferritin, pulmonary involvement in more than 50% of cases, and other findings associated with increased interleukins [8–12].

Chronic kidney disease shows a progressive increase in frequency associated with the need for replacement therapy in any of its modalities [2]. The population with chronic kidney disease in all stages has multiple comorbidities associated with increased mortality during COVID-19 disease. The immune response of patients with chronic kidney disease is diminished, with less chance of presenting cytokine storm, which explains why some case series presents low percentages of severe manifestations. However, thay are at increased risk of severe respiratory infections due to associated comorbidities, nutritional status and hospital admissions [12–15].

Studies of hemodialysis patients with COVID-19 show different results. Some report mild disease with non-severe pneumonia, associated with reduced immune response and decreased cytokine storm [15,16]. In contrast, another study reported a 28% mortality with severe clinical manifestations [17]. There is consensus that: older age, diabetes, hypertension, cardiovascular disease, lung disease, a less efficient immune system, outpatient hemodialysis in overcrowded dialysis centers, together with the number of years on dialysis and increased inflammatory markers, lead to increased prevalence and mortality [18–21].

In Latin America, there is little information on the burden of COVID-19 in hospitalized patients with stage-5 chronic kidney disease on dialysis so this data would be important to optimize care strategies and clinical outcomes.

The study's main objective is to evaluate the factors related to the mortality of patients with stage-5 chronic kidney disease on dialysis with COVID-19 disease in a public hospital in Lima, Perú.

Methods

Design and population

This is a retrospective case series study made at the Hospital Nacional Arzobispo Loayza in Lima, Perú, between April and December 2020. This public hospital is a national referral center and belongs to the Peruvian Ministry of Health (MINSA). The study population was selected by non-probabilistic sampling, including the entire universe of patients hospitalized with stage-5 chronic kidney disease on renal replacement therapy and COVID-19 disease during the study period.

Inclusion criteria were hospitalized patients older than 18 years; having stage-5 chronic kidney disease on hemodialysis or chronic peritoneal dialysis; renal transplant patients with functioning kidneys; patients who started chronic hemodialysis or peritoneal dialysis during hospitalization; clinical diagnosis of COVID-19 disease made by their treating physician and/or diagnosis of COVID-19 in the discharge summary, including antigen testing or reverse transcriptase polymerase chain reaction (RT-PCR) test on a nasopharyngeal swab. Exclusion criteria were patients diagnosed with acute kidney injury, an episode of acute kidney injury on chronic kidney disease, and incomplete data in clinical history records. All were new cases of COVID-19; 107 patients diagnosed with stage-5 chronic kidney disease and COVID-19 disease were registered; 105 met the inclusion criteria. The primary data source was clinical records, which were recorded retrospectively, assigning sequential numbering.

Variables

The study included demographic, clinical, and laboratory variables; the dependent variable was vital status at discharge. Clinical and laboratory data were considered within the first 24 hours of hospital admission and processed in the laboratory. Patients did not receive any vaccine against COVID-19 since, during that period, it was not yet available in our country.

The variables were: age categorized ≤ 60 years and > 60 years, sex, body mass index (underweight, normal, overweight, and obese), hypertensive and non-hypertensive etiology of chronic kidney disease, smoking history, cause of hospitalization, dialysis admission modality (new: patient with stage-5 chronic kidney disease starting dialysis during hospitalization, and chronic: patient with stage-5 chronic kidney disease, receiving regular maintenance dialysis prior to hospitalization), the severity of COVID-19 disease: mild, moderate and severe [22], inflammatory parameters (hemoglobin, C-reactive protein, ferritin, D-dimer, Lactate dehydrogenase, lymphocyte, and leukocyte counts), blood gas values (pH, bicarbonate, partial oxygen pressure and arterial oxygen pressure / inspired oxygen fraction), urea, creatinine, hospital stay, renal replacement therapy modality: chronic hemodialysis or chronic peritoneal dialysis.

Additionally, laboratory variables were classified according to reference value: lymphocytes (> 1000 and ≤ 1000 cells per microliter) [16], leukocytes (≤ 11 000 and > 11 000 cells per milliliter) [16], platelets (>150 000 and ≤ 150 000 cells per microliter) [16], D - dimer (≤ 1.5 and > 1. 5 milligrams per liter) [14], ferritin (≤ 1000 and > 1000 milligrams per deciliter), C-reactive protein (≤ 10 and > 10 milligrams per deciliter) [14], lactate dehydrogenase (≤ 400 and > 400 international units per liter) [14], bicarbonate > 20 and ≤ 20 millimoles per liter) [13], potassium (≤ 5.5 and > 5.5 mmol/L) [13], alanine aminotransferase (< 40 and ≥ 40 U/L) [13], aspartate aminotransferase (< 40 and ≥ 40 U/L) [13], and arterial oxygen pressure/inspired oxygen fraction (> 150 and ≤ 150 millimeters of mercury).

