

# Mortality Rate in Covid-19 Positive Patients with Acute Kidney Injury Requiring Hemodialysis

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## Abstract

**Introduction:** According to statistics till April, 2020 1,995,983 cases and 131,037 deaths have been reported globally with COVID-19 being a global threat posing great challenges to the healthcare system. Clinical data reviews and researchers have revealed that COVID-19 affects multiple organ especially liver, kidney and heart with primary damage to the respiratory system. Acute kidney injury and COVID-19 infection has been found to be linked to each other but the etiology remains unclear still.

**Method:** This is an observational retrospective study conducted in nephrology department of Patel Hospital, Karachi. Data was collected retrospectively from medical records of patients. The study was carried out during the time period of March, 2020 till May 2021 for duration of 15 months. Patients with positive COVID-19 PCR and having AKI requiring hemodialysis were included in the study. Data was collected by complete evaluation of COVID-19 patient records and their symptoms, clinical status and final outcome during their hospital stay was noted.

**Results:** The frequency of acute kidney injury requiring hemodialysis in our tertiary care setup was found to be 12.2% (n=41). Amongst these there were 53.7% males (n=22) and 46.3% females (n=19) and the mean age of patients was found to be 64.82± 11.2 years. The mean level of lymphocyte count was found to be 11.3 + 4.8 \*10<sup>9</sup>/L. The in hospital mortality of COVID-19 positive patients having AKI was documented to be 73.2% (n=30) as shown in table-4. The other group of patients included 11 patients who recovered from acute kidney injury after hemodialysis sessions and were discharged from the hospital.

**Conclusion:** Since COVID-19 infection became pandemic in 2020 there still needs to be a lot of research done in different populations. Hospitalized patients with COVID-19 infection should be Screen for kidney impairment and provided proper treatment. There has been found a very close association between the severity of acute kidney injury and mortality among the critically ill patients.

**Keywords:** mortality rate; acute kidney injury; hemodialysis

## Introduction

COVID-19 is a single stranded RNA virus belonging to corona viridae family of virus and emerged as a pandemic in 2019 starting from city Wuhan, China. It has been named internationally as SARS-COV-2 by researchers and it primarily affects the respiratory system infecting more than 70,000 people during the first five days of pandemic in Wuhan [1]. According to statistics till April, 2020 1,995,983 cases and 131,037 deaths have been reported globally with COVID-19 being a global threat posing great challenges to the healthcare system [2]. Overtime researchers need to be educated about COVID-19 and its presentation. COVID-19 infection of the respiratory tract

can be divided into three phases: phase 1 is asymptomatic incubation period, phase 2 symptomatic period and phase 3 being severe acute respiratory syndrome (SARS) with high viral load [3]. COVID-19 affects lung in the form of viral pneumonia, inflammation and endothelial damage causing breathing difficulties [4]. Clinical data reviews and researchers have revealed that COVID-19 affects multiple organ especially liver, kidney and heart with primary damage to the respiratory system. Acute kidney injury and COVID-19 infection has been found to be linked to each other but the etiology remains unclear still [5]. Acute kidney injury is indicated by rising blood urea nitrogen, serum creatinine and uric acid levels from the baseline levels of the patient. In a study conducted in China to analyse risk factors for AKI in COVID-19 positive patients and mortality risk [6].

AKI was more prevalent in patients with severe COVID-19 infection and older age groups, although the etiology is unclear. COVID-19 infection severity is found to be increased in older age groups and proportionally the chances for AKI increase [7]. In fewer studies co morbidities are also confounding factors for acute kidney injury such as COVID-19 positive patients having preexisting diabetes mellitus are more susceptible to AKI, whereas this isn't found to be the case with hypertension [8]. Patients having diabetes have raised levels of blood urea nitrogen and serum creatinine as compared to non-diabetics posing more risk to development of AKI. Non modifiable risk factors affecting risk of AKI in COVID-19 positive patients are male gender and older age. Males generally tend to have higher baseline serum creatinine, blood urea nitrogen and uric acid levels in contrast to females. Although we need more studies to analyze the impact of these risk factors on severity of AKI and mortality rate in COVID-19 positive patients. Hence with severe COVID-19 and simultaneous presence of AKI, the mortality rate is found to be proportionally increased in such groups of patients in previous studies. During a retrospective study in China, approximately one third of COVID-19 positive patients with AKI died on the 11<sup>th</sup> day of admission [9]. AKI and coronavirus relationship to mortality rate was studied previously in the MERS-CoV epidemic which had 43% mortality rate. Currently patients with co-morbid and severe COVID-19 infection have been found to have 90% or more mortality rate with the presence of AKI [10].

