Renal Replacement Therapy

REVIEW

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The status of dialysis patients in Asian countries under COVID-19 disaster as of December 2019–June 2022: Vietnam, Indonesia, and Mongolia

Toru Hyodo[1*], Nobuhito Hirawa[1], Takahiro Kuragano[1], Yoshiaki Takemoto[2], Bui Van Pham[3], Ha Minh Nguyen[4], Loc Duc Nguyen[5], Hoa Vu[5], Giang Le[5], Hang Nguyen[5], Tung Nguyen[5], An Phan[5], I. Gde Raka Widiana[6], Saruultuvshin Adiya[7], Mandkhai Nergui[7], Galmunkh Dashmend[8], Narantungalag Bayankhuu[9], Tsatsral Dorjsuren[10], Dolzodmaa Ulziibayar[11], Nurguli Zulpihar[12], Bolorchimeg Batbold[13], Amartuvshin Bat-Ochir[14] and Chuluuntsetseg Dorj[7]

Abstract

On 1 December 2019, an outbreak of coronavirus disease 2019 (COVID-19) occurred in Wuhan, China, and quickly spread around the world. In an effort to prevent transmission, global traffic flows were affected and lectures by international speakers at the 2022 Annual Meeting of the Japanese Society for Dialysis Therapy were streamed over the internet. Speakers from Vietnam, Indonesia, and Mongolia reported on the status of COVID-19 infection in dialysis patients from December 2019 to June 2022. In addition, the situation in Japan is discussed in the introduction. In Japan, the mortality rate due to COVID-19 infection in dialysis patients was approximately 20% in a national statistical survey before the introduction of the vaccine, and decreased to 3.1% with the introduction of the vaccine. In Vietnam, the mortality rate was 42% in non-vaccinated recipients and 21% in two-dose recipients, but this was reported by a single center. Mortality among dialysis patients with COVID-19 infection in Indonesia was 57%, although reported by a single center. In Indonesia, 6 million people were infected with COVID-19, and the number of COVID-19 cases among dialysis patients was estimated to be around 52,200. Mongolia was considered to be the country that was able to move to vaccination while most effectively controlling the domestic spread of severe acute respiratory syndrome coronavirus 2 compared with many other countries.

Keywords COVID-19, Dialysis patients, Japan, Vietnam, Mongolia, Indonesia

*Correspondence:
Toru Hyodo
thyodomd@gmail.com
Full list of author information is available at the end of the article

Background

Toru Hyodo, Nobuhito Hirawa, Takahiro Kuragano, Yoshiaki Takemoto, Japan.

In order to explain the situation of dialysis patients in Asian countries under COVID-19, we thought it necessary to introduce the situation in Japan as a background

In late November 2019, an outbreak of infection caused by a new type of coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), occurred in Wuhan, China, and quickly spread around the world. Many people died or suffered from complications and sequelae. In Japan, infection was first confirmed in a returnee from Wuhan on 16 January 2020. The first case of infection in a dialysis patient was confirmed on 1 March. The patient was a taxi driver and was thought to have been infected by a foreign traveler.

The evolution of coronavirus disease 2019 (COVID-19) among dialysis patients in Japan can be broadly divided into three periods: the first period from March 2020 to March 2021, before the introduction of messenger ribonucleic acid (mRNA) vaccination; the second period from the time of the first vaccination to the end of the second vaccination, i.e., from April 2021 to December 2021; and the third period from the third vaccination, i.e., from January to June 2022. Mortality rates among dialysis patients improved dramatically as vaccination progressed.

From January 2020 to February 2021, the pandemic strain in Japan was the Wuhan strain, and there were three waves of the pandemic during this period, with an overall mortality rate among dialysis patients of 20.7% in the first wave (January–June 2020), 11.4% in the second wave (July–September 2020), and 17.3% (October 2020 - March 2021) in the third. This period corresponds to the first period before the introduction of the vaccine in Japan, when the mortality rate among dialysis patients was very high (Table 1) [1].

The predominant strain from March to June 2021 was the alpha strain, from July to December 2021 the delta strain, and from January to June 2022 the omicron BA.1/BA.2 strain.

The fourth wave of the pandemic (April–July 2021) corresponds to the period when the first dose of the vaccine was administered, and the second dose was administered 1 month later, with a mortality rate of 20.4% among dialysis patients. The fifth wave, from August to December 2021, corresponds to the period when dialysis patients received the second dose of the vaccine, and here the mortality rate dropped significantly for the first time, to 8.2%. In the sixth wave, from January to June 2022, when dialysis patients had received the third dose of the vaccine, the mortality rate dropped dramatically to 3.1%. The table presents mortality rates for patients in their 70s, 80s, and older, as well as overall (Table 2) [1]. Considering that the average age of dialysis patients in Japan is 71.1 years [2], it is easy to imagine that the high mortality rate of patients in their 70s and older was such that nearly half of all Japanese dialysis patients faced the fear of a fatal infection.

