International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Website: https://ijmpr.in/

Research Article

Clinical profile and outcome of Acute Kidney Injury in COVID-19 patients hospitalised at Tertiary care centre

Dr Kritank Mishra[1], Dr Subodh Vikas Patil[2], Dr Shreya Devidas Badhe[3]

[1]Assistant Professor Department of Medicine ,United Institute of Medical Sciences ,Prayagraj ,Uttar Pradesh
[2]Assistant Professor Department of Medicine, Government Medical College, Buldhana, Maharashtra
[3]Senior Resident Department of Pathology, Government Medical College, Buldhana, Maharashtra

OPEN ACCESS

Corresponding Author:

Dr Subodh Vikas Patil
Assistant Professor Department of Medicine, Government Medical College, Buldhana, Maharashtra

Received: 12-08-2025
Accepted: 27-09-2025
Available online: 08-10-2025

ABSTRACT

Background: Initial reports suggested that incidence of Acute Kidney Injury (AKI) in COVID-19 positive patients was less. However with time, we found that evidence of AKI among patients with COVID-19, was significantly more particularly in intensive care unit (ICU) patients. New York City health system admitted total 3993 COVID -19 patients. Out of which AKI occurred in 1835 (46%) patients. From them 19% patients required dialysis treatment and 50 % of them died in hospital during treatment. Out of which 35% did not recover their creatinine level to baseline at the time of discharge.
However, according to Indian data available, overall incidence of AKI is 5.1%.Data on AKI is insufficient as initial reporting incidence is on basis of case series and retrospective studies. AKI can be a severe complication of COVID-19 and hence we wish to assess, define and report the course of AKI in patients with COVID-19.
Incidence of AKI may vary with age, severity of disease, comorbid conditions and ethnicity of patients .The pathogenesis of AKI in COVID-19 is through many mechanisms rather than one. Study of AKI in COVID-19 in depth is necessary to know and draw conclusions.
Materials and Methods: Descriptive observational Retrospective and Prospective Cohort study was done on 200 patient admitted in medicine department. RTPCR positive COVID-19 patients with age more than 18 years included in study .All necessary clinical data collected from patient records.
Results: Incidence of AKI in COVID-19 was 71% in hospitalised patients. AKI is more in elder patients, those having comorbid conditions. Mortality rate is more inpatients having AKI.73.6% of patient's serum creatinine did not return to base level.
Conclusion: This study indicate that AKI frequently complicates COVID-19 . There is high mortality rate in patients with COVID -19 AKI and lower rate of recovery of renal function .Early detection of comorbidities and kidney outcomes is essential to improve outcomes in COVID-19.Assessing, defining, and reporting the course of AKI in COVID-19 patients becomes crucial.

Key Words: COVID-19, AKI, Outcome.

INTRODUCTION

Initial reports suggested that incidence of Acute Kidney Injury (AKI) in COVID-19 positive patients was less.[1]However with time ,we found that evidence of AKI among patients with COVID-19,was significantly more particularly in intensive care unit (ICU) patients.[2]New York City health system admitted total 3993 COVID -19 patients. Out of which AKI occurred in 1835 (46%) patients. From them 19% patients required dialysis treatment and 50 % of them died in hospital during treatment. Out of which 35% did not recover their creatinine level to baseline at the time of discharge.
However, according to Indian data available, overall incidence of AKI is 5.1%.[3]Data on AKI is insufficient as initial reporting incidence is on basis of case series and retrospective studies. AKI can be a severe complication of COVID-19 and hence we wish to assess, define and report the course of AKI in patients with COVID-19.

Incidence of AKI may vary with age, severity of disease, comorbid conditions and ethnicity of patients .The pathogenesis of AKI associated with COVID-19 is through many mechanisms rather than one. From lung kidney cross-talk to direct viral cellular invasion. Other mechanisms like pre- renal through insensible and sensible water loss, etc. It is necessary to study AKI associated with COVID-19 in depth to know and draw conclusions like: Is any particular group of people more affected than other, so that majority of resources can be directed in finding these vulnerable group of population and treating them; what can be done to prevent development of AKI and hence reduce its incidence or decrease it's severity.

