Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.03.008

Outcomes of COVID 19 patients with acute kidney injury in Thi Qar province, south of Iraq

Dheyaa Khalf Al-Omer[1*]
[1]Department of Medicine ,Collage of Medicine ,University Of Thi-Qar, Iraq
***Corresponding author:** Dheyaa Khalf Al-Omer, Department of Medicine ,Collage of Medicine ,University Of Thi-Qar, Iraq, Email: dheya.kh@utq.edu.iq

Submitted: 05 November 2022; Accepted: 10 December 2022; Published: 04 January 2023

ABSTRACT

Background: Acute kidney injury (AKI) has been associated with an increased mortality rate among hospitalized patients with Coronavirus disease 2019 (COVID-19). However, AKI among hospitalized patients with COVID-19 is not well described.

Methods: In this retrospective cohort study, we enrolled adult patients who were referred to Al-Hussein Teaching Hospital in Thi-Qar Governorate, Iraq, from 15 February to 15 May 2020, diagnosed with Corona Varus by Real-Time polymerase chain reaction (PCR) A test with a diagnosis of COVID. -19. AKI was determined according to the outcome criteria for creatinine determination and Introduced by the KDIGO in 2012. Patients were stratified based on recovery, dialysis, and hospital mortality. We also assessed risk indicators associated with AKI during hospitalization along with in-hospital outcomes, recovery rate, and death at the time of discharge. And after three months of going out for both sexes.

Results: We evaluated 2044 patients, whose ages ranged from 18 to more than 65 years, for both males and females, and the percentage of males 54.7% and females 45.3% were admitted with a diagnosis of COVID-19. AKI occurred in 194(8.02%) patients; 55(35.5%) of the patients with AKI required dialysis. It was observed that 43.1% of males recovered to 43.8% of the females who were cured inside the hospital, and there was a percentage of patients Those who needed dialysis, and there was a percentage of deaths among males and females. Patients with AKI showed a significantly higher mortality rate. The patients' condition was followed up after their discharge from the hospital, and the percentage of those who were cured and the patients who needed dialysis was determined, and the rate and mortality.

conclusion: We found that male sex, patients' ages, history of chronic kidney disease, and disease severity were independent risk factors associated with AKI in COVID-19 patients. Whereas, acute renal insufficiency was associated with an increased risk of death, increased dialysis patients, and in-hospital complications. Our results indicate the need for more careful care and monitoring of AKI during hospitalization in patients with COVID-19, and non-recovery of acute renal impairment on hospital discharge is a common complication in these patients.

Keywords: *COVID-19; Acute Kidney Injury; Recovery ;dialysis and mortality*

.

INTRODUCTION

Acute kidney injury (AKI) is common among COVID-19 patients (Kunutsor and Laukkanen 2020) , due to multifactorial COVID 19-related factors (Ronco .,2020). According to previous studies from China, the United States, and Europe, patients with COVID-19 who were hospitalized had an incidence of AKI that varied from 1 to 80% (Kunutsor and Laukkanen, 2020). AKI has also been considered to be a sign of the severity of COVID-19 and a risk factor for COVID-19-related in-hospital death (Hansrivijit et al., 2020)

Acute respiratory disease is the main symptoms of COVID-19, although it can also damage the kidney, heart, blood, brain system, and gastrointestinal system. This disease can lead in hematuria, proteinuria, and potentially acute kidney damage (AKI) in the kidney (Chen et al., 2020; Wang et al., 2020). According to various research, the incidence of AKI in COVID-19 varies from 0.5% to 36.6%. (Guan et al., 2020; Pei et al., 2020). In up to 46% of patients, COVID-19 complications such (AKI) are common. Data on kidney function post-discharge in a large cohort were unavailable, and a limited study found decreased kidney function in 182 COVID-19 patients with AKI. AKI is linked to higher mortality in COVID-19 patients (Gupta et al., 2020). (Nugent et al.,2021). AKI is a clinically relevant risk factor for chronic kidney disease (CKD), hence more research into the long-term post-acute consequences of AKI linked to COVID-19 is required. However, studies on kidney function recovery outcomes in AKI linked to COVID-19 have had a number of significant drawbacks up to this point. First, insufficient pre-admission serum creatinine levels were used in kidney function recovery trials to evaluate the quantitative loss in kidney function following AKI (Zhang et al.,2021). The pathophysiology of COVID-related AKI is multifaceted and involves both direct and indirect viral infection pathways; both are still being investigation and require additional investigation. Researchers have described the typical pathways involved in COVID-related AKI, despite the pathological results sharing some similarities with those of other kinds of AKI. It is challenging to separate the various mechanisms because most of them overlap, intensifying their strength. During AKI brought on by COVID-19, tubulointerstitial, glomerular, and vascular damage occur in the kidney. A diffuse proximal tubule damage with loss of the brush boundary and frank necrosis is apparent in the kidney image, along with vacuolar degeneration and tubulointerstitial fibrosis. SARS-CoV-2 viruses have been identified in the tubular epithelium, primarily in the proximal tubule and podocytes, according to electron microscope imaging (Chong et al., 2020). Edema and inflammatory cell infiltration can be found in the interstitial compartment. The basement membrane is the only barrier preventing the filtrate from reaching the peritubular interstitium in cases of severe kidney damage. Glomerular filtrate seeps into the interstitial space from the tubular lumen as a result of enhanced endothelial permeability (Bonventre and Yang 2011). Finally, even in those with maintained kidney function, COVID-19 is linked to a sizable risk of acute kidney damage (AKI), which can cause serious illness and even death and frequently necessitate dialysis and other types of renal replacement therapy. Several times throughout the pandemic