In Japan, restrictions on entry from abroad were in place until 29 April 2023, while restrictions on holding meetings and other public events in the country continued until 7 May 2023. Due to the COVID-19 disaster,

Table 1 Mortality in hemodialysis patients before the start of vaccination in Japan

First wave (~June 2020)								
Age (years)	**<40**	**40~**	**50~**	**60~**	**70~**	**80~**	**Unknown**	**Total**
Infected (No.)	2	9	15	24	36	25	0	111
Death (No.)	0	0	2	3	11	7	0	23
Mortality (%)	0	0	13.3	12.5	30.6	28.0	0	20.7
Second wave (July–September 2020)								
Age (years)	**<40**	**40~**	**50~**	**60~**	**70~**	**80~**	**Unknown**	**Total**
Infected (No.)	2	23	31	40	41	36	2	175
Death (No.)	0	0	3	4	8	5	0	20
Mortality (%)	0	0	9.7	10.0	19.5	13.9	0	11.4
Third wave (October 2020–March 2021)								
Age (years)	**<40**	**40~**	**50~**	**60~**	**70~**	**80~**	**Unknown**	**Total**
Infected (No.)	26	99	169	251	327	284	41	1197
Death (No.)	0	5	8	24	70	100	0	207
Mortality (%)	0	5.1	4.7	9.7	21.4	35.2	0	17.3

Table 2 Mortality rates for patients in their 70s, 80s, and older, as well as overall, after vaccination in Japan

Fourth wave (April 2021–July 2021)								
Age (years)	**< 40**	**40 ~**	**50 ~**	**60 ~**	**70 ~**	**80 ~**	**Unknown**	**Total**
Infected (No.)	13	72	136	158	199	144	19	741
Death (No.)	0	6	14	27	44	58	2	151
Mortality (%)	0	8.3	10.3	17.1	22.1	40.3	10.5	20.4
Fifth wave (August 2021–December 2021)								
Age (years)	**< 40**	**40 ~**	**50 ~**	**60 ~**	**70 ~**	**80 ~**	**Unknown**	**Total**
Infected (No.)	16	39	120	92	129	83	12	491
Death (No.)	0	1	1	6	21	11	0	40
Mortality (%)	0	2.6	0.8	6.5	16.3	13.3	0	8.2
Sixth wave (January 2022 ~ June 2022)								
Age (years)	**< 40**	**40 ~**	**50 ~**	**60 ~**	**70 ~**	**80 ~**	**Unknown**	**Total**
Infected (No.)	136	390	814	1009	1248	933	52	4582
Death (No.)	0	3	8	21	47	62	0	141
Mortality (%)	0	0.8	1.0	2.1	3.8	6.7	0	3.1

the annual meeting of the Japanese Society for Dialysis Therapy (JSDT) was held entirely on online in June 2020 and as a hybrid of local and online events in June 2021 with strict infection control measures. The 67th Annual Meeting of JSDT was held locally in Yokohama, Japan, on 1–3 July 2022. At that time, the three-dose mRNA vaccination program had been completed in Japan, and although the Omicron strain of COVID-19 was prevalent, the meeting was held under conditions where real people could gather and infection control measures were enforced. However, it was also a time when travel to Japan from abroad was restricted, and the Committee of International Communication for Academic Research of the Japanese Society for Dialysis Therapy (JSDT International Committee) had no choice but to hold two web-based symposia. The traditional open call for general abstracts from abroad with travel grants was abandoned.

In this paper, we would like to present the contents of the presentations on COVID-19 given by speakers from Vietnam, Indonesia, and Mongolia at the 67th Congress International Committee Symposium in 2022.

COVID-19 infection in patients on maintenance hemodialysis at a Tertiary Hospital in Ho Chi Minh City, Vietnam

Bui Pham Van, Minh Ha Nguyen, Loc Nguyen, Hoa Vu, Giang Le, Hang Nguyen, Tung Nguyen, An Phan

Introduction

Novel coronavirus [(now designated severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2)] belongs to the coronavirus cluster, which also includes severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) viruses [3, 4]. Novel coronavirus disease is a newly discovered infectious disease that spreads more than SARS and MERS; is transmitted from person to person via droplets, feces, or direct contact; and has an incubation period estimated at 1–14 days (usually 3–7 days). Infection has been reported in all age groups, including children [5], and presents primarily as an acute respiratory disease with interstitial and alveolar pneumonia.

The first SARS-Cov-2 infection was reported in Wuhan, China, in late 2019 and spread throughout China and the world. It quickly became a global pandemic [6]. In addition to the lungs, many other organs can be affected. These include the kidneys, heart, digestive tract, blood, and nervous system [7]. Patients with renal disease, pregnant women, neonates, the elderly, and those with comorbidities such as diabetes mellitus, hypertension, and cardiovascular disease are susceptible to SARS-Cov-2 infection and are likely to develop more severe disease [8]. In addition, SARS-Cov-2 infection poses unique challenges and threats to patients on dialysis, particularly those on in-center hemodialysis (HD). Dialysis patients are particularly susceptible to infection and may exhibit greater variability in clinical symptoms and infectivity. In-center HD significantly increases the risk of transmission of infection, including to medical

and facility staff, patients themselves, family members, and others [6].

Vietnam was safe during the first three waves of the COVID-19 pandemic, but was severely affected by the fourth wave. Ho Chi Minh City, the economic, industrial, and technological center of the country, was most affected.

The aim of our study was to investigate the outcomes of maintenance hemodialysis (MHD) patients infected with COVID-19 at the Department of Nephrology–Dialysis–Transplantation, Nguyen Tri Phuong First Rank University Hospital in Ho Chi Minh City, Vietnam.

