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The role of after-hours house-call medical service in the treatment of COVID-19 patients awaiting hospital admission
A retrospective cohort study

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Abstract

Due to the increasing number of coronavirus disease 2019 (COVID-19) cases in Japan, hospitals are unable to provide admission and immediate inpatient care. The after-hours house call (AHHC) service offers telephone consultations and in-home care to patients awaiting admission. Currently, there is no report on the management of COVID-19 patients when inpatient beds are insufficient.

We aimed to describe the clinical characteristics and outcomes of COVID-19 patients treated by an AHHC medical service in Osaka and Tokyo, between April and May 2021 (during the fourth wave in Japan). Patients were classified into 2 groups: Moderate I and Moderate II, according to the severity of infection under Japanese guidelines. A retrospective study of the hospital records and follow-up telephone consultations was performed.

The AHHC treated a total of 55 COVID-19 patients (17 with Moderate I, 38 with Moderate II disease). The median ages (interquartile range) were 63 (49–80.5) and 64 (50.8–81), respectively. In each group, approximately 30% of AHHC patients received out-of-hospital oxygen therapy for the duration of their treatment until it was no longer required. Major symptoms, including shortness of breath or difficulty breathing (47.1% and 78.9%, respectively) and fever or chills (41.2% and 76.3%, respectively) were lower in the Moderate I group than in the Moderate II group. Overall, 16.4% of patients died, with 17.6% in the Moderate I group and 15.8% in the Moderate II group.

We found the proportion of mortality in patients treated by the AHHC was slightly higher to that of patients treated in Japanese hospitals. This study will provide an alternative management of patients requiring oxygen in situations where hospital beds are in short supply.

Abbreviations: AHHC = after-hours house call, COVID-19 = coronavirus disease 2019, IQR = interquartile range.

Keywords: emergency department, out-of-hours services, public health center

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2, began in December 2019.[1] Since April 2021, Asian countries have responded to the new surge of patients infected with fast-spreading variants of the virus.[2] Japan found itself in the midst of a fifth wave during the Olympic games in 2021. In the fourth wave (April–June 2021), although the government declared a state of emergency, the number of patients in Japan's metropolitan areas continued to rapidly increase. This surge led to circumstances where many patients could longer be admitted to hospitals for oxygen and receive immediate inpatient care.[3] In this fifth wave, with the increasing number of patients, Japan has recorded the highest growth rate of COVID-19 cases.[4]

During the fourth wave, Tokyo and Osaka, the first- and second-largest cities in Japan, respectively, requested that a private after-hours house call (AHHC) medical service should be implemented. This service allows access to telephone consultations during nights and holidays, as well as the treatment of oxygen-dependent COVID-19 patients in their homes or in assisted living residences as they await hospital admission.

In this study, we describe the characteristics and prognosis of patients treated by the AHHC service in the fourth wave. This study will provide a basis for future discussion on whether the

AHHC service is an effective and necessary intervention method or if the number of hospital beds should be increased to cater to similar situations where the provision of hospital services or admission spaces are limited.

2. Method

2.1. Study design

We conducted a retrospective cohort study. We included all patients who utilized the AHHC medical service from April 1, 2021 to May 31, 2021. Patients were divided into 2 groups according to the severity of the COVID-19 infection, and we compared the characteristics of these 2 groups. The study design was reviewed and approved by the Research Ethics Committee of the University of Tsukuba (approval number: 1527). The requirement for consent was waived because the study was based on a retrospective review of anonymized data.

2.2. Definition of severity of COVID-19 infection

Under Japanese guidelines developed by the Ministry of Health, Labor, and Welfare, and the National Institute of Infectious Diseases, the severity of COVID-19 infection is divided into 4 types: Mild, Moderate I, Moderate II, and Severe.[5] The classification of severity is based on respiratory symptoms: Mild, $SpO_2 \geq 96\%$, no respiratory symptoms or shortness of breath, coughing alone; Moderate I, $93\% < SpO_2 < 96\%$, shortness of breath or pneumonia findings; Moderate II, $SpO_2 \leq 93\%$; and Severe, admission to an intensive care unit or requirement for mechanical ventilator. Priority for hospitalization is determined by this severity index. This definition in Japan is similar to that in the COVID-19 Treatment Guidelines of the US Centers for Disease Control and Prevention, which divides illness severity into mild, moderate, severe, or critical.[6]

2.3. AHHC medical service

A private AHHC medical service in Tokyo (Fast Doctor Ltd., Shinjuku, Tokyo, Japan) deploys doctors directly to the residence of patients who may need hospital admission. The service operates 7 days a week outside of regular hospital visiting hours (18:00–06:00 from Monday–Saturday and 24 hours on Sundays and holidays).[7–10] The AHHC medical service administers at-home or in-facility treatment to Moderate I and Moderate II patients who cannot be admitted to a hospital. Those with Moderate I COVID-19 receive oxygen and 3 telephone consultations per day, while those with Moderate II COVID-19 receive oxygen, dexamethasone (remdesivir is not approved for home care), and 8 telephone consultations per day.