Ethics

The Institutional Ethics and Research Committee of the Cayetano Heredia Peruvian University approved the study under the number 039-01-21. Since it is a retrospective study, it is exempt from informed consent.

Statistical analysis

Descriptive statistics: We used means and standard deviation to describe the numerical variables with normal distribution. Normality was assessed with the Shapiro-Wilks test. Categorical variables were described in proportions (%). Frequency tables are presented, including clinical, demographic, laboratory characteristics, and mortality.

Inferential statistics: Being an exploratory analysis, we used relative risk to assess the association between categorical variables and outcome (relative risk and 95% confidence intervals). For multivariate analysis, logistic regression models were used. In addition, the variables sex and age were also included in the model because they were considered potential confounders. Data were analyzed with Stata software version 17. For the analysis, $p < 0.05$ was considered statistically significant.

Table 1. General characteristics of stage-5 chronic kidney disease on dialysis and COVID-19: Hospitalized patients (n=105).

Characteristic	n (105)	%
Male	**57**	**54.3**
Age (years)		
≤ 60	57	54.3
> 60	48	45.7
Chronic kidney disease etiology		
Nephroangiosclerosis	57	54.3
Diabetic nephropathy	26	24.8
Unknown	16	15.3
Obstructive uropathy	3	2.8
Others	3	2.8
Cause of hospitalization		
Respiratory insufficiency	80	76.2
Acid-base disorder/electrolytes	11	10.5
Severe anemia	5	4.8
Sensory disorder	4	3.7
Other	5	4.8
Comorbidities		
Arterial hypertension	102	97.1
Diabetes mellitus	25	23.8
Obesity	8	7.6
Obstructive uropathy	6	5.7
Hypothyroidism	4	3.8
Others	6	5.7
Symptom		
Dyspnea	75	71.4
General discomfort	15	14.3
Fever	12	11.4
Other	3	2.9
COVID-19 severity		
Mild	4	3.8
Moderate	56	53.3
Severe	45	42.9
Body mass index (kg/m2)		
Normal	65	61.7
Overweight	32	30.8
Obese	8	7.5
Death	21	20
Hospital stay duration (days)[1]	11.8 ± 7.8	

[1]Hospital stay is expressed as mean ± standard deviation (SD).
Source: Based on the results of this study.

Results

In the study period, 105 patients diagnosed with stage-5 chronic kidney disease and COVID-19 disease were evaluated. Mean age was 58.6 years (standard deviation: 14.3), 57 patients (54.3%) were male, and the most frequent etiology of chronic kidney disease were arterial hypertension and diabetic nephropathy (Table 1).

Of the patients who started hemodialysis during hospitalization, 40 (38.1%) did so for the first time. The indications for

Table 2. Factors related to mortality among patients with stage-5 chronic kidney disease on dialysis with COVID-19, sociodemographic and clinical factors (n=105).

Variable	Alive		Deceased		
	n (84)	%	n (21)	%	Relative risk (95% CI)
Age (years)					
≤ 60	48	84.2	9	15.8	
> 60	36	75	12	25	1.77 (0.69 to 4.58)
Sex					
Female	39	83	8	17	
Male	45	77.6	13	22.4	1.47 (0.57 to 3.84)
Dialysis admission modality					
New	31	77.5	9	22.5	
Chronic	53	81.5	12	18.5	1.28 (0.49 to 3.33)
Smoker					
No	81	81	19	19	
Yes	3	60	2	40	0.71 (0.39 to 2.34)
Chronic kidney disease etiology					
Arterial hypertension	44	78.6	12	21.4	
No Arterial hypertension	40	81.6	9	18.4	0.85 (0.39 to 2.34)
COVID-19 severity					
Mild	4	80	1	20	
Moderate/Severe	80	80	20	20	1.10 (1.09 to 4.21)
Body mass index (kg/m^2)					
Normal	39	60	26	40	
Overweight/Obese	15	37.5	25	62.5	1.51 (1.11 to 1.92)

Source: Based on the results of this study.

dialysis were: pulmonary congestion, present in 46 (43.8%); hyperkalemia in 40 (38.1%); metabolic acidosis in 12 (11.4%) and uremic encephalopathy in 5 (4.8%); 104 (99.04%) received hemodialysis and only one (0. 96%) peritoneal dialysis. The initial vascular access used was temporary central venous catheter 51 (48.5%) followed by tunneled catheter 34 (32.4%) and 20 (19.1%) arteriovenous fistulas; 46 (43.8%) required oxygen mask and 39 (37.1%) nasal cannula, the mean body mass index was 24.3 kilogram per square meter (SD 3.87).

