(RESEARCH ARTICLE)

To assess the impact of covid-19 on maintenance haemodialysis patients: A retrospective study in a tertiary care hospital in south Kerala

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Abstract

COVID-19 was started as a global pandemic in March 2020. It is an infectious disease caused by the SARS COV-2 virus and it has affected the care and outcomes of patient treated with dialysis. Patients with CKD could be more vulnerable to a severe form of COVID-19. Higher risk of mortality caused by COVID-19 in haemodialysis patient is detected with older age, comorbidities and impaired immune response. Clinical presentation of COVID-19 on haemodialysis patient is fluctuating from asymptomatic or mild disease to severe life threatening illness. Initially, common symptoms were presented including fever, dry cough, fatigue, diarrhea and dyspnea. On computerized tomography scan patients had shown bilateral ground-glass opacities revealing that COVID-19 predominantly affected the respiratory system. Maintenance haemodialysis is the most widely used treatment for end stage CKD patients and it has the higher risk of initial mortality from coronavirus 2019. CKD is a severe medical entity with a higher prevalence of comorbid conditions, mostly including diabetes, hypertension, disproportionally affecting older adults. The aim of this study is to assess the impact of COVID-19 on maintenance haemodialysis patient and the objective of the study is to assess the mortality of COVID-19 on maintenance haemodialysis patient and risk factors associated with it and also the severity of COVID19 on maintenance haemodialysis patient. We performed a retrospective cross sectional study using 39 samples. The samples were collected from the case files of the patients who fulfill the inclusion criteria and then the collected data was statistically interpreted using SPSS software version 22.0 and then the severity and mortality of the COVID-19 on maintenance haemodialysis patient was analyzed. The final analysis included 39 patient who met the inclusion criteria .Here the incidence of COVID-19 on maintenance haemodialysis patient is more prone on 41-60 years of age.

Keywords: Haemodialysis; COVID-19; Severity; Risk factors; Mortality; Vaccination.

1. Introduction

Chronic kidney disease (CKD) is defined as the presence of deformity in kidney structure or function, there are some criteria for CKD - glomular filtration rate (GFR) less than 60 ml/min/1.73 m^2; albuminuria (urine albumin ≥ 30 mg per 24 hours or urine albumin-to- creatinine ratio (ACR) ≥ 30 mg/g); irregularity in urine sediment; abnormalities detected by histology and imaging; renal tubular disorders; history of kidney transplantation, either of this criteria should persist for more than 3 months.[1] Chronic kidney disease is a condition that influence more than 10% of the general population

worldwide, denoting to >800 million individuals and it is more common in aged individuals, women, racial minorities, and in people undergoing hypertension and diabetes mellitus. [2]

Coronavirus disease 2019 (COVID-19) is a highly contagious infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), it is a member of the family Coronaviridae and order Nidovirales.. It has had a disastrous effect on the world, resulting in more than 6 million deaths worldwide. [3] It was first identified as an outbreak of respiratory illness cases in Wuhan City, Hubei Province, China. It was initially reported to the WHO on December 31, 2019. On January 30, 2020, the WHO declared the COVID-19 outbreak a global health emergency. On March 11, 2020, the WHO declared COVID-19 a global pandemic. [4]

Patients undergoing maintenance dialysis are at higher chance for SARS-CoV-2 infection and its serious consequence including death. Higher risk of mortality caused by COVID-19 in haemodialysis patient is detected with older age, comorbidities and impaired immune response. Clinical presentation of COVID-19 on haemodialysis patient is fluctuating from asymptomatic or mild disease to severe life threatening illness. [5] Initially, common symptoms were presented including fever, dry cough, sore throat, fatigue, diarrhea and dyspnea. On computerized tomography (CT) scan patients had shown bilateral ground-glass opacities revealing that COVID-19 predominantly affected the respiratory system. [6].

This study assesses the mortality, risk factors and severity of COVID-19 on haemodialysis patients.

2. Methodology

The investigation was performed in the department of Hemodialysis in a tertiary care hospital in Kerala, India between November 2022 and April 2023. The sample size required for this study was minimum 37 (purposive sampling). We performed a retrospective cross sectional study using 39 samples. The samples are collected from the case files of the patients who fulfill the inclusion criteria and then the collected data was statistically interpreted using SPSS software version 22.0 and then the severity and mortality of the COVID-19 on maintenance haemodialysis patient was analyzed.