Our aim is to study Incidence of AKI among COVID-19 patients and death/Recovery rates and outcome among those who develop AKI. We studied effect of comorbidities in AKI development in COVID 19 patients.

MATERIALS AND METHODS

Patients admitted to Tertiary Care Hospital during 01 April 2020 to 31 January 2022 were included for study. Total number of patients is 200. Out of 200, 126 were male and 84 were female patients. All the patients records of COVID-19 positive was screened for retrospective study from 1 April 2020 to 31December 2020.All the patients record of RTPCR covid-19 positive patients was screened for prospective study from 01 April 2021 to 31 January 2022.Data was retrieved from Medical Record Office after screening for inclusion and exclusion criteria for retrospective study and for prospective study new patients fulfilling inclusion criteria were selected.

Patient details regarding age, sex, symptoms, comorbidities noted. All lab parameters and findings related to COVID 19 outcome noted. The term Acute Kidney Injury (AKI) was according to KDIGO (Kidney Disease Improving Global Outcomes) guideline. AKI staging according to KDIGO guideline is as STAGE 1- Increase in baseline creatinine by 1.5-1.9 times (within 7 days) or absolute increase by 0.3mg/dl (within 48 hrs) or Urine Output<0.5 ml/kg/hr for 6 hr. STAGE 2- Increase in baseline creatinine by 2.0-2.9 times or Urine output<0.5ml/kg/hr for 12hrs. STAGE 3-Increase in baseline creatinine by 3 times or Absolute value of Creatinine >=4.0mg/dl or Urine output<0.3ml/kg/hr for 24hrs or Anuria for >=12hrs or need of dialysis.

Study Design

Descriptive Observational Retrospective and Prospective Cohort Study.

Inclusion Criteria

RTPCR positive COVID-19 patients with Age more than18 years included in study

Exclusion Criteria

Patients having Chronic kidney disease-On haemodialysis/Stage-V, febrile illness, obstructive Uropathy, Diabetic ketoacidosis, Accelerated hypertension, History of Nephrotoxic drugs intake ,Urinary tract infection with Pyelonephritis are excluded from study.

Statistical Analysis

Association between qualitative variables was assessed by Chi-Square test and by Fisher's exact test where Chi-Square test was not valid due to small counts. The significance of the findings was assessed at a 5% level of significance .Comparison of Quantitative data measured between binomial qualitative variable was done using Unpaired t-test or by Mann–Whitney U test.

Microsoft Excel software isused for data entry and data compilation. PSPP version 1.0.1 (1st July 2022 release) will be used for statistical analysis.

RESULTS AND OBSERVATIONS

Table 1: Acute Kidney Injury and Outcome (Deceased and Discharged) in COVID-19 patients

Acute Kidney Injury		Outcome		Total
		Deceased	Discharged	
Yes	No.	69	79	148
	%	46.6%	53.4%	100.0%
No	No.	0	52	52
	%	0.0%	100.0%	100.0%
Total	No.	69	131	200
	%	34.5%	65.5%	100.0%

Chi-Square Tests	Value	df	p-value	Association is-
Pearson Chi-Square	37.013	1	1.17E-09	**Significant**
Continuity Correction	34.978	1	3.33E-09	**Significant**

Risk Estimate	Value	95% Confidence Interval	
		Lower	Upper
For cohort Outcome = Discharged	0.534	0.459	0.621

In the above table, out of 200 COVID-19 patients, 148 patients (74%) developed Acute Kidney Injury. Among patients who got Acute Kidney Injury, 69 patients (46.6%) got deceased, while none of the patients died who did not developed Acute Kidney Injury. Discharge rate for patients who did not developed Acute Kidney Injury was 100% (52 patients) while it was only 53.4% (79 patients) for those who developed Acute Kidney Injury.

