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ORIGINAL ARTICLE

Outcome of Acute Kidney Injury Among COVID-19 In Al-Azhar University Hospital

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Abstract

Background: **A spate of pneumonia cases around the end of 2019 discovered in China, and researchers eventually traced the outbreak to a new coronavirus known as SARS-CoV-2. Patients with COVID-19, whether just suspected or confirmed, may also present with AKI. There seems to be variation in prevalence based on the research setting and the percentage of critically ill patients included. However, only a small number of studies focusing on the clinical features of AKI in individuals with COVID-19 infection have been conducted in Egypt. The goal of this study is to provide a description of the result of AKI among COVID-19 patients treated in hospitals affiliated with Al-Azhar University. This study was done at Al-Azhar University Hospitals during the period between 1-01-2022 and 30-06-2022 A total of 100 confirmed COVID-19 patients were recruited for this survey. Their anthropometrics and laboratory data were collected. Statistical analyses were conducted to evaluate the outcome of AKI among these COVID-19 positive infection. In all studied patients, there were 22 patients (22%) with direct renal mortality and 56 patients (56%) with mortality due to non-renal causes. There were 46 patients (46%) in RRT need, RRT was done for 28 patients (28%). Eight patients (28.6%) had CRRT, 18 patients (64.3%) had CHD and 2 patient (7.1%) had SLED 10 patients (10%) developed CKD, 6 of them developed ESRD with permanent RRT, while 12 patients (12%) had completely recovered from AKI.AKI among COVID-19 infection patients was correlated with high RRT, and high mortality rate.**

Keywords: AKI, COVID-19, ESRD, Outcome, RRT

1. Introduction

Wuhan, a city in China's Hubei Province, saw a spate of pneumonia cases around the end of 2019, and researchers eventually traced the outbreak to a new coronavirus known as SARS-CoV-2.[1] By the year 2020, it had caused a global epidemic that had affected most nations.[2] Symptoms of SARS-CoV-2 illness (COVID-19) often include a lung infection with a wide spectrum of severity, from a common cold to life-threatening pneumonia and acute respiratory distress syndrome.[3] Multiorgan dysfunction may occur in high-risk individuals with COVID-19's severe acute respiratory syndrome due to pulmonary and systemic inflammation. The most frequent life-threatening consequences during exacerbation are acute respiratory distress syndrome, sepsis, and sudden cardiac decompensation. A significant proportion (15–33%) of COVID-19 patients have a severe course and need critical care, with up to >30% requiring mechanical breathing.[4] Patients with COVID-19, whether just suspected or confirmed, may also present with AKI. The incidence of acute kidney injury (AKI) ranges from 5% to 60%, with a tendency towards higher rates (30–60%) when adopting the risk, injury, failure, loss of kidney function, end-stage renal failure (RIFLE), or Acute Kidney Injury Network (AKIN) classification.[5]

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2. Patients and methods

This was an observational cohort study with prospective data analysis including one hundred (age and sex matched) patients with confirmed COVID-19. The study was conducted at Al-Azhar University Hospitals during the period between January 2022 and May 2022.

2.1. Inclusion criteria

Patients aging 18 years or more. All patient presenting with a critical illness who develop acute kidney injury either at presentation or after admission. AKI as defined according to the KDIGO guidelines.

2.2. Exclusion criteria

Age <18 years, Patients with chronic kidney disease, including ESRD who are on Renal Replacement Therapy (RRT). Methods: At enrollment, all patients will be subjected to the following: Detailed medical history with stress on risk factors of renal impairment and exclusion criteria from patients if possible or from relatives. Complete clinical examination. Basal laboratory work-up (serum creatinine, Blood Urea, S. Na, S. K, S. Albumin, CBC). The use and duration of mechanical ventilation and the need for vasopressor drugs were recorded, also time on vasopressors will be recorded. The need of kidney replacement therapy and duration. Dialysis will be recorded with subsequent clinical complications especially: Intradialytic Hypotension and arrhythmias. Quick COVID-19 Severity Index (qCSI), which Predicts 24-h risk of critical respiratory illness will be applied to all positive patients Mortality SARS-CoV-2 infection is defined as the detection of SARS-CoV-2 RNA in a nasopharyngeal swab specimen with quantitative real-time RT-PCR or in case of negative RT-PCR, a chest CT scan with a high level of suspicion (COVID-19 Reporting and Data System [CO-RADS] score of greater than or equal to four) in combination with suggestive clinical signs (fever, new-onset respiratory symptoms). Quick COVID-19 Severity Index: - include respiratory rate, pulse oximetry, oxygen flow rate and will be interpretated as in text.

