

# Acute Kidney Injury in Covid 19 Pneumonia Patients and its Impact on Clinical Outcomes

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## ABSTRACT

**Introduction:** COVID-19 which started in China in December 2019, spread all over the world and had a significant mortality. Many other organ systems other than the lungs were involved in the disease. The present study was undertaken to evaluate acute kidney injury in COVID-19 pneumonia patients and to study its impact on clinical outcomes.

**Material and methods:** Methodology 150 patients of moderate and severe COVID-19 diagnosed by RT-PCR were included in the study. There were 98 males and 2 females in the study. Acute kidney injury was diagnosed by the KDIGO criteria.

**Results:** The prevalence of acute kidney injury in the study population was 28%. Patients with AKI had significantly higher requirement of mechanical ventilation. Also the patients of COVID-19 pneumonia had higher mortality rates as compared with those who did not have acute kidney injury.

**Conclusions:** The present study reveals that Acute kidney injury is common in COVID-19 pneumonia and impacts the clinical outcomes adversely.

**Keywords:** Acute Kidney Injury, Covid 19, Pneumonia Patients

## INTRODUCTION

COVID-19 is a pathogenic infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It emerged in Wuhan, China in December 2019 and proved to be highly transmissible between humans and rapidly spread to all countries<sup>1,2,3</sup>. WHO declared the Coronavirus Disease 2019 (COVID-19) as a pandemic on March 11th, 2020<sup>4</sup>. Though COVID-19 infection was observed in all ages yet older age people, people with comorbidities like diabetes mellitus, hypertension, cardiorespiratory disorders, chronic liver disease and renal diseases were more affected and had higher mortality rates<sup>5,6,7</sup>.

COVID-19 virus binds to angiotensin converting enzyme 2 (ACE2) receptors present in vascular endothelial cells, lungs, heart, brain, kidneys, intestine, liver, pharynx, and other tissues<sup>8</sup>. It can directly injure these organs. There are studies that show acute kidney injury (AKI) is found commonly in patients of COVID-19. Although, patients with chronic kidney disease (CKD) are at a higher risk of deterioration of renal functions as well as having higher mortality owing to COVID-19, yet a large proportion of patients have deteriorated renal functions and consequently poor clinical outcomes with no history of renal disease and are thus have an acute renal impairment<sup>9</sup>.

Therefore the present study was undertaken to study the

prevalence of AKI in patients of COVID-19 in a tertiary care hospital and to study its impact on clinical outcomes.

## MATERIAL AND METHODS

This was a cross-sectional study done in a L3 COVID care centre. Moderate and severe patients of COVID-19 were included in the study. Mild COVID-19 and CKD patients were excluded from the study. The diagnosis of COVID-19 was done by RT-PCR. The diagnosis of acute kidney injury was done by the KDIGO criteria. A total of 150 patients with COVID-19 pneumonia (moderate and severe categories) were included in the study. CBC, LFT, KFT, RBS, Inflammatory markers (D-dimer, CRP, Ferritin, ) and chest x-ray were done in all patients. Ethical clearance for the study was taken from the institutional ethical committee.

## RESULTS

A total of 150 patients having moderate to severe COVID-19 were enrolled in the study. There were 98 males and 52 female patients. The mean age of the patients was 59.99±13.70 years. Majority of the patients were aged >50 years (n=115; 76.7%). Only 14 (9.3%) patients were aged ≤40 years, 21 (14.0%) were aged between 41-50 years. Mean age of AKI patients (65.50±10.03 years) was significantly higher than that of patients without AKI (57.85±14.37 years).

Out of 150 patients enrolled in the study, 42 (28.0%) had acute kidney injury (AKI). Prevalence of AKI in COVID-19 patients with pneumonia was 28.0%. Prevalence of AKI was higher among males as compared to females (32.7% vs. 19.2%) but this association was not found to be significant statistically.

Mechanical Ventilation use was significantly higher among patients with acute kidney injury as compared to Non-AKI patients (45.2% vs. 23.1%). Requirement of Oxygen support via nasal prongs was significantly higher among patients who did not have acute kidney injury as compared to AKI patients (24.1% vs. 9.5%). Use of Face mask, HFNC, NIV

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and NRM were comparable in AKI and Non-AKI patients. The association was not found to be significant statistically. The mortality rate was higher (52.4%) in patients who had AKI in comparison to patients who did not have AKI (25.9%).

Total duration of hospital stay of COVID-19 pneumonia patients ranged from 2 to 34 days and the mean duration was  $13.66 \pm 6.76$  days. Though duration of hospital stay of non-AKI patients was higher as compared to AKI case ( $13.90 \pm 6.50$  vs.  $13.05 \pm 7.45$  days) yet this difference was not found to be significant statistically.

Proportion of hypertensive patients was higher among patients without AKI (52.8% vs. 35.7%) but this difference was not found to be significant statistically.

Majority of overall patients (n=80; 53.3%) as well as those with AKI (54.8%) and non-AKI (52.8%) were diabetic. Proportion of diabetic patients was slightly higher among AKI group but this difference was not found to be significant statistically.

In both the groups (AKI and non-AKI), 16.7% patients were suffering from CAD. Proportion of patients with

hypothyroidism were significantly higher among AKI cases (28.6% vs. 13.9%).