3. Results

The samples were collected from 39 subjects. The main objective of the study was to assess the severity of symptoms of covid-19 on maintanence haemodialysis patients and another objective was to assess the mortality of covid-19 on maintenance haemodialysis patients and risk factors associated with it.

3.1. To assess the severity of symptoms of covid-19 on maintanence haemodialysis patients

From 39 subjects the incidences of covid-19 on heamodialysis patients were high among the age group of 41-60 and less among ≤40 age (Table 1). Figure 1 shows the percentage distribution according to age. Male haemodialysis patients were predominantly affected by covid-19 than females (Table 2). Figure 2 shows the percentage distribution according to gender. Based on vaccination, not vaccinated patients are more likely affected by covid-19 followed by first dose (Table 3). Figure 3 shows the percentage distribution according to vaccination status.

Table 1 Percentage distribution according to age

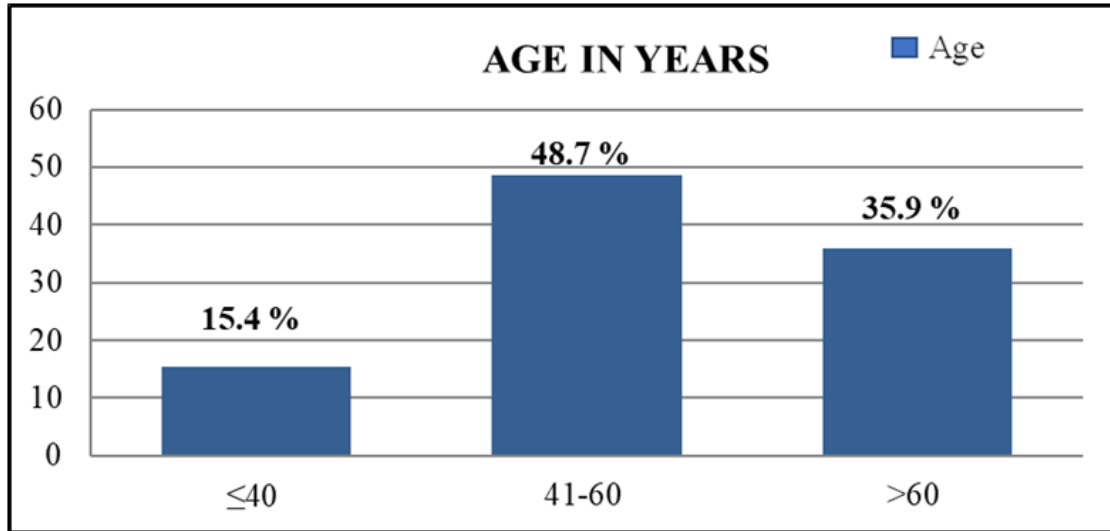| Age in years	Frequency (n)	Percentage (%)
≤40	6	15.4
41-60	19	48.7
>60	14	35.9
Total	39	100

Figure 1 Percentage distribution according to age

Table 1 Percentage distribution according to gender

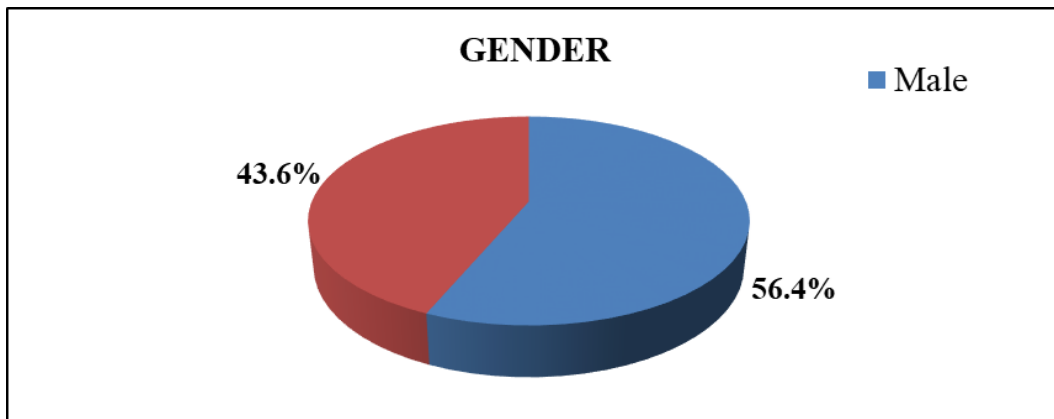| Gender	Frequency (n)	Percentage (%)
Male	22	56.4
Female	17	43.6
Total	39	100