In the bivariate analysis, patients with moderate to severe COVID-19 disease had 1.10 (95% CI: 1.09 to 4.21) times the risk of dying than those with a mild presentation. Those who were overweight and obese had 1.51 (1.11 to 1.92) times the risk of dying than those with normal body mass index. Similarly, patients with lymphocytes ≤ 1000 cells per microliter, leukocytes > 11 000 cells per microliter, D-dimer >1.5 milligrams per liter, ferritin >1000 milligrams per deciliter, C-reactive protein >10 milligrams per deciliter, lactate dehydrogenase >400 international units per liter, bicarbonate < 20 millimoles per liter and arterial oxygen pressure/ fraction of inspired oxygen ≤ 150 millimeters of mercury, were at higher risk than those with normal values (tables 2 and 3).

In the multivariate analysis using logistic regression, the following outcomes were associated with mortality: severe clinical condition of COVID-19, C-protein reactive mg/dL > 10, and PaO_2/FiO_2 < 150 mmHg, had 1.48 (95% CI 2.24 to 7.77), 9.72 (1.41 to 8.58) and 10.23 (5.87 to 36.06) times the risk of dying compared to those who did not have this condition, adjusted for age and sex. (Table 4)

The mortality rate was 20%, and there was no difference between patients in the chronic hemodialysis program and those who started hemodialysis during hospitalization.

Discussion

In this study, an exploratory analysis was carried out to evaluate possible factors related to mortality in patients with stage-5 chronic kidney disease on dialysis with COVID-19, taking into account that during the pandemic, patients with stage-5 chronic kidney disease on renal replacement therapy were a vulnerable population, presenting with mild, moderate and severe infection. Among them, there was a higher need for hospitalization, intensive care unit admission, and mortality [4,23].

In the present study, most patients were male, and hypertension (97.1%) and diabetes mellitus (23.8%) were the most frequent comorbidities, similar to the general population [9,10,13]. The main cause of hospitalization was respiratory failure (76.2%), requiring oxygen support with oxygen masks, similar to other series [15,23–26]. Cai *et al.* reported that six (15.5%) of patients with chronic kidney disease were admitted to the intensive care unit [26], differing from the present study. No patient was admitted to critical care units, due to high demand and limited capacity to care for this type of patients [15,23–26]. Concerning

Table 3. Factors related to mortality among patients with stage-5 chronic kidney disease on dialysis with COVID-19, laboratory factors (n=105).

Variable	Alive		Deceased		Risk relative (95% CI)
	n	%	n	%	
Creatinine mg/dL					
≤ 7	21	39.6	32	60.4	Ref.
> 7	17	32.7	35	67.3	1.21 (0.58 to 3.21)
Lymphocytes cell count x uL					
> 1000	32	94.1	2	5.9	Ref
≤ 1000	52	73.2	19	26.8	1.28 (1.95 to 4.89)
Leukocytes cell count x uL					
≤ 11 000	48	96	2	4	Ref
> 11 000	34	61.8	21	38.2	1.55 (2.28 to 38.02)
Platelets cell count x uL					
> 150 000	70	78.7	19	21.3	Ref.
≤ 150 000	14	87.5	2	12.5	0.89 (0.15 to 2.27)
D-dimer mg/L					
≤ 1,5	49	89.1	6	10.9	Ref
> 1,5	35	70	15	30	1.27 (1.15 to 6.53)
Ferritin mg/dL					
≤ 1000	57	89.1	7	10.9	Ref
> 1000	27	65.9	14	34.1	1.35 (1.34 to 7.08)
CRP mg/dL					
≤ 10	58	98.3	1	1.7	Ref
> 10	26	56.5	20	43.5	1.74 (1.57 to 20.13)
LDH U/L					
≤ 400	52	98.1	1	1.9	Ref
> 400	32	61.5	20	38.5	1.59 (2.83 to 36.40)
HCO_3 mmol/L					
> 20	56	93.3	4	6.7	Ref
≤ 20	28	62.2	17	37.8	1.51 (1.24 to 15.68)
Potassium mmol/L					
≤ 5.5	53	76.8	16	23.2	Ref.
> 5.5	31	86.1	5	13.9	0.89 (0.24 to 1.51)
ALT U/L					
< 40	25	80.7	6	19.3	Ref.
≥ 40	59	79.7	15	20.3	1.05 (0.45 to 2.45)
AST U/L					
< 40	16	76.2	5	23.8	Ref.
≥ 40	68	80.9	16	19.1	0.94 (0.33 to 1.93)
PaO_2/FiO_2 mmHg					
> 150	79	97.5	2	2.5	Ref
≤ 150	5	20.8	19	79.2	4.68 (4.03 to 27.95)

