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ORIGINAL ARTICLE

COVID-19 with kidney disorders in Dustira Hospital

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ABSTRACT

Corona virus diseases-19 (COVID-19) affects the respiratory system and the kidneys. Kidney disorders manifestations in COVID-19 patients are AKI, AKI superimposed chronic kidney disease (CKD), and COVID -19 in CKD sufferers on hemodialysis. The SARS CoV-2 virus can cause deterioration and decline in kidney function because it can bond with angiotensin converting enzyme 2 (ACE-2) receptors on the surface cells of the kidney. This study is a descriptive cross-sectional study that aims to know the profile of kidney abnormalities in COVID -19 patients treated at Dustira Hospital based on the description of age, sex, type of kidney disorder, therapy, and outcome of therapy. This study takes the total sampling data in the form of medical record data from January to December 2021. During this time 275 samples were obtained. Research results show the average age of patients is 57 $\pm$ 13.5 years. The majority of the patients were male (58.5%). The highest percentage of diagnosed kidney disorders in COVID-19 patients was AKI-superimposed CKD (38.2%). 53.5% COVID-19 patients with kidney disorders received conservative therapy, while 46.5% received hemodialysis With 68.7% conservative therapy and 77.3% hemodialysis, the majority of Covid-19 patients with kidney disorders were able to survive. The study concludes that COVID-19 with kidney disorders is most common in elderly men (>55 years), with the most cases developing AKI-superimposed CKD. There were a lot of patients who receive conservative therapy but endure life, and many have therapy action hemodialysis, resulting in a higher survival rate.

Keyword: Covid-19, Kidney disorder, AKI, AKI superimposed CKD, CKD on HD

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious disease that was first discovered in Wuhan, Hubei Province, China, in December 2019. The spread of this virus is very fast every day.[1–3] Based on World Health Organization (WHO) data as of October 3, 2022, there were 615,310,890 confirmed cases of COVID-19 with 6,524,568 cases reported dead worldwide.[4] In Indonesia, based on data from the Ministry of Health of the Republic of Indonesia (Kemenkes RI), the spread of COVID-19 cases was reported as of October 3, 2022. There were 6,435,719 confirmed cases of COVID-19, 6,261,282 recovered cases, 158,143 dead cases, and 16,294 active cases.[5] Based on data from the Center for Information and Coordination of West Java Province (PIKOBAR), as of October 3, 2022, there were 1,180,732 confirmed cases of COVID-19 in West Java.[6]

COVID-19 has an impact on the respiratory system and affects the kidney organs, resulting in kidney disorders. A kidney disorder is a pathophysiological process with various etiologies marked by decreased kidney function. The form of kidney abnormality in COVID-19 patients can be acute kidney ***failure injury***(AKI), acute kidney failure which exacerbates existing chronic kidney failure (AKI superimposed CKD), or COVID-19 that affects patients with end-stage renal failure who have already routinely undergone hemodialysis (CKD on HD).[7,8] SarsCOV-2 binds to ACE2 in the target organ, the kidney, causing a surge of chemokines and pro-inflammatory cytokines, such as IL-6, TNF- α, IL-8, MCP-1, IL-1β, CCL2, CCL5, and interferons that worsen and damage kidney function in COVID-19 patients.[9–11] Damage to kidney function can be seen from an increase in serum creatinine or a decrease in glomerular filtration rate which can lead to AKI, AKI superimposed on CKD, and CKD on HD.[12,13] In addition, this rapid surge of pro-inflammatory cytokines triggers the inflammatory infiltration of lung tissue, resulting in acute respiratory distress syndrome (ARDS) and multi-organ failure, which can cause death in a short period of time.[13–16]

The number of confirmed COVID-19 patients in Indonesia has increased every day, until the present. Cimahi, one of the cities in the province of West Java, shows high cases of COVID-19. Given the close link between the severity of kidney disorders and increased morbidity and mortality in Covid-19, and the limited research on kidney disorders in Covid-19 patients in Indonesia, especially in Cimahi City, researchers are interested in conducting research to find out if the COVID-19 causes kidney disorders in Dustira Hospital.

METHODS AND SUBJECT

This is a cross-sectional study. The sampling was conducted using secondary data, specifically the medical records of patients diagnosed with COVID-19 and kidney disorders at Dustira Hospital from January to December 2021. The inclusion criteria for this study included all medical records of confirmed COVID-19 patients with kidney disorders at Dustira Hospital from January to December 2021. Exclusion criteria, namely incomplete, damaged or lost patients' medical records.