Patients and methods

We conducted a retrospective cohort study enrolling 107 MHD patients with COVID-19 during the fourth wave of the COVID-19 pandemic in Vietnam, from June 2021 to November 2021, to evaluate the impact of COVID-19 infection severity, vaccination status, and the city's pandemic preparedness policy/strategy of dealing with pandemic on the health outcomes of these patients.

Standard HD method for treating patients infected with COVID-19

MDH patients infected with COVID-19 were dialyzed 2–3 times per week for 3–4 h each as usual, which could be changed if any events occurred during their hospitalization.

Statistical analysis

Differences between groups were tested using the chi-squared test. All analyses were performed in Microsoft Excel (version 2020) on Windows, and $p<0.05$ was defined as statistical significance.

Results

During the study period, 107 (37%) of the 290 MHD patients had community-acquired SARS-Cov-2 infection, with 58% (62/107) of the cases occurring in August. The overall mortality rate was 33%, with a higher rate in male patients than in female patients (38% versus 27%, $p=0.07$), in unvaccinated than in vaccinated individuals (42% versus 24% in those vaccinated with one dose, 21% in those vaccinated with two doses, $p=0.01$), and in older than in younger individuals (55% in 65+ years versus 29% in 65–50 years and 14% in < 50 years, $p=0.000007$). In patients > 65 years of age, the mortality rate was higher in the unvaccinated subgroup than in the single-dose vaccinated subgroup (67% versus 33%, $p=0.0007$). Finally, last but not least, the mortality rate changed remarkably (from 51% to 14% then 31%, $p=0.00025$) when the city switched from the "zero coronavirus disease (zero-COVID)" policy imposed at the beginning of the pandemic (i.e., complete lockdown of the city and concentration of all patients infected with SARS-Cov-2 and their contacts in COVID-19 specialized hospitals) to the modified "zero-COVID" policy associated with the vaccination campaign (i.e., still city lockdown, but hospitals separated rooms into COVID-19 quarantined and non-COVID-19 zones, with dialysis units receiving and treating mild-to-moderate cases, including MHD individuals with COVID-19), and finally the "co-living with COVID-19" policy since October 2021 (i.e., no more city lockdown, home quarantine for mild-to-moderate cases, hospitalization for severe cases, which only explains the higher inpatient mortality rate of 31%, and continuous promotion of vaccination campaigns). In addition, the mortality rate was reduced from 42% to 14% ($p=0.00025$) by simply improving the dialysis facility to accommodate more patients infected with SARS-Cov-2 and providing adequate dialysis. Mortality in MHD patients younger than 50 years was 17%, regardless of their vaccination status.

Discussion

It is clear that patients on MHD are vulnerable to SARS-CoV-2 infection and are at higher risk of developing severe complications due to their relative immunocompromised state. Many patients also have comorbidities such as diabetes mellitus, hypertension, and/or cardiovascular disease, which further increase their risk of poor outcomes. Of the 290 MHD patients, 107 patients (37%) acquired SARS-CoV-2 infection from the community, and the overall mortality rate was 33%, mainly due to SARS-CoV-2 infection. Most of the deceased patients had preexisting comorbidities; more than 20% had chronic kidney disease (CKD), according to Ida Gagliard et al. [9]. At a single HD center in Renmin Hospital, Wuhan University, 37 out of 230 patients on HD developed SARS-CoV-2 infection between 14 January and 17 February 2020. A total of seven patients on HD died, six of whom had SARS-CoV-2 infection [8]. As in non-dialysis patients [10–12], age seemed to be the most important risk factor for SARS-CoV-2 infection in MHD patients, which was most common in the age group 50–65 years (44%), and the mortality rate of older MHD patients infected with SARS-CoV-2, especially those > 65 years, was also higher than that of younger patients (55% in > 65 years versus 29% in 50–65 years and 14% in < 50 years, $p=0.000007$). Our study also showed that vaccination played a crucial role in reducing the risk of infection and mortality in MHD patients infected with SARS-CoV-2; in addition to the number of vaccinations, the willingness of people and patients to be vaccinated also played a role.

Since the start of vaccination (in late March 2021), the mortality rate of MHD patients infected with SARS-CoV-2 has dramatically decreased from 42% in unvaccinated patients to 24% in patients vaccinated with one dose and 21% in patients vaccinated with two doses ($p=0.01$). The vaccination program in our city started at the end of March 2021, when the pandemic incidence was at its peak. The vaccine used was from Astra-Zeneca, Pfizer, and Moderna, which were first donated to Vietnam directly or through the World Health Organization (WHO)'s Covax program by countries such as the USA, Japan, and Australia, as well as the European Union (EU), and then purchased by the government. MHD patients were given priority for vaccination. Surprisingly, the mortality in MHD patients younger than 50 years was 17%, regardless of their vaccination status (with or without vaccination and number of doses). However, in MHD patients > 50 years of age, the mortality rate was much lower in individuals with only one dose compared with those without vaccination (33% versus 67%, $p=0.0007$), highlighting the essential role of vaccination in the outcome of individuals aged ≥ 50 years. In addition to the virulence and spread characteristics of COVID-19, the pandemic management policy contributed significantly to the outcomes of individuals infected with SARS-Cov-2, especially MHD patients infected with SARS-Cov-2.

