ORIGINAL ARTICLE

Dialysis-dependent patients' outcomes during Covid-19 hospitalization: early vs. late survival

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Summary

Introduction: During the COVID-19 pandemic, receiving hemodialysis was recognized as a predictor of poor survival. This study evaluated in-hospital and late survival in patients treated with hemodialysis during COVID-19 hospitalization.

Methods: This single-center retrospective study included 176 patients requiring hemodialysis during COVID-19 hospitalization. Patients were divided into three groups: acute kidney injury (AKI), acute-on-chronic kidney disease (aCKD), and chronic hemodialysis (HD). Data was collected from patients' electronic records.

Results: The majority (73.3%) of the study population were chronic hemodialysis patients. The overall in-hospital mortality was high (35.8%), and differed significantly among groups: 82.1%, 57.9% and 22.5% in the AKI, aCKD, and HD patients, respectively ($p<0.001$). After 12 months, death occurred in almost 30% of the reached patients, of whom the majority were from the chronic hemodialysis group.

Conclusion: Dialysis-dependent patients experience high mortality during COVID-19, especially those who develop AKI and aCKD. Chronic hemodialysis patients are exposed to better in-hospital survival; however, their one-year mortality remains significant.

Keywords: COVID-19, acute kidney injury, chronic kidney disease, acute-on-chronic kidney disease, hemodialysis

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INTRODUCTION

The 2019 Coronavirus disease (COVID-19) pandemic has disrupted healthcare systems worldwide due to its sudden onset, rapid spread, and severe disease, thereby requiring reorganization of infrastructure, routine healthcare practices, and treatment strategies (1-5). Given the epidemiological circumstances, hemodialysis units were quickly recognized as in need of adequate management, mainly due to group transportation, prolonged time spent within the dialysis unit, and close contact with other patients and medical staff (4-6). Each country developed its own policy regarding dialysis unit measures, based on available resources and epidemiological situation (2,4,6).

Dialysis-dependent patients, among the other high-risk groups, were considered particularly vulnerable to COVID-19, due to altered immune response, vascular dysfunction, and associated comorbidities (5,7). Furthermore, dialysis patients were prone to atypical symptoms, such as anorexia and fatigue, rather than respiratory symptoms, when compared to the non-dialysis population (5). For that reason, many studies have been developed to analyse the outcomes in this patient population, stating an increased mortality risk of approximately 20-30% (8-11). However, so far, most mortality data in dialysis patients have been examined as short-term outcomes, e.g., 28 days or 3 months, whereas long-term outcomes have been less often evaluated. To date, few studies have assessed one-year survival in this high-risk population.

Although COVID-19 has been found to affect primarily respiratory function, severe forms may lead to multiple organ dysfunction syndrome (MODS), including renal function deterioration (12). Acute kidney injury (AKI) and acute-on-chronic kidney disease (aCKD) were often observed forms of renal function decline, especially in critically ill patients (7). Additionally, both AKI and aCKD were recognized as contributing factors to poor outcomes in COVID-19-positive patients (5,12).

This study aimed to evaluate mortality rates among COVID-19-positive patients receiving hemodialysis during hospitalization.

MATERIALS AND METHODS

This study was a single-center, retrospective, observational analysis of patients requiring hemodialysis during hospitalization for COVID-19 infection at Clinical Hospital Centre Zemun in Belgrade, Serbia, from March 2020 to March 2021, during which the hospital was designated to treat only COVID-19-positive patients. The study protocol was approved by the Ethics Committee of the Clinical Hospital Centre Zemun (approval number15-1/1, approval date 20 June 2023).

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection was confirmed by either an antigen test or a reverse transcriptase polymerase chain reaction (RT-PCR) test. Buccal and nasopharyngeal swabs were taken.

Patients included in the study were aged 18 or older and required hemodialysis during hospitalization. Patients receiving other forms of renal replacement therapy (transplanted patients and peritoneal dialysis patients) were not included in the study. It is necessary to emphasize that, under the national regulations during the first wave of the COVID-19 pandemic in Serbia, all hemodialysis patients who tested positive were required to be hospitalized, regardless of their clinical status.