## DISCUSSION

The virus binds to angiotensin converting enzyme 2 (ACE2) receptors present in vascular endothelial cells, lungs, heart, brain, kidneys, intestine, liver, pharynx, and other tissues and can affect these organs directly<sup>10</sup>. Kidney involvement has also been observed in COVID 19. The most frequent abnormality in patients with COVID-19 is mild-to-moderate proteinuria. In a study, Acute kidney injury (AKI) was more common in critically ill patients with about 90% of patients who required mechanical ventilation developed AKI<sup>11</sup>. Kidney biopsy specimen obtained from COVID-19 patients have been shown to be positive for viral infected renal tissue<sup>12</sup>. Variation in prevalence of AKI among COVID-19 patients has been found in different studies. Apart from this, it has been observed that differences in clinical outcome of these patients was also dependent on the ethnicity and nationality of the patients. These differences might be due to availability of infrastructural facilities and natural immunity of the inhabitants. In India, the association between kidney injury and COVID 19 has been dealt by only few researchers from South India<sup>13,14</sup>. The present study was conducted on moderate and severe COVID-19 hospitalized cases wherein incidence of AKI was found to be 28.0%. Number of other workers who included patients with varying severity of disease found the AKI incidence to be between

SN	AKI Status	No. of patients	Percentage
1-	AKI	42	28.0
2-	No AKI	108	72.0
	Total	150	100.0

**Table 1: Prevalence of AKI in Study Population (n=150)**

SN	Outcome Variables	Total (N=150)	AKI (n=42)		AKI (n=108)		Chi-square test	'p'
			No.	%	No.	%		
1-	Type of Oxygen support							
	Face Mask	15	4	9.5	11	10.2	0.015	0.904
	HFNC	10	2	4.8	8	7.4	0.340	0.560
	MV	44	19	45.2	25	23.1	7.119	0.008
	N/P	30	4	9.5	26	24.1	4.001	0.045
	NIV	5	1	2.4	4	3.7	0.164	0.685
	NRM	46	12	28.6	34	31.5	0.120	0.729
	Chi-square test		$\chi^2=8.804$ (df=5); p=0.117					
	Final Outcome							
2	Referred to highercentre	1	0	0.0	1	0.9	0.391	0.532
	Discharged	99	20	47.6	79	73.1	8.783	0.003
	Death	50	22	52.4	28	25.9	9.524	0.002
		Chi-square test		$\chi^2=9.724$ (df=2); p=0.008				
3	Duration of hospital stay(days)	$13.66 \pm 6.76$ (2-34)	$13.05 \pm 7.45$ (2-30)		$13.90 \pm 6.50$ (3-34)		't'=0.688;p=0.492	
% Column wise								

**Table-2: Association of AKI with Clinical Outcomes**

SN	Comorbidities	Total (N=150)	AKI (n=42)		No AKI (n=108)		Chi-square test	'p'
			No.	%	No.	%		
1-	Hypertension	72	15	35.7	57	52.8	3.528	0.060
2-	Diabetes mellitus	80	23	54.8	57	52.8	0.048	0.827
3-	CAD	25	7	16.7	18	16.7	0.000	1.000
4-	Hypothyroidism	27	12	28.6	15	13.9	4.417	0.036
% Column wise								

**Table-3: Association of AKI with Comorbidities**

25-30%<sup>15,16</sup>. Diabetes mellitus (53.3%), Hypertension (48%) were the common comorbidities observed in the overall study population in the present study. In our study less common comorbidities were hypothyroidism (18.0%) and CAD (16.7%). We did not find any significant association of comorbidities except hypothyroidism, which was observed in higher proportion of AKI cases in our study. In the present study, we found a significant association of AKI with increased use of mechanical ventilation and higher in-hospital mortality, which indicated AKI worsened the clinical course of disease. We did not find any significant association of hospital stay with AKI.

Mechanical ventilation was required in total 44 (29.3%) patients, in which significantly higher proportion of AKI cases required mechanical ventilation as compared to non-AKI cases (45.2% vs. 23.1%). Various workers have also endorsed the findings of present study, showing higher requirement of ventilatory support to COVID-19 cases with AKI<sup>17,18</sup>.

Contrary to the findings of present study, wherein duration of hospital stay did not show significant association with AKI, numerous workers such as Hirsh *et al.*<sup>11</sup>, Bowe *et al.*<sup>15</sup>, Dober *et al.*<sup>19</sup>, Rahimzadeh *et al.*<sup>20</sup> had reported longer hospital stay of AKI patients.

Out of 150 COVID-19 pneumonia patients, 50 (33.3%) expired during hospital stay. Mortality was significantly higher among AKI cases as compared to those who did not have AKI (52.4% vs. 25.9%).

The present study highlights that AKI is one of the most important non- respiratory complications associated with COVID-19. It also shows the significance of occurrence of AKI in determination of clinical course and outcome. The findings of the study highlight the need to monitor the COVID- 19 patients for development of AKI and to formulate appropriate strategies to prevent it.

Limitations of the study include not studying the role of socio-economic status, duration of symptoms and treatment before confirmation of COVID-19.

## CONCLUSIONS

The present study revealed that the prevalence of Acute kidney injury in COVID 19 patients is 28%. The requirement of mechanical ventilation was significantly higher in patients who had acute kidney injury in comparison to those who did not have AKI. The mortality rates were also significantly higher in patients with AKI. The study shows that Acute kidney injury is fairly common in patients of COVID19 pneumonia and has significant impact on clinical outcomes.

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