METHODS

Participants

All adult patients who received a positive COVID-19 swab from 15 February to 15 May 2020 were identified through an electronic patient record and their data extracted. Exceptions included patients under 18 years of age, pregnant women, and patients with end-stage renal failure, who were identified by documentation of dialysis in the electronic patient record. Patients whose creatinine levels were not recorded during their stay were also excluded. In the case of patients with multiple admissions during the study period, only the first admission with a positive COVID-19 swab was considered in the analysis. The deaths included both in-hospital death and post-discharge death.

Definitions

Patients with coronavirus were identified through real-time PCR technology, and acute renal injury were identified based on AKI creatinine criteria for kidney disease, and this includes patients whose creatinine values are high and Introduced by the KDIGO in 2012(Khwaja., 2012) specific criteria exist for the diagnosis of AKI.AKI can be diagnosed if any one of the following is present:

Increase in SCr by ≥0.3 mg/dl (≥26.5 μmol/L) within 48 hours; or

Increase in SCr to ≥1.5 times baseline, which has occurred within the prior 7 days; or

Urine volume < 0.5 mL/kg/h for 6 hours.

The occurrence of AKI after infection with the Covid-19 virus was likely associated and was known from the analysis.

study design

In this cohort study, we retrospectively enrolled 2044 general patients admitted to Al-Hussein Teaching Hospital, a government-designated teaching center for patients with COVID-19, in Thi-Qar Governorate, Iraq from February 15 to May 15, 2020. We used electronic medical records from each individual to obtain personal data, including demographic characteristics, previous medical history, admission vital signs, laboratory parameters, and in-hospital outcomes and complications. The gender of the patients was determined, male and female, and the age of the patients was determined, ranging from 18 to over 65. By examining creatinine, the proportions of patients with acute kidney infection, numbering 194 patients, were determined, patients who needed dialysis were isolated, and the proportions of patients who recovered in the hospital after continuing their treatment and medical care were also recorded. Cases of death inside the hospital were recorded for males and females. The patient's condition was followed up three months after their discharge from the hospital, and the percentages of patients who had recovered and those who still needed dialysis were determined. Cases of death were also recorded.

Statistical Analysis

The observative non-parametric data of the current study were statistically analysis by using SPSS (Statistical Package of Social Science version 26), based in using Descriptive and Non-parametric Chi-square at p. value < 0.05.

RESULTS

Characteristics of patients with AKI and COVID-19 diagnosis

Of the 2044 patients hospitalized with COVID-19, AKI occurred in 164 (8.02%) patients, 98 males (59.8%) and 66 females (40.2) (Table1)(Figure1,2 and 3);

When following up patients after their discharge from the hospital, some of them recovered. They are patients whose ages ranged from 18-39, 70% of males and 77.7% of females. As for patients whose ages ranged between 40-65, the recovery rate for males was 54.1%, while for females, the recovery rate was 54.1%. 56% For patients whose age is more than 65, the cure rate for males was 43.1% and for females 43.8%.

As for the patients who needed dialysis, it was for males between the ages of 18-39 with a rate of 20% and for females with a rate of 22.3%. As for patients who underwent dialysis for ages between 40-65, males with a rate of 35.3% and females with a rate of 31.2%. As for the ages over 65, the number Male patients who underwent dialysis accounted for 35.3%, while females accounted for 31.2%.