Based on previously known kidney function, patients were divided into three study groups: AKI, aCKD, and chronic hemodialysis (HD). Diagnosis of AKI was determined following the Kidney Disease Improving Global Outcomes (KDIGO) criteria. At the same time, aCKD included patients with previously known chronic kidney disease (CKD) (evidence of sustained estimated glomerular filtration rate (eGFR) 15 ml/min per 1.73m2 within the 6 months before COVID-19 hospitalization), who did not initiate dialysis before COVID-19 hospitalization, but have experienced kidney function worsening during hospitalization, such as oliguria, anuria, a decrease of estimated glomerular filtration rate and/or uremia (13). Indications for initiating hemodialysis were based on clinical experience, including volume overload and metabolic requirements exceeding native kidney capacity that did not respond to conservative treatment (13,14). The dialysis modality performed in all patients was bicarbonate hemodialysis for 4 hours, as continuous renal replacement therapy (CRRT) was not available during the pandemic.

Patients' demographic data were collected from the hospital's electronic health records. The following baseline characteristics were collected: age, gender, primary disease, comorbidities, hospital duration, in-hospital complications, pneumonia, and acute hypoxemic respiratory failure, with or without mechanical ventilation. The collected data related to in-hospital complications included respiratory failure, sepsis, gastrointestinal bleeding, *Clostridium difficile* infection, and/or arteriovenous fistula thrombosis. For in-hospital outcomes, we recorded whether a patient died during their hospital stay. Laboratory assessment included whole blood count and biochemistry analyses. All patients underwent a chest X-ray on admission and a repeat if required.

In terms of the severity of the clinical condition, patients were observed to be asymptomatic, mild, moderate, severe, or critical. As suggested by the National Institute of Health COVID-19 treatment guideline, the following parameters were evaluated: presence/absence of symptoms such as fever, cough, malaise, muscle pain, shortness of breath, need for oxygen therapy based on hemoglobin oxygen saturation, need for non-invasive and/or invasive mechanical ventilation, radiographic finding of pneumonia (15). According to the proposed guideline,

asymptomatic patients were those who tested positive for SARS-CoV-2 but without any symptoms. Mild illness was defined as a variety of symptoms of COVID-19, excluding shortness of breath, dyspnea, or abnormal chest imaging. Moderate illness was described in patients presenting with symptoms and/or radiographic findings of lower respiratory disease and with oxygen saturation greater than 94% on room air. Severe illness included oxygen saturation below 94% on room air, a respiratory rate above 30 breaths/minute, and/or radiographic findings of more than 50% lung infiltrates. Critical illness was defined in patients with respiratory failure, septic shock, and/or MODS.

The primary outcome was in-hospital and one-year mortality rates across all three study groups. Secondary outcomes were in-hospital complications and need for mechanical ventilation.

All collected data were analyzed and presented in an anonymized form and cannot be linked to any individual patient. Descriptive statistics are presented as median (interquartile range, IQR) or mean ± standard deviation (SD) for continuous variables, and as numbers and percentages for categorical variables. The Shapiro-Wilk test was used to assess the normality of the sample's distribution. Groups were compared by ANOVA for normally distributed data, or the Kruskal-Wallis test if the data did not meet the normality assumption. The Cox proportional hazards model and logistic regression were used to predict in-hospital and 1-year mortality, respectively. For survival analysis, Kaplan-Meier was performed.

Statistical significance for all outcomes was set at $p < 0.05$. Data were analyzed using SPSS (version 20, IBM SPSS Statistics).

RESULTS

During the 12-month observational period, 196 patients received renal replacement therapy during hospitalization in our clinic due to COVID-19 infection. Following the exclusion criteria, 176 patients, who were receiving hemodialysis, were included in the final analyses.