Our study aims to determine the mortality of COVID-19 positive patients having acute kidney injury requiring hemodialysis during their covid treatment phase.

## Method

### Study design

This is an observational retrospective study conducted in nephrology department of Patel Hospital, Karachi. Data was collected retrospectively from medical records of patients. The study was carried out during the time period of March, 2020 till May 2021 for duration of 15 months.

### Study participants

All patients admitted in the nephrology department of our hospital during the above mentioned time period were reviewed for selection. Patients with positive COVID-19 PCR and having AKI requiring hemodialysis were included in the study. Patients were labelled as COVID-19 positive by PCR testing within the last 72 hours of admission into hospital. Patients with end stage renal disease or having maintenance hemodialysis were excluded from the sample.

Gender	Frequency (n)	Percentage (%)
Male	22	53.7
Female	19	46.3

**Table 1:** Gender Distribution of Patients

Comorbidities of patients were also noted upon admission and they are described in table-2 as under. The most prevalent co-morbid in these patients was found to be hypertension found in 63.4% of patients followed by diabetes in 36.6% of individuals.

Comorbid disease	Frequency (n)	Percentage (%)
Diabetes	15	36.6
Hypertension	26	63.4
Copd	4	9.8
Ischemic heart disease	9	22

**Table 2:** Comorbidities in the Study Group

The presenting symptoms of these patients at the time of admission were fever (85.4%), shortness of breath and cough (73.2%) and diarrhea (12.2%). The mean creatinine level of patients having acute kidney injury was found to be 4.84 + 2.70 mg/dl. Table-3 shows the laboratory

Investigation	MEAN + S.D	Normal Range

## Operational definitions

In our study we defined acute kidney injury (AKI) as increase in serum creatinine level to  $\geq 0.3$  mg/dL or increase in baseline serum creatinine levels to  $\geq 150\%$ , or initiation of hemodialysis without previous history of chronic kidney disease. Baseline serum creatinine level was taken as serum creatinine at the time of admission at the hospital [11].

## Data Source

Data was collected by complete evaluation of COVID-19 patient records and their symptoms, clinical status and final outcome during their hospital stay was noted. Basic information like age, gender, co-morbidities was extracted from the files. Co-morbidities of patients like hypertension, diabetes mellitus, COPD and ischemic heart disease were noted. Patient's total lymphocyte count, serum creatinine level, CRP, ferritin, D-Dimer and procalcitonin levels were also retrieved from the data. The final outcome of the patients was noted during their clinical course of COVID-19 and AKI. All this information was filled on a preformed questionnaire. Patient's identities were kept anonymous throughout the study.

## Statistical analysis

Statistical analysis was done by using SPSS version 21.0. Demographic variables will be analyzed in terms of mean + standard deviation for age and qualitative variables like age were shown in terms of frequency and percentage. The mortality rate of patients will be calculated through frequency and risk factors for AKI calculated by paired sample t-test. Statistical significance was determined at  $P < 0.05$ .

## Results

### Baseline characteristics

In our hospital during the given time interval, we received 334 COVID-19 positive cases admitted, out of which 41 patients suffered acute kidney injury and they required hemodialysis as treatment. In contrast to COVID-19 positive patients, non-COVID patients had 7.5% incidence of AKI. The frequency of acute kidney injury requiring hemodialysis in our tertiary care setup was found to be 12.2% (n=41). Amongst these there were 53.7% males (n=22) and 46.3% females (n=19) and the mean age of patients was found to be 64.82+ 11.2 years. The mean level of lymphocyte count was found to be 11.3 + 4.8  $10^9/L$ .

parameters of the patients. During the hospital stay each patient required on average two to three hemodialysis sessions. The average duration of hospital stay for these patients was 7 days.