ALT: alanine aminotransferase. AST: aspartate aminotransferase. CRP: C-protein reactive. IU/L: international units per liter. LDH: Lactate dehydrogenase. PaO_2/FiO_2: Arterial Oxygen Pressure / Inspired Oxygen Fraction. cell/uL: cells per microliter. g/dL: grams per deciliter. mg/dL: milligrams per deciliter. mmHg: millimeters of mercury. mmol/L: millimoles per liter. HCO_3: bicarbonate. Ref.: Reference.
Source: Based on the results of this study.

body mass index, a direct association between obesity and increased risk of COVID-19 disease is known. In this study, the prevalence of overweight was 30.48% and obesity 7.1%, lower than that reported in other studies and unrelated to mortality. This is explained by the fact that in our population on chronic dialysis, obesity is less prevalent than in the general population [15,18,27–29].

The indications for dialysis were pulmonary congestion, hyperkalemia, and metabolic acidosis [15,23–28], due to irregular outpatient hemodialysis (shortened dialysis time, irregular dialysis attendance due to fear of infection, or lack of money).

A short-term mortality rate in patients with COVID-19 disease and on chronic dialysis has been documented to range between

Table 4. Factors related to mortality: Adjusted and unadjusted odds ratios.

Variable	Bivariate analysis			Multivariate analysis		
	OR	95% CI	p	OR	95%CI	p
Sex						
Female	Ref.			Ref.		
Male	1.11	0.91 to 1.19	0.291	1.23	0.48 to 3.17	0.655
Age (years)						
≤ 60	Ref.			Ref.		
> 60	1.01	0.98 to 1.04	0.418	1.02	0.91 to 1.14	0.423
COVID-19 severity						
Mild	Ref.			Ref.		
Moderate	1.92	0.82 to 1.35	0.436	1.21	0.71 to 2.31	0.091
Severe	1.54	4.51 to 5.23	< 0.001	1.48	2.24 to 7.77	0.042
Body mass index (kg/m2)						
Normal	Ref.			Ref.		
Overweight	1.18	0.88 to 3.48	0.059	1.11	0.49 to 1.84	0.098
Obese	1.42	1.01 to 6.32	0.111	1.29	1.0 to 5.81	0.213
Lymphocytes cell count x uL						
> 1000	Ref.			Ref.		
≤ 1000	9.01	3.73 to 21.71	0.027	6.88	3.93 to 47.42	0.751
Leukocytes cell count x uL						
≤ 11 000	Ref.			Ref.		
> 11 000	3.8	1.20 to 15.12	0.012	2.58	0.78 to 5.84	0.842
D-dimer mg/L						
≤ 1.5	Ref.			Ref.		
> 1.5	2.87	1.11 to 7.42	0.029	0.67	0.12 to 3.66	0.648
Ferritin mg/dL						
≤ 1000	Ref.			Ref.		
> 1000	3.05	1.22 to 7.06	0.016	2.26	0.81 to 6.31	0.117
CRP mg/dL						
≤ 10	Ref.			Ref.		
> 10	7.73	3.71 to 10.82	0.001	9.72	1.41 to 18.58	0.021
LDH U/L						
≤ 400	Ref.			Ref.		
> 400	6.32	3.12 to 9.07	0.002	4.62	0.49 to 13.38	0.182
HCO_3 mmol/L						
> 20	Ref.			Ref.		
≤ 20	7.58	2.53 to 12.65	0.001	1.23	0.31 to 4.85	0.763
PaO_2/FiO_2 mmHg						
> 150	Ref.			Ref.		
≤ 150	8.31	8.83 to 16.49	0.001	10.23	5.87 to 36.06	< 0.001

AST: aspartate aminotransferase. CRP: C-protein reactive ALT: alanine aminotransferase. IU/L: international units per liter. LDH: Lactate dehydrogenase. PaO_2/FiO_2: arterial oxygen pressure / inspired oxygen fraction. cell/uL: cells per microliter. mg/dL: milligrams per deciliter. mmol/L: millimoles per liter. mmHg: millimeters of mercury.. HCO_3: Bicarbonate. Ref.: Reference.
Source: Based on the results of this study.