The basic demographic data are presented in **Table 1**. Most patients included in the study were receiving chronic dialysis. No statistically significant difference in patients' age was observed among the groups, although the oldest were among the AKI patients. The majority of the patients were men, except in the AKI group, where men and women were equally represented. Patients with AKI were defined as critically ill, also with the highest rate of sepsis, respiratory failure, mechanical ventilation, and vasopressors when compared to other groups ($p<0.001$). Maintenance HD patients mainly were experiencing a mild form of COVID-19, with the lowest rate of sepsis and respiratory failure compared to AKI and aCKD patients. Almost half of the patients who experienced worsening of previous kidney disease (aCKD) during COVID-19 hospitalization were defined with critical illness and respiratory failure. Bilateral pneumonia was the predominant radiography finding in all study groups, almost equally present in AKI and aCKD. The in-hospital mortality of patients receiving dialysis was 35.8 % in total, being highest in AKI and the least in HD patients, 82.1 % and 22.5 %, respectively. Kaplan-Meier analyses showed that in-hospital survival was significantly higher in HD patients than in the other groups (Log Rank = 36.101; $p < 0.001$) **(Figure 1)**. Median survival was 10, 31, and 16 in

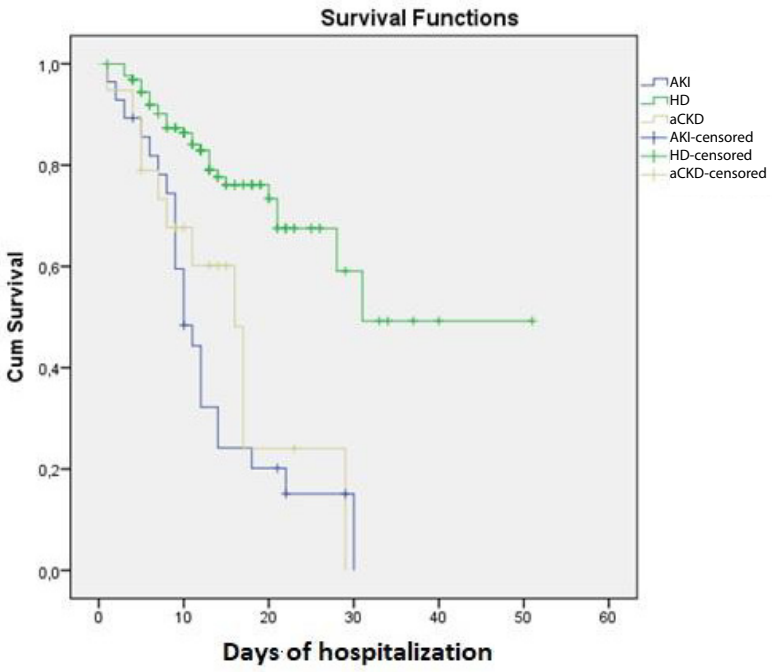

Figure 1. In-hospital survival in patients with acute kidney injury, receiving chronic hemodialysis, and patients with acute-on-chronic kidney disease

Abbreviations: AKI – acute kidney injury, HD – chronic hemodialysis, aCKD - acute-on-chronic kidney disease

Table 1. Demography and clinical data in COVID-19 positive patients receiving dialysis based on renal status