Figure 2 Percentage distribution according to gender

Table 3 Percentage distribution according to vaccine status

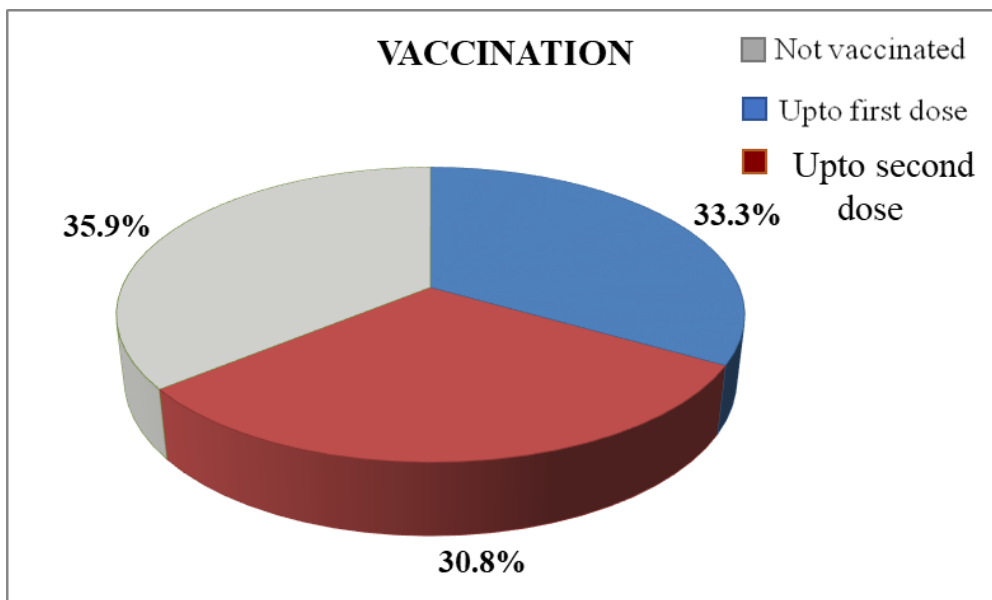| Vaccination	Frequency (n)	Percentage (%)
Not vaccinated	14	35.9
Upto first dose	13	33.3
Upto second dose	12	30.8
Total	39	100

Figure 3 Percentage distribution according to vaccine status

In this study we classified the severity of symptoms such as mild, moderate, severe and critical. The patients affected with mild and moderate symptoms were equal and high in number followed by critical and severe (Table 4). Figure 4 shows percentage distribution according to severity

Table 4 Percentage distribution according to severity

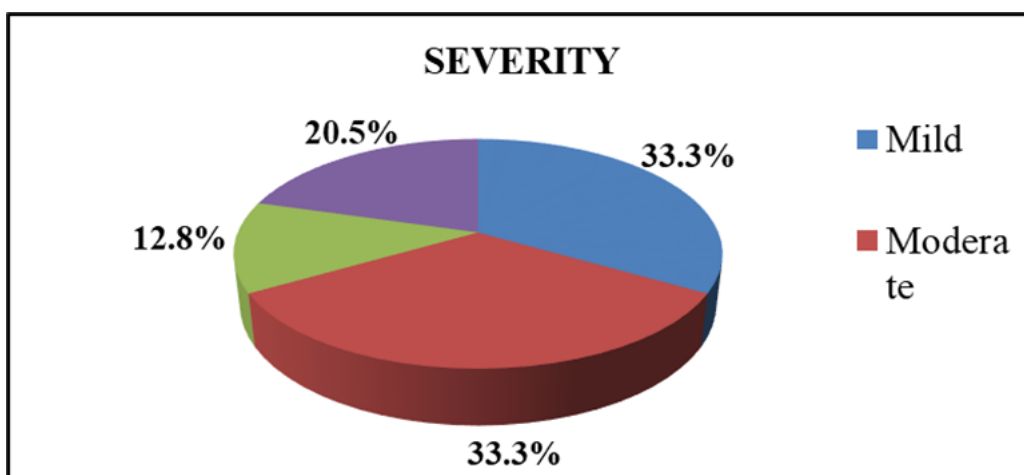| Severity	Frequency (n)	Percentage (%)
Mild	13	33.3
Moderate	13	33.3
Severe	5	12.8
Critical	8	20.5
Total	39	100