In this study, the number of deaths was also determined for patients who had been infected with the Corona virus and had acute kidney infection. The death rate of males between the ages of 18-39 was found to be 10%. As for females of the same age, no deaths were recorded. The death rate for males aged 40-65 was recorded at a rate of 8.1%, and for females at a rate of 8%. As for deaths cases for ages over 65, the death rate was for males at a rate of 21.6%, and for females, the death rate was 22.9%.

TABLE 1: Demographic distribution of patients with COVID 19 infection

Sex	**Male**		**Female**		**Total**	
Age group	**No.**	**%**	**No.**	**%**	**No.**	**%**
18 – 39 years	226	20.2	211	22.8	437	21.4
40 – 65 years	533	47.5	421	45.5	954	46.7
More than 65 years	360	32.3	293	31.7	653	31.9
Total	1119	54.7	925	45.3	2044	100
CalX^2=2.145 TalX^2=5.99 DF=2 p. value 0.342						

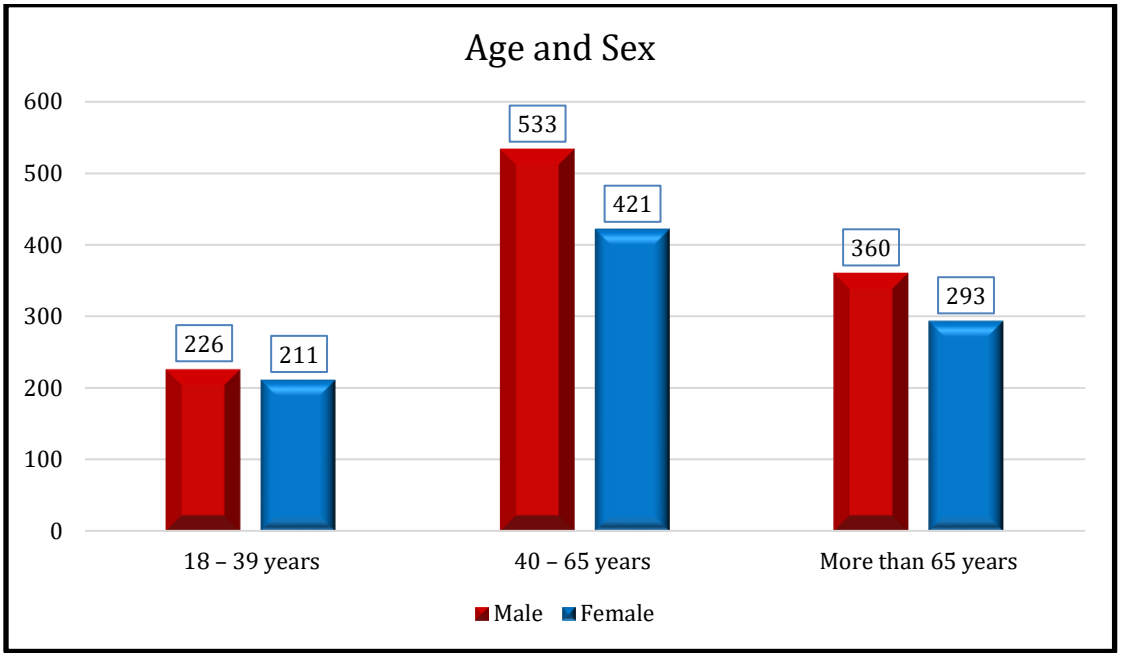

FIGURE 1 . Clinical characteristics of patients (n = 2044) according to the presence of COVID-19 of males and females .