Dialysis status		AKI	HD	aCKD	p-value
Patient number		28	129	19	
Age (X±SD)		70±15	66±12	67±12	0.407
Gender (N, %)	Men	14 (50%)	84 (65.1%)	16 (84.2%)	0.054
	Women	14 (50%)	45 (34.9%)	3 (15.8%)	
Length of stay (days, N)		10 (1-30)	12 (1-51)	10 (1-29)	0.260
Comorbidities (N, %)	HTA	20 (71.4%)	100 (77.5%)	12 (63.1%)	0.380
	Diabetes	12 (42.8%)	32 (24.8%)	7 (36.8%)	0.128
	CVD	11 (39.2%)	46 (35.7%)	8 (47.0%)	0.665
	CVI	5 (17.8%)	6 (4.7%)	1 (5.3%)	0.053
	Malignancy	4 (14.3%)	22 (17.1%)	1 (5.3%)	0.369
	COPD	1 (3.6%)	7 (5.4%)	1 (5.3%)	0.912
Clinical status (N, %)	Asymptomatic	0 (0%)	8 (6.2%)	2 (10.5%)	<0.001
	Mild	2 (7.1%)	50 (38.8%)	1 (5.3%)	
	Moderate	2 (7.1%)	19 (14.7%)	4 (21.1%)	
	Severe	5 (17.9%)	29 (22.5%)	3 (15.8%)	
	Critical	19 (67.9%)	23 (17.8%)	9 (47.4%)	
Pneumonia (N, %)	No	2 (7.1%)	16 (12.4%)	1 (5.3%)	0.464
	Unilateral	1 (3.6%)	13 (10.1%)	1 (5.3%)	
	Bilateral	25 (89.3%)	100 (77.5%)	17 (89.5%)	
Respiratory failure (N, %)		22 (78.6%)	23 (17.8%)	9 (47.4%)	<0.001
Mechanical ventilation (N, %)		19 (67.9%)	21 (16.4%)	6 (33.3%)	<0.001
Vasopressors (N, %)		17 (60.7%)	11 (8.6%)	5 (27.8%)	<0.001
Sepsis (N, %)		6 (21.4%)	7 (5.4%)	2 (10.5%)	0.044
GIT bleeding (N, %)		1 (3.6%)	6 (4.7%)	1 (5.3%)	0.956
Clostidium difficile (N, %)		4 (14.3 %)	10 (7.8%)	1 (5.3%)	0.495
AVF thrombosis (N, %)			13 (10.1%)	1 (5.3%)	1.000
Outcome (N, %)	Discharge	2 (7.1%)	77 (59.7%)	6 (31.6%)	<0.001
	Transferred	3 (10.7%)	23 (17.8%)	2 (10.5%)	
	Death	23 (82.1%)	29 (22.5%)	11 (57.9%)	

Abbreviations: aCKD – acute-on-chronic kidney disease, AKI – acute kidney injury, AVF – arteriovenous fistula, CVD – cardiovascular disease, CVI – cerebrovascular insult, COPD – chronic obstructive pulmonary disease, GIT – gastrointestinal, HD – hemodialysis, HTA – hypertension

the AKI, HD, and aCKD groups, respectively. Notably, a high mortality rate during hospitalization was observed in aCKD patients, over half of the group **(Table 1)**.

Cox regression analysis is presented in **Table 2**. Predictors of in-hospital death were AKI (HR=4.423; p<0.001), aCKD (HR=3.250; p=0.021), prior cardiovascular disease (HR=2.367; p=0.001), respiratory failure (HR=10.438; p<0.001), mechanical ventilation (HR=8.319; p<0.001), vasopressors use (HR=5.753; p<0.001), WBC count (HR=1.041; p<0.001), CRP (HR=1.004; p=0.001), LDH at admission (HR=1.001; p=0.008) and fibrinogen (HR=1.141; p=0.048). When all three study groups were compared as potential predictors for the lethal outcome, chronic HD was marked as protective **(Table 2)**.

A multivariate Cox regression model was performed for the study analyses **(Table 3)**. The model included variables with p<0.1, namely AKI, HD, aCKD, CVD, respiratory failure, vasopressor use, CRP, LDH, and fibrinogen at admission. Statistical significance in the model was observed for respiratory failure (OR=17.783; p<0.001) and prior cardiovascular disease (OR=2.049; p=0.050).

After 1 year, data on 112 patients (99.11%) out of 113 who survived hospitalization were collected successfully: 4 out of 5 from the AKI group, all 100 from HD, and all eight aCKD patients. The overall 1-year mortality among the reached patients was 33 (29.46%), of which one from the AKI group (25%), 32 from the HD group (32%), and none from the aCKD group (0%). **Figure 2** shows mortality rates among the studied patient groups during COVID-19 hospitalization and 1 year after. The predominant cause of death was cardiovascular, whereas other causes were associated with COVID-19 infection or reinfection, cerebrovascular insult, or carcinoma. Univariate logistic regression analyses showed that patients' age, duration of hospitalization, and respiratory failure

Table 2. Univariate Cox regression analysis of the factors influencing mortality during hospitalization in COVID-19 positive patients