Figure 4 Percentage distribution according to severity

3.2. To assess the mortality of covid-19 on maintenance haemodialysis patients and risk factors associated with it

Most of the haemodialysis patients with hypertension were mainly affected by covid-19 compared to other diseases (Table 6). Figure 6 shows the percentage distribution according to comorbidities

Table 5 Percentage distribution according to patient comorbidities

Comorbidities	Frequency (n)	Percentage (%)
DM	24	61.5
HTN	34	87.2
DLP	12	30.8
CAD	11	28.2
Hypothyroidism	4	10.3
Gout	2	5.1
Stroke	1	2.5
Seizure	1	2.5
Nil	2	5.1
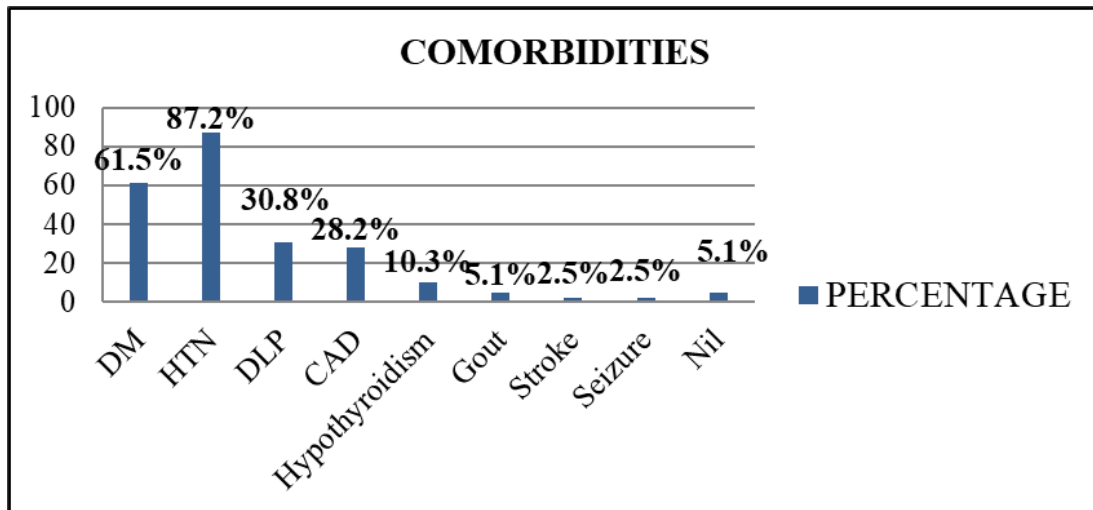
Figure 5 Percentage distribution according to patient comorbidities

From a total of 39 patients, 5 patients were died due to covid-19 complications and 34 were survived.

Table 6 Percentage distribution according to patient status

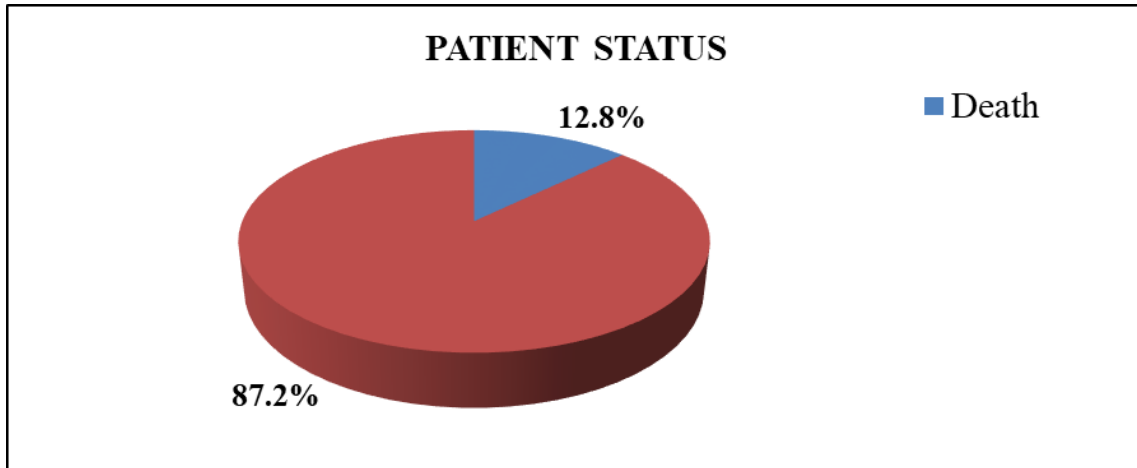| Patient status	Frequency (n)	Percentage (%)
Death	5	12.8
Survived	34	87.2
Total	39	100

