



Research

COVID-19 in a haemodialysis unit: Our experience in the pandemic, and the measures taken

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Abstract

Patients on haemodialysis are more susceptible to the novel 2019 corona virus disease (COVID-19). Its complications remain high in the presence of co-morbidities such as CKD. However, there is a relative lack of data on impact of COVID on patients undergoing haemodialysis, and on infection control measures to prevent further spread in the haemodialysis unit. The objective of this study is to describe the clinical features and outcome of patients undergoing haemodialysis at our unit with COVID-19, and the measures taken to prevent further transmission of the infection. This is a single-center, descriptive, observational study. There were 189 patients on regular haemodialysis at our dialysis unit at the tertiary care hospital in Chennai, India during the study period of March–October 2020. We included in this study 32 haemodialysis (HD) patients who were diagnosed with COVID-19, confirmed by RT–PCR and CT chest. Of 17.9% of patients undergoing haemodialysis were detected to have COVID-19. Among the 32 patients, 22 were males and the median age was 62.9 ± 2.10 years. The most common clinical features reported were fever (78.1%), body pain (56.3%) followed by cough (50%). CT chest showed positive findings in 28 patients – ground glass opacity was present in 18 patients, consolidation in eight patients and crazy-paving pattern was present in two patients. Of the 32 patients, only seven patients required hospitalization. The rest of the patients were managed as outpatients, with telemedicine monitoring of their symptoms. Among them, three patients were discharged, three died due to ARDS and one patient among the non-hospitalized suffered sudden cardiac death at home. Strict isolation protocols and identification of cases were the keys to the low prevalence of COVID-19 in our unit.

Keywords: Haemodialysis, COVID-19, CT chest, acute respiratory distress syndrome

1. Background

The coronavirus disease (COVID-19) has emerged as a pandemic in 2019 affecting large populations worldwide, becoming a serious public health concern. WHO reported 1,178,475 deaths worldwide in October 2020 [1]. COVID-19 affects all age groups in the population and several studies have demonstrated an association of poor prognosis with age and co-morbid conditions [2–4].

According to the Global Burden of Disease (GBD) study, China and India are two major contributors to Chronic Kidney Disease (CKD) worldwide. CKD has been the 12th leading cause of death in 2017 and has affected 9.1% of the world population [5]. In 2017, 1.2 million deaths were reported due to CKD diagnosis and it has been estimated to increase to an astounding 2.2 million by 2040 and reports suggest that this will continue to rise [6]. Patients with End Stage Renal Disease are predisposed to infectious diseases due to impaired immune system and the co-existence of other morbid conditions [7,8]. Published data has revealed that patients with CKD are more susceptible to pneumonia [9,10].

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Quarantine and social distancing strategies have been proposed to contain COVID-19 transmission [11]. However, this is a challenge in haemodialysis patients as they have to undergo haemodialysis multiple times a week at an outreach haemodialysis centre or a hospital. The haemodialysis patients carry a high risk of contracting COVID-19 from asymptomatic SARS-Co-V positive carriers; studies from India and other countries have reported asymptomatic carriers at an incidence of 20–35%, causing concern [12–14]. Dialysis patients need frequent transport, and accompanying attendees, to visit the hospital. Furthermore, the dialysis sessions require interaction with hospital staffs, patients have to remain in a closed environment with reduced ventilation for several hours. These factors are conducive to easy acquiring of COVID-19 infection.

Our main aim of this present study is to describe the clinical presentations and management of haemodialysis patients with COVID-19 infection in our dialysis unit at a tertiary care hospital. We also highlight the importance of strict infection control measures and isolation policies and practises in a haemodialysis unit to prevent spread to other patients.

2. Methods

2.1. Study population

In this retrospective study, we included 32 haemodialysis (HD) patients who were diagnosed with symptomatic COVID-19 at our hospital from March–October 2020 in a tertiary care hospital in Chennai, India. There were 189 haemodialysis patients in our unit during the study period. We did not screen all patients for asymptomatic infection.

2.2. Study method

The baseline data of patients include age, sex, presence of co-morbid conditions, the onset of symptoms, frequency of haemodialysis, need for admission to hospital, treatment with steroids and remdesivir, results of CT chest radiograph of SARS-Co-V-2 RNA real-time reverse transcription–polymerase chain reaction (RT-PCR) were collected. Co-morbidities included the history of diabetes mellitus, hypertension, ischaemic heart disease, peripheral vascular disease, obstructive sleep apnoea/chronic obstructive pulmonary disease and stroke syndromes

2.3. Statistical analysis

The data was entered in Microsoft Excel 2016 and statistical analysis was performed using the statistical package for social sciences (SPSS) version 27 for Windows. Continuous variables were presented as mean \pm standard deviation and categorical variables were presented in number (percentage).