Samples were obtained using a total sampling technique. The collection was carried out by reviewing the medical record data of patients diagnosed with COVID-19 with kidney disorders. There were originally 286 patients, but 11 were excluded due to the incomplete data, leaving 275 patients to be analyzed.

Data was analysed using the SPSS program version 26 on Windows. The research results for the numerical data variables will present the data in the form of mean, median, standard deviation (SD), and range. In categorical data, variables will be presented in the form of percentages and amounts. This research has receive

ethical approval from the research and research ethics committee of Dustira Hospital, Cimahi City, with the letter number Etik.RSD/004/I/2023 dated January 5, 2023.

RESULTS AND DISCUSSION

Description of COVID-19 Patients with Kidney Disorders Treated at Dustira Hospital by Age

Based on Table 1, it can be seen that Covid-19 patients with kidney disorders who are being treated at Dustira Hospital have an average age of 57 ± 13.5 years, with the youngest being 18 years and the oldest being 91 years. Most of the patients had an age range of 50-59 years (30.5%), of 60-69 years (25.8%), and 40-49 years (16.0%).

Table 1. Age Covid-19 patients with kidney disorders

Age	Amount (N)
mean ± Std Deviation	57.4 ± 13.5
median	57.0
Range (Min-Max)	18.0 – 91.0
< 20 years	3(1.1)
20 – 29 years	5(1.8)
30 – 39 years	21(7.6)
40 – 49 years	44(16.0)
50 – 59 years	84(30.5)
60 – 69 years	71(25.8)
70 – 79 years	35(12.7)
80 – 89 years	11(4.0)
90 – 99 years	1(0.4)

The results of this research confirmed a previous study conducted by Upadhana PS. et al. in 2022, in which the average age of COVID-19 patients at Sanglah Hospital Denpasar in 2021 was 59 years, with a range of 20–92 years.[17] In a study by Nurhayati et al., patients with kidney failure were found to be in the age range of 50 years and productive age.[18]

Patients who are older are more susceptible to kidney disorders than younger patients. Due to the inability of the kidneys to regenerate new nephrons, the number of nephrons decreases when there is damage and decreased kidney function.[18,19] The severity of Covid-19 with kidney disorders is associated with a decrease in the immune system. This occurs because comorbidities and mitochondrial dysfunction increase with age. Mitochondrial dysfunction plays an important role in the development of kidney disorders, namely acute renal failure and chronic renal failure. Mitochondrial dysfunction is associated with an immunological response to viral infection susceptibility and chronic inflammation and is responsible for the release of inflammatory cytokines, leading to severe pneumonia, multi-organ failure, and death.[20]

Description of Covid-19 Patients with Kidney Disorders Treated at Dustira Hospital Based on Gender

Based on Table 2, it can be seen that COVID-19 patients with kidney disorders who were treated at Dustira Hospital had the male percentage of 58.5% and female percentage of 41.5%.

Table 2. Percentage of the Covid-19 patients' gender with kidney disorders

Gender	Amount	Percentage (%)
Man	161	58.5
Woman	114	41.5
Total	275	100.0

This research is in agreement with research conducted by Xiang HX. et al. in 2021, which revealed that there were more men (59.7%) than women (40.3%) with kidney disorders in COVID-19 patients at Fuyang City Hospital of Anhui.[21]

Women have stronger immunity due to the activation of the X chromosome which produces higher CD4+ T cells. In addition, women also produce estrogen and progesterone hormones, which can stimulate an immune response and increase antibody production, providing better immunity than men. Estrogen regulates several cytokines (IL-1, IL-10, and IFN- γ) that modulate the immune response and progesterone increases IL-4, reduces T helper cell type 1 (Th1) IFN- response γ, and reduces T cell proliferation.[22,23]

Description of Covid-19 Patients with Kidney Disorders Treated at Dustira Hospital Based on Type of Kidney Disorders

Based on Table 3, COVID-19 patients with various diagnoses of kidney disorders who were treated at Dustira Hospital showed a diagnosis of AKI superimposed CKD (38.2%), which was the most common diagnosis of kidney disorders, followed by a diagnosis of CKD on HD (34.5%) and the diagnosis of AKI (27.3%). In this study, there were more AKI patients with superimposed CKD than patients with AKI or CKD alone.