In the initial phase of the pandemic (no vaccination yet), with the imposition of the zero-COVID policy, all patients infected with SARS-Cov-2, including MHD patients and their first, secondary, tertiary contacts, had to be concentrated in the newly established COVID-19 specialized centers, which had a lack of staff experience and equipment, poor infrastructure, and shortage of professional staff, resulting in very high transmission and mortality rates. The SARS-CoV-2 infected MHD patients were very much associated with the fact that they were not properly cared for and treated as they were previously in the dialysis centers, resulting in high mortality of these subjects. After learning many painful and heartbreaking lessons from the zero-COVID policy, the city government implemented what we call a "modified zero-COVID policy" in conjunction with the vaccination program (right after the vaccine became available). All hospitals were transformed into "divided hospitals," which was introduced in some countries such as Korea [13]. All hospitals were divided into two separate and isolated sectors: one for non-SARS-Cov-2 patients and one for patients infected with SARS-Cov-2. In the COVID-19 quarantine sector, in addition to units for the care of patients infected with SARS-Cov-2 with or without comorbidities, there was a dialysis unit reserved for patients with SARS-Cov-2-induced acute kidney injury or MHD patients infected with SARS-Cov-2. All staff were required to work 24 h a day, 7 days a week, with a shift change every 2 weeks (each assigned staff team was required to work continuously 24 h a day, 7 days a week in the hospital or on the epidemic front for 2 weeks without a day off).

Although exhausted by the working hours, the overwhelming workload, and being away from their families, the staff always worked with dedication to ensure the survival of the patients. Unfortunately, the mortality rate was still high at 57% when the policy was first implemented. The causes were multifactorial, including the severity of the disease and comorbidities, the lack of adequate equipment and experience in caring for MHD patients infected with SARS-Cov-2, the shortage of staff, and the overwhelming number of patients compared with the number of dialysis machines [only one dialysis unit with a mini-reverse osmosis (RO) system used for ten patients/day], forcing shorter or delayed dialysis; in addition, the vaccination had not yet taken effect. Faced with this tragedy, the hospital's board of directors launched a humanitarian campaign, appealing to benefactors, patrons, and humanitarian organizations to donate the necessary equipment, including dialysis machines and mini-RO systems. This event, coupled with the dedication and enthusiasm of the staff, the reallocation of dialysis machines from non-COVID-19 to COVID-19 zones, and the staff's experience in caring for patients infected with SARS-Cov-2, contributed greatly to the remarkable decrease in mortality from 57% to 42% and then to 14% ($p=0.00025$) when the "co-living with COVID-19" policy was implemented due to the large-scale vaccination program conducted throughout the country, with more than 80% of the population vaccinated in a short period of time. At that time, the majority of MHD patients infected with SARS-Cov-2 were quarantined at home, and the small remaining number had to be hospitalized due to the severity of their infection and/or comorbidities, and thus the mortality rate of these patients was still high compared with those quarantined at home (31% versus 14%).

Conclusions

The COVID-19 pandemic had a drastic impact on the community life of our city. Proper policy, coupled with successful vaccination strategies, played a critical role in controlling the pandemic and helping communities adjust to the "new normal" lifestyle.

The status of dialysis patients in Indonesia under the COVID-19 disaster as of 2019–2022

I Gde Raka Widiana.

Background

In Indonesia, by 22 March 2022, the number of confirmed COVID-19-positive cases had increased by 7464 from the previous day to 5,974,646 cases, with approximately 155,000 deaths. Over the same period, the number of deaths increased by 170 to 154,062, while the number of recovered patients increased by 29,084 to 5,639,029. As of March 24, 2022, 195,366,825 Indonesians had received their first vaccination, 137,294 more than the day before. Meanwhile, 156,336,412 people received their second vaccination, or 196,896 more than the previous day. The bed occupancy rate in isolation wards and intensive care units by patients with COVID-19 remained at 38% on 20 February 2022, showing that there was no overcrowding of health facilities during the Omicron wave. By 23 February 2022, the weekly hospitalization rate was 9.02/100,000 population, compared with 33.69/100,000 population during the Delta wave on 17 July 2021. The daily case fatality rate (CFR) during the Omicron wave on 23 February 2022 was 227/day, compared with the peak CFR during the Delta wave on 27 July 2021, which was 2069 deaths/day.

Indonesia had passed variants of SARS COV-2 pandemics among its population. By March 2022, there were three dominant variants of SARS CoV-2 spreading among Indonesian populations, including Alpha variant, formerly called the UK variant and officially referred to as B.1.1.7, which was first found in London and Kent; Delta variant, formerly called the India variant and officially referred to as B.1.617.2; and Omicron variant, which originated from South Africa and was referred to as B.1.1.529. In terms of infection rate and national vaccination program, as of 22 March 2022, COVID-19 positive cases were nearly 6 million (5,974,646), with 154,062 deaths and 5,639,029 cases recovered. As of 24 March 2022, more than 195 million people had received their first vaccination and more than 156 million had received their second vaccination (Ministry of Health, Republic of Indonesia). There are also reports from the hospital setting, including hospitalization and CFR. It was reported that the bed occupancy rate (BOR) in isolation wards and intensive care units was 38% in February 2022. Comparing the Delta wave (in July 2021) with the Omicron wave (in February 2022), the weekly hospitalization rate was 33.69/100,000 population versus 9.02/100,000 population, almost four times higher, and the weekly death rate was 2069/day versus 227/day, about nine times higher [14]. With a population of more than 260 million people, this pandemic COVID-19 causes a great burden of disease and overwhelms health facilities, especially during the delta wave [15].