3. Results

3.1. Patient characteristics

The mean age was 62.9 years with the oldest being 82-years-old. We found a higher proportion of males (68.75%) in this study. Among the total of 32 patients, 28 (87.5%) patients were predominantly hypertensive and 22 (68.8%) were diabetic. 9 (28.1%), 3 (9.4%), 4 (12.5%) and 3 (9.4%) had ischaemic heart disease, peripheral vascular disease, Chronic obstructive pulmonary disease and cerebrovascular disease respectively. Table 1 illustrates the clinical characteristics of patients. The most common symptom was fever (78.1%) and body pain (56.3%) followed by cough (50%) (Fig. 1).

Table 1. Baseline Characteristics of haemodialysis patients with COVID-19.

Patient Characteristics	Total n (%) (n=32)
Age	
Mean age (years) \pm SD	62.90 \pm 2.10
Sex (n%)	
Male	22 (68.75)

Co-morbidities

Type 2 Diabetes Mellitus	22(68.8)
Hypertension	28(87.5)
Ischaemic heart disease	9(28.1)
Peripheral vascular disease	3(9.4)
Obstructive sleep apnoea/Chronic obstructive pulmonary disease	4(12.5)
Cerebrovascular accident	3(9.4)

*Data are presented as mean ± standard deviation or n (%)

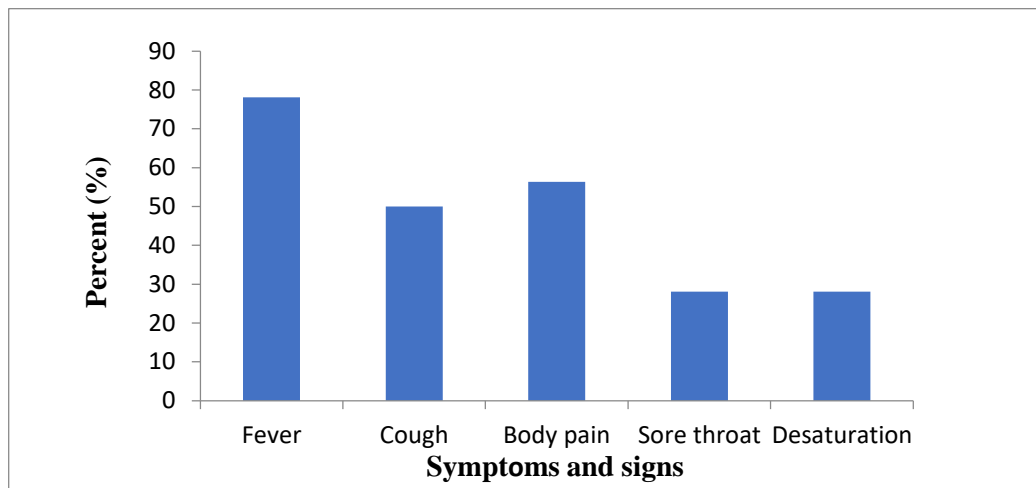


Fig. 1. Clinical features of haemodialysis patients with COVID-19.

3.2. CT chest findings

Abnormal CT Chest radiograph findings were present in 87.5% of patients and were classified into mild, moderate and severe categories based on COVID-19. Reporting and Data System (CORADS) scoring system. CT Chest findings revealed ground glass opacity in 18 patients, consolidation in eight patients and a crazy-paving pattern in two patients (Table 2).

Table 2. Severity of lung involvement on CT Chest in haemodialysis patients with COVID-19.

Classification	Patients (n=32) n(%)
Normal	4(12.5)
Mild	18(56.25)
Moderate	8(25)
Severe	2(6.25)

3.3. Infection control measures and isolation protocols

All patients visiting our haemodialysis unit were thoroughly examined by the medical team in a designated screening area as recommended by the Indian Society of Nephrology. Patients with clinical symptoms suggestive of COVID-19 infection were tested for RT-PCR swab and CT Chest. Patients who are suspicious of COVID-19 infection and who require a CT scan are transported to the CT scan room in a separate stretcher after a green channel was established between the screening area and the CT scan room, and with an N95 mask. All other routine scans were postponed. The CT scan room is then deep-cleansed with Bacillol solution. Confirmed or highly suspected patients (CORADS 4 or 5) were isolated and haemodialysis was performed in

designated wards for COVID-19 patients for 14 days. Patients with mildly symptomatic or those with CORADS 1, 2 or 3 by CT scan were allocated to the last shift of the day and were dialyzed in few dedicated machines in one corner of the HD unit for two weeks. If they worsened clinically, a repeat RT-PCR swab was ordered and they were transferred to designated wards (Fig. 2) The Haemodialysis unit was fumigated daily after the last shift. N95 mask was made compulsory for all patients, manager, housekeeping staff and dialysis technicians.

