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Clinical Profile and Outcome of COVID-19 Patient with Kidney Disease in a Tertiary Care Centre in Manipur

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Abstract

Aim: *To find out the demographic characteristics, co- morbid conditions, clinical course and outcomes among COVID- 19 patients with renal disease admitted at in a tertiary care hospital in north east India.*

Materials and Method*: It is a prospective observational study conducted in the department of nephrology, Regional Institute of Medical Sciences (RIMS), Imphal, during the period between 1st of March 2020 and 31st of April 2021. All adult patients of both the sexes with COVID-19 infectionwith kidney diseaseswere included in the study.*

Result*: During the study period, out of 2287 patient with COVID-19 infection, 103 (4.50%) patients had kidney disease either at the time of admission or developed later on during hospital stay. The incidence of renal dysfunction in males and females were 62.14% and 37.86% respectivelyand 64% had chronic kidney disease (CKD)while 17.4% were acute kidney injury (AKI). Most common age group was 41-60 years. 64.08% of patients needed hemodialysis(HD) duringthe hospital stay.Among CKD patients86.3% required HD.*

In the CKD group, 27 (40.91%) patients expired whereas in the AKI including acute on chronic kidney disease (ACKD) group, 5 patients expired. Mortality was significantly higher in patients having renal dysfunction in comparison to patient without renal dysfunction (p<0.001).

Conclusion*: Presence of co-morbidities influences the prognosis of the COVID-19 patients. Patients with renal dysfunction have higher mortality in comparison to patients without renal dysfunction. So we should take up every step to prevent development of renal dysfunction in COVID -19 patients.*

Keywords*: COVID-19, chronic kidney disease, acute kidney injury, hemodialysis.*

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I. INTRODUCTION

COVID-19, the disease caused by the novel corona virus was first described in Wuhan, China but rapidly affected >24 countriesworldwide at the time of writing of this article.[1]The clinical presentation is highly variable with one of the major organ involved is the kidney which manifest as COVID-19 related acute kidney injury (AKI) in hospitalized patient, especially in those requiringintensive care unit (ICU) management.Another important aspect of COVID-19 as related to kidney disease is patient with end stage renal disease (ESRD), kidney transplant recipient, those with glomerular disease and other chronic kidney disease (CKD) may be at increased risk for infection and associated morbidity, because of underlying immune-compromised state.

Early report from Wuhan, China, concluded that COVID-19 does not result in significant AKI [2] with zero cases among 116 hospitalized patients, rangingup to 15% in the other studies.[3-5] Subsequent studies in the United Statesreported higher incidence, up to 14-69% in hospitalized patients, especially those requiring ICU and mechanical ventilation. [6,7] Reported mortality was also variable ranging from 1% - 28% in Chinese [3,5,8] and 15% - 24% in US studies.[6,7]In china, the incidence of AKI requiring renal replacement therapy (RRT) ranged from 0% - 7%.[2,5,9]

The prevalence of CKD – non-dialyzed among patients with COVID-19 varies from 3.5 % to 48% in US cohorts.[6,7,10] Risk of in hospital death was significantly higher among ESRD patient as compared to non- ESRD patient, with older age and need for mechanical ventilation increasing risk. Most early report of mortality came from small cohorts, where mortality ranged from 14%-30%.[11,12] A more recentlarge cohort reported mortality of 31.7 % in ESRD patient as compared to 25.4% in non- ESRD patient.[13]There I no study available in the North-East India on renal dysfunction in COVID-19 infection hence this study aims todescribe

the demographic characteristics, co-morbid condition, clinical course and outcome among COVID-19 patients admitted in a tertiary care hospital in North – East India.

II. MATERIALS AND METHODS

It is a prospective observational study conducted in the department of nephrology, RIMS, Imphal, during the period from 1st of March 2020 to 31st of April 2021. All patient with COVID-19 infection (confirmed by either reverse transcriptase-polymerase chain reaction i.e. RT-PCR,TrueNat , or rapid antigen test were included in the study. Out of those, patient developing renal disease during the hospital stayor patients with pre-existing kidney disease were chosen for further analysis. Patient who were not willing to participate in the study were excluded from the study.

Demographic details, medical history including co-morbidities, history of exposure to COVID-19 and vital parameters, treatment details and clinical outcome were also collected. Patients were followed up till the end of hospital stay. Working definitions of AKI, acute on chronic kidney disease disease (ACKD) and CKD were used as per KDIGO guideline [14,15]

Statistical analysis was carried out using statistical package for the social science (SPSS Inc., Chicago,IL,USA, version 20.0 for window) and Microsoft excel 2016.

All quantitative data such as age, gender, length of hospital stay were estimated using measures of central location (mean). Qualitative or categorical variable were described as counts and percentage. Data analysis was done by Chi- square test.

III. Results and Observations

During the study period, 2287 patient with COVID-19 infection were admitted in our hospital, out of which 103 patients had kidney disease (4.50%) either at the time of admission or developed later on during hospitalization period.