COVID-19 and the Kidneys

Looking at global data from a systematic review and meta-analysis, the pooled rate of acute kidney injury (AKI) (among 54 studies) was 28% and kidney replacement therapy (KRT) was 9% (among 49 studies) [16]. Of these, 46% had renal events and 19% received KRT in patients admitted to the intensive care unit (ICU). In the non-ICU setting, the prevalence of renal complications was lower (12%) and those receiving KRT was 1%.

Using estimates of hospitalized patients during the Omicron variant of COVID-19, which were 9.02/100,000 population, and during the Delta variant of COVID-19, which were 33.69/100,000 population, we then had an average of 21.35/100,000 or 213.5 million population of patients with COVID-19 who were hospitalized for moderate and severe COVID-19 infection. If there was 9% of hospitalized COVID-19 patients treated with dialysis, using the number of population of Indonesia, 273 million people, then the number of dialysis cases in patients with COVID-19 was $9\% \times 213.5 \times 273 = 52{,}200$ cases.

In terms of direct costs for dialysis patients with COVID-19, human resources and COVID-19 polymerase chain reaction (PCR) testing costs accounted for 89% of the increased costs. Compared with the same month in 2019 (pre-pandemic), costs for protective equipment and wages for workers were more than doubled. Environmental disinfection costs were 1.34 times higher [17].

Epidemiology of COVID-19 infection and associated dialysis treatment in Indonesia

In Indonesia, the standard HD regimen for MDH patients infected with COVID-19 was twice a week, 4.5 h per HD session.

There are some studies conducted in our setting in Indonesia that have been carried out. A study conducted by Suryana et al. on the severity of anxiety disorder and other factors associated with disease severity among patients with COVID-19 in a hospital, Bali, Indonesia showed that the prevalence of renal involvement was 19.2%, and was significantly associated with severe COVID-19 [prevalence ratio (PR) 2.3; 95% CI 1.6–3.3; $p < 0.001$] [18]. Another study was also done in Bali by Bagiada, who reported that renal disease 65 (49.6%) and hypertension 57 (43.5%) are among the highest prevalence of comorbidities in hospital setting [19].

Survival analysis and risk factors of patients with COVID-19 with HD were also investigated at Sanglah Hospital, Bali, Indonesia. A total of 157 patients who had HD treatment in isolation room Sanglah Hospital Bali

Indonesia in the pandemic from early 2020 to the end of 2021 were included. It was reported that the overall in-hospital survival at 10, 20, 40, 50, and 60 days was 75%, 38%, 29%, 29%, and 29%, respectively [20].

Regarding the indication for dialysis, we divided patients with regular HD and emergency indication for dialysis. It was shown that those who underwent regular HD had 15 days longer survival than those with emergency HD (26 days; 95% CI 15–36 versus 11 days 95% CI 9–13; $p<0.001$). Using multivariate logistic regression analysis, age less than 63 years had 6 days longer survival compared with age more than 63 years (17 days; 95% CI 13.74–20.26 versus 11 days; 95% CI 8.99–13; $p<0.001$); hyponatremia was also associated with increased risk of mortality.

In a multicenter study in hospitals in Bali, Indonesia, Masyeni et al. compared healthy and non-COVID-19 patients with patients with mild COVID-19 and severe COVID-19 [21]. It was shown that among them, there were differences in lymphocyte count, neutrophil–lymphocyte ratio, hemoglobin concentration, platelet count, C-reactive protein, lactate dehydrogenase, interleukin-6 (IL-6), interleukin-8 (IL-8), and interleukin-1 receptor (IL-1 R). It can be interpreted that compared with healthy and non-COVID-19 patients, patients with COVID-19 infection had more inflammatory profiles, anemia, and lower platelet counts.

A cross-sectional study was also conducted by Tresna Erawan et al. among HD patients in a tertiary hospital in Bali. It was shown that among 157 HD patients with COVID-19 , 87.2% subjects had high neutrophil–lymphocyte ratio(NLR) (NLR, > 2.9 ng/L) and 26.8% subjects had high D-dimer (≥ 3.5 mcg/mL). There was a significant positive correlation between NLR and D-dimer ($R=0.38$; $R^2=0.15$; $\beta=0.23$; $p<0.001$). Multiple linear regression test showed that NLR was positively correlated with D-dimer ($R=0.40$, $R^2=0.16$, $\beta=0.379$, $p<0.001$) after standardization for age, platelet, PCO2, and procalcitonin concentrations. These findings can be interpreted that in patients with HD and COVID-19, there was increased inflammation and coagulation, and both were interrelated to produce severe COVID-19 [22].

Conclusions

There were nearly 6 million (5,974,646) positive cases and approximately 150,000 (154,062) deaths from COVID-19 in Indonesia. There were an estimated 52,200 cases of HD among patients with COVID-19. The Delta variant was associated with worse morbidity and mortality than the other two variants, Omicron and Alpha. Severe inflammation (associated with coagulation) predicts severe/renal complications in HD patients with severe COVID-19.