Table 3. Percentage of kidney disorders type diagnosed in COVID-19 patients

Types of Kidney Disorders	Number of Patients	Percentage (%)
Acute Kidney Injury (AKI)	75	27.3
AKI superimposed CKD	105	38.2
CKD on HD	95	34.5
Total	275	100.0

The kidney damage observed in COVID-19 patients is the result of complex mechanisms induced both directly and indirectly by SARS-CoV-2, leading to kidney decline.[10,24] Decreased kidney function is characterized by increased levels of creatinine or decreased glomerular filtration rate, resulting in AKI and CKD. In hospitalized patients, patients with AKI-superimposed CKD had significantly higher peak creatinine levels than patients with AKI or CKD alone. AKI contributes to the initiation and development of CKD. In addition, CKD predisposes patients to AKI.[21,23]

The results of this study are consistent with research conducted by Upadhana PS. et al. in Bali in 2022, stating that AKI-superimposed CKD was the most diagnosed (42.8%), followed by CKD on HD diagnosis of 35.1% and 22.1% of AKI diagnoses.[17] Research by Xu Z. et al. in 2022, confirmed a study of COVID-19 patients with kidney disorders at Wuhan Union Hospital from January to April 2020, which stated that the majority had CKD of as much as 58% and AKI of as much as 42%.[23]

Description of COVID-19 Patients with Kidney Disorders Treated at Dustira Hospital Based on Therapy for Kidney Disorders in COVID-19 Patients

According to Table 4, it can be that the majority of COVID-19 patients with kidney disorders treated at Dustira Hospital may have received conservative therapy as much as 53.5% and renal replacement therapy (hemodialysis) as much as 46.5%.

Table 4. Percentage of therapy for kidney disorders in Covid-19 patients

Kidney Disorders Therapy	Amount	Percentage (%)
Conservative	147	53.5
Hemodialysis	128	46.5
Total	275	100.0

Management of kidney disorders can be done conservatively or with hemodialysis. The main goal of treating kidney failure is to prevent kidney damage, maintain hemostasis, prevent metabolic complications and infections, and keep the patient alive until his kidney function recovers spontaneously.[24–26]

Conservative management of kidney disorders consists of actions to inhibit the development of kidney failure, stabilize the patient's condition, and treat any reversible factors. Conservatively, initial management of renal failure can be performed by using a ventilator to prevent worsening by limiting the hemodynamic effects due to lung damage, regulating a protein diet that functions to prevent or reduce azotemia, a potassium diet to prevent hyperkalemia, which endangers patients, a calorie diet to increase energy in kidney failure patients who often experience malnutrition, and regulating fluid, mineral, and electrolyte needs, which is useful for reducing circulatory overload and intoxication fluid. If conservative treatment can no longer maintain kidney function, renal replacement therapy, or hemodialysis, is performed.[24–26]

Hemodialysis is also known as life support. Hemodialysis has a way of working by connecting the human body to the dialysis machine through a catheter. Hemodialysis functions to clean and separate waste in the blood, and later the blood that has been circulated and cleaned in the dialysis machine will flow back into the person's body.[25,27]

Description of COVID-19 Patients with Kidney Disorders Treated at Dustira Hospital Based on Outcomes of Therapy for COVID-19 Patients with Kidney Disorders

Table 5. Outcome therapy of COVID-19 patients with kidney disorders

Variable	Total		Survival			
			deceased		Survive	
	N	%	n	%	n	%
Types of Kidney Disorders						
Acute Kidney Injury (AKI)	75	100.0	27	36.0	48	64.0
AKI superimposed CKD	105	100.0	26	24.8	79	75.2
CKD on HD	95	100.0	22	23.2	73	76.8
Therapy						
Conservative	147	100.0	46	31.3	101	68.7
Hemodialysis	128	100.0	29	22.7	99	77.3

Based on Table 5, the majority of COVID-19 patients with kidney disorders who died had AKI (36.0%), followed by AKI-superimposed CKD (24.8%) and CKD on HD (23.2%). The majority of patients who died during treatment were those receiving conservative therapy (31.3%) and hemodialysis (22.7%).

