Original Research Article

A cross-sectional study to assess impact of COVID-19 infection amongst patients with chronic kidney disease

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ABSTRACT

Background: In December 2019, a series of unknown origin cases of acute respiratory illness occurred in Wuhan, Hubei Province, China. Although diffuse alveolar damage and acute respiratory failure were the main features of COVID-19, the involvement of other organs needed to be explored. After lung infection, the virus may enter the blood, accumulate in the kidney, and cause damage to resident renal cells. Hence, this study was planned to analyze the potential impact of this pandemic of COVID-19 amongst the chronic kidney disease (CKD) patients.
Methods: Cross-sectional observational study was conducted at Seven Hills Dedicated Covid-19 hospital, Andheri, Mumbai. Data was collected from hospital records of CKD patients admitted in the study duration.
Results: This study was conducted on 310 patients. Mean age was 53.33+14.21 years, and 191 (61.6%) of patients were male while mean duration of hospitalization was 16.78+10.31. Majority of the patients presented with symptoms like fever 80%, breathlessness 61.3%, and co-morbidities like Diabetes Mellitus 65.5% followed by Hypertension 61.8%. Patients (15.5%) over age of 60 years tested swab report positive for more than 5 times. Recovery rate being 76.1% while mortality rate found to be 23.87%.
Conclusions: Early detection and effective intervention may help to reduce deaths among CKD patients with COVID-19.

Keywords: COVID-19, CKD, Impact, Mortality rate, Recovery rate

INTRODUCTION

In December 2019, a series of unknown origin cases of acute respiratory illness occurred in Wuhan, Hubei Province, China.[1,2] High-throughput sequencing showed that the disease was caused by named "severe acute respiratory syndrome coronavirus 2" (SARS-CoV-2).[3] On February 11, 2020, the World Health Organization officially changed the name of the disease caused by SARS-CoV-2 to coronavirus disease 2019 (COVID-19). The disease rapidly spread from Wuhan to other areas worldwide. However, all clinical characteristics of the patients suffering from COVID-19 cases were defined only progressively. Identifying and eliminating factors predicting a negative outcome is a key to improving survival from COVID-19.

Although diffuse alveolar damage and acute respiratory failure were the main features of COVID-19, the involvement of other organs needed to be explored. After lung infection, the virus may enter the blood, accumulate in the kidney, and cause damage to resident renal cells.

Indeed, COVID-19 RNA was found in the plasma of 15% of patients by real-time polymerase chain reaction.[4] Of note, it is reported showed that 6.7% of patients with SARS developed acute kidney injury (AKI, and the mortality of those with AKI was 91.7%.[5] Thus, understanding how the kidney is affected by SARS-CoV-2 is urgently warranted. COVID-19 disproportionately affects patients with pre-existing comorbidities like diabetes, hypertension, chronic kidney disease (CKD) etc. Among those suffering from CKD, is a subgroup of patients who receive Renal Replacement by undergoing hemodialysis at intermittent intervals. These patients are vulnerable to infections due to their existing comorbidities and relatively immune-suppressed states.[6]

The previous studies published on topic of Kidney diseases in Covid-19 have hinted towards a higher intramural mortality rates associated with Chronic Kidney Disease.[7] A meta-analyses of previous studies has also called for stringent preventive measures in patients with liver and kidney diseases to nullify the higher potential of morbidity and mortality due to Covid-19 in such patients.[8] Therefore it is essential to periodically review the "COVID-19 in CKD scenario" and this study is planned to further these objectives.

India is amongst the leaders of the globe with respect to the absolute number of cases of SARS novel Coronavirus-2 infected individuals. As per recent reports, India stands 2nd in the patient tally only behind USA.[9]

In such a scenario where the cases are ever rising and the health sector resources are exhausted every day more than before it is extremely important that epidemiological studies to be conducted to chalk out predictive determinants so that risk stratification and optimal resource allocation can be performed.

Hence, this study was planned to analyze the potential impact of this pandemic of COVID-19 amongst the Chronic Kidney Disease (CKD) patients.

METHODS

This cross-sectional observational study was conducted at Seven Hills Dedicated Covid-19 hospital situated in Marol, Andheri, Mumbai. Total of 310 CKD patients admitted between 01st April 2020 and 31st July 2020 included in the study.

Average duration of hospital stays, average time to achieve a negative throat swab, no. of Positive swab tested and mortality was considered as surrogate markers for severity of Covid-19 disease. Data was collected from hospital records like admission line-list, discharge line-list, death line-list and patients record maintained in individual wards/HDUs/ICUs.

The average duration for a negative throat swab result obtained from ward details of patients. The mortality related data obtained from death line-list and average duration of hospital stay was deduced using the patient discharge records. Data entered into the Microsoft Excel Spreadsheet and analyzed using Open Epi (version 3.01) and SPSS (version 21.0) software.