COVID-19 of Dialysis Patients in Mongolia

Saruultuvshin Adiya, Mandkhai Nergui, Galmunkh Dashmend, Narantungalag Bayankhuu, Tsatsral Dorjsuren, Dolzodmaa Ulziibayar, Nurguli Zulpihar, Bolorchimeg Batbold, Amartuvshin Bat-Ochir, Chuluuntsetseg Dorj.

Background: general aspects of COVID-19 in Mongolia

In Mongolia, a total of 920,000 patients were infected with COVID-19 during the 2-year pandemic, and 2000 (0.24%) of them died [23]. Mongolia is considered to be one of the countries that successfully responded to the COVID-19 pandemic due to its intensive vaccination, hospitalization of high-risk populations and severe patients, and relatively low mortality rate.

At the onset of the pandemic, the State Committee for COVID-19 implemented public health measures such as border restrictions, mandatory face masks, health education on television, etc. The Mongolian government scheduled monthly charter flights by MIAT Mongolian Airlines. From 27 January to 30 April 2020, the Mongolian government had closed the air and land border crossing between China and Mongolia (international flights and passenger trains), while COVID-19 had expanded in Wuhan, China. The Mongolian government had arranged a charter flight to Wuhan, China, and 35 Mongolian students returned home. The Mongolian government arranged charter flights by MIAT national airlines every month. A total of 27,717 Mongolians returned from other countries such as China, Korea, Japan, Turkey, Germany, the USA, Australia, and India on 171 charter flights over the past year. Epidemic control measures included temperature checks for passengers entering Ulaanbaatar, health questionnaires, and the requirement of face masks. Passengers were quarantined for 21 days (Fig. 1).

All public events, including conferences, sports, and festivals, were canceled throughout the country during the pandemic. The country successfully contained the spread of the virus with no local transmissions until November 2020. However, on 11 November 2020, the State Emergency Committee and the Ministry of Health announced the first confirmed case of community transmission in Mongolia. The city of Ulaanbaatar was placed under lockdown. Confirmed patients with COVID-19 are hospitalized in approximately 50 hospitals across the country. COVID-19 has gradually spread throughout the country. There have been four waves of the pandemic in Mongolia. The daily number of new confirmed cases of COVID-19 during the pandemic wave was about 3500 [23] (Fig. 2). Home isolation was used for the majority of confirmed COVID-19 patients.

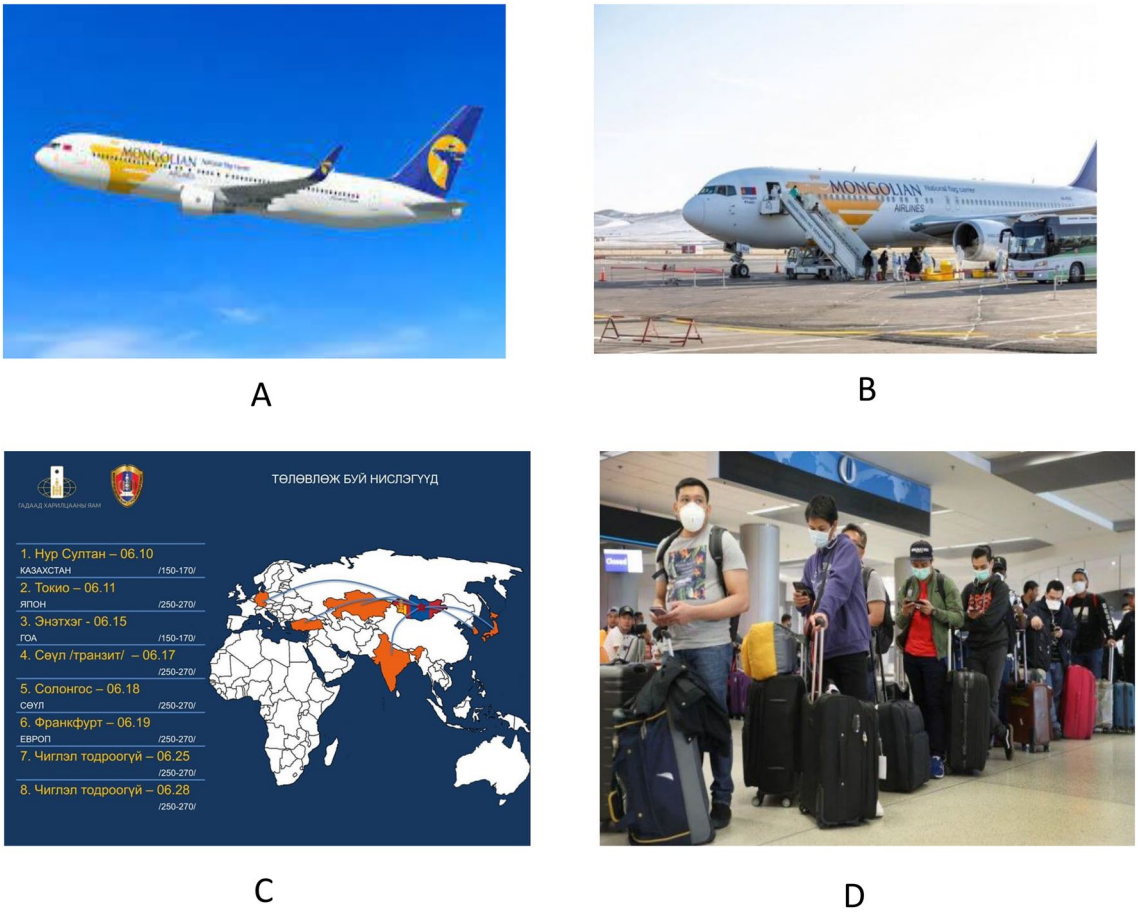

Fig. 1 **A**–**C**: Mongolians who returned from other countries by charter flights. **D**: The checks for passengers entering Ulaanbaatar