20 and 30% [29–31]. A Peruvian study reported mortality rates of 16.3% in hospitalized patients [32]; in our investigation, mortality was 20%, similar to what has already been reported.

Sosa *et al.* [29] reported a decrease in survival during hospitalization for COVID-19 disease related to the disease severity and inflammatory markers. In our study, survival was 65.3% and 56% at days 20 and 30 of hospitalization, respectively, lower than the general population [31,33].

There is evidence that the factors associated with increased mortality are age, male gender, comorbidities such as hypertension, diabetes mellitus, obesity, inflammatory markers, and respiratory involvement [26–33]. In the present investigation, and a spanish study, no relationship was found between age, gender, and comorbidities [34].

Regarding laboratory markers, there are reports of the relationship between increased leukocytes, C-protein reactive, lactate

dehydrogenase, ferritin, D-dimer, and decreased lymphocytes with mortality, related to an exaggerated inflammatory response in patients with COVID-19. Such findings are congruent with ours [31–34]. It is described that oxygen saturation < 90% persistent despite oxygen administration, oxygen partial pressure < 68 millimeters of mercury, and decreased arterial oxygen pressure/inspired oxygen fraction are associated with increased mortality in the context of severe respiratory compromise [35]. In this series, most patients were observed to require oxygen support and showed a significantly low arterial oxygen pressure/inspired oxygen fraction.

In our study, increased inflammatory markers and decreased oxygenation status indicators were related to increased mortality. Variables associated with lower survival were C-reactive protein values >10 milligrams per deciliter and arterial oxygen pressure/inspired oxygen fraction values ≤ 150 millimeters of mercury, similar to that described by Wang *et al.* [35], who mentioned that arterial oxygen pressures/inspired oxygen fraction < 136 millimeters of mercury were characteristic of patients with higher mortality. On the other hand, Turgutalp *et al.* [36] noted that an increase of more than ten times the normal value of C-reactive protein was associated with lower survival, the latter in patients hospitalized on maintenance hemodialysis. In addition, severe COVID-19 disease was associated with increased mortality in a study evaluating more than 300 patients undergoing chronic hemodialysis, as in the present report [37].

The study's main limitations are that it is a retrospective study and that the main source of data was hospital medical records, which may implicitly compromise the validity and reliability of the recorded data. Two different groups of patients are described: chronic and new, which could constitute two different populations, with different hospitalization admission conditions and mortality risk, despite the fact that the groups were comparable in all the variables evaluated, except for creatinine levels. This potential bias source could be handled with a larger sample size and a longer follow-up time. Data such as time on dialysis prior to hospital admission (of patients on chronic dialysis) and the number of hemodialysis sessions were unavailable.

The results obtained in the study provide insight into the presentation and clinical outcome of COVID-19 disease in patients with chronic kidney disease on dialysis. This information could be used to reduce the morbidity and mortality of these patients, even more so knowing that in Latin America, there is a progressive increase in patients with chronic kidney disease whose approach and maintenance are still deficient, generating high costs for the healthcare system. Additional studies should be carried out in our region, including a larger number of patients, distributed according to the dialysis modality, and evaluating the evolution of survivors after COVID-19 disease.

Conclusion

In patients with stage-5 chronic kidney disease hospitalized for COVID-19, severe COVID-19 disease, C-protein reactive levels > 10 milligrams per deciliter, arterial oxygen pressure/inspired oxygen fraction ≤ 150 millimeters of mercury and severe COVID-19 disease were the main factors associated with mortality.

Notes

Contributor roles

YV: design, study development, data collection, analysis, and article writing. CL: statistical analysis, interpretation, critical review, and approval of the final version. AH: critical review and approval of the final version.

Acknowledgments

To the nephrology unit of the Hospital Nacional Arzobispo Loayza for their hard work.

Competing interests

The authors declare no competing interests.

Funding

The authors declare no source of funding for this study.

Ethics

The Institutional Ethics and Research Committee of the Cayetano Heredia Peruvian University approved the study under the number 039-01-21. Since it is a retrospective study, it is exempt from informed consent.

Provenance and peer review

Not commissioned. Externally peer-reviewed by five peer reviewers, double-blind.