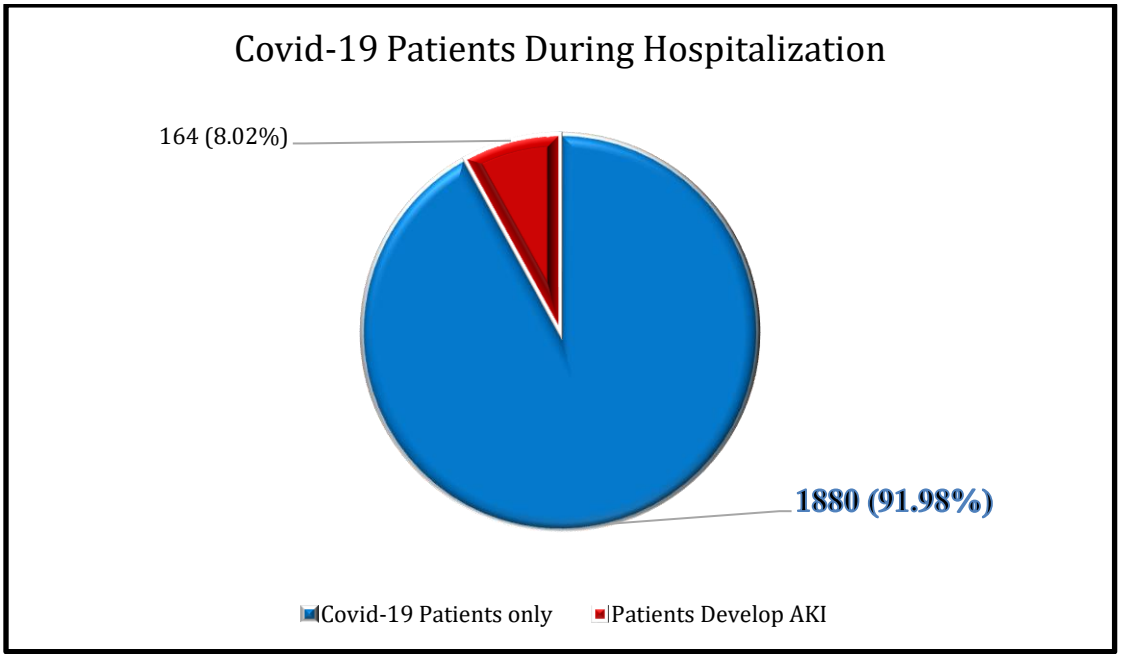

FIG.2 Clinical characteristics of patients (n = 2044) according to the presence of acute kidney injury (AKI) and COVID-19 diagnosis, respectively

TABLE 2 : Rate of AKI in hospitalized patients with COVID-19

Sex / **Age group**	**Male**		**Female**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
18 – 39 years	10	10.2	9	13.6	19	11.6
40 – 65 years	37	37.8	25	37.9	62	37.8
More than 65 years	51	52.0	32	48.5	83	50.6
Total	98	59.8	66	40.2	164	100
CalX^2=0.751 TalX^2=5.99 DF=2 p. value 0.687						

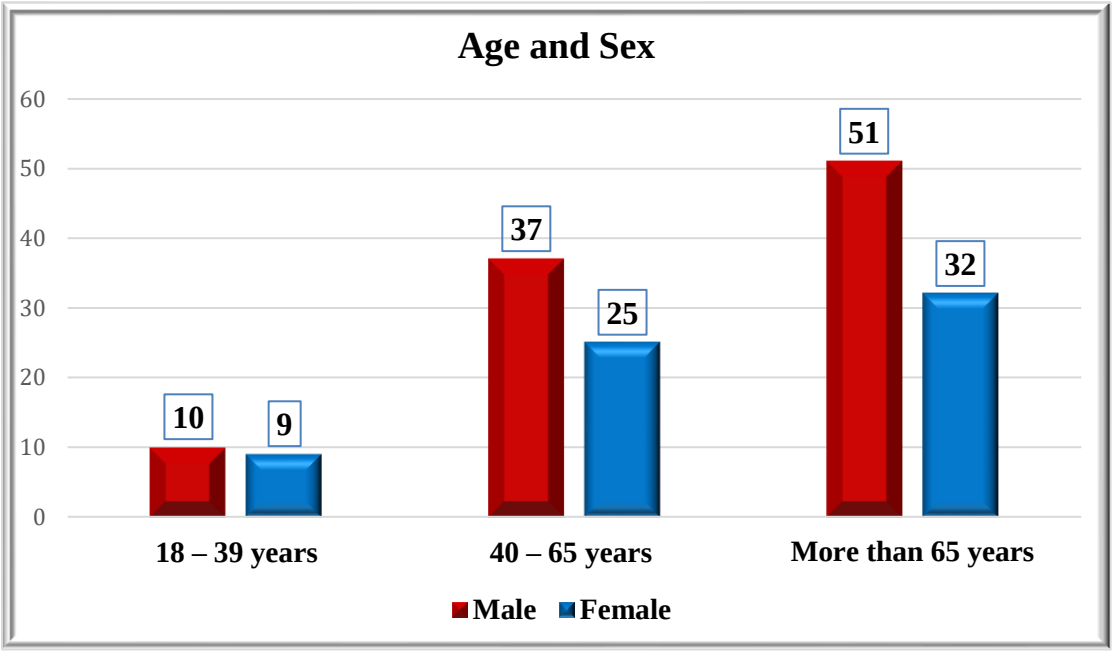

FIG.3 Clinical characteristics of patients (n = 164) according to the presence of acute kidney injury (AKI) and COVID-19 diagnosis of males and females, respectively

