

# COVID-19 Infected Kidney Transplant Patients Outpatient Management—A Single-center Experience With a Hospital-at-home Program

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Repeated resurgence of COVID-19 viral variants continues to strain healthcare systems globally. Kidney transplant recipients (KTRs) remain vulnerable to complications of COVID-19 infections.<sup>1,2</sup> COVID-19 vaccination, monoclonal antibodies, and telemedicine have allowed us to safely manage KTRs with COVID-19 in a hospital-at-home (HaH) program described as follows.

From February 16 to March 31, 2022, we enrolled 62 KTRs with COVID-19 infection triaged by video consult and laboratory tests into an HaH program with inclusion/exclusion criteria as shown (Table 1). Patients underwent remote monitoring and daily teleconsults until deisolation based on a time-based criterion. Emergency contact was provided for round-the-clock teleconsult. Monoclonal antibodies—Sotrovimab and Tixagevimab with Cilgavimab—were administered in a COVID-19 dedicated clinic as indicated. If the patient's condition warranted escalation to hospital, a direct inpatient transfer was facilitated by dedicated transport.

Among patients enrolled, 48.4% were male with mean age 54.9 y (SD, +11.6). Mean transplant vintage was 11.6 y (SD, +7.8). Fifty-three (85.5%) completed home recovery without complications, whereas 9 (14.5%) patients required inpatient hospitalization for monoclonal antibody infusion (n=3), evaluation of fever (n=3), and miscellaneous medical issues (n=3). One hospitalized patient progressed to COVID-19 pneumonia requiring mechanical

ventilation. Patients hospitalized were more likely of Malay ethnicity ( $P=0.02$ ), anemic (11.4 versus 13.4 g/dL,  $P<0.05$ ) or had a lower estimated glomerular filtration rate (39.8 versus 62.9 mL/min/1.73 m<sup>2</sup>,  $P<0.05$ ). The number of COVID vaccinations, Charlson's comorbidity scores, International Severe Acute Respiratory Infection Consortium 4C (ISARIC4C) scores, and C-reactive protein levels were not associated with hospitalization (Table 2). No deaths were observed.

The disproportionate hospitalization rate in Malay patients may be due to the lower socioeconomic status of the Malay population compared with the Chinese and Indian populations.<sup>3</sup> There have been no reported data from South-East Asia on differences in COVID-19 severity based on ethnicity.

**TABLE 1.**  
Inclusion and exclusion criteria

Inclusion criteria
Recipient of minimally 2 doses of a COVID-19 vaccine
Normal mental state
Stable vital signs (defined as systolic blood pressure 100–160 mmHg, heart rate 60–100 beats/min, pulse oximetry saturations >94% on room air)
Able to self-care in isolation (does not require assistance with activities of daily living)
Competent to participate in telemedicine
Exclusion criteria
Kidney transplantation <6 mo
Recent treatment/augmentation of immunosuppression for rejection <3 mo
Significant pulmonary disease, eg, chronic obstructive pulmonary disease
Other medical concerns of increased adverse outcome if home-based recovery
Significant abnormalities on preenrollment screening tests <sup>a</sup>
Ongoing chest/abdominal pain
Dyspnea
Severe vomiting or diarrhea where absorption of drugs may be impaired
Oliguria or anuria
Vulnerable uninfected household people (eg, ≥ 80 y, pregnant) and/or inability for self-isolation in the home
Patient declines enrollment into HaH program

<sup>a</sup>Patients underwent preenrollment screening tests of complete blood count, kidney function test, and C-reactive protein levels. A confirmatory polymerase chain reaction testing for SARS-CoV-2 and RBD levels was performed at time of preenrollment screening tests.

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**TABLE 2.**  
**Characteristics of KTRs enrolled into the hospital-at-home program**