Figure 6 Percentage distribution according to patient status

3.3. Association of mortality rate according to age

Table 7 Association of mortality rate according to age

Age in years	Death		Survived		Total		P
	N	%	N	%	N	%	
≤40	1	20	5	14.7	6	15.4	0.341
41-60	1	20	18	52.9	19	48.7	
>60	3	60	11	32.4	14	35.9	
Total	5	100	34	100	39	100	
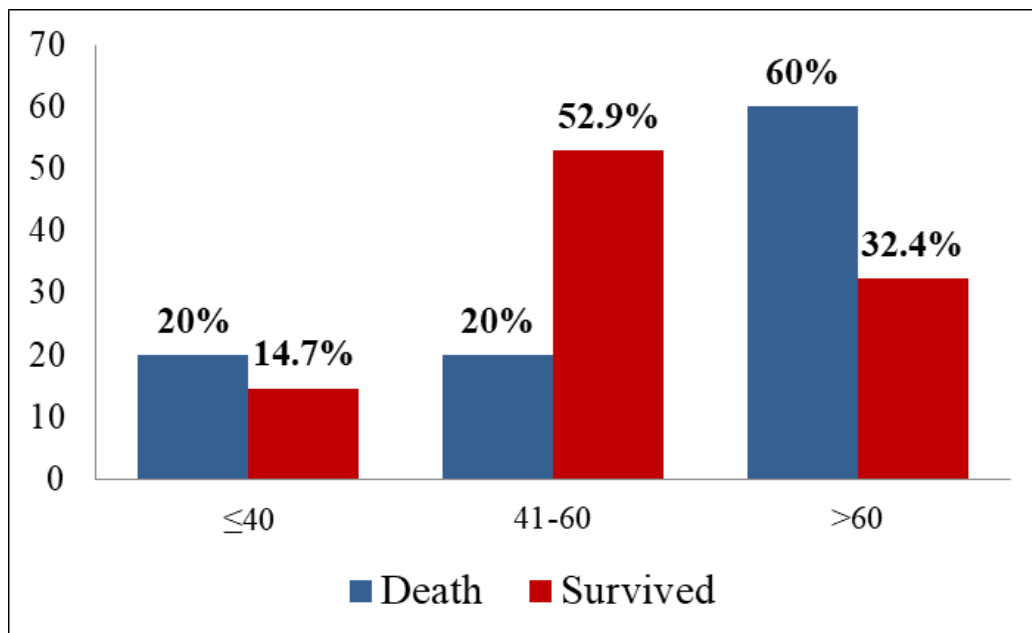
Figure 7 Association of mortality rate according to age

3.4. Relationship of mortality rate according to gender

Table 8 Relationship of mortality rate according to gender

Gender	Death		Survived		Total		p
	N	%	N	%	N	%	
Male	4	80	18	52.9	22	56.4	
Female	1	20	16	47.1	17	43.6	0.363
Total	5	100	34	100	39	100	
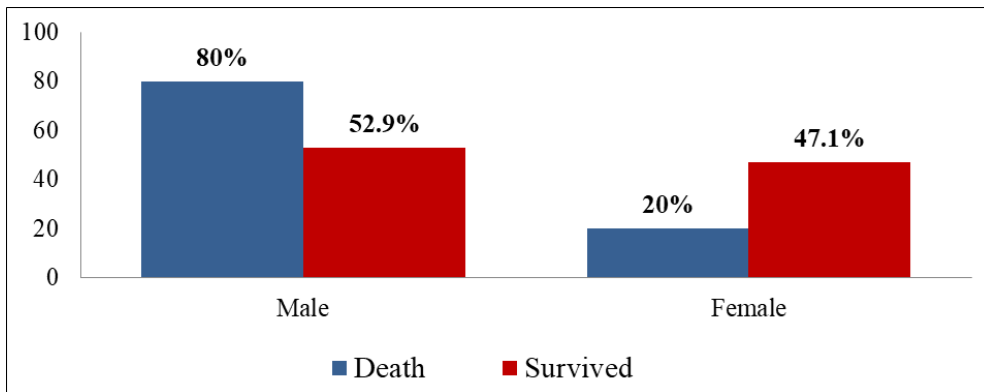
Figure 8 Relationship of mortality rate according to gender