2.3. Statistical analysis

Statistics have been done to evaluate the results. Data were analyzed using Statistical Program for Social Science (SPSS) version 24. Quantitative data were expressed as mean ± SD. Qualitative data were expressed as frequency and percentage. Mean (average): the central value of a discrete set of numbers, specifically the sum of values divided by the number of values. Standard deviation (SD): is the measure of the dispersion of a set of values. A low SD indicates that the values tend to be close to the mean of the set, while a high SD indicate that the values are spread out over a wider range. Ethics and patient consent: All procedures followed Al-Azhar University ethical committee regulations, and all patients gave consents. Looking at a set of numbers, the average is the number that falls in the center. It is determined by dividing the total number of numbers in the set by the sum. The standard deviation quantifies the degree to which a set of numbers differs from the mean (SD). A smaller standard deviation indicates that the values are more closely clustered around the mean, as opposed to the opposite, which would be the case if the SD were larger. The correlation strength between both data sets was assessed using Pearson's correlation coefficient (r).

3. Results

There was a total of 100 patients investigated; their ages ranged from 19 to 82, with a mean of 56.4% 16.4%. There was a total of 100 patients in the study, including 50 men and 50 females (or 50% males and 50% females). Fifty patients (50%) had DM and 58 patients (58%) had HTN, as shown in the following table. As regard CORAD score, there were 36 patients (36%) of CORAD 3 and 64 patients (64%) of CORAD 4 in the studied patients. As regard QCSI, the mean QCSI of all studied patients was 6.7 ± 2.1 with minimum QCSI of 1 and maximum QCSI of 11 as shown in the next table as regard hospital stay, the mean stay in all studied patients was 5.8 ± 1.5 days with minimum stay of 3 days and maximum stay of 9 days. As regard the onset of AKI during admission, the mean onset in all studied patients was 2.5 ± 0.7 with minimum onset of 1 and maximum onset of 5. As regard minimum Creat, the mean value in all studied patients was 0.91 ± 0.3 with minimum value of 0.34 and maximum value of 1.6, As regard maximum Creat, the mean value in all studied patients was 4.08 ± 1.7 with minimum value of 1.6 and maximum value of 7.6, As regard minimum blood urea, the mean value in all studied patients was 35.5 ± 12.8 with minimum value of 12 and maximum value of 66, As regard maximum blood urea, the mean value in all studied patients was 161.1 ± 73.3 with minimum value of 65 and maximum value of 317, As regard onset of maximum Creat, the mean onset in all studied

Table 1. Description of demographic data in all studied patients.

	Studied patients (*N* = 100)	
Sex		
Male	50	50%
Female	50	50%
Age (years)		
Mean ± SD	56.4 ± 16.4	
Min – Max	19–82	
Chronic diseases		
DM	50	50%
HTN	58	58%

patients was 4.2 ± 1.2 with minimum onset of 3 and maximum onset of 8, as shown by the next table. In all studied patients, there were 22 patients (22%) with direct renal mortality and 56 patients (56%) with mortality due to nonrenal causes. Dialysis intra-hospital was done in 28 patients (28%), while dialysis extra-hospital was done in 6 patients (6%). There were 46 patients (46%) in RRT need, RRT was done for 28 patients (28%). Eight patients (28.6%) had CRRT, 18 patients (64.3%) had CHD and 2 patient (7.1%) had SLED. The mean RRT duration in all studied patients was 2.1 ± 0.86 with minimum duration of 1 and maximum duration of 4, as per the next table as regard the renal outcome, there were 4 patients (4%) developed CKD, 6 patients (6%) developed ESRD, 78 patients (78%) died, while there was the recovery in 12 patients (12%) as per the next table. Shows not statistically significant (*P* value > 0.05) correlation between QCSI and other studied parametric data (hospital stay, maximum Create, minimum Creat, onset of AKI, maximum urea, and minimum urea) in all studied patients Tables 1–7, Figs. 1–4.