	Total N = 62		Completed home recovery N = 53		Required inpatient admission N = 9		P
Male, n (%)	30 (48.4)		26 (49.1)		4 (44.4)		0.80
Age, y (SD)	54.9 (11.6)		53.8 (11.8)		61.3 (7.9)		0.07
<b>Ethnicity, n (%)</b>							
Chinese	45 (73.8)		41 (77.4)		4 (44.4)		0.02
Malay	13 (21.3)		8 (15.1)		5 (55.6)		
Indian	4 (6.6)		4 (7.5)		0 (0.0)		
<b>Etiology of ESKD, n, (%)</b>							
DKD	8 (12.9)		8 (15.1)		0 (0.0)		0.16
Chronic GN	46 (74.2)		37 (69.8)		9 (100.0)		
Others	8 (12.9)		8 (15.1)		0 (0.0)		
<b>Type of kidney transplant, n, (%)</b>							
Deceased	24 (38.7)		19 (35.8)		5 (55.6)		0.52
Living	26 (41.9)		23 (43.4)		3 (33.3)		
Overseas	12 (19.4)		11 (20.8)		1 (11.1)		
Body mass index, kg/m <sup>2</sup> (SD)	25.2 (6.0)		25.4 (5.1)		24.5 (4.8)		0.65
Transplant vintage, y (SD)	11.6 (7.8)		10.6 (7.0)		17.8 (9.8)		0.09
Number of immunosuppressants, mean (SD)	2.8 (0.4)		2.8 (0.4)		2.8 (0.4)		0.88
<b>Comorbid, n (%)</b>							
Diabetes	16 (25.0)		14 (25.9)		2 (25)		0.96
Hypertension	46 (71.9)		38 (70.4)		8 (100)		0.05
Coronary artery disease	6 (9.4)		6 (11.1)		0 (0)		0.32
Congestive cardiac failure	0 (0.0)		0 (0.0)		0 (0)		-
Peripheral artery disease	0 (0.0)		0 (0.0)		0 (0)		-
Cancer	2 (3.1)		2 (3.7)		0 (0)		0.58
Lung disease	1 (1.6)		1 (1.9)		0 (0)		0.70
Liver disease	3 (4.7)		3 (5.6)		0 (0)		0.50
Charlson score, mean (SD)	3.4 (1.3)		3.4 (1.4)		3.6 (0.9)		0.64
<b>Vaccinations and symptom duration</b>							
Mean number of vaccinations, n (SD)	3.0 (0.3)		3.0 (0.4)		3.0 (0.0)		0.88
Mean duration of symptoms, d (SD)	2.7 (1.5)		2.7 (1.5)		2.4 (1.3)		0.49
<b>Screening laboratory tests</b>							
	Mean	SD	Mean	SD	Mean	SD	
White blood cell (10 <sup>9</sup> /L)	6.9	2.1	6.9	1.9	6.9	2.9	0.97
Hemoglobin (g/dL)	13.1	1.9	13.4	1.7	11.4	1.9	<0.05
Platelet (10 <sup>9</sup> /L)	224.7	68.7	226.2	64.8	216.2	92.0	0.69
Neutrophil count (10 <sup>9</sup> /L)	4.8	2.3	4.9	2.3	4.8	2.2	0.92
Lymphocyte count (10 <sup>9</sup> /L)	1.3	0.6	1.3	0.7	1.1	0.4	0.26
C-reactive protein (mg/L)	13.2	13.4	12.3	10.4	17.8	24.3	0.26
Creatinine (μmol/L)	120.2	42.3	114.0	39.0	155.0	44.8	<0.05
Urea (mmol/L)	7.5	3.7	6.9	3.2	11.0	4.4	<0.05
eGFR (mL/min/1.73m <sup>2</sup> )	59.4	20.2	62.9	19.4	39.8	11.4	<0.05
RBD (AU/mL)	3491.0	6515.0	4021.8	6938.4	542.3	1150.1	0.14
ISARIC4C score	3.8	2.7	3.6	2.6	5.1	3.1	0.13

RBD SARS-CoV-2 spike receptor-binding domain bound to ACE2 receptor.

DKD, diabetic kidney disease; eGFR, estimated glomerular filtration rate; ESKD, end-stage kidney disease; GN, glomerulonephritis; ISARIC4C, International Severe Acute Respiratory Infection Consortium 4C.

During the study period, the HaH saved 511 inpatient bed days. Although outpatient models of care have been described for solid organ transplant recipients with COVID-19 infections, hospitalization rates range 0%–27% with 6% mortality.<sup>4</sup> Our HaH program showed comparable hospitalization rates (15%) with no mortality encountered. Charlson or ISARIC4C scoring did not

impact inpatient admission but care should be taken with triaging patients with anemia and reduced kidney function to a HaH program.

The HaH is a viable model of care for KTRs with COVID-19 infection, potentially alleviating the burden on inpatient resources while delivering comparable medical care.

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