Incidence of Covid -19 and AKI during hospitalization

Based on final discharge or death status, among 164 (8.02%) patients with acute renal insufficiency who survived, 84 (51.2%) patients with acute renal injury recovered (table 3), and 55 patients (33.5%) required dialysis. The results also showed cases of death, 25 deaths, with a rate of (15.2). The results of the current study also showed that the value (p value = 0.937) for patients' cases of recovery, dialysis, and death cases (Figure 4).

TABLE 3: Table showing recoveries, dialysis, and deaths for patients with COVID-19 and acute kidney injury inside the hospital

		18 – 39 years		40 – 65 years		More than		Total	
		No.	%	No.	%	No.	%	No.	%
Recovery	**Male**	7	70	20	54.1	22	43.1	49	50
	Female	7	77.7	14	56	14	43.8	35	53
Total		14	73.7	34	54.8	36	43.4	84	51.2
On Dialysis	**Male**	2	20	14	37.8	18	35.3	34	34.7
	Female	2	22.3	9	36	10	31.2	21	31.8
Total		4	21.1	23	37.1	28	33.7	55	33.5
Death	**Male**	1	10	3	8.1	11	21.6	15	15.3
	Female	0	0	2	8	8	25	10	15.2
Total		1	5.2	5	8.1	19	22.9	25	15.2

Recovery:	$CalX^2$= 0.130	$TalX^2$=5.99	DF=2	p. value 0.937
On dialysis:	$CalX^2$= 0.304	$TalX^2$=5.99	DF=2	p. value 0.859
Death:	$CalX^2$= 9.609	$TalX^2$=5.99	DF=2	p. value 0.008
Overall:	$CalX^2$= 702.7	$TalX^2$=37.65	DF= 25	p. value < 0.001

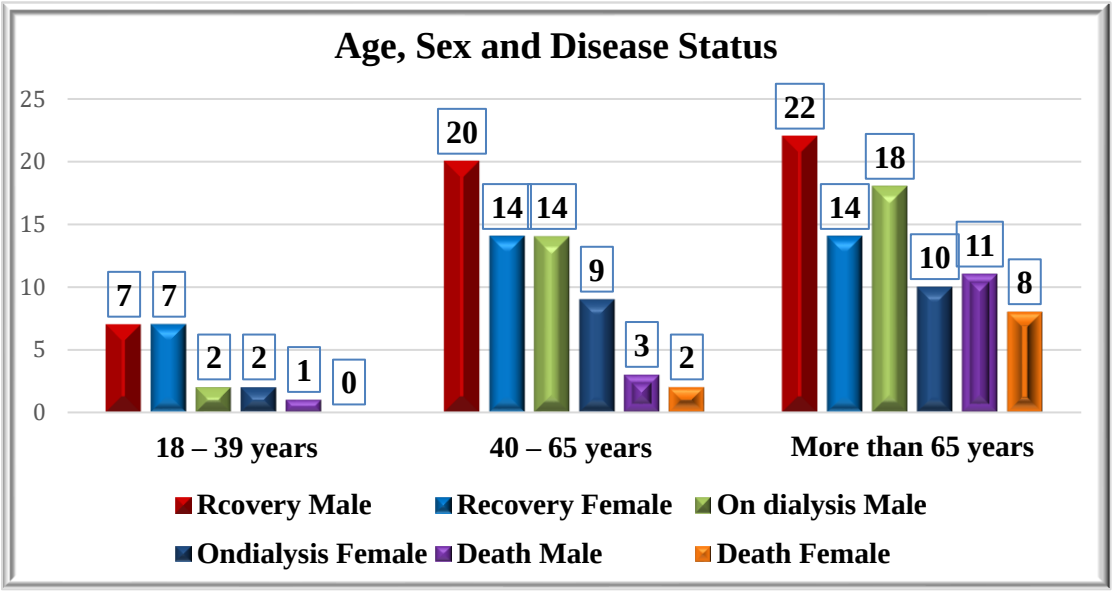

FIGURE 4: Odds ratios Recovery, dialysis and mortality in-hospital by the presence of acute kidney injury and COVID-19 in patients