Of the 103 patients, 62.14% were male and 37.86% were female. More than half i,e 54.37% covid-19 patient belong to the age group 41-60 years followed by 26.21% having their age group more than 60 years. Only 4.85%ofthe patients were having their age less than20 years as shown in **Table 1.**

Table-1: Age-Sex distribution of the cases (n=103)

age	sex		total (%)
	male n=64 (%)	female n=39 (%)	
<20 yrs	1(20.00%)	4(80.00%)	5(4.85%)
20-40 yrs	10(66.67%)	5(33.33%)	15(14.56%)
41-60 yrs	35(62.50%)	21(37.50%)	56(54.37%)
>60 yrs	18(66.67%)	9(33.33%)	27(26.21%)
total	64(62.14%)	39(37.86%)	103(100.00%)

Among patient with COVID-19 infections and kidney disease, various co morbidities were present with CKD being the most common co morbidity followed by hypertension (HTN) and type 2 diabetes mellitus (T2DM) (0.83, 0.74 and 0.39% respectively).**Table 2** shows the different categories of renal dysfunction among the COVID -19 patients and CKD was the most common form (64.08%).Incidence of CKD, ACKD and AKI was 2.88, 0.65 and 0.7%respectively.

Table 2: Different categories of renal disease in covid-19 patients.

different categories of renal disease	male	female	total	discharge (%)	expired (%)
ACKD	10	5	15(14.56%)	12(80.00%)	3(20.00%)
AKI	13	5	18(17.48%)	16(88.89%)	2(11.11%)
CKD	38	28	66(64.08%)	39(59.09%)	27(40.91%)
post-transplant	3	1	4(3.88%)	3(75.00%)	1(25.00%)
total	64	39	103(100.00%)	70(67.96%)	33(32.04%)

ACKD: acute on chronic kidney disease AKI: acute kidney injury

CKD: chronic kidney disease.

Of the total 103 patient, 66 patients (64.08%) needed HD during hospital stay (**Table 3**). Requirement of dialysis was varied depending on the categories of the renal diseases.

Table 3: Dialysis requirement in different categories of renal disease.

different catagories of renal disease	treatment given		total (%)
	non-dialysed n= 37 (%)	dialysed n=66 (%)	
ackd	9(60.00%)	6(40.00%)	15(14.56%)
aki	17(94.44%)	1(5.56%)	18(17.48%)
ckd	9(13.64%)	57(86.36%)	66(64.08%)
post-transplant	2(50.00%)	2(50.00%)	4(3.88%)
total	37(35.92%)	66(64.08%)	103(100.00%)

ACKD: acute on chronic kidney disease AKI: acute kidney injury

CKD: chronic kidney disease.

Presence of renal dysfunction was associated with worse prognosis. Mortality rate was significantly higher in patient having or developing renal dysfunction in comparison to without renal dysfunction($p<0.001$). A total of 33 (32.04%) out of 103 patients with renal dysfunction expired during the hospital stay.Fifteen (38.46 %) female patients expired whereas 18(28.13%) males expired. Mortality (32.04%) was the highest in the age group >60yrs with CKD (40.91%)($p<0.008$) as shown in **Table 4.**

Table 4: Comparison of outcome between AKI (AKI+ ACKD) and CKD (n=99)

	outcome		total (%)	chi-square p-value	odd ratio
	discharge n=67 (%)	expired n=32 (%)			
AKI (AKI+ACKD)	28 (84.85%)	5 (15.15%)	33 (33.33%)	6.672 (0.008)	11.3
CKD	39 (59.09%)	27 (40.91%)	66 (66.67%)		
total	67 (67.68%)	32 (32.32%)	99 (100.00%)		

AKI: acute kidney injury ACKD: acute on chronic kidney disease CKD: chronic kidney disease

IV. Discussion

Our instituteis a central government undertaking hospital and right from the beginning of the COVID-19 pandemic we set up isolated dialysis area for providing dialysis treatment. Closure of many dialysis centers that had been running earlier caused hardship to the patients. We tried to provide all necessary medical care for all types of patients having renal involvement.

In our present study overall incidence of kidney disease among COVID-19 infectionswas 4.5% which is very similar to previous studies (3%-9%).[3,4,16]Incidence of CKD was 3% in a study in Italy[17],very close to that of ours which was 2.88%. Till date, the published data showed the incidence of AKI among patients with COVID-19 is highly variable. It has been reported to occur in up to 27% of patients with COVID-19. [18]This may be due to variation of the working definition of AKI used by different authors. In our study overall incidence of AKI was only0.7% using KDIGO.

Incidence of COVID-19 infection with renal dysfunction was more in male in comparison to female (62% vs. 38%) as shown in other previous studies where males outnumberedfemales.[19] This may be because of greater mobility of the males in comparison to female counterpart because of male dominance nature of the society, exposing them more to the risk factors of the infection.

In the present study, more than half (54.37%) of COVID-19 patient with kidney disease belong to the age group 41 – 60 years followed by age group more than 60 years(26.21%). Only 4.85 % patients are having their age less than 20 years.This may be because of the fact that this age group patients have greater social mobility exposing to COVID-19, inappropriate behaviors in addition to presence of higher prevalence of risk factors and co morbidities of kidney diseases. Moreover the renal reserve of older patients arereduced and have lower immunity level in comparison to young adults.