4. Discussion

Covid-19 epidemic-associated Acute Kidney Injury (AKI) has emerged as a worldwide public health concern because to its high morbidity and death.[6] Acute kidney injury (AKI) was discovered to be prevalent during the most recent pandemic, the 2009 pandemic influenza A (H1N1). Although AKI rates may be comparable between the two

Table 2. Description of CORAD score and QCSI in all studied patients.

	Studied patients (*N* = 100)	
CORAD score		
CORAD 3	36	36%
CORAD 4	64	64%
QCSI		
Mean ± SD	6.7 ± 2.1	
Min - Max	1–11	

Table 3. Description of clinical data in all studied patients.

	Studied patients (*N* = 100)
Hospital stay	
Mean ± SD	5.8 ± 1.5
Min - Max	3–9
Onset of AKI during admission	
Mean ± SD	2.5 ± 0.7
Min – Max	1–5
Minimum Creat	
Mean ± SD	0.91 ± 0.3
Min – Max	0.34–1.6
Maximum Creat	
Mean ± SD	4.08 ± 1.7
Min – Max	1.6–7.6
Minimum blood urea	
Mean ± SD	35.5 ± 12.8
Min – Max	12–66
Maximum blood urea	
Mean ± SD	161.1 ± 73.3
Min – Max	65–317
Onset of maximum Creat	
Mean ± SD	4.2 ± 1.2
Min - Max	3–8

pandemics, COVID-19 has spread at a much faster rate than H1N1.[7] The death rate in this research was high, like that seen in previous investigations. With respect to all-cause mortality at 2, 4, and 6 weeks, however, there were no statistically significant differences; this is even though the mortality rate associated with AKI among patients without Covid infection was 78% higher in our study than

Table 4. Description of mortality and RRT in all studied patients.

	Studied patients (*N* = 100)	
Direct renal mortality		
No	78	78%
Yes	22	22%
Mortality due to nonrenal causes		
No	44	44%
Yes	56	56%
Dialysis intrahospital		
No	72	72%
Yes	28	28%
Dialysis extra-hospital		
No	94	94%
Yes	6	6%
RRT needed		
No	54	54%
Yes	46	46%
RRT		
No	72	72%
Yes	28	28%
RRT type		
CRRT	8	28.6%
CHD	18	64.3%
SLED	2	7.1%
RRT duration		
Mean ± SD	2.1 ± 0.86	
Min - Max	1–4	

Table 5. Description of outcome in all studied patients.

	Studied patients ($N = 100$)	
Outcome		
Recovery	12	12%
CKD	4	4%
ESRD	6	6%
Death	78	78%

the 23–42% shown by many other studies.[7] While 78 patients (78%) passed away, 22 (22%) were still alive after 30 days; 10% had developed CKD, 6% had developed ESRD requiring permanent RRT, and 12% had made a full recovery from AKI; there was no statistically significant difference between the percentage of patients who developed CKD and ESRD in this group and the percentage of patients who developed CKD and ESRD among AKI patients who were not infected with covid, as noted in other studies[8] This is the first report of long-term renal dysfunction (failure of recovery) in survivors of COVID-19-associated acute kidney injury (AKI) in Egypt. In the context of COVID-19, 16% of patients with AKI did not make a full recovery of renal function. Since many patients with COVID-19 exhibit severe acute tubular damage on tissue inspection, possible microthrombi, and a high incidence of proteinuria, the poor recovery rate is predictable given the overall severity of AKI (high peak creatinine, requirement for dialysis).[9] There was a statistically significant ($P = 0.008$) increase in the prevalence of HTN between CORAD 3 (24 patients, 33.3%) and CORAD 4 (46 patients, 71.9%) patients. Furthermore, when comparing patients' CORAD classifications with respect to minimum blood urea, those in CORAD 4 had a statistically significant (P value $= 0.03$) higher minimum blood urea (38.7 12.9) than those in CORAD 3 (29.7 10.8). However, there is no statistically significant relationship between CORAD type and any of the other variables examined (including but not limited to diabetes, hospital length of stay, acute kidney injury onset, minimum creatinine, maximum creatinine, maximum urea, direct renal mortality, RRT requirement, or outcome).[10] We found no statistically significant relationship between QCSI and the other non-parametric parameters (diabetes, hypertension, direct renal mortality, RRT requirement, and outcome) of the patients investigated. The