Recovery, dialysis, death due to COVID and AKI at discharge

In the current study, the patients were followed up after a period of three months after their discharge from the hospital, where it was found that the male patients between the ages of 18-39 were not subject to dialysis, while the patients between the ages of 40-65 were 57.1% of males and 62.5% of females. They need dialysis. For patients over 65 years of age, the percentage of males was 68.7% and females were 50% who still needed dialysis (Table 4).As for patients who do not need dialysis, the rate is 35.7% for males and 37.5% for females, for ages between 40-65, and for those over 65 years old, males account for 12.5%, and females account for 25%.As for deaths, there is no death case for the injured, whose ages ranged between 18-39.

As for the injured, whose ages ranged between 40-65, one death case was recorded for males, and there was no death case for a female.

As for people over 65 years of age, three deaths of males and two deaths of females were recorded after they were followed up for three months after their discharge from the hospital(Figure5).

TABLE 4: A table showing cases of recovery, dialysis, and deaths for males and females after discharge from the hospital

		18 – 39 years		40 – 65 years		More than		Total	
		No.	%	No.	%	No.	%	No.	%
Still on dialysis	**Male**	0	0	8	57.1	11	68.7	19	59.4
	Female	0	0	5	62.5	4	50	9	50
Total		0	0	13	59.1	15	62.5	28	56
Non-need Dialysis	**Male**	2	100	5	35.7	2	12.5	9	28.1
	Female	2	100	3	37.5	2	25	7	38.9
Total		4	100	8	36.4	4	16.7	16	32
Death	**Male**	0	0	1	7.2	3	18.8	4	12.5
	Female	0	0	0	0	2	25	2	11.1
Total		0	0	1	4.5	5	20.8	6	12

Still on dialysis:	$CalX^2$=2.634	$TalX^2$=3.84	DF=1	p. value 0.105
Non-need Dialysis:	$CalX^2$= 3.222	$TalX^2$=5.99	DF=2	p. value 0.200
Death:	$CalX^2$= 0.433	$TalX^2$=5.99	DF=2	p. value 0.510
Overall:	$CalX^2$= 1273.9	$TalX^2$=37.65	DF= 25	p. value < 0.001

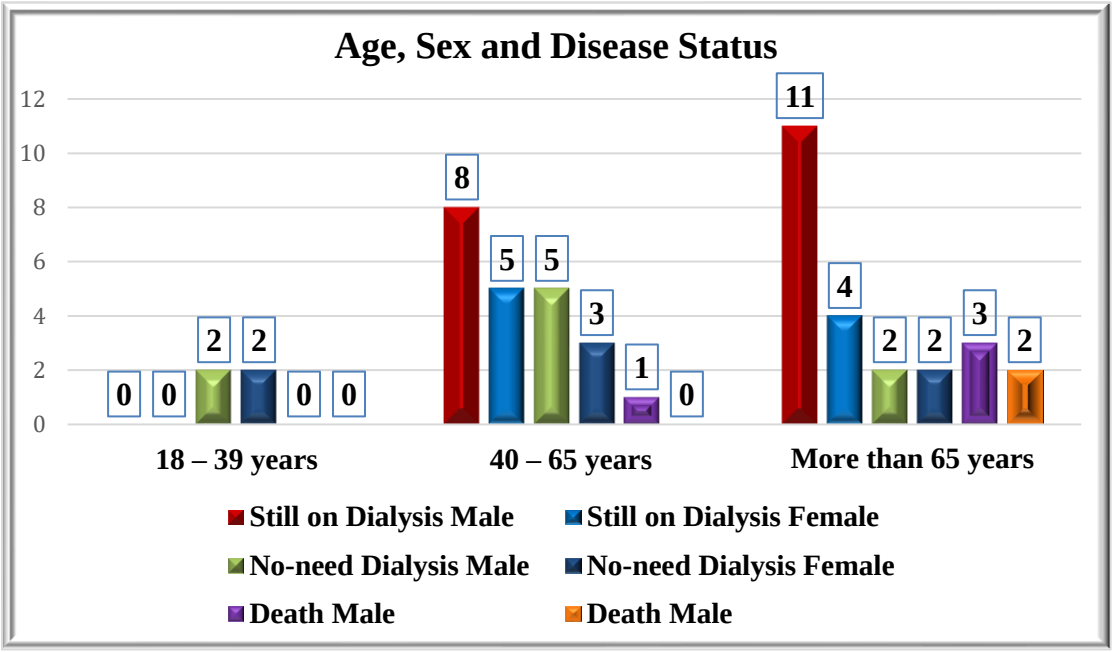

FIGURE 5: Outcomes of renal function recovery, dialysis, and deaths from AKI associated with COVID-19 after following patients for 3 months from hospital discharge.