Factor	HR	CI 95%		p-value
		Lower limit	Upper limit	
Gender	1.307	0.788	2.168	0.299
Age	1.023	0.999	1.046	0.056
Dialysis				
-HD (reference category)				
-AKI	4.423	2.543	7.693	**<0.001**
-aCKD	3.250	1.614	6.543	**0.001**
HTA	0.685	0.399	1.174	0.169
DM	1.150	0.912	2.498	0.109
CVD	2.367	1.439	3.894	**0.001**
CVI	1.782	0.811	3.918	0.151
Malignancy	0.490	0.211	1.140	0.101
COPD	0.333	0.046	2.402	0.275
Pneumonia	1.448	0.883	2.374	0.143
Respiratory failure	10.438	5.667	19.225	**<0.001**
Mechanical ventilation	8.319	4.805	14.404	**<0.001**
Vasopressors	5.753	3.496	9.468	**<0.001**
Hgb	1.005	0.994	1.017	0.365
WBC	1.041	1.018	1.063	**<0.001**
Plt	1.002	0.999	1.004	0.128
CRP	1.004	1.002	1.007	**0.001**
Ferritin	1.000	1.000	1.000	0.951
LDH	1.001	1.000	1.001	**0.008**
D-dimer	1.000	1.000	1.000	0.238
Fibrinogen	1.141	1.001	1.301	**0.048**

Abbreviations: aCKD - acute-on-chronic kidney disease, AKI – acute kidney injury, CVD – cardiovascular disease, CVI – cerebrovascular insult, COPD – chronic obstructive pulmonary disease, DM – diabetes mellitus, HD – hemodialysis, HTA – hypertension, Hgb – hemoglobin, LDH – lactate dehydrogenase, Plt – platelet, WBC – white blood cells

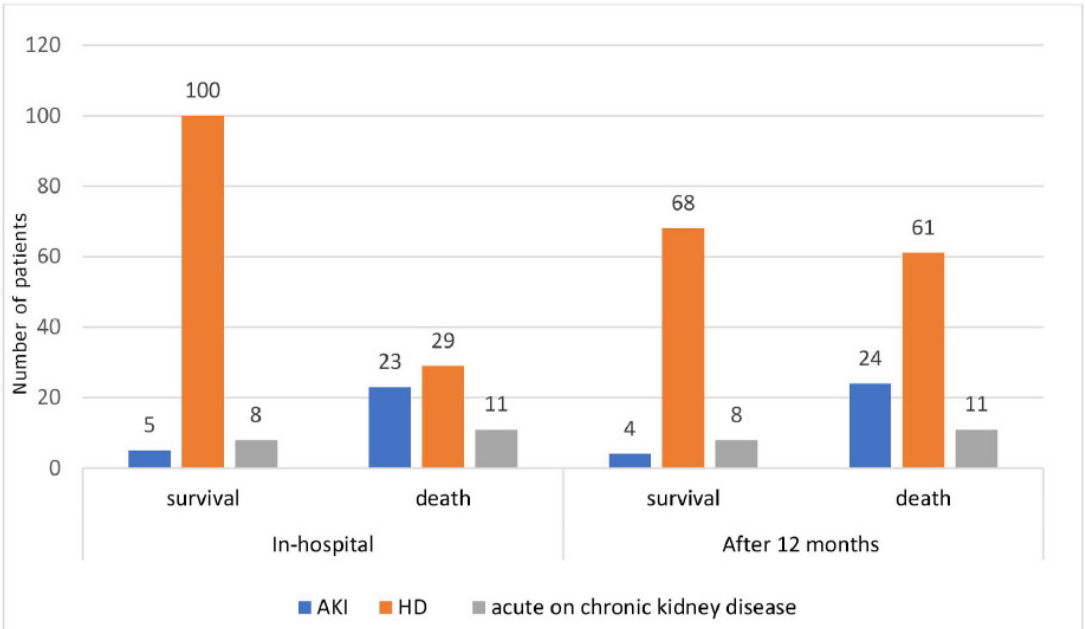

Figure 2. Survivor outcomes during hospitalisation and after 12 months in patients who received dialysis due to acute kidney injury, previous dialysis patients and patients who received dialysis due to acute-on-chronic kidney disease.