Table 7. Correlation study between QCSI and other studied parametric.

	Pearson correlation coefficient	
	r	P value
QCSI vs Hospital Stay	0.16	0.267 NS
QCSI vs Onset AKI	−0.12	0.416 NS
QCSI vs Minimum Creat	0.11	0.434 NS
QCSI vs Maximum Creat	−0.06	0.687 NS
QCSI vs Min Urea	0.15	0.306 NS
QCSI vs Max Urea	−0.07	0.643 NS

Table 6. Correlation between CORAD type in studied patients and other studied data.

	CORAD 3 ($N = 36$)		CORAD 4 ($N = 64$)		St. test	P value
Chr. diseases						
DM	14	38.9%	36	56.3%	X2 = 1.38	0.24 NS
HTN	12	33.3%	46	71.9%	X2 = 7.02	0.008 S
Hospital stay						
Mean ± SD	5.8 ± 1.7		5.7 ± 1.5		MW = 287	0.98 NS
AKI onset						
Mean ± SD	2.7 ± 0.8		2.4 ± 0.7		MW = 248	0.37 NS
Min. Creat						
Mean ± SD	0.87 ± 0.2		0.93 ± 0.3		MW = 250	0.44 NS
Max. Creat						
Mean ± SD	3.7 ± 1.8		4.2 ± 1.6		MW = 228	0.23 NS
Min Bl. urea						
Mean ± SD	29.7 ± 10.8		38.7 ± 12.9		MW = 181	0.03 S
Max urea						
Mean ± SD	137.8 ± 71.5		174.3 ± 71.9		MW = 196	0.06 NS
Direct renal mortality	8	22.2%	14	21.9%	$X^2 = 0.001$	0.98 NS
RRT needed	14	38.9%	32	50%	$X^2 = 0.57$	0.45 NS
Outcome						
Recovery	8	22.2%	4	6.3%		
CKD	4	11.1%	0	0%	$X^2 = 7.04$	0.07 NS
ESRD	2	5.6%	4	6.3%		
Death	22	61.1%	56	87.5%		