3.5. Correlation of mortality rate according to vaccination

Table 9 Correlation of mortality rate according to vaccination

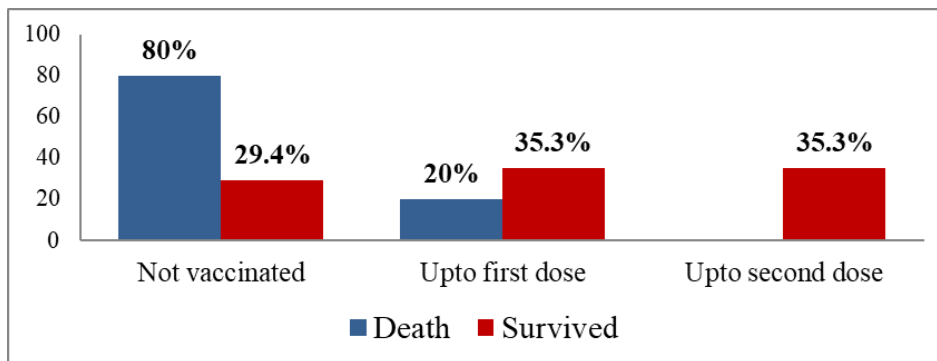| Vaccination	Death		Survived		Total		P
	N	%	N	%	N	%	
Not vaccinated	4	80	10	29.4	14	35.9	
Upto first dose	1	20	12	35.3	13	33.3	0.045
Upto second dose	0	0	12	35.3	12	30.8	
Total	5	100	34	100	39	100	

Figure 9 Correlation of mortality rate according to vaccination

3.6. Association of mortality rate according to severity to symptoms

Table 10 Association of mortality rate with severity of symptoms

Severity	Death		Survived		Total		p
	N	%	N	%	N	%	
Mild	0	0	13	38.2	13	33.3	
Moderate	0	0	13	38.2	13	33.3	
Severe	0	0	5	14.7	5	12.8	0.000
Critical	5	100	3	8.8	8	20.5	
Total	5	100	34	100	39	100	
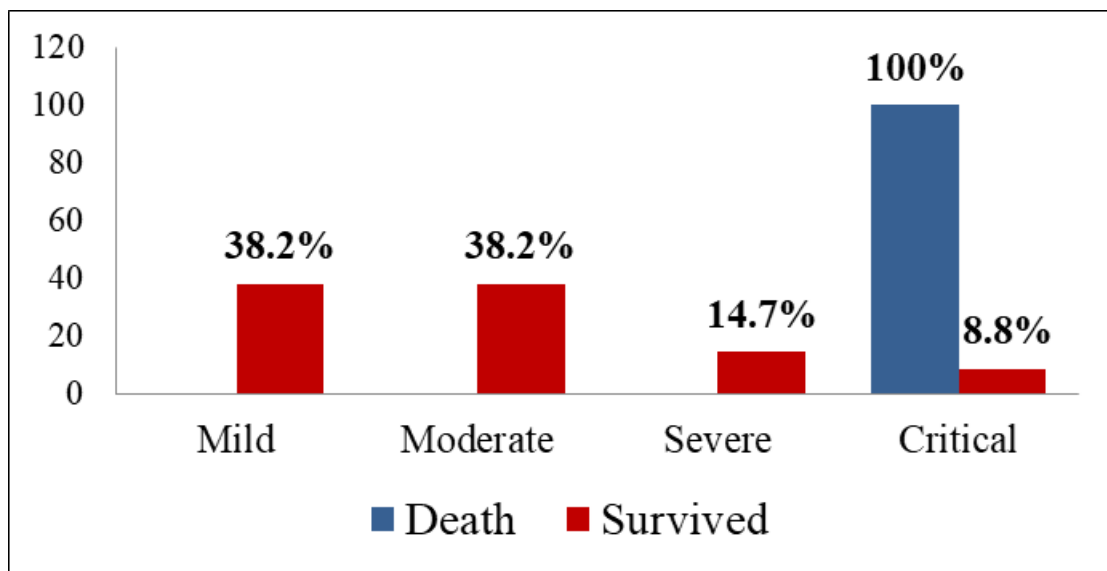
Table 10 Association of mortality rate with severity of symptoms