Abbreviations: AKI - acute kidney injury, HD - chronic hemodialysis

Table 3. Multivariate Cox regression model of the factors influencing mortality in COVID-19 positive patients

Factor	OR	CI 95%		p-value
		Lower limit	Upper limit	
Dialysis				
-HD (reference category)				
-AKI	0.830	0.346	1.990	0.676
-aCKD	1.017	0. 366	2.829	0.974
CVD	2.049	1.001	4.197	**0.050**
Respiratory failure	17.783	4.639	68.164	**<0.001**
Vasopressors	1.261	0.558	2.852	0.578
CRP	1.001	0.996	1.005	0.767
LDH	1.001	1.000	1.001	0.155
Fibrinogen	1.076	0.870	1.331	0.499

Abbreviations: aCKD - acute-on-chronic kidney disease, AKI – acute kidney injury, CRP – C-reactive protein, CVD – cardiovascular disease, HD – hemodialysis, LDH – lactate dehydrogenase

Table 4. Univariate logistic regression analysis of factors influencing mortality 12 months after COVID-19 hospitalization

Factor	OR	CI 95%		p-value
		Lower limit	Upper limit	
Gender	1.086	0.461	2.555	0.851
Age	1.066	1.024	1.109	**0.002**
Dialysis				
HD (reference category)				
AKI	1.579	0.136	18.394	0.715
aCKD	-	-	-	0.999
Hospitalization duration	0.928	0.882	0.978	**0.005**
HTA	0.509	0.173	1.492	0.218
DM	0.820	0.325	2.069	0.674
CVD	0.437	0.184	1.035	0.060
Respiratory failure	0.096	0.010	0.895	**0.040**
Hgb	0.991	0.971	1.010	0.335
WBC	0.947	0.853	1.052	0.312
Mo	0.969	0.886	1.060	0.491
Neu	1.009	0.983	1.035	0.508
Plt	0.999	0.994	1.005	0.816
CRP	0.997	0.992	1.002	0.248
Ferritin	1.000	1.000	1.000	0.438
LDH	1.000	0.998	1.001	0.587
D-dimer	1.000	1.000	1.000	0.382

Abbreviations: aCKD - acute-on-chronic kidney disease, AKI – acute kidney injury, CVD - cardiovascular disease, CVI – cerebrovascular insult, COPD – chronic obstructive pulmonary disease, DM – diabetes, HD – hemodialysis, HTA – hypertension, Hgb – hemoglobin, LDH – lactate dehydrogenase, Plt – platelet, WBC – white blood cells

were predictors of poor outcome at 12 months of follow-up (**Table 4**). Regarding the complication rate over the 12 months of follow-up, 2 (25%) of the 8 contacted aCKD patients commenced maintenance hemodialysis. Additionally, in 3 out of 100 HD patients, either AVF or deep vein thrombosis occurred within 12 months following the COVID-19 infection.

DISCUSSION

Several key findings were obtained in our single-center observational study of patients with SARS-CoV-2 who commenced dialysis during hospitalization. The highest mortality rate was observed in patients who developed AKI, followed by aCKD. In contrast, chronic HD patients mainly experienced mild clinical presentation and the highest in-hospital survival when compared to other

patients with kidney function impairments. Besides overall poor survival, severe clinical presentation and high burden of complications were observed in AKI patients with COVID-19, which is similar to the previous studies. These observations were explained at the beginning of the pandemic by Ronco and other authors by "organ crosstalk" and the fact that dialysis-dependent AKI reflects high severity of illness (12,16). In support of this, our study showed sepsis, bilateral pneumonia, and respiratory failure to be the common findings in AKI, which is in concordance with AKI presentation in acutely ill patients with medical issues other than COVID-19 (14,16).