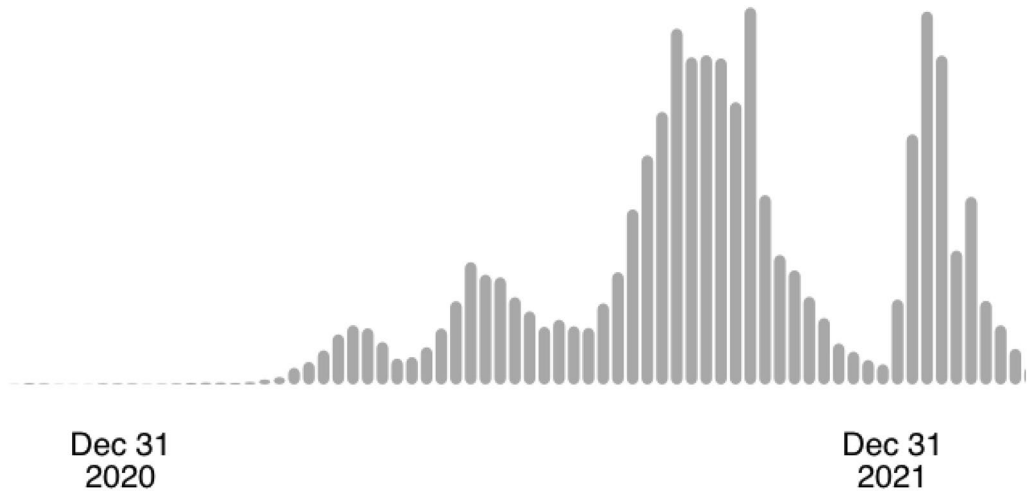

Fig. 2 Four pandemic waves in Mongolia [23]

Fig. 3 Mongolian emergency medical teams for patients with severe COVID-19

At the beginning of the pandemic, the State Committee for COVID-19 increased the number of beds for patients with COVID-19 in government and private hospitals throughout the country. Call centers to answer health questions for people with suspected symptoms, emergency medical teams for patients with severe COVID-19, and counseling teams near the State Committee for COVID-19 were established (Fig. 3).

The Mongolian government attempted to initiate a vaccination program against COVID-19. On 23 February 2021, the Mongolian government was received an initial 150,000 doses of vaccine from AstraZeneca-Oxford Covishield (India) to administer to prevent COVID-19, starting with high-risk frontline healthcare workers. Other priority groups, including the elderly and people with medical conditions such as dialysis and transplant patients, who were at higher risk of severe disease, were vaccinated against SARS-Cov 2 with Pfizer's vaccine. International studies have reported that CKD, especially in dialysis patients, increases the risk of severe disease, adverse events, and complications in patients with COVID-19 [24]. The majority of the population of Mongolia would be vaccinated with Vero cell from China. Sputnik V vaccine was also administered to persons over 65 years of age (Fig. 4).

COVID-19 and dialysis patients in Mongolia

The Mongolian Nephrology Association provided a working recommendation for dialysis facilities. We also referred to the recommendation of the International Society of Nephrology [25]. The three hospitals in Ulaanbaatar City provided HD therapy for confirmed non-dialysis and dialysis patients with COVID-19. All dialysis facilities attempted to provide HD therapy for suspected MHD patients with COVID-19 in a separate room. They were dialyzed three times per week, at least two times per week for 4 h each as usual if possible.

Staff were educated and trained in the care of dialysis patients with suspected COVID-19 and in facility disinfection procedures. Education was also provided to dialysis patients and their caregivers on recognition of COVID-19 signs, information, and self-quarantine.

We elucidated the incidence and mortality of COVID-19 in dialysis patients, as well as their COVID-19 vaccination and clinical presentation. Data were collected

Fig. 4 Vaccination scene in Mongolia

Table 3 Vaccination status of dialysis patients and the general population in Mongolia

Vaccination	In dialysis patient	In general population (%)
First dose	60.7% (875/1440)	69.3
Second dose	51.2% (738/1440)	66.3
Booster dose	49.8% (718/1440)	31.6

Table 4 Mortality rate for dialysis patients and general population in Mongolia

	In dialysis patient	In general population
COVID-19 incidence	41.3% (596/1440)	26.9% (920,584/3,409,939)
Mortality rate	7.75 (46/596)	0.24% (2177/920,584)

Table 5 Clinical symptoms of the 596 dialysis patients with COVID-19 in Mongolia

Clinical presentation of COVID-19 In dialysis patients	% (*N*)
Fever	57.7% (344/596)
Dry cough	74.5% (444/596)
Dyspnea	56.8% (339/596)
Gastrointestinal symptoms	16.9% (101/596)
Asthenia/myalgia	71.1% (424/596)

from a nationwide registry initiated by the Mongolian Nephrology Association in 2022.

