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Clinico-demographic Profile and Outcome of COVID-19 Patients with Kidney Disease: A Single Center Study

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ABSTRACT

Introduction: A severe acute respiratory syndrome (SARS-CoV-2), causing COVID-19 disease has shown to have multi-organ involvement. Information on kidney disease in patients with COVID-19 and effect of prior kidney disease on COVID-19 is limited worldwide and in Nepal. Therefore, this study was done to provide information on clinico-demographic profile and outcome of kidney disease patients with COVID-19 .

Methods: This study was a descriptive cross-sectional study done in the department of Nephrology, College of Medical Sciences Teaching Hospital (COMSTH) from January 2021 to July 2021 after ethical approval from the Institutional Review Committee.Convenient sampling was done and all the kidney disease patients above 18 years irrespective of their gender and kidney diagnosis were included in the study. Clinico-demographic profile and outcome of kidney diseases with COVID-19 were analyzed using statistical package for the social sciences version 20 and were represented as mean, standard deviation, number, percentage and ratio.

Results: Out of 54 patients, 38 (70.4%) were males and 16 (29.6%) were females. The mean age of the patient was 61.5±14.9 years. Acute kidney injury was the most common presentation accounting for 20 (37.0%) cases. Proteinuria was present among 36 (66.7%) patients and microscopic hematuria was present among 11 (20.4%) patients. Mortality occurred in 14 (26%) patients.

Conclusion: Acute kidney injury was the most common presentation among the spectrum of kidney diseases in patients with COVID-19 .

Keywords: acute kidney injury; chronic kidney disease; COVID-19.

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INTRODUCTION

Diffuse alveolar damage and acute respiratory failure were the main features of COVID-19 during its emergence. Over the time, involvement of other organs have been observed. COVID-19 can affect kidneys and kidney patients are also prone to develop COVID-19. Kidney transplant patients due to immunosuppression and patients undergoing in-center maintenance hemodialysis due to inability to self-isolate, are more prone to develop COVID-19. Patients with kidney disease also have other comorbidities, including hypertension, diabetes mellitus, and cardiovascular diseases, that are risk factors for poor outcomes in COVID-19.[1]

Information on kidney disease in patients with COVID-19 and effect of prior kidney disease on COVID-19 is limited worldwide and in Nepal.Therefore, this study aims to provide information on clinico-demographic profile and outcome of COVID-19 patients with kidney involvement.

METHODS

This study was a descriptive cross-sectional study done in the department of Nephrology in College of Medical Sciences Teaching Hospital from January 2021 to July 2021 after ethical approval from the Institutional Review Committee (reference number COMSTH-IRC/2021-06). Convenient sampling was done. All the consecutive patients above 18 years with COVID-19 and kidney involvement admitted in the department of Nephrology, irrespective of their gender and kidney diagnosis, were included in the study.

COVID-19 status was confirmed by RT-PCR (Reverse Transcription-Polymerase Chain Reaction) in those patients with clinical manifestations like fever and/ or respiratory symptoms; decreased appetite; loss of smell and taste; fatigue or with imaging features of COVID-19 infection. Kidney disease in the form of Acute Kidney Injury (AKI), Chronic Kidney Disease (CKD) either on conservative management or kidney replacement therapy were included in the study. Patient was defined as suspected AKI if oliguria (<200ml/6hours) and any AKI related clinical signs and symptoms were present. Signs and symptoms included: 1. listlessness, confusion, fatigue, anorexia, nausea, vomiting, weight gain, or edema.[2] 2. Anuria (urine output less than 100 mL per day), 3. Uremic encephalopathy (manifested by a decline in mental status, asterixis, or other neurologic symptoms). For those with suspected AKI, Serum creatinine was measured on the day of admission. Serum creatinine was repeated after 48 hours. If it fulfilled the modified KDIGO criteria[3] (as mentioned below), the patient was categorized as confirmed AKI. If it failed to fulfill the criteria, serial monitoring of creatinine was done on the 3rd, 5th and 7th day of admission. Serial monitoring was done until it fulfilled the criteria by day 7. Once the criteria was met, serum creatinine was not further repeated. AKI was confirmed if they meet at least one of the following modified KDIGO(Kidney Disease Improving Global Outcome) criteria;[3] 1. Increase or decrease in serum creatinine >0.3mg/dl from reference, 2. Increase or decrease in serum creatinine >50% from reference, 3. Urine output <400ml/day for adults or approximately <0.5ml/kg/hr over 24hrs. Staging of AKI was done according to KDIGO criteria using serum creatinine value.[4]

Among the patients with known CKD not on any form of kidney replacement therapy, acute on chronic CKD was defined if the patient fulfilled the above mentioned AKI criteria with reference to their last known baseline creatinine value.
CKD was defined as abnormalities of kidney structure or function, present for 3 months, with implications for health. GFR was estimated from the Modification of Diet in Kidney Disease (MDRD) Study equation.[5]
General information of patients including age, gender, serial serum creatinine, and urine routine/ microscopic findings were collected. Information regarding dialysis dependency during hospital stay were collected.

Outcome of the study were assessed in terms of 1. Death, 2. Left against medical advice, 3. Kidney recovery, 4. Dialysis dependency.