Language of submission

English.

Data availability statement

Data are available upon request to the corresponding author.

References

1. Roper T, Kumar N, Lewis-Morris T, Moxham V, Kassimatis T, Game D, et al. Delivering Dialysis During the COVID-19 Outbreak: Strategies and Outcomes. Kidney Int Rep. 2020;5: 1090–1094. https://doi.org/10.1016/j.ekir.2020.05.018
2. Sarnak M, Jaber B. Mortality caused by sepsis in patients with end-stage renal disease compared with the general population. Kidney Int. 2020;58: 1758–1764. https://doi.org/10.1111/j.1523-1755.2000.00337
3. Verma A, Patel AB, Tio MC, Waikar SS. Caring for Dialysis Patients in a Time of COVID-19. Kidney Med. 2020;2: 787–792. https://doi.org/10.1016/j.xkme.2020.07.006

4. Ajaimy M, Melamed ML. COVID-19 in Patients with Kidney Disease. Clin J Am Soc Nephrol. 2020;15: 1087–1089. https://doi.org/10.2215/CJN.09730620
5. Alberici F, Delbarba E, Manenti C, Econimo L, Valerio F, Pola A, et al. Management of Patients on Dialysis and With Kidney Transplantation During the SARS-CoV-2 (COVID-19) Pandemic in Brescia, Italy. Kidney Int Rep. 2020;5: 580–585. https://doi.org/10.1016/j.ekir.2020.04.001
6. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395: 497–506. https://doi.org/10.1016/S0140-6736(20)30183-5
7. Robinson BM, Guedes M, Alghonaim M, Cases A, Dasgupta I, Gan L, et al. Worldwide Early Impact of COVID-19 on Dialysis Patients and Staff and Lessons Learned: A DOPPS Roundtable Discussion. Kidney Med. 2021;3: 619–634. https://doi.org/10.1016/j.xkme.2021.03.006
8. Rabb H. Kidney diseases in the time of COVID-19: major challenges to patient care. J Clin Invest. 2020;130: 2749–2751. doi https://doi.org/10.1172/JCI138871 https://doi.org/10.1172/JCI138871
9. Hsu CM, Weiner DE. COVID-19 in dialysis patients: outlasting and outsmarting a pandemic. Kidney Int. 2020;98: 1402–1404. https://doi.org/10.1016/j.kint.2020.10.005
10. UK renal registry. Weekly COVID-19 Surveillance Report for Renal Centres in the UK; London – up to 22 April 2020. Bristol, UK: The Renal Association; 2020. https://ukkidney.org/sites/renal.org/files/ALL_REGIONS_CENTRES_covid_report_01072020
11. American Society of Nephrology. Nephrologists Transforming Dialysis Safety (NTDS), coronavirus disease 2019. 2020. https://www.asn online.org/ntds
12. Mokrzycki MH, Coco M. Management of Hemodialysis Patients with Suspected or Confirmed COVID-19 Infection: Perspective of Two Nephrologists in the United States. Kidney360. 2020;1: 273–278. https://doi.org/10.34067/KID.0001452020
13. Alberici F, Delbarba E, Manenti C, Econimo L, Valerio F, Pola A, et al. A report from the Brescia Renal COVID Task Force on the clinical characteristics and short-term outcome of hemodialysis patients with SARS-CoV-2 infection. Kidney Int. 2020;98: 20–26. https://doi.org/10.1016/j.kint.2020.04.030
14. Fisher M, Yunes M, Mokrzycki MH, Golestaneh L, Alahiri E, Coco M. Chronic Hemodialysis Patients Hospitalized with COVID-19: Short-term Outcomes in the Bronx, New York. Kidney360. 2020;1: 755–762. https://doi.org/10.34067/KID.0003672020
15. Ozturk S, Turgutalp K, Arici M, Odabas AR, Altiparmak MR, Aydin Z, et al. Mortality analysis of COVID-19 infection in chronic kidney disease, haemodialysis and renal transplant patients compared with patients without kidney disease: a nationwide analysis from Turkey. Nephrol Dial Transplant. 2020;35: 2083–2095. https://doi.org/10.1093/ndt/gfaa271
16. Ma Y, Diao B, Lv X, Liang W, Zhu J, Liu L, et al. COVID-19 in hemodialysis (HD) patients: Report from one HD center in Wuhan, China. Nephrology. 2019. 10.1101/2020.02.24.20027201 https://doi.org/10.1101/2020.02.24.20027201
17. Rombolà G, Brunini F. COVID-19 and dialysis: why we should be worried. J Nephrol. 2020;33: 401–403. https://doi.org/10.1007/s40620-020-00737-w