DISCUSSION

Acute kidney injury is common amongst patients with SARS-CoV-2 infection, especially critically ill ones, and is without a doubt associated with higher mortality (Yan et al., 2020). There are numerous possible pathomechanisms which are still being investigated, but the most probable ones are direct cellular invasion, ARDS, cytokine storm and hypovolemia. Histopathological reports showed that most COVID-19 patients with AKI presented acute tubular damage, sometimes with necrosis and collapsing glomerulopathy. The most important steps that should be taken in AKI prevention are the following: minimizing the risk of hypovolemia and monitoring serum creatinine levels in the early stages of COVID-19 infection, especially in regard to the high-risk patients at an older age with diabetes mellitus, hypertension and cardiovascular diseases (Ronco et al.,2020)

In this retrospective cohort study, 2044 patients with COVID-19 were evaluated for the development of AKI. We detected an incidence of 8.02.% for AKI among all patients with a positive PCR test. In the multivariate model, male and female sex, disease severity, history of chronic kidney disease, and elevated serum creatinine levels on admission were identified as independent risk predictors for the development of acute renal impairment during hospitalization. Of 164 who developed AKI, 15.2% of them died. For patients requiring dialytic support 33.5%.

In this study, a considerable number of patients (56%) did not exhibit full recovery at the time of discharge. Lack of AKI recovery in the COVID-19 setting has been pointed out before (Pei et al., 2020). A study by Pei et al. (Pei et al.,2020) showed that only 45.7% of patients with COVID-19 made a complete recovery from AKI at the time of discharge. The discrepancy seen among recovery rates may be due to different hospital lengths of stay and follow-up in studies. This rate is significant and highly alerting that warrants further research to fully understand the processes of pathophysiology and appropriate interventions to prevent this complication in patients with COVID-19.

On the other hand, in previously reported studies in China, there was a significantly lower incidence rate of AKI varying from 0.5% to 29.% (Zhou et al.,2020; Cheng 2020; Guan et al.,2020), and Fu et al. (Fu et al.,2020) reported an overall incidence rate of 5.5% for studies conducted in China. Different population studies and the underlying conditions of the patients with COVID-19 in these studies may help to explain why there are differences between different ranges of AKI incidence.

The baseline characteristics of our population in this study were more comparable to earlier data from Europe, the USA, and Brazil. Different definitions of AKI employed in various research could also account for the variable ranges of AKI occurrence. In Chinese studies, the initial creatinine record obtained after patient admission is frequently used to calculate baseline SCr. While reports with higher rates of AKI use imputation based on a glomerular filtration rate of 75 mL/min/1.73 m2 or previous creatinine records of patients prior to hospitalization to determine the baseline SCr (Chan et al.,2020). In addition to the requirements for admission, patients' ethnic backgrounds in various nations may have an impact on their initial characteristics. (Zahid et al. 2020).

In conclusion, our study shows that in this cohort of patients, those with COVID-19 had a higher incidence of AKI . COVID-19 and lower baseline kidney function may be a risk factor for AKI. In-hospital mortality risk was highest in patients with AKI and COVID-19. Since the development of AKI is one of the most important risk factors for mortality in COVID-19 patients, focus on, and optimal management of, AKI may improve the outcome of COVID-19 in patients.Hence, close monitoring for serum creatinine during hospitalization and a long-term follow-up to further investigate CKD after COVID-19-associated AKI might be crucial in susceptible patients with COVID-19, and more supportive care must be considered in patients with AKI.