RESULTS

A total of 310 patients were included in our study. Table 1 shows the Age and gender wise distribution of patients. Mean age was 53.33+14.21 years, and 191(61.6%) of patients were male. Majority of male (23.5%) and female (16.8%) patients were from age group 46 to 60 years followed by 61 to 75 Years age group. (Table 1).

Table 1: Age and gender wise distribution of patients.

Age group (in years)	Gender			
	Male		Female	
	N	%	N	%
≤ 30	11	3.5	6	1.9
31 to 45	44	14.2	26	8.4
46 to 60	73	23.5	52	16.8
61 to 75	48	15.5	31	10.0
>75	15	4.8	4	1.3
Total	191	61.6	119	38.4

Minimum duration of hospitalization was 1 day to maximum up to 71 days. Mean duration of hospitalization was 16.78+10.31. Majority of the male patients (25.5%) and female patients (13.9%) were hospitalized for the duration of 6 to 15 days followed by 16 to 25 days. Total of 2.6% male patients and 1.6% female patients were hospitalized for the duration of more than 35 days. 19.03% Patients from age group of 41 to 60 years were

hospitalized for the duration of 16 to 25 days followed by 13.23% patients aged more than 60years up to 15 days while around 2% patients from the same age group were hospitalized for more than 35 days. (Table 2).

At the time of admission patients presented with symptoms like fever (80%), breathlessness (61.3%), altered sensorium (34.8%), cough (54.5%), fatigue

(52.7%) and oliguria (49%). Majority of the patients had co-morbidities of diabetes mellitus (65.5%) followed by hypertension (61.8%), diabetes mellitus with hypertension (39.1%), lung diseases (10.9%) and

coronary artery disease (10.1%). More than half of the patients required dialysis more than three times a week. (Table 3).

Table 2: Gender and age wise distribution of patients for duration of hospitalization.

Duration of hospitalization	Gender				Age Group					
	Male		Female		<40 Years		41to60 Years		>60 years	
	N	%	N	%	N	%	N	%	N	%
< 5 days	21	6.8	13	4.2	6	1.9	14	4.5	14	4.5
6 to 15 days	79	25.5	43	13.9	30	9.7	51	16.4	41	13.2
16 to 25 days	66	21.3	40	12.9	22	7.1	59	19.0	25	8.1
26 to 35 days	17	5.5	18	5.8	7	2.3	16	5.2	12	3.9
>35 days	8	2.6	5	1.6	2	0.6	5	1.6	6	1.9
Total	191	61.6	119	38.4	67	21.6	145	46.7	98	31.6
	P value =0.5503				P value = 0.1031					

Table 3: Distribution of symptoms, co-morbidities and frequency of dialysis.

Symptoms & co-morbidities at admission		Frequency	Percentage
Symptoms	Fever	248	80.0
	Cough	169	54.5
	Fatigue	163	52.7
	Breathlessness	190	61.3
	Altered sensorium	108	34.8
	Oliguria	152	49.1
	Burning micturition	6	1.8
	Vomiting	6	1.8
	Loose motions	28	9.1
Co-morbidities	Hypertension (HTN)	192	61.8
	Diabetes Mellitus (DM)	203	65.5
	HTN +DM	121	39.1
	Coronary Artery Disease	32	10.1
	Lung diseases	34	10.9
Frequency of Dialysis	<3/Week	106	34.1
	>3/Week	165	53.2

Table 4: Age and gender wise details of no. of swabs tested positive.

Gender	Age group (in years)	No. of Swabs tested positive									
		One		Two		Three		Four		≥ Five	
		N	%	N	%	N	%	N	%	N	%
Male	≤40	41	21.5	31	16.2	15	7.9	4	2.1	5	2.6
	41 to 60	81	42.4	61	31.9	34	17.8	22	11.5	9	4.7
	>60	63	33	45	23.6	26	13.6	13	6.8	11	5.8
Female	≤40	24	20.2	17	14.3	15	12.6	8	6.7	5	4.1
	41 to 60	59	49.6	44	37	24	20.2	10	8.4	11	9.3
	>60	33	27.7	24	20.2	15	12.6	7	5.9	7	5.9
Total		301	97.1	222	71.6	129	41.6	64	20.6	48	15.5

15.5% patients tested swab report positive for more than 5 times out of which majority were over age of 60 years followed by 4 times amongst 20.6% of the patients and 3 times amongst 41.6% of the patients. (Table 4).