3.7. Correlation of mortaly rate according to comorbidities

Table 11 Correlation of mortality rate according to comorbidities

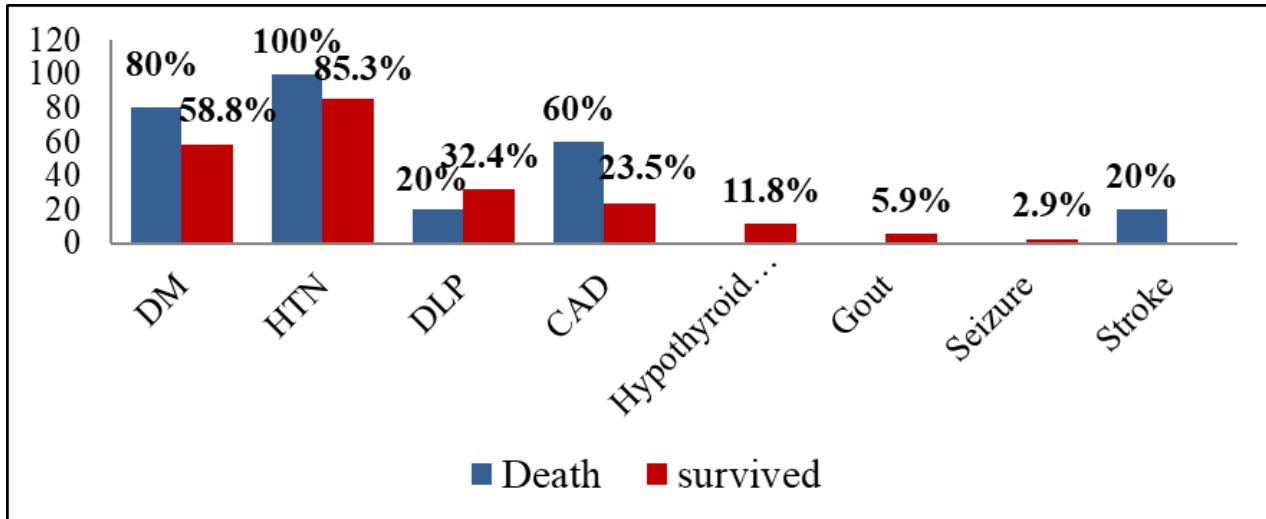| Comorbidities	Death		Survive		Total		p
	N	%	N	%	N	%	
DM	4	80	20	58.8	24	61.5	0.631
HTN	5	100	29	85.3	34	87.2	1.000
DLP	1	20	11	32.4	12	30.8	1.000
CAD	3	60	8	23.5	11	28.2	0.125
Hypothyroidism	0	0	4	11.8	4	10.3	1.000
Gout	0	0	2	5.9	2	5.1	1.000
Seizure	0	0	1	2.9	1	2.5	1.000
Stroke	1	20	0	0	1	2.5	1.00

Figure 11 Correlation of mortality rate according to comorbidities

4. Discussion

This study was conducted in CKD patients having COVID-19. Patient with CKD are more prone to a severe form of COVID-19 infection. The main objective of the study is to assess the mortality and risk factors associated with it and also used to assess the severity of patients. Association of mortality with age, gender, blood group and vaccination are also assessed in this study.

For this study, 39 samples were collected from the single centered tertiary care hospital among which 22 were males and 17 were females with CKD having COVID -19. This is a retrospective study in which patients informations are collected from the case file that fulfill the inclusion criteria and then analyse the severity and mortality of COVID-19 in maintenance haemodialysis patients. According to the study conducted by *Trivedi M et al.,* [7] the incidence of COVID-19 on maintenance haemodialysis patient is more on elderly patients and males are more likely to COVID-19. In current study the incidence of COVID-19 on maintenance haemodialysis to the age group of 41-60 years (48.7%) is high and based on gender wise distribution males (56.4%) are more prominent than females (43.6%).