The results are in line with research by Upadhana PS. et al. in Bali, in 2022, revealing 69 patients (27.8%) died [during the treatment].[17] Comorbid kidney disease is quite often associated with a severe COVID-19 outcome. Hakami et al.'s 2021 study showed that COVID-19 patients with comorbid kidney disease had a higher mortality risk and poor clinical outcomes.[28]

Research by Zhifeng Xu et al. in 2022, showed that COVID-19 patients who suffered from complications of AKI had a higher overall death rate and shorter survival time than patients without AKI.[23] The patients with AKI-superimposed CKD and Covid-19 infection have a worse prognosis than Covid-19 patients with AKI alone. The mortality of Covid-19 patients with AKI-superimposed CKD was significantly higher than the mortality of patients with AKI or CKD. The peak creatinine level during hospitalization was significantly higher in patients with AKI-superimposed CKD than that in patients with AKI or CKD alone. AKI contributes to the initiation and development of CKD. In addition, CKD predisposes patients to AKI.[23,29]

Description of Laboratory Results for COVID-19 Patients with Kidney Disorders Treated at Dustira Hospital

Table 6. Laboratory results of Covid-19 patients with kidney disorders

VARIABLE	Total Patients (N=275), MEAN (STD Deviation)	AKI (N=75), MEAN (STD Deviation)	AKI superimposed CKD (N=105), MEAN (STD Deviation)	CKD on HD (N=75), MEAN (STD Deviation)
Hemoglobin (g/dl)	10.6 (± 4.1)	13.6 (± 5.8)	10.3 (± 2.7)	8.5 (± 1.3)
Sodium (mEq/L)	132.9 (± 9.4)	135.4 (± 13.7)	131.9 (± 7.6)	132.1 (± 6.1)
Potassium (mEq/L)	4.5 (± 1.1)	4.3 (± 1.1)	4.7 (± 0.8)	4.5 (± 1.2)
Chloride (mEq/L)	108.1 (± 8.4)	110.6 (± 9)	108.1 (± 7.1)	105.3 (± 8.6)
Urea (mmol/L)	131.9 (± 68.9)	101.2 (± 51.5)	147.1 (± 76.9)	139.4 (± 64.5)
Creatinine (mol/L)	5.6 (± 4.1)	2.3 (± 1.4)	4.8 (± 2.4)	9.2 (± 4.4)

Table 6 shows laboratory results of COVID-19 patients with kidney disorders have significant difference, namely the average hemoglobin level in patients with AKI, AKI superimposed CKD, and CKD on HD. COVID-19 patients with CKD on HD have a lower hemoglobin level of 8.5 ± 1.3 g/dL, while the normal value of hemoglobin is 12-14 g/dl. Patients with COVID-19 with kidney disorders have anemia due to several factors, such as blood loss from repeated sampling, dialysis, invasive procedures, inflammation, erythropoietin deficiency, and kidney dysfunction. In addition, COVID-19 patients with kidney disorders have imbalanced electrolytes with an average sodium content of 132.9 ± 9.4 mEq/L, potassium 4.5 ± 1.1 mEq/L, and chloride 108.1 ± 8.4 mEq/L. This happens because the inflammatory response causes storm cytokines, which increase the permeability of microvascular and extravasation liquid. Besides, it is also caused by the occurrence of congested breath, dehydration, hypothermia, hyperthermia, diarrhea, nausea, and vomiting. [30,31]

COVID-19 patients with kidney disorders are marked with an enhanced rate of urea and creatinine. Table 6 shows that the urea level is 131.9 ± 68.9mg/dL and the creatinine is 5.6 ± 4.1mg/dL. According to research by Zhifeng Xu et al. in 2022, it indicated that COVID-19 patients with kidney disorders had significantly higher peak creatinine levels during hospitalization in patients with AKI Superimposed CKD than in patients with AKI or CKD alone. AKI contributes to the initiation and development of CKD. In addition, CKD predisposes patients to AKI. Therefore, AKI-superimposed CKD has a poor prognosis.[23]

CONCLUSION

COVID-19 with kidney disorders affects the severity of kidney disease. Patients with renal disease at admission and AKI during hospitalization were associated with a higher risk of in-hospital mortality. Conservative therapeutic intervention and treatment, such as hemodialysis can prevent mortality and optimize life expectancy.

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DECLARATION OF INTERESTS

Hereby declare that there is no conflict of interest in the scientific articles we write.

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