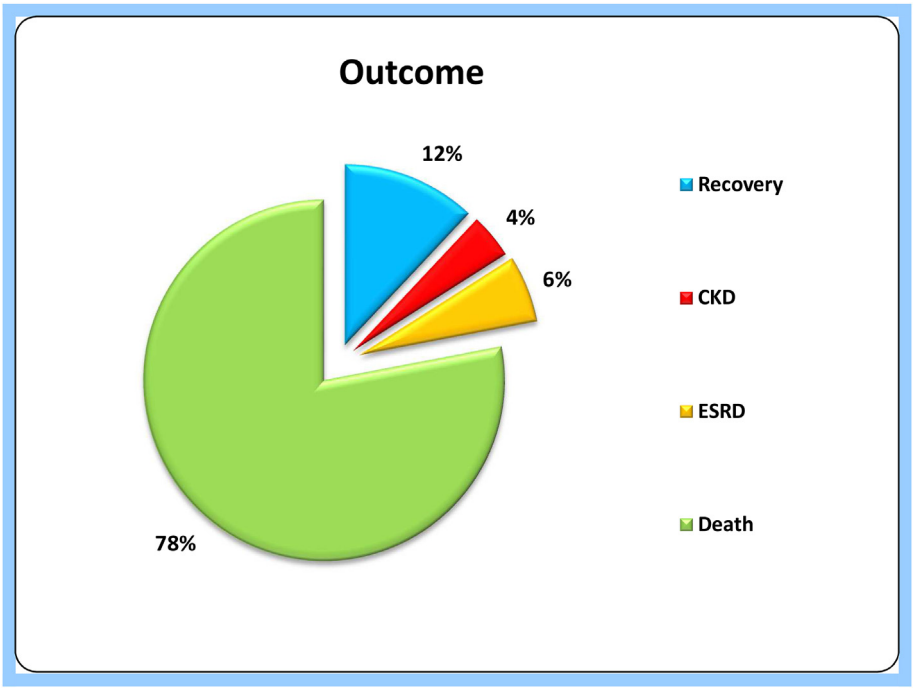

Fig. 1. Showing outcome in all studied patients.

quantitative coagulation state index (QCSI) was not statistically correlated with other examined parametric data (hospital stay, maximum Creat, minimum Creat, start of AKI, maximum urea, and minimum urea) in all patients.[11] Patients with certain comorbidities of interest, such as diabetes or hypertension, require further research to clarify the risk imposed by AKI in their cases. There was a severe lack of this kind of information for the cohorts we found. Furthermore, we were only able to examine the correlation between renal disease and death or severe illness; other important clinical questions, such as the apparent temporal correlation between AKI and intubation, or the correlation

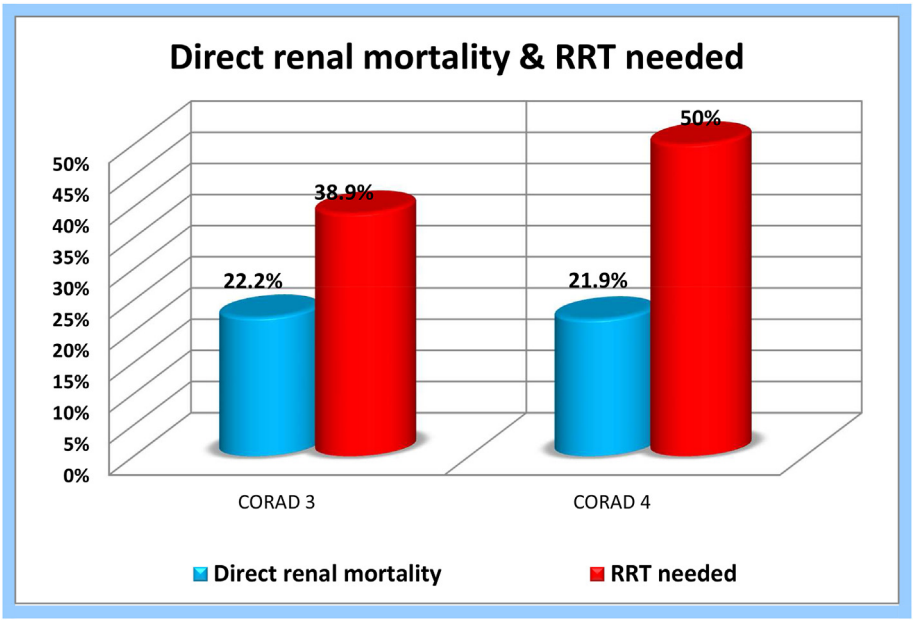

Fig. 2. Correlation between CORAD type in studied patients and Direct renal mortality and RRT needed.