Table 2: Association between Acute Kidney Injury Severity (Stage) and Outcome (Deceased/Discharged) in COVID-19 patients

Acute Kidney Injury Stage		Outcome		Total
		Deceased	Discharged	
No AKI	**No.**	0	52	52
	%	0.0%	100.0%	100.0%
Stage 1	**No.**	0	32	32
	%	0.0%	100.0%	100.0%
Stage 2	**No.**	1	28	29
	%	3.4%	96.6%	100.0%
Stage 3	**No.**	68	19	87
	%	78.2%	21.8%	100.0%
Total	**No.**	69	131	200
	%	34.5%	65.5%	100.0%

Chi-Square Tests	Value	df	p-value	Association is-
Pearson Chi-Square	130.010	3	5.38E-28	**Significant**

Out of 32 patients who developed Stage 1 AKI, death rate was 0%, while discharge rate was 100%. As the severity of AKI increased to Stage 2, out of 29 patients, 1 patient (3.4%) got deceased, while 28 patients (96.6%) got discharged. As the severity of AKI rose to Stage 3, out of 87 patients, 68 patients (78.2%) got deceased, while 19 patients (21.8%) got discharged.

Table 3) Age distribution with Acute Kidney Injury (AKI) Severity (Stage) in COVID-19 patients

Age (Yrs.)		Acute Kidney Injury Stage				Total
		No				
		AKI	1	2	3	
21 to 30	**No.**	6	1	0	0	7
	%	85.70%	14.3%	0.0%	0.0%	100.0%
31 to 40	**No.**	21	9	4	2	36
	%	58.30%	25.0%	11.1%	5.6%	100.0%
41 to 50	**No.**	17	13	6	10	46
	%	37.00%	28.3%	13.0%	21.7%	100.0%

51 to 60	**No.**	8	7	8	22	45
	%	17.80%	15.6%	17.8%	48.9%	100.0%
61 to 70	**No.**	0	2	9	36	47
	%	0.00%	4.3%	19.1%	76.6%	100.0%
71 to 80	**No.**	0	0	2	13	15
	%	0.00%	0.0%	13.3%	86.7%	100.0%
>= 81	**No.**	0	0	0	4	4
	%	0.00%	0.0%	0.0%	100.0%	100.0%
Total	**No.**	52	32	29	87	200
	%	26.00%	16.0%	14.5%	43.5%	100.0%

Chi-Square Tests	**Value**	**df**	**p-value**	**Association is-**
Pearson Chi-Square $	102.244	18	8.58E-14	**Significant**
Pearson Chi-Square ^	55.780	3	4.68E-12	**Significant**

Above table shows, incidence of AKI, increased with increasing age. Furthermore AKI severity increased with increasing age.

Table 4) Association between Comorbidity and Acute Kidney Injury in COVID-19 patients

Comorbidity		**Acute Kidney Injury Stage**				**Total**
		No AKI	**1**	**2**	**3**	
Hypertension	**No.**	1	6	12	10	29
	%	3.4%	20.7%	41.4%	34.5%	100.0%
Hypertension, Diabetes Mellitus	**No.**	0	2	1	9	12
	%	0.0%	16.7%	8.3%	75.0%	100.0%
Hypertension, IHD	**No.**	0	1	5	4	10
	%	0.0%	10.0%	50.0%	40.0%	100.0%
Hypertension, IHD, Diabetes Mellitus	**No.**	0	1	4	35	40
	%	0.0%	2.5%	10.0%	87.5%	100.0%
Diabetes Mellitus	**No.**	0	1	1	13	15
	%	0.0%	6.7%	6.7%	86.7%	100.0%
IHD	**No.**	0	3	0	1	4
	%	0.0%	75.0%	0.0%	25.0%	100.0%
IHD, Diabetes Mellitus	**No.**	0	1	1	1	3
	%	0.0%	33.3%	33.3%	33.3%	100.0%
No comorbidity	**No.**	51	17	5	14	87
	%	58.6%	19.5%	5.7%	16.1%	100.0%
Total	**No.**	52	32	29	87	200
	%	26.0%	16.0%	14.5%	43.5%	100.0%

Chi-Square Tests	Value	df	p-value	Association is-
Pearson Chi-Square $	152.572	21	5.69E-22	**Significant**
Pearson Chi-Square ^	98.954	3	2.61E-21	**Significant**

In the above table, out of total 200 patients, one or more of comorbidities like hypertension, diabetes mellitus, ischemic heart disease was present in 113 patients(56.5%).almost 112 patients got AKI after COVID-19 infection.
Out of 87 patients with no comorbidity, 51 patients (58.6%) did not developed AKI, whereas 36(41.37%) patients developed AKI.