In this study we classified the symptoms as asymptomatic, mild, moderate, severe and critical based on the study by *Xia L et al*[8]. According to study conducted by *Bacharaki D et al.,*[9] the mild symptoms are more prominent compared with other class of symptom, but in our study from out of 39 patient, 13 patients (33.3%) are with mild and moderate disease, 5 patients (12.8%) with severe disease and 8 patient (20.5%) with critical disease . The most common symptoms reported are breathing difficulty, fever, cough and headache. The mild symptoms refer to patients those who did not show the manifestations of viral pneumonia on chest CT scan. Moderate refers to patients who had symptoms such as fever and respiratory tract symptoms etc, along with the manifestation of viral pneumonia on chest CT scan. Severe symptom refers to patients who met the respiratory rate ≥ 30 breaths/min; oxygen saturation ≤ 93% at rest state; arterial PO$_2$ or oxygen concentration ≤ 300 mmHg and patients with pulmonary lesion progression > 50% within 24-48 hours on radiologic imaging. Critical symptom refers to patients who met respiratory failure requiring mechanical ventilation, presence of shock and other organ failure that requires monitoring and treatment in the intensive care unit.

Out of a total population of 39 samples, 34 patients (87.2%) has been survived without any further complication meanwhile rest of the 5 patients (12.8%) passed away with the complication of septicaemia. Septicaemia is a blood poisoning, especially that caused by bacteria or other toxins. According to our study, out of 8 patients admitted to ICU with a critical disease and 5 were died as similar as the study by *Islam M et al* [10]. Out of 5 deaths, 3 were among the age group of above 60 years and 4 were males.

In relation with the study carried out by *Ahmed W et al.,* [11] indicate that the most frequent comorbidities were hypertension followed by diabetes. Similar to this, in our study a total of 39 patients had hypertension (87.2%), 24 patients (61.5%) had diabetes mellitus, 12 patient (30.8%) had dyslipidemia, 11 patient (28.2%) had CAD, 4 patients (10.3%) had hypothyroidism and 2 patient (5.1%) had gout and 2 patients (5.1%) had no comorbidities which indicates hypertension is the most frequent comorbidity. The entire non survivor patient had a medical history of hypertension.

Based on the vaccination status of the patient, not vaccinated patients (35.9%) are more likely to have COVID-19 compared to the patient who had taken upto first dose (33.3%) or upto second dose (30.8%). Similar observations are found in the study conducted by *Yen CC et al* [12]. In relation of mortality with vaccination among 5 deaths, 4 of them were not vaccinated and rest of the one patient were partially vaccinated which shows fully vaccinated patients are survived.

The major laboratory findings that have been conducted in our study are D-Dimer, CRP and ESR, which is similar to the study conducted by *Jin G et al* [13]. HRCT chest is the main diagnostic test used for assessing the severity of COVID-19 infection, which shows bilateral ground-glass opacities. The main treatments used for COVID-19 in maintenance haemodialysis patient are antivirals.

Abbreviations

- CKD- Chronic kidney disease,
- SARS- Severe acute respiratory syndrome

5. Conclusion

Covid-19 epidemic has been going on for over 3 years and has spread all around the world. This study concluded that the severities of symptoms, that patient with mild and moderate symptoms are more prominent than other symptoms. The risk factor associated with mortality was hypertension, diabetes, CAD, hypothyroidism, dyslipidemia, gout etc. The main complication that developed to expire was septicemia. The patient with fully vaccinated are less affected with complication when compared with non-vaccinated patient.

Compliance with ethical standards

Words prove a meagre media to write down our feelings to our parents for providing us constant encouragement, divine presence and supporting us spiritually throughout.

We are also thankful and fortunate enough to get constant encouragement, support and guidance from all the teaching staffs of Ezhuthachan College of Pharmaceutical Sciences who helped us in successfully completing our project work. Also, we would like to extend sincere regards to all the non-teaching staff for their timely support.

Last but not least we express our sincere thanks and gratitude to all who directly and indirectly helped us for our thesis.

Disclosure of conflict of interest

The author has no conflict of interest to declare.

Statement of ethical approval

The study received approval and certification from the Institutional Research Committee (ECPS/RC-163/2023) of Ezhuthachan College of Pharmaceutical Sciences, Neyyattinkara, Trivandrum.

Statement of informed consent

As per international standard, informed consent was obtained from the participants and kept it on record by the author(s).

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