In the current study, CKD, HTN and T2DM were detected as co morbidities causing poor prognosis. In previousstudies also, the most common co morbidities associated with poor prognosis include diabetes, HTN, respiratory disease, cardiac disease, pregnancy, renal disease and malignancy [7, 10,20]

To manage the COVID-19 in patients having renal dysfunction especially CKD is more challenging given the immunosuppressed state and presence of severe co-morbidities. Requirement for hemodialysis was much more in CKD patient (86.3%) in the present study as compared to ACKD (40%) and AKI (3.3%). This may be due to fact that many patients of CKD was already on regular maintenance hemodialysis and got infected with COVID-19 later on. Even those patients who had not been on regular dialysis deteriorated renal function very fast because of COVID-19 and primary disease of CKD like DM, HTN etc, again which is risk for other complications like development of sepsis, cardiac complication etc.

Incidence of AKI requiring RRT ranged from 0-7% [2, 5, 21]in other studies which was very similar to that of our finding (3.3%).This high incidence could be due to the kidney-lung crosstalk during COVID-19 infection and amplification of inflammation during AKI leading to rapid deterioration of renal function.

In the current study, in COVID-19 infections with kidney disease patientsmortality was 33% and in COVID-19 patients without kidney involvement that was only 8.7%among the hospitalized patients($p<0.001$). This verifies the fact that presence of co morbidity increase the severity.The common contributing factors for higher mortality were mostly those patients who presented late in hospital because of social stigma around the disease, with high fever , severe dyspnoea, altered sensorium with severe hypoxia. Most of the patients died of ARDS.

Meta – analysis showed that CKD was associated with an increased mortality in patient hospitalized with COVID-19 infections although it is not clear whether models were adjusted for hypertension and Diabetes.[22]Risk of hospital death is significantly higher among ESRD patient as compared to non ESRD patient, with older age and need for mechanical ventilation increases the risk [11,13,23]**.** Most early reports of mortality came from small cohorts where mortality ranged from 14% to 30%.[11, 24, 25]A more recent larger cohort reported mortality of 31.7% in ESKD patient as compared to 25.4% in non ESRD patient.[13]However in a study by Gibertoni D et al. the crude mortality rate among CKD patients with COVID-19 was 44.6% (86/193), compared to 4.7% (215/4,523) in CKD patients without COVID-19.[26]

In this study also the highest mortality was found in the age group of > 60 years (33.3%), followed by 41-60 years age group (32.14%) and <40 years (30%) as in other studies.[11,13,23] However the p – value was not statistically significant. Hence from present study we could not conclude that any particular age group at increased risk of mortality.This is probably because elderly patients are more likely to have other complications (such as hypertension, diabetes, coronary heart disease, and COPD). These comorbidities will increase the risk of death associated with COVID-19. This higher mortality is also probably because in CKD patients, the levels of pro-inflammatory cytokines are increased, and this leads to an increase in oxidative stress that eventually produces an inflammatory immune response.

In our study, mortality in CKD patient was40.91% whereas inAKI that was 15.15% with a significant p-value and odd ratio of 11.3, showing that CKD patient with COVID-19 infection had significantly higher risk of mortality as compared to AKI patient.Factors contributing to this high mortality were requirement of RRT

during hospital stay, severe hypoxia at presentation, sepsis and presence of other comorbidities etc.This higher mortality is also probably because in CKD patients, the levels of pro-inflammatory cytokines are increased leading to an increase in oxidative stress and an inflammatory immune response.

Requirement of RRT is also a strong predictor of poor outcome. Yang et al. in a study of 52 COVID-19 confirmed cases found that 8 out of 9 subjects who required RRT did not survive.[27]In another study by Zhou F et al. found that out of 33 confirmed COVID-19 cases who developed AKI, 32 patients did not survive.[28]In one study with a median follow up of 12 days, reported 18% recovery rate in patient with AKI by KDIGO criteria and 46% by expanded criteria i,e change in serum creatinine by $\geq$ 0.3 mg/dl.[21] A multicentre U.S. study of more than 3000 ICU patient reported that 63% with AKI-RRT died, 34% were discharged, and 3 % remained hospitalized at 17 days of admissionand of those discharged , 34% remained RRT dependent at discharge and 18% remained RRT dependent 60 days after ICU admission[29]. This higher mortality in these studies in comparison to our study may be due to fact that all these studies were conducted in the beginning phase of the pandemic when we all were struggling to know the different behaviors of COVID-19 along with sudden pressure on the health care system.The reason for high mortality in COVID-19 patients and severe AKI, even with RRT, may be due to the kidney-lung crosstalk during COVID-19 infection and amplification of inflammation during AKI in a cohort with high incidence of acute respiratory distress syndrome.

V. Conclusion

COVID-19 infection in a patient with renal dysfunction or renal dysfunction developing in a COVID-19 infected patients has got a great impact especially on mortality. When patients required RRT prognosis was worse. So, all due precautions and COVID appropriate behaviors should strictly be followed to prevent this infection.

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