Table 5: Association between acute on Chronic Kidney Disease and Outcome(Deceased/Discharged)

Chronic Kidney Disease		Outcome		Total
		Deceased	Discharged	
Yes	**No.**	32	1	33
	%	97.0%	3.0%	100.0%
No	**No.**	37	130	167
	%	22.2%	77.8%	100.0%
Total	**No.**	69	131	200
	%	34.5%	65.5%	100.0%

Chi-Square Tests	Value	df	p-value	Association is-
Pearson Chi-Square	68.251	1	1.44E-16	**Significant**
Continuity Correction	64.980	1	7.57E-16	**Significant**

Risk Estimate	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Chronic Kidney Disease (Yes /No)	112.432	14.861	850.592
For cohort Outcome = Deceased	4.377	3.273	5.853
For cohort Outcome = Discharged	0.039	0.006	0.269

Relative risk of 4.377: Patients known to be CKD were 4.377 times more likely to die as compared with patients without CKD

Table 6) Percentage of patients with Acute Kidney Injury whose creatinine returned to baseline, as compared with patients whose creatinine remain elevated at the time of discharge in COVID-19 patients.

Whether Creatinine returned to Baseline	No.	Percentage
Yes	39	26.4%
No	109	73.6%
Total	148	100.0%

Above table shows total cases who developed Acute Kidney Injury(148) ; only 39 patients(26.4%) creatinine returned to baseline , while 73.6%(109 patients) creatinine did not returned to baseline at the time of discharge.

DISCUSSION

Acute Kidney Injury (AKI) incidence rate was 74% in this hospitalized study. Western countries was having much lower incidence rates AKI of around 22% to 40%. [4] AKI incidence had been reported 0.5 % in study of China by Guan et al. [5] AKI incidence of 80% in critically ill patient had been reported by Rubin et al.[6] Silver et al. demonstrated that Acute

kidney injury occurred in 30% of COVID-19 admitted patients. Also risk AKI of increased to more than 45% in patients requiring ICU admission. According to Indian data available, incidence of AKI was 5.1 % .[3] Incidence of AKI is widely variable , probably related to population demographics, risk factors for AKI and variable inclusion criteria. Furthermore, high incidence of AKI in this study could be due to presence of ARDS in majority of patients (84.5%). Maximum mortality was for patients with Stage 3 AKI, AKI severity in COVID-19 patients was associated with decreased survival of patient and result was statistically significant.

In Chan L et al[7] study , the proportions with stages 1, 2, or 3 AKI were 39%, 19%, and 42%, respectively. In G Xiao et al [8],stage 1 AKI incidence was 14.3% and that of stage 2 or 3 AKI was 4.9%.Both study showed higher mortality in patients with COVID-19 AKI . Tarrangon B et al study [9] also shows that mortality was higher in COVID19 AKI.

There was association between AKI stage (severity) and age. Thus, age is risk factor for severity of AKI. This can be explained as increasing age results in decreased renal reserve and functional nephron [10], which cannot compensate for the renal function. Incidence of AKI, increased with increasing age. Furthermore AKI severity increased with increasing age.

Cai x et al[10] , Cantaluppi V et al[11] ,Zhang J et al[12] studies also shows increased incidence of AKI with older age patients .Results of above studies are similar with present study.

“In present study, AKI incidence is more in COVID 19 patients having comorbidities like Hypertension, Diabetes Melliltus, Ischemic Heart Disease alone or multiple comorbidities .However AKI is less in non comorbidpatients. Present study results for association of AKI and comorbidities are comparable with studies of Sullivan MK et al[13], CaiXet al , Zhang J et al, Martono et al[14].In Zhang J et al odds ratio for association for Hypertension, Diabetes Melliltus , Ischemic Heart Disease is 1.42,1.40 and 1.14 respectively.