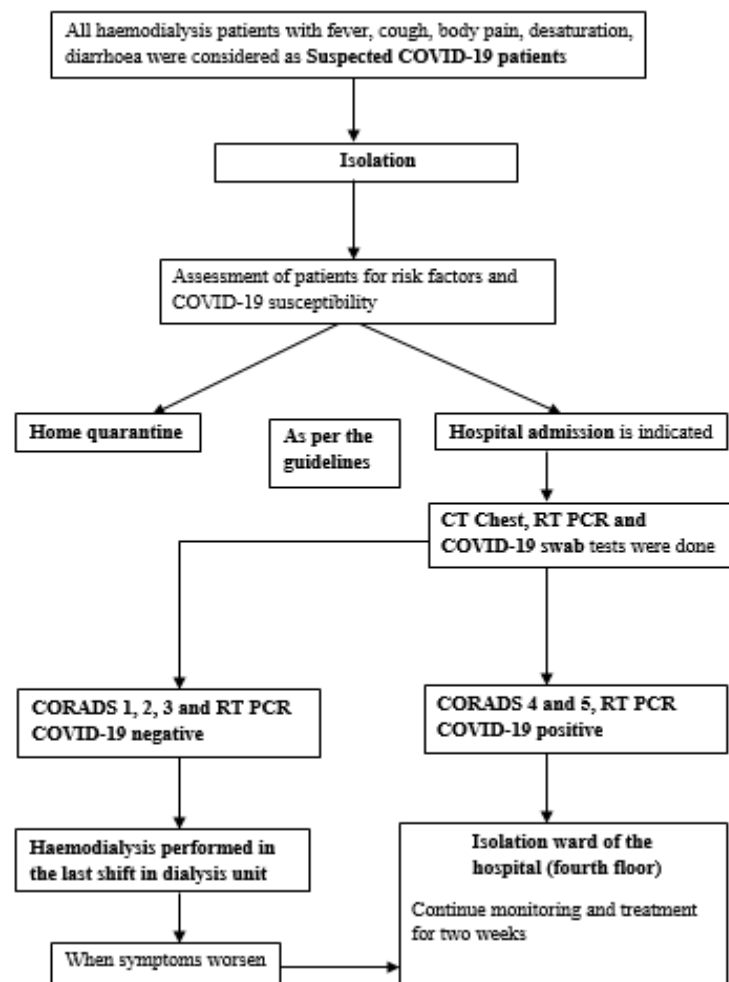


Fig. 2. Identification and management of haemodialysis patients with suspected/confirmed COVID-19 infection. Abbreviation: CORADS – COVID-19 Reporting and Data System (CORADS), COVID-19 – corona virus disease.

The staffs in the dialysis ward wore the disposable gown, gloves, cap, N95 face mask and face shield. The staffs were screened for COVID-19 infection daily and any staffs suspicious for COVID-19 infection were quarantined in the hospital. They were not allowed to go to their hostel or their residence. They were tested for COVID-19 and after completing the quarantine period and confirming negative status, they were assigned to the dialysis unit. Due to manpower shortage, at a time when there were more COVID-19 positive HD patients, COVID-19 positive staffs who were recovering but still in the quarantine period handled COVID-19 positive HD patients in the isolation ward. The staffs were not allowed to dine together and no more than one staff went for a break at one point of time. The staffs were instructed not to use the common canteen as it could serve as a point of spread of COVID-19. All dialysis filters were disposed of as infectious waste after use following a single use dialyzer system.

In this outbreak, we experienced two waves of COVID-19 infection and we followed the same measures for the medical team and patients. Most of the cases, in patients as well as the staff, presented as clusters. The index case was traced and we followed all people in contact. We had contacted the patient's family members and enquired about their symptoms. They were all isolated and told to report if any symptoms arise.