Nevertheless, the overall outcome of HD patients in our study is similar to that reported by other authors, including the ERACODA database, and is higher than in the general population (8-11). However, our results imply that the HD population may benefit from a disturbed/suppressed immune response to COVID-19 infection, at least in terms of better survival and a lower complication rate compared to patients with AKI or aCKD. Similar observations have been addressed recently by other authors (17,18). Prietl et al. analyzed cytokine profiles and immune phenotypes in both HD and non-HD COVID-19 patients. They discovered that, in contrast to non-dialysis-dependent patients, T cell counts and cytokine levels did not increase significantly in HD patients in response to COVID-19 infection, thereby limiting viral spread (17). They conclude that chronic inflammation might protect HD patients from severe forms of COVID-19. In support of this, our results show that hospital-acquired complications, such as sepsis and respiratory failure, were least common in the HD population. On the contrary, a rare but significant complication in HD patients was arteriovenous fistula (AVF) thrombosis, which is probably associated with the hypercoagulation state induced by COVID-19 infection itself rather than hemodynamic factors such as stenosis. AVF thrombosis in COVID-19 has been investigated recently by several authors and recognized as a contributing factor to disease severity in dialysis patients, associated with a higher mortality risk (19-20). A new approach beyond the suggested prophylactic use of antiplatelet agents in HD patients with a high thrombosis rate has not yet emerged for specifically COVID-19-positive patients (21).

As previously mentioned, underlying kidney disease has already been recognized as a risk factor for poor outcomes in COVID-19-infected patients. It is mainly explained by uremic toxin accumulation, immune system impairment, vascular dysfunction, and chronic inflammation (7-11,22). The ERACODA database and the Global Burden of Disease Collaboration identified chronic kidney disease (CKD) as the most prevalent risk factor for severe COVID-19 infection (8,10,23). A study developed in the intensive care unit (ICU) patients showed high in-hospital mortality in HD patients, while an intermediate association in previously non-dialysis dependent CKD (7). These data differ from our study, as our results show that patients with underlying kidney disease before COVID-19 have better outcomes than those with AKI.

In contrast, they are significantly worse than HD patients. However, the previously mentioned study included only ICU-treated patients, whereas in our study, the majority of HD patients experienced mild symptoms that did not require ICU treatment. This observation attenuates the impact of clinical presentation on COVID-19 outcomes, with different stages of kidney impairment being contributing factors, consequently urging appropriate monitoring of these patients. Supporting this statement, the study by Coca et al. proved aCKD, rather than CKD itself, was the primary determinant of COVID-19 prognosis (22).

Comorbidities, such as CVD and respiratory failure, were the significant risk factors for in-hospital mortality in our study. Among laboratory markers, WBC, CRP, LDH, and fibrinogen levels at admission also emerge as significant predictors of mortality. However, data regarding the following comorbidities and laboratory analyses as predictors of mortality varied significantly across research groups (8,22-25).

Long-term COVID-19 outcomes in patients with CKD have not been well studied. Research comparing 28 versus 90 days' outcomes showed overall good survival, with 90% for non-hospitalized patients in the intermediate period and decreasing to 40% for those treated in the ICU (9,12). Our data showed poor outcomes for those who developed AKI during COVID-19 hospitalization, while HD patients had mortality rates of approximately 20-30% both during COVID-19 hospitalization and after a year. Interestingly, although aCKD patients experienced high mortality during COVID-19 hospitalization, their 1-year survival was high. A recently published study on mortality in patients with diabetes and CKD 1 year after COVID-19 hospitalization has reported a high risk of all-cause mortality after discharge (26). The risk for one-year mortality was most pronounced in patients with sepsis and severe forms of COVID-19 infection who required mechanical ventilation, but also in CKD patients who developed further worsening of kidney function during COVID-19 hospitalization. These data appear to contradict our results on long-term mortality in aCKD. The differing results might be biased by the small sample size of the aCKD group in our study and by the selection of individuals with coexisting diabetes and CKD in the other study cohort (26,27).

Furthermore, the majority of aCKD patients from our study remained dialysis independent during follow-up, while a subset progressed to end-stage kidney disease necessitating dialysis commencement within one year. This rapid decline in kidney function among the CKD population in the year following COVID-19 is consistent with previous findings from the larger study, which reported that approximately 20% of CKD patient-initiated main-

tenance dialysis within a year of contracting COVID-19 (26). Despite these observations, there remains limited data on the precise timing of dialysis initiation in this high-risk patient group. Further research should be conducted to identify specific factors influencing long-term outcomes in patients with worsening kidney function, including those with aCKD and AKI in COVID-19.