18. Corbett RW, Blakey S, Nitsch D, Loucaidou M, McLean A, Duncan N, et al. Epidemiology of COVID-19 in an Urban Dialysis Center. J Am Soc Nephrol. 2020;31: 1815–1823. https://doi.org/10.1681/ASN.2020040534
19. Yang D, Xiao Y, Chen J, Chen Y, Luo P, Liu Q, et al. COVID-19 and chronic renal disease: clinical characteristics and prognosis. QJM. 2020;113: 799–805. https://doi.org/10.1093/qjmed/hcaa258
20. Wu J, Li J, Zhu G, Zhang Y, Bi Z, Yu Y, et al. Clinical Features of Maintenance Hemodialysis Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. Clin J Am Soc Nephrol. 2020;15: 1139–1145. https://doi.org/10.2215/CJN.04160320
21. Pio-Abreu A, do Nascimento MM, Vieira MA, de Menezes Neves PDM, Lugon JR, Sesso R. High mortality of CKD patients on hemodialysis with Covid-19 in Brazil. J Nephrol. 2020;33: 875–877. https://doi.org/10.1007/s40620-020-00823-z
22. Prevención y atención de personas afectadas por COVID-19 en el Perú. https://www.gob.pe/institucion/minsa/informes-publicaciones/459969-atencion-y-manejo-clinico-de-casos-de-covid-19
23. Analysis of the Situation of Chronic Kidney Disease in Peru. General Office of Epidemiology Peru department of health. 2015; 1–96. https://doi.org/10.1093/inthealth/ihz071
24. Dorjee K, Kim H, Bonomo E, Dolma R. Prevalence and predictors of death and severe disease in patients hospitalized due to COVID-19: A comprehensive systematic review and meta-analysis of 77 studies and 38,000 patients. PLoS ONE. 2020;15. https://doi.org/10.1371/journal.pone.0243191 https://doi.org/10.1371/journal.pone.0243191
25. Mirjalili H, Dastgheib SA, Shaker SH, Bahrami R, Mazaheri M, Sadr-Bafghi SMH, et al. Proportion and mortality of Iranian diabetes mellitus, chronic kidney disease, hypertension and cardiovascular disease patients with COVID-19: a meta-analysis. J Diabetes Metab Disord. 2021;20: 905–917. https://doi.org/10.1007/s40200-021-00768-5
26. Cai R, Zhang J, Zhu Y, Liu L, Liu Y, He Q. Mortality in chronic kidney disease patients with COVID-19: a systematic review and meta-analysis. Int Urol Nephrol. 2021;53: 1623–1629. https://doi.org/10.1007/s11255-020-02740-3
27. Pakhchanian H, Raiker R, Mukherjee A, Khan A, Singh S, Chatterjee A. Outcomes of COVID-19 in CKD Patients: A Multicenter Electronic Medical Record Cohort Study. Clin J Am Soc Nephrol. 2021;16: 785–786. https://doi.org/10.2215/CJN.13820820
28. Henry BM, Lippi G. Chronic kidney disease is associated with severe coronavirus disease 2019 (COVID-19) infection. Int Urol Nephrol. 2020;52: 1193–1194. https://doi.org/10.1007/s11255-020-02451-9
29. Sosa R, Garcia P, Cipriano EO, Hernández A, Hernández EE, Chavez PI, et al. Coronavirus Disease 2019 in Patients With End-Stage Kidney Disease on Hemodialysis in Guatemala. Kidney Int Rep. 2021;6: 1110–1117. https://doi.org/10.1016/j.ekir.2021.01.028
30. Hilbrands LB, Duivenvoorden R, Vart P, Franssen CFM, Hemmelder MH, Jager KJ, et al. COVID-19-related mortality in kidney transplant and dialysis patients: results of the ERACODA collaboration. Nephrol Dial Transplant. 2020;35: 1973–1983. https://doi.org/10.1093/ndt/gfaa261
31. Jager KJ, Kramer A, Chesnaye NC, Couchoud C, Sánchez-Álvarez JE, Garneata L, et al. Results from the ERA-EDTA Registry indicate a high mortality due to COVID-19 in dialysis patients and kidney transplant recipients across Europe. Kidney Int. 2020;98: 1540–1548. https://doi.org/10.1016/j.kint.2020.09.006
32. Meneses-Liendo V, Medina Chávez M, Gómez Lujan M, Cruzalegui Gómez C, Alarcón-Ruiz CA. Insuficiencia renal y hemodiálisis en pacientes hospitalizados con COVID-19 durante

la primera ola en Lima, Perú. Acta Med Peru. 38: 249–256. http://dx.doi.org/10.35663/amp.2021.384.2169 https://doi.org/10.35663/amp.2021.384.2169