Existence of CKD was strongly associated with worse outcome. This is in consistent with study done by Betjes MG et al[15], Chan L et al . Possible explanations are CKD is pro inflammatory state and also immunocompromised state which causes severe course of disease. Also in CKD patient’s functional reserve of kidneys is reduced.

In present study, at the time of discharge serum creatinine of patients did not return to baseline even after Hemodialysis. Possible reason is high prevalence of stage 3 AKI in present study. Chan Let al, Sun siao et al [16], Tan BWL et al study [17] results are similar to present study.

CONCLUSION

AKI can be severe complication of COVID -19 and hence it is important to assess, define and report the course of AKI.
In this study, the age of majority of patients was between 4th to 7th decade of life. Acute Kidney Injury occurred in approximately two-third of patients. Both genders were equally affected. There is high mortality rate among patients who developed Acute Kidney Injury. AKI severity increases mortality .Presence of one or more comorbidities is associated increased incidence of AKI and increased severity of AKI. Presence of Chronic kidney disease has worst outcome in COVID-19 patients. Majority of patients serum creatinine level did not return to normal level on discharge.

Due to adverse impact of AKI, early detection of comorbidities and renal complications is essential to improve outcome of COVID-19 patients.

Funding: None
Conflicts of interest: None

Abbrevations

- COVID-19 - Corona virus disease
- AKI - Acute Kidney Injury
- CKD - Chronic Kidney Disease
- IHD - Ischemic Heart Disease

REFERENCES

1. Dawei Wang, Bo Hu, Chang Hu, Fang fang Zhu, Xing Liu, Jing Zhang et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA.2020; 323:1061-69.
2. 2.Guangchang Pei, Zhiguo Zhang, Jing Peng, Liu Liu, Chunxiu Zhang, Chong Yu et al. Renal involvement and early prognosis in patients with COVID-19 pneumonia.J.Am.Soc.Nephrol. 2020; 31:1157-65
3. Prasad N, Agrawal S.COVID 19 and acute kidney injury.Indian journal of Nephrology.2020;30(3):161.