Death was defined as expiry of a patient during the study period. Left against medical advice was defined as a patient who terminated the treatment in the hospital and left. Kidney recovery was defined as; 1. Partial recovery: creatinine failed to return to normal range or previous baseline value during the course of study, 2. Complete recovery: creatinine returned to normal range or previous baseline value during the course of study. Dialysis dependency was defined as a patient requiring dialysis who was not on dialysis prior to admission. The data collected were then entered in the Microsoft excel sheet 2013 and were

transferred to statistical package for social sciences version 20 (Chicago, IL, USA) for analysis. The data were analyzed using mean, standard deviation, number, percentage and ratio

RESULTS

Total of 54 patients with COVID-19 and kidney disease were enrolled in the study. Out of them, 38 (70.4%) were males and 16 (29.6%) were females. The mean age of the patient was 61.5±14.9 years. The minimum age was 35 years and maximum age was 90 years.

Most patients included in the study were between 61-80 years of age (44.40%).

Table 1. Age distribution of patients.

Age (in years)	Number		Total	Percentage
	Male	Female		
18-40	2	2	4	7.40
41-60	15	5	20	37.03
61-80	15	9	24	44.40
>80	5	1	6	11.11

Acute Kidney Injury (AKI) was the most common presentation accounting for 20 (37.0%) cases followed by Acute on Chronic kidney disease 18(33.3%). Mortality occurred in 14(26%) cases. COVID-19 with AKI was the most common cause for mortality.

Table 2. Spectrum of kidney disease and outcome.

Kidney Disease	Number (percentage)	Mortality	Discharge
AKI	20 (37%)	6	14
CKD5d	12 (22.2%)	2	10
Acute on CKD	18 (33.3%)	4	14
Kidney transplant recipient	4 (7.4%)	2	2
Total	54 (100%)	14 (26%)	40 (74%)
CKD5d= Chronic kidney disease on maintenance hemodialysis			

Table 3. Recovery of AKI according to stage.

Stage of AKI	Partial Recovery	Complete Recovery	Total
1	7 (35%)	4 (20%)	11(55%)
2	2 (10%)	1 (5%)	3 (15%)

Table 4. Urine routine examination.

Functional abnormalities	Cases
Proteinuria	36 (66.7%)
Microscopic hematuria	11 (20.4%)

Table 5. Dialysis during hospital stay.

Kidney Disease	Received	Not Received	Refused
AKI	None	None	None
Acute on CKD	5	12	1
CKD5d	11	1	None
Kidney Transplant Recipient	None	4	None

DISCUSSION

There is mounting evidence supporting that patients with kidney disease are particularly vulnerable to COVID-19. Reports have confirmed that SARS-CoV-2 can invade cells via angiotensin-converting enzyme (ACE2) receptors[6, 7] which are highly expressed in the human kidney.

In our study, majority of the patients were male 38(70.4%) with male to female ratio of 2.3:1. Similar observation of male preponderance (92%) was seen in one of the studies from Nepal done by Dhakal et al.[8] Early experience from China in a study by Huang et al confirmed male predominance (58%).[9]

This scenario of male predominance reflects the social influence of our society, where male population have easy accessibility to healthcare facilities. It also raises a question that may be males are inherently predisposed to develop kidney diseases. This area of research needs multicentric genetic studies.

In terms of age distribution, majority of the patients were between 61-80 years of age (44.40%). The mean age of the patient was

61.5±14.9 years. Our study was similar to the study done by Cheng et al which also showed median age of 63 years.[9] Increase in life expectancy and multiple comorbidities in elderly population may be the cause of increased

However, in contrast to our study, a study done in Nepal by Dhakal et al showed average age of 30.5 years.[8]

AKI occurs frequently among patients with COVID-19 disease. COVID-19 with respiratory failure and concomitant kidney involvement is associated with a poor prognosis.[10]

In our study, acute kidney injury was the most common presentation accounting for 20 (37.0%) cases. Our study was similar to the study done by Ronco et al where more than 50 % patients had AKI.[11]

In our study, 33.3% patients had acute worsening of the pre-existing chronic kidney disease that is similar to a study done by Russo et al which also showed significant percentage of COVID-19 patients with acute worsening of pre-existing chronic kidney disease (45%).[12]

These findings of increased AKI and acute on chronic kidney disease in COVID-19 patients suggest that the kidney could be a primary target of SARS-COV-2 independent of the involvement of lungs.

Proteinuria was the most common functional abnormality, 33 (66.7%), followed by microscopic hematuria 11 (20.4%) in our study. A study by Ouahmi et al. reported significant proteinuria in 60% of patients.[13] Previous studies showed that 43.9% of patients with COVID-19 had proteinuria on admission.[14] Hematuria and proteinuria are associated with poor prognosis.[15]

In our study, none of the patients with acute kidney injury required dialysis. However, 5 out of 18 patients with previously diagnosed CKD who were on conservative management required dialysis.
Mortality occurred in 26% patients in our study. Among those who expired, maximum had AKI (42%). Cheng and colleagues also showed that AKI during hospitalization in COVID-19 patients lead to higher in-hospital mortality.[14] Russo et al in their study also showed increased risk of death by 60% (HR 1.60 [95% IC 1.21–2.49] p = 0.002) among patients with acute kidney injury. Among those who survived AKI, 25% had complete recovery and 45% had partial recovery.

It is unknown whether kidney patients would represent a distinct group of patients who share some characteristics that could predispose them to have higher infectivity. Chronic systemic inflammation may also contribute to higher morbidity and mortality in CKD patients.[16]

CONCLUSION

This study has helped us understand the fact that the kidneys may also be affected as commonly as lungs by COVID 19 and adds on to the mortality of patients. Hence, timely identification of kidney disease in COVID-19 patients or vice versa could help decrease the mortality.

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