Creatinine	4.84 + 2.70 mg/dl	0.1- 1.2 mg/dl
Ferritin	1966 + 2675 mcg/dl	11- 300 mcg/dl
Procalcitonin	18 + 46.6 ng/ml	<0.05 ng/ml
Crp	174 + 365 mg/dl	<0.3 mg/dl
D dimer	6671 + 6231	<0.50 (considered negative)

**Table 3:** Laboratory Parameters of Patients

The in hospital mortality of COVID-19 positive patients having AKI was documented to be 73.2% (n=30) as shown in table-4. In the non-COVID positive patients the mortality rate due to AKI in our setup was found to be 4.3%. The mortality rate in COVID-19 positive patients with AKI is 17 times higher as compared to the non-control group. During treatment 51.2% (n=21) patients required only one hemodialysis session while others required more than one. There were 11 COVID-19 positive patients

who recovered from acute kidney injury after hemodialysis sessions and were discharged from the hospital. Paired sample t-test shows that presence of hypertension as a co-morbid has higher chances of mortality due to AKI (p-value = 0.001) whereas diabetes, COPD and ischemic heart disease have no association with mortality and AKI in COVID-19 positive patients.

Outcome	Frequency (n)	Percentage (%)
Alive	11	26.8
Dead	30	73.2

**Table 4:** Patient Outcome after Acute Kidney Injury

## Discussion

The severity of COVID-19 infection and acute kidney injury are directly proportional to each other as shown in previous studies and meta-analysis. In a recent meta-analysis, It was found that patients critically ill with COVID-19 infection have around 76% chances of getting acute kidney injury. The risk of a Acute kidney injury in moderate and severe COVID-19 patients varied from 1.3% to 2.8% [12]. Risk factors for development of AKI include hypertension, diabetes, older age, severe respiratory failure the need for vasopressors and longer hospital stay. Some populations are at higher risk of getting acute kidney injury than others due to the risk factors and genetic variability [13]. AKI associated mortality risk showed that patients with a key I had 13 times more chances of dying as compared to the patients not having acute kidney injury. Multivariate Meta regression analysis also did not reveal any link between hypertension diabetes cardiovascular disease chronic pulmonary diseases to development of acute kidney injury Among the COVID-19 patients [14]. In our study the incidence of acute kidney injury in hospitalized COVID-19 patients was found to be 12.2% whereas in other studies it ranges from 3% to 13% [15]. The variability of COVID-19 severity can be explained by ACE2 receptor gene expression among different races, as this receptor is used by SARS CoV2 to enter the target cells. ACE2 Receptor is found mostly in the kidneys, lungs and peripheral blood [16]. Cytokine storm in severe COVID-19 cases causes respiratory failure and its prothrombotic effects reduce perfusion to vital organs like heart and kidney. It is also observed that respiratory failure and mechanical ventilation occur simultaneously with acute kidney injury [17]. Early findings of acute kidney injury were found on urinalysis having +2 proteinuria and >5 RBCs per high power field. Kidney biopsy from visions showed a tubular lesions and severe acute tubular necrosis with prominent expression of ACE2 in tubular cells. Cytokine storm leading to immuno thrombosis, macrophage activation leads to raised ferritin C reactive protein and D dimer levels, all of these variables are also raised in our study group indicating worse clinical outcomes [18]. The in hospital mortality of patients in ICU with COVID-19 infection was found to be 50% in a recent study, In contrast in our study the mortality was found to be 73.2% . In a research focusing on acute kidney injury and severe COVID-19 patients the requirement for haemodialysis was indicated in 23% of the patients and their mortality varied from 90 to 100%. As our study focused on patients requiring hemodialysis as the treatment the mortality in our study group was found to be 72.3% [19].

Although COVID-19 is a respiratory virus it can damage the kidneys by various mechanisms especially in critically ill patients.

## Conclusion

Since COVID-19 infection became pandemic in 2020 there still needs to be a lot of research done in different populations. Hospitalized patients with COVID-19 infection should be Screen for kidney impairment and provided proper treatment. There has been found a very close association between the severity of acute kidney injury and mortality among the critically ill patients.

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