4. 4.Guan W-j, Ni Z-y,Hu Y, Liang W-h,Ou C-q, He J-x,etal.Clinical characteristics of coronavirus disease 2019 in China.NewEngl J Med.(2020) 382:1708-20.
5. Rubin S, Orieux A, Prevel R, Garric A, Bats M-L, Dabernat S, et al.Characterization of acute kidney injury in critically ill patients with severe coronavirus disease-2019 (COVID-19).medRxiv.(2020):2020.05.06.20069872.10.1101/2020.05.06.20069872.
6. 6. KolheNV,Fluck RJ, Selby NM, TaalMW.Acutekidney injury associated with COVID-19:A retrospective cohort study.PLoS Med 2020;17:e1003406.doi:10.371/journal.pmed.1003406.
7. Chan L, Chaudhary K, Saha A, Chauhan K, Vaid A, Zhao S, Paranjpe I, Somani S, Richter F, Miotto R, Lala A, Kia A, Timsina P, Li L, Freeman R, Chen R, Narula J, Just AC, Horowitz C, Fayad Z, Cordon-Cardo C, Schadt E, Levin MA, Reich DL, Fuster V, Murphy B, He JC, Charney AW, Böttinger EP, Glicksberg BS, Coca SG, Nadkarni GN; on behalf of the Mount Sinai COVID Informatics Center (MSCIC). AKI in Hospitalized Patients with COVID-19. J Am SocNephrol. 2021 Jan;32(1):151-160. doi: 10.1681/ASN.2020050615. Epub 2020 Sep 3. PMID: 32883700; PMCID: PMC7894657.
8. Xiao G, Hu H, Wu F, Sha T, Zeng Z, Huang Q, Li H, Han J, Song W, Chen Z, Cai S. [Acute kidney injury in patients hospitalized with COVID-19 in Wuhan, China: a single-center retrospective observational study]. Nan Fang Yi Ke Da XueXueBao. 2021 Feb 25;41(2):157-163. doi: 10.12122/j.issn.1673-4254.2021.02.01. PMID: 33624587; PMCID: PMC7905239.
9. Tarragón B, Valdenebro M, Serrano ML, Maroto A, Llópez-Carratalá MR, Ramos A, Rubio E, Huerta A, Marques M, Portolés J. Acute kidney failure in patients admitted due to COVID-19. Nefrologia (Engl Ed). 2021 Jan-Feb;41(1):34-40. English, Spanish. doi: 10.1016/j.nefro.2020.08.005. Epub 2020 Oct 9. PMID: 33162225; PMCID: PMC7546258.
10. 10.Cai X, Wu G, Zhang J, Yang L. Risk factors for acute kidney injury in adult patients with COVID-19: a systematic review and meta-analysis. Front Med [Lausanne] 2021; 8:719472. [DOI] [PMC free article] [PubMed] [Google Scholar]
11. Cantaluppi V, Guglielmetti G, Dellepiane S, Marengo M, Mehta RL, Ronco C. A call to action to evaluate renal functional reserve in patients with COVID-19. Am J Physiol Renal Physiol. 2020 Nov 1;319(5):F792-F795. doi: 10.1152/ajprenal.00245.2020. Epub 2020 Sep 24. PMID: 32969711; PMCID: PMC7641895.
12. Zhang, J., Pang, Q., Zhou, T., Meng, J., Dong, X., Wang, Z., & Zhang, A. (2023). Risk factors for acute kidney injury in COVID-19 patients: an updated systematic review and meta-analysis. *Renal Failure*, *45*(1). https://doi.org/10.1080/0886022X.2023.2170809
13. Sullivan MK, Lees JS, Drake TM, et al. Acute kidney injury in patients hospitalized with COVID-19 from the ISARIC WHO CCP-UK Study: a prospective, multicentre cohort study. Nephrol Dial Transplant 2022; 37:271–284. [DOI] [PMC free article] [PubMed] [Google Scholar]; Largest cohort study to date describing kidney outcomes in patients hospitalised with COVID-19; 31.5% of inpatients had biochemical AKI.
14. Martono, Fatmawati F, Mulyanti S. Risk Factors Associated with the Severity of COVID-19. Malays J Med Sci. 2023 Jun;30(3):84-92. doi: 10.21315/mjms2023.30.3.7. Epub 2023 Jun 27. PMID: 37425387; PMCID: PMC10325129.
15. Betjes MG. Immune cell dysfunction and inflammation in end-stage renal disease. Nat Rev Nephrol. 2013 May; 9(5): 255-6
16. Sun, Siao1; Annadi, Raji R.2; Chaudhri, Imran3; Munir, Kiran3; Hajagos, Janos4; Saltz, Joel4; Hoai, Minh2; Mallipattu, Sandeep K.5; Moffitt, Richard4; Koraishy, Farrukh M.5. Short- and Long-Term Recovery after Moderate/Severe AKI in Patients with and without COVID-19. Kidney360 3(2):p 242-257, February 2022. | DOI: 10.34067/KID.0005342021.
17. Tan BWL, Tan BWQ, Tan ALM, Schriver ER, Gutiérrez-Sacristán A, Das P, Yuan W, Hutch MR, García Barrio N, Pedrera Jimenez M, Abu-El-Rub N, Morris M, Moal B, Verdy G, Cho K, Ho YL, Patel LP, Dagliati A, Neuraz A, Klann JG, South AM, Visweswaran S, Hanauer DA, Maidlow SE, Liu M, Mowery DL, Batugo A, Makoudjou A, Tippmann P, Zöller D, Brat GA, Luo Y, Avillach P, Bellazzi R, Chiovato L, Malovini A, Tibollo V, Samayamuthu MJ, Serrano Balazote P, Xia Z, Loh NHW, Chiudinelli L, Bonzel CL, Hong C, Zhang HG, Weber GM, Kohane IS, Cai T, Omenn GS, Holmes JH, Ngiam KY; Consortium for Clinical Characterization of COVID-19 by EHR (4CE). Long-term kidney function recovery and mortality after COVID-19-associated acute kidney injury: An international multi-centre observational cohort study. EClinicalMedicine. 2022 Nov 7;55:101724. doi: 10.1016/j.eclinm.2022.101724. PMID: 36381999; PMCID: PMC9640184.