REFERENCES

1. Basile DP(2004): Rarefaction of peritubular capillaries following ischemic acute renal failure: A potential factor predisposing to progressive nephropathy. Curr Opin Nephrol Hypertens 13: 1–7
2. Bonventre, J. V., & Yang, L. (2011). Cellular pathophysiology of ischemic acute kidney injury. The Journal of clinical investigation, 121(11), 4210-4221.
3. Chan L, Chaudhary K, Saha A, Chauhan K, Vaid A, Shan Z, et al (2020). AKI in hospitalized patients with COVID-19. J Am Soc Nephrol.;32:151–60.
4. Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., et al. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 395, 507–513. doi: 10.1016/s0140-6736(20)30211-7
5. Cheng Y, Luo R, Wang K, Zhang M, Wang Z, Dong L, et al(2020). Kidney disease is associated with in-hospital death of patients with COVID-19. Kidney Int.;97((5)):829–38.
6. Chong, S., Huang, Y., & Chang, C. H. D. (2020). Supporting interdependent telework employees: A moderated-mediation model linking daily COVID-19 task setbacks to next-day work withdrawal. Journal of Applied Psychology, 105(12), 1408.
7. Coca SG, Garg AX, Thiessen-Philbrook H, Koyner JL, Patel UD, Krumholz HM, et al(2014).; for the TRIBE-AKI Consortium : Urinary biomarkers of AKI and mortality 3 years after cardiac surgery. J Am Soc Nephrol 25: 1063–1071.
8. Fu, L., Wang, B., Yuan, T., Chen, X., Ao, Y., Fitzpatrick, T., ... & Zou, H. (2020). Clinical characteristics of coronavirus disease 2019 (COVID-19) in China: a systematic review and meta-analysis. Journal of Infection, 80(6), 656-665.
9. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al(2020). Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med.;382((18)):1708–20.
10. Guan, W. J., Ni, Z. Y., Hu, Y., Liang, W. H., Ou, C. Q., He, J. X., et al. (2020). Clinical characteristics of Coronavirus Disease 2019 in China. N. Engl. J. Med. 382, 1708–1720.
11. Gupta S, Hayek SS, Wang W, et al(2020). Factors associated with death in critically ill patients with coronavirus disease 2019 in the US. JAMA Intern Med.;180(11):1436–1446.
12. Hansrivijit P et al (2020). Incidence of acute kidney injury and its association with mortality in patients with COVID-19: a metaanalysis. J Investig Med. https://doi.org/10.1136/jim-2020-00140.
13. Khwaja A. (2012). KDIGO clinical practice guidelines for acute kidney injury. Nephron Clin Pract.;120(4):c179-84. doi: 10.1159/000339789. Epub 2012 Aug 7. PMID: 22890468.
14. Kunutsor SK, Laukkanen JA (2020). Renal complications in COVID-19: a systematic review and meta-analysis. Ann Med. https://doi.org/10.1080/07853890.2020.1790643
15. Lumlertgul N, Pirondini L, Cooney E, et al(2021). Acute kidney injury prevalence, progression and long-term outcomes in critically ill patients with COVID-19: a cohort study. Ann Intensive Care.;11(1):123.
16. Nugent J, Aklilu A, Yamamoto Y, et al(2021). Assessment of acute kidney injury and longitudinal kidney function after hospital discharge among patients with and without COVID-19. JAMA Netw Open.;4(3):e211095.

17. Pei, G., Zhang, Z., Peng, J., Liu, L., Zhang, C., Yu, C., et al. (2020). Renal involvement and early prognosis in patients with COVID-19 pneumonia. J. Am. Soc. Nephrol. 31, 1157–1165. doi: 10.1681/asn.2020030276.
18. Ronco C, Reis T, Husain-Syed F (2020). Management of acute kidney injury in patients with COVID-19. Lancet Respir Med 8:738–742. https://doi.org/10.1016/s2213-2600(20)30229-0.
19. Wang, D., Hu, B., Hu, C., Zhu, F., Liu, X., Zhang, J., et al. (2020). Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA 323, 1061–1069. doi: 10.1001/jama.2020.1585
20. Yan Q et al (2020). Acute kidney injury is associated with inhospital mortality in older patients with COVID-19. J Gerontol Ser A Biol Sci Med Sci. https://doi.org/10.1093/gerona/glaa181
21. Zahid U, Ramachandran P, Spitalewitz S, Alasadi L, Chakraborti A, Azhar M, et al. (2020). Acute kidney injury in COVID-19 patients: an inner city hospital experience and policy implications. Am J Nephrol.;51((10)):786–96.
22. Zhang NH, Cheng YC, Luo R, Zhang CX, Ge SW, Xu G.(2021). Recovery of new-onset kidney disease in COVID-19 patients discharged from hospital. BMC Infect Dis.;21(1):397.
23. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al.(2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet.;395((10229)):1054–62.