33. Savino M, Casula A, Santhakumaran S, Pitcher D, Wong E, Magadi W, et al. Sociodemographic features and mortality of individuals on haemodialysis treatment who test positive for SARS-CoV-2: A UK Renal Registry data analysis. PLoS ONE. 2020;15. https://doi.org/10.1371/journal.pone.0241263
34. Goicoechea M, Sánchez Cámara LA, Macías N, Muñoz de Morales A, Rojas ÁG, Bascuñana A, et al. COVID-19: clinical course and outcomes of 36 hemodialysis patients in Spain. Kidney Int. 2020;98: 27–34. https://doi.org/10.1016/j.kint.2020.04.031
35. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020;323: 1061–1069. https://doi.org/10.1001/jama.2020.1585
36. Turgutalp K, Ozturk S, Arici M, Eren N, Gorgulu N, Islam M, et al. Determinants of mortality in a large group of hemodialysis patients hospitalized for COVID-19. BMC Nephrol. 2021;22: 29. https://doi.org/10.1186/s12882-021-02233-0 https://doi.org/10.1186/s12882-021-02233-0
37. Ozturk S, Turgutalp K, Arici M, Odabas AR, Altiparmak MR, Aydin Z, et al. Mortality analysis of COVID-19 infection in chronic kidney disease, haemodialysis and renal transplant patients compared with patients without kidney disease: a nationwide analysis from Turkey. Nephrol Dial Transplant. 2020;35: 2083–2095. https://doi.org/10.1093/ndt/gfaa271

Factores relacionados con mortalidad de pacientes con enfermedad renal crónica en estadio 5 en diálisis con COVID-19: Análisis exploratorio de una serie de casos

Resumen

Introducción

Diferentes estudios describen el perfil clínico y los factores que podrían explicar la evolución y el resultado de los pacientes con enfermedad renal crónica y COVID-19. El objetivo de este estudio fue evaluar los factores relacionados con la mortalidad de los pacientes con enfermedad renal crónica estadio-5 en diálisis crónica hospitalizados por COVID-19 en el Hospital Nacional Arzobispo Loayza de abril a diciembre de 2020.

Métodos

Serie de casos retrospectiva y análisis exploratorio. Se incluyeron pacientes con enfermedad renal crónica estadio 5 en diálisis, mayores de 18 años, hospitalizados por COVID-19. La fuente primaria de datos fueron las historias clínicas.

Resultados

Se revisaron 105 historias clínicas. 57 (54,3%) eran varones, con una edad media de 58,6 años (desviación estándar: 14,3). Sobrevivieron 84 (80%) pacientes y fallecieron 21 (20%). La principal causa de ingreso hospitalario fue la insuficiencia respiratoria en 80 (76,2%). La estancia hospitalaria fue de 11,8 días (desviación estándar: 7,8). En el análisis bivariante: los pacientes con COVID-19 moderada a grave, sobrepeso y obesidad, aumento de los niveles de leucocitos, dímero D, ferritina, proteína c reactiva, lactato deshidrogenasa, así como, disminución de los niveles de linfocitos, bicarbonato y presión arterial de oxígeno/fracción inspirada de oxígeno se relacionaron con el riesgo de mortalidad. En el análisis multivariante, sólo la enfermedad grave por COVID-19 (odds ratio: 1,48; intervalo de confianza del 95%: 2,24 a 7,77), la proteína C reactiva > 10 mg/dL (odds ratio: 9,72; intervalo de confianza del 95%: 1,41 a 18,58) y una presión arterial de oxígeno/fracción de oxígeno inspirado ≤ 150 milímetros de mercurio (odds ratio: 10,23; intervalo de confianza del 95%: 5,87 a 36,06) fueron factores asociados a una mala supervivencia.

Conclusiones

En los pacientes con enfermedad renal crónica en estadio-5 hospitalizados por COVID-19, la enfermedad grave por COVID-19, los niveles de proteína C reactiva > 10 miligramos por decilitro, la presión arterial de oxígeno/fracción inspirada de oxígeno ≤ 150 milímetros de mercurio y la enfermedad grave por COVID-19 fueron los principales factores relacionados con la mortalidad.