3.4. Outcomes and treatment

Admission criteria

Any patient with fever for more than five days, desaturation ($\text{SpO}_2 < 93\%$), or hypotension required admission. We also had to admit patients who did not satisfy the above criteria for logistic reasons also. All hypoxic patients received Inj. Dexamethasone; 8 mg IV once a day for three days, followed by 6 mg per day for three days, followed by 4 mg once a day for three days and stopped. Five admitted patients received Inj. Remdesivir; 200 mg IV was given on Day 1, followed by 100 mg IV for a total of five doses, before the next haemodialysis sessions. The first two patients who were admitted did not receive remdesivir because of a lack of data among usage in CKD patients at that point of time. Among the total 32 patients included in the study, 8 (25%) patients received glucocorticoid therapy, 5 (15.6%) patients received remdesivir and 7 (21.8%) patients required hospitalization. Among the seven patients, three (9.37%) patients were discharged and a total of 4 (12.5%) patients died in our study. two patients died due to acute respiratory distress syndrome (ARDS) and one patient died due to ARDS and secondary sepsis. All COVID-19 positive patients received oral nicomalone, an oral anticoagulant, 1 mg per day on a non-dialysis day. All admitted patients received unfractionated heparin 5000 units per day intravenously and later switched over to oral nicoumalone. at the time of discharge. We did not use newer oral anticoagulants on our haemodialysis patients. Those patients who were in home quarantine were followed up daily over the phone by our manager and dialysis technicians. In the non-hospitalized patient group, one patient succumbed to sudden cardiac death at home.

4. Discussion

The incidence of COVID-19 infection in our unit was 17.9%. This is similar to studies reported from the US (14%) and France (19%) during their peak transmission period [15,16]. Data from India are sparse. One study from Mumbai reported COVID infection incidence in haemodialysis patients to be only 6.74%. But this study duration was for two months and also early in the pandemic in India. In our study, we have spanned our data collection to eight months and have seen peaks and troughs during the COVID pandemic [17]. We have reported the baseline characteristics of 32 haemodialysis patients with COVID-19 infection. In our study, we found a higher proportion of patients with hypertension (71.8%), followed by diabetes (56.4%). Hypertension, cardiovascular disease, diabetes mellitus, renal disease, smoking and COPD were most common among hospitalized patients with COVID-19 [18]. In our study, we found the most common symptoms in the COVID-19 positive patients included fever, body pain and cough, which were similar to the findings of other studies on haemodialysis patients with COVID-19 [19,20]. Screening of the entire cohort of haemodialysis patients was not done as per the instructions from the hospital administration. So, we could not decipher the asymptomatic caseload in our unit. If strict infection control and isolation policies are followed, these asymptomatic patients who are known to have prolonged viral shedding rates still may not be a threat and cause the spread of COVID-19 [21].

Management of haemodialysis patients who have contracted the COVID-19 is challenging. We did not administer HCQ, ivermectin or macrolide antibiotics to our patients. Those patients who were hypoxic received steroids as highlighted above. Available data suggest that the use of dexamethasone lowered mortality in patients on invasive ventilation [22]. remdesivir was initially shown to be contraindicated in $\text{eGFR} < 30 \text{ ml/min/m}^2$ [23]. We

gave remdesivir to all our patients after there was evidence from studies showing a safety profile in CKD Haemodialysis patients [24]. In our study, we found mortality in three patients who had been put on steroid therapy and remdesivir. However, this finding cannot be generalized as this study was conducted in a small sample. We reported a very low mortality rate of 12.5%. This is in contrast to the western countries, where the mortality rate is 20–30% [25]. Dialysis patients may not mount a severe cytokine response due to weakened immune system from uraemia and this could be postulated as one of the reasons, they do reasonably well. Another reason for the difference in mortality rates could be the advanced age of the geriatric population in western countries.

We reemphasize the isolation and standard precautionary measures advised by the European Dialysis Working Group (EUDIAL) and the Centre for Disease Control and Prevention (CDC) have framed protocols for COVID-19 management of the dialysis population [26,27]. A report revealed the measures taken in Wuhan to contain the risk of infection of patients on long term haemodialysis included patient education, compulsory temperature screening, designated COVID-19 hospitals, and chest CT screening were key to early identification [28]. Similar reports have been published in a study conducted in Korea [29].

The limitation of our study is that it is a descriptive study and the sample size is small. Further research with a large sample and analytical studies are recommended.

We have gained experience in the management of haemodialysis patients during the COVID-19 outbreak by prompt implementation of strict standardized measures. We brace ourselves to the next wave of the new strains of COVID-19, with the ray of hope that the vaccine would be available to all in the near future.

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