Table 3 presents the vaccination status of dialysis patients and the general population. Half of the dialysis patients received three doses of the vaccine, which was significantly higher than that of the general population. Most patients (80.7%/1163) were vaccinated with the Pfizer-BioNTech mRNA vaccine. Others were vaccinated with AstraZeneca/COVISHIELD and Vero cells/Sinopharm vaccines. The mortality rate in dialysis patients was very high, 32.3 times that of the general population (Table 4). The clinical severity was as follows: mild 35.6% (212/596), moderate 44.9% (268/596), severe 10.1% (60/596), and very severe 9.4% (57/596). Clinical symptoms are presented in Table 5. The most common symptom was dry cough and the second was asthenia/myalgia,

and 556 (93.3%) of the 596 dialysis patients with COVID-19 were hospitalized, of which 121 (20.3%) were admitted to the intensive care unit.

At the beginning of the pandemic, the State Committee for COVID-19 decided to vaccinate patients with chronic diseases such as end-stage renal disease, heart disease, and diabetes mellitus against COVID-19 first. The majority of dialysis patients with COVID-19 were hospitalized, regardless of the severity of their clinical presentation. Dialysis therapy for all hospitalized patients with COVID-19 was provided separately in the dialysis units of three general hospitals in Ulaanbaatar City during these pandemic years. At the provincial level, dialysis patients with COVID-19 were treated in a separate dialysis room of their dialysis facility.

Conclusions

Patients with chronic kidney disease on dialysis have a high risk of COVID-19-associated in-hospital mortality compared with the general population with COVID-19.

It seems important to prevent SARS-Cov-2 infection and severe disease in dialysis patients through prevention and treatment measures such as standard precautions, vaccines, and antiviral drugs.

Abbreviations

COVID-19	Coronavirus disease 2019
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
mRNA	Messenger ribonucleic acid
JSDT	Japanese society for dialysis therapy
JSDT International Committee	The Committee of International Communication for Academic Research of the Japanese Society for Dialysis Therapy
SARS	Severe acute respiratory syndrome
MERS	Middle East respiratory syndrome
HD	Hemodialysis
MHD	Maintenance hemodialysis
Zero-COVID	Zero coronavirus disease
CKD	Chronic kidney disease
WHO	World Health Organization
RO	Reverse osmosis
CFR	Case fatality rate
BOR	Bed occupancy rate
AKI	Acute kidney injury
KRT	Kidney replacement therapy
ICU	Intensive care unit
PCR	Polymerase chain reaction
PR	Prevalence ratio
HR	Hazard ratio
NLR	Neutrophil–lymphocyte ratio

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Author details

[1]The Committee of International Communication for Academic Research of the Japanese Society for Dialysis Therapy, 2-38-21 Hongo, Bunkyoku, Tokyo 113-0033, Japan. [2]The Japanese Society for Dialysis Therapy, 2-38-21 Hongo, Bunkyoku, Tokyo 113-0033, Japan. [3]Nephrology-Urology-Transplantation Department, Pham Ngoc Thach University of Medicine, 468 Nguyen Trai, Dictrict 05, Ho Chi Minh City 70000, Viet Nam. [4]Biomedical Research Center, Pham Ngoc Thach University of Medicine, 468 Nguyen Trai, Dictrict 05, Ho Chi Minh City 70000, Viet Nam. [5]Nephrology and Hemodialysis Department, Nguyen Tri Phuong Hospital, 468 Nguyen Trai, Dictrict 05, Ho Chi Minh City 70000, Viet Nam. [6]Division of Nephrology and Hypertension, Department of Internal Medicine, Faculty of Medicine, Udayana University, Diponegoro Street, Denpasar, Bali 80114, Indonesia. [7]Kidney Center, The First Central Hospital, Zorig Street 2, Sukhbaatar District, Ulaanbaatar 210648, Mongolia. [8]Medvic Dialysis Center, Zorig Street 2, Sukhbaatar District, Ulaanbaatar 210648, Mongolia. [9]Hemodialysis Unit, Department of Internal Medicine, Orkhon Province General Hospital, Zestei Bag, Street Khantai 1, Bayan-Undur Sum, Erdenet, Orkhon Province 61029, Mongolia. [10]Hemodialysis Unit, Selenge Province General Hospital, 43000, 3rd Bag, Sukhebaatar, , Selenge Province, Mongolia. [11]Hemodialysis Unit, Arkhangai Province General Hospital, 1st bag, Erdenebulgan Sum, Tsetserleg, Arkhangai Province 65141, Mongolia. [12]Hemodialysis Unit, Songinohairkhan District General Hospital, 13th Khoroo, Songinokhairkhan District, Ulaanbaatar 200306, Mongolia. [13]Hemodialysis Unit, Central Military Hospital, 22th Khoroo, Bayanzurkh District, Ulaanbaatar 13341, Mongolia. [14]Department of Nephrology, Second State Hospital, Peace Avenue 49, Bayanzurkh District, Ulaanbaatar 210349, Mongolia.

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