Out of the total 310 CKD patients 74 patients died due to COVID-19. Majority (16.8%) of the patients died were male. 9.7% of the male patients and 4.5% of the female patients died were more than 60 years of age followed by patients aged 41 to 60 years. It has been observed from

the findings that there is strong association between age& gender of the patients with survival status due to COVID-19. (P value = 0.000000846). Mortality rate found to be 23.87% among the all CKD patients. (Table 5).

Table 5: Age wise distribution of patients for survival status.

Age group	Survived				Diseased			
	Male		Female		Male		Female	
	N	%	N	%	N	%	N	%
≤40 Years	39	12.6	23	7.4	4	1.3	1	0.3
41 to 60 Years	67	21.6	53	17.1	18	5.8	7	2.3
>60 years	33	10.6	21	6.8	30	9.7	14	4.5
Total	139	44.8	97	31.3	52	16.8	22	7.1

Table 6: Recovery of patients according to severity of the disease.

Severity of disease	Survived		Diseased		Total	
	N	%	N	%	N	%
Severe	12	3.9	69	22.3	81	26.1
Moderate	103	33.2	5	1.6	107	34.5
Mild	121	39.0	0	0.0	122	39.4
Total	236	76.1	74	23.9	310	100
P value = 0.0000001						

Total 236 patients recovered and went home. Recovery rate being 76.1%. Out of the 81 severely ill patients 22.3% were not survived while 39% of the mild and 33.2% of the moderate severe patients got recovered and went home safely. It has been observed that there is strong association between severities of the disease Recovery of patients (p=0.0000001) (Table 6).

DISCUSSION

Total of 6564 patients were positive for the COVID-19 RT-PCR test during the study period, with 310 (4.7%) CKD patients. The primary aim of the study was to provide descriptive information on how COVID-19 impacting on CKD patients and its outcome.

In this cross-sectional study conducted in a hospital among total of 310 patients, the mean age was 53.33+14.21 and 61.6% of patients were male. Majority of male (23.5%) and female (16.8%) patients were from age group 46 to 60 years whereas the study conducted by Marian Goicoechea et al. mean age was 71+12 and 64% were male.[10] Also in the study conducted by Yichun Cheng et al. the median age was 63 years, and 52.4% of patient were male.[7]

As per the study conducted by Jeremy A. W. Gold median duration of hospitalization was 8.5 days (IQR-5.0–14.0 days) and duration increased with age while in this study the mean duration of hospitalization was 16.78+10.31 (IQR- 1-71 days).[11] The duration of hospitalization also increased as per increase in age.

It has been observed in study conducted by Marian Goicoechea et al. that patients having co-morbidities like Hypertension (97%), Diabetes (64%) Coronary heart disease (22%) and in study by Yichun Cheng et al. 42.6% were reported as having ≥1 co-morbidities like hypertension 33.4%, diabetes 14.3%, chronic obstructive pulmonary disease 1.9%, chronic kidney disease 2.0%, and tumor 4.6% in addition to it in the study by Jeremy A. W. Gold co-morbidities reported as Diabetes mellitus 39.7%, COPD 5.2%, Chronic lung disease 20.3%, Coronary artery disease 11.5% in contrast to these study findings, in this study majority of the patients had co-morbidities of Diabetes Mellitus 65.5% followed by Hypertension 61.8%, Diabetes Mellitus with Hypertension 39.1%, lung diseases 10.9% and Coronary Artery Disease 10.1%.[10,7,11] These more no. of co-morbidities must be due to the demographic variation and also India being the capital for non-communicable diseases like diabetes and hypertension.

In this study most of the patients presented with symptoms like fever (80%), breathlessness 61.3%, altered sensorium 34.8%, cough 54.5%, fatigue 52.7% and oliguria 49% while in the study by Marian Goicoechea et al. the symptoms were Fever 67% Cough 44% Fatigue 25% Diarrhea, nausea or vomiting 17% and in the study of Yichun Cheng et al. 32.5% patients presented with Fever on admission.[10,7] The proportion of elderly patients was significantly higher in patients with CKD. Without adjusting age groups, patients with CKD had a higher risk of mortality. In the study by Takayuki Yamada et al. mortality rate amongst CKD patients was 17.1% where as in this study mortality rate was 23.8%.[12]

Limitation: The data used is from a convenience sample of hospitalized adult patients in Seven Hills DCH. These patients do not necessarily represent all hospitalized

patients with COVID-19 at other hospitals. Also, patients were not tracked after discharge in this study.

CONCLUSION

CKD being one of the co-morbidities being impacted by infections like COVID-19 CKD patients had a higher risk of mortality suggesting that all adults, regardless of underlying conditions or age, are at risk for serious COVID-19–associated illness. Early detection and effective intervention among CKD patients may help to reduce deaths of patients with COVID-19.

Recommendations

More studies of CKD patients having COVID-19 infection are warranted.

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