The major strength of our study is that it treats aCKD patients as a separate group, which is rarely reported in previously published articles. This emphasizes the specific burden of these high-risk patients and provides insight into both short- and long-term complications, enabling improved, timely diagnosis, effective management strategies, and future resource planning. Furthermore, our study enhances knowledge of long-term outcomes, as we followed patients for 12 months to assess survival and remaining dialysis dependence, whereas most research papers observed no more than 90 days after COVID-19 hospitalization. However, we acknowledge some limitations of our study. The study was performed as a single-centre experience in which only conventional hemodialysis was performed, as continuous renal replacement therapy was unavailable during the pandemic. It may have influenced the outcomes, especially in the AKI group. The findings from the regression analysis should be interpreted with caution due to the small sample sizes in the AKI and aCKD groups, especially given the number of variables analyzed. This constraint may have resulted in an underestimation of the actual risks. Moreover, a low proportion of patients in the AKI and aCKD groups limits the generalizability of the study findings, as these patients had more severe COVID-19 and restricted access to continuous renal replacement therapy._Nevertheless, our study accurately reflects the management of dialysis-dependent patients during the COVID-19 pandemic in a limited-resource setting.

CONCLUSION

Dialysis-dependent patients experience high mortality and in-hospital complications during COVID-19 infection, especially those who develop AKI and aCKD. HD patients are exposed to better overall survival, clinical presentation, and a lower rate of critical in-hospital complications when compared to patients with AKI or worsening CKD. One-year mortality in HD patients remains significant, while aCKD patients have a good one-year survival rate but an increased risk of CKD progression. Worsening kidney function in COVID-19 infection, especially in those with aCKD and AKI, necessitates thorough and timely monitoring and treatment to improve outcomes in these high-risk groups. Findings of our study underscore the importance of early nephrology involvement and long-term follow-up in COVID-19-infected patients with kidney disease.

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Ethical approval: This study was reviewed and approved by the Ethics Committee of Clinical Hospital Centre Zemun, approval number 15-1/1, 20.06.2023.

Informed consent: This is retrospective study and all collected data were anonymized and analyzed in a manner that prevents identification of individual patients.

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ISHODI BOLESNIKA ZAVISNIH OD DIJALIZE TOKOM HOSPITALIZACIJE USLED INFEKCIJE VIRUSOM KOVID-19: RANO I KASNO PREŽIVLJAVANJE

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Sažetak

Uvod: Tokom pandemije kovida-19, hemodijaliza je prepoznata kao značajan prediktor lošeg preživljavanja. Ovo istraživanje je imalo za cilj analizu ranog i kasnog preživljavanja bolesnika koji su lečeni hemodijalizama tokom hospitalizacije usled infekcije izazvane kovidom-19.

Metodologija: Ovom retrospektivnom studijom obuhvaćeno je 176 bolesnika, koji su zahtevali hemodijalizno lečenje tokom hospitalizacije usled infekcije kovidom-19. Bolesnici su bili podeljeni u tri grupe: akutno bubrežno oštećenje (ABO), akutizacija hronične bubrežne slabosti (aHBI) i hronična hemodijaliza (HD). Podaci su dobijeni iz elektronske baze podataka.

Rezultati: Većinu studijske populacije činili su bolesnici na HD (73,3%). Ukupan intrahospitalni mortalitet je bio visok (35,8%), a značajno je varirao među grupama: 82,1%, 57,9% i 22,5% kod ABO, aHBI i HD, respektivno (p<0.001). Nakon 12 meseci praćenja, smrtni ishod je nastupio kod 30% kontaktiranih bolesnika, a najveća smrtnost je zabeležena u HD populaciji.

Zaključak: Bolesnici koji zahtevaju lečenje hemodijalizom tokom infekcije izazvane kovidom-19 imaju visoku smrtnost, posebno bolesnici koji razviju ABO i aHBI. HD bolesnici imaju bolje intrahospitalno preživljavanje, ali značajan mortalitet nakon godinu dana od preležane infekcije izazvane kovidom-19.

Ključne reči: kovid-19, akutna bubrežna slabost, hronična bubrežna slabost, akutizacija hronične bubrežne slabosti, hemodijaliza

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