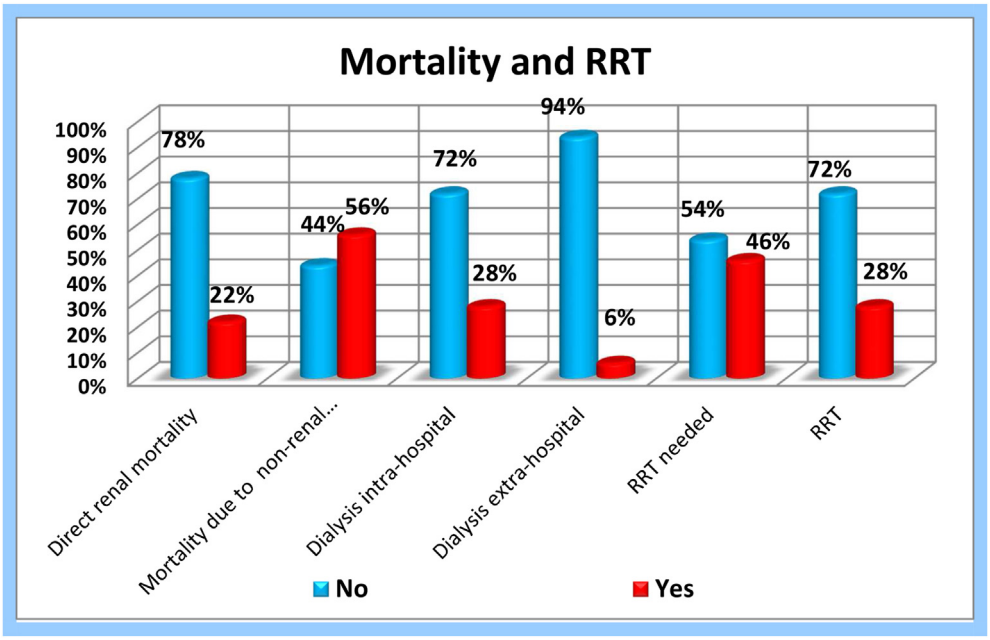

Fig. 3. Showing mortality and RRT in all studied patients.

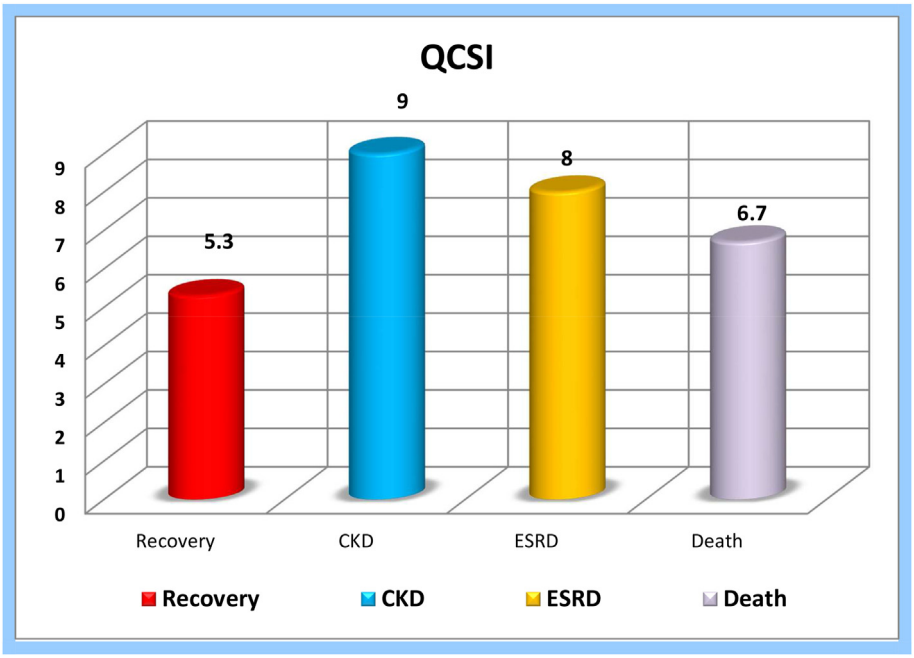

Fig. 4. Showing correlation between QCSI and outcome.

between AKI and time to extubating, hospitalization time, and overall disease-related morbidity, could not be examined with the data at hand[8]

4.1. Conclusion

Patients with AKI on top of non-covid pneumonia had a higher death rate and higher requirement for RRT, but there was no significant increase in the prevalence of CKD or ESKD in this group of patients after AKI.

Conflicts of interest

None declared.

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