2.4. Study participants

Patients with COVID-19 who had been treated by the AHHC medical services between April 1, 2021 and May 31, 2021 were included in this study.

2.5. Data source

The study used anonymized data from the medical records of COVID-19 patients who used the AHHC medical service. In addition, the AHHC service conducted a follow-up of patients via telephone 30 days after consultation.

Data on the following patient variables were extracted from the medical records: age, sex, body mass index, smoking history, alcohol consumption, comorbidities (hypertension, hyperlipidemia, diabetes mellitus, cardiac disease, cerebral infarction, liver disease, chronic lung disease, cancer, chronic kidney disease, and dementia), location of treatment (home or assisted living residence), activities of daily living, cohabitant information, hospital attendance situation (visiting a hospital or clinic regularly, home-visit medical care, or no medical care), time from symptom onset to consultation at the public health center, mortality, vital signs, radiographic findings, and symptoms (shortness of breath or difficulty breathing, fever or chills, fatigue or tiredness, cough, diarrhea, headache, muscle pain or body aches, vomiting, sore throat, change in or loss of taste or smell, nasal congestion or rhinitis, or no symptoms) (Tables 1 and 2). Unknown parameters were not treated as missing values.

2.6. Statistical analysis

Baseline characteristics are summarized as median and interquartile range (IQR) and as proportions for continuous and categorical variables, respectively. The Mann–Whitney U test was used to analyze continuous variables and the chi-square test or Fisher exact test was used to analyze categorical variables. Analyses were performed using JMP 15.1 statistical software (SAS Institute Inc., Cary, NC) and Stata MP15.1 (StataCorp, College Station, TX). The significance threshold was set at $P < .05$.

3. Results

A total of 55 patients were treated, including 17 patients with Moderate I disease and 38 patients with Moderate II disease.

3.1. Basic characteristics of patients with Moderate I and Moderate II infections

The median (IQR) ages of patients with the Moderate I and Moderate II were 63 (IQR, 45–80.5) and 64 (IQR, 50.8–81) years, respectively. Patients aged 80 years and above comprised the majority of cases in both groups (35.3% and 26.3%, respectively). Most patients in the Moderate II group were male (68.4%), and half of the patients had never smoked (52.9% and 52.6%, respectively). The most common underlying disease was hypertension (29.4% and 39.5%, respectively). Most of patient's activities of daily living were independently performed (88.2% and 81.6%, respectively), and most patients had cohabitants (76.5% and 76.3%, respectively). The median interval from symptom onset to consultation was 6 (IQR, 1–8) days and 7 (IQR, 4–9.8) days, respectively.

3.2. Supportive care and outcome

70.6% (12/17) with Moderate I and 73.7% (28/38) with Moderate II infections were admitted to the hospital. Among the hospitalized patients, the interval from consultation to hospital admission for the Moderate I and Moderate II groups was 2 (IQR, 1–2) days and 3 (IQR, 2–5) days, respectively. The total mortality rate was 16.4% (9/55): 17.6% (3/17) in the Moderate I group and 15.8% (6/38) in the Moderate II group, respectively. No patient died at home or in the assisted living residences.

Table 1

Patient demographics.

	Total (N = 55)	Moderate I (N = 17)	Moderate II (N = 38)	P-value
Age, yr: median (range)	63 (49–81)	63 (45–80.5)	64 (50.8–81)	.92
Category, n (%)				
20–29	1 (1.8)	1 (5.9)	0	
30–39	1 (1.8)	0	1 (2.6)	
40–49	12 (21.8)	5 (29.4)	7 (18.4)	
50–59	9 (16.4)	1 (5.9)	8 (21.1)	
60–69	7 (12.7)	2 (11.8)	5 (13.2)	
70–79	9 (16.4)	2 (11.8)	7 (18.4)	
80–	16 (29.1)	6 (35.3)	10 (26.3)	
Male sex, n (%)	35 (63.6)	9 (52.9)	26 (68.4)	.27
Body mass index, kg/m^2, median (IQR)	24.6 (22.2–27.8)	26.0 (23.6–28.6)	24.0 (21.8–27.3)	.18
Smoking history, n (%)				.33
Current smoker	1 (1.8)	1 (5.9)	0	
Previous smoker	11 (20.0)	2 (11.8)	9 (23.7)	
Never smoker	29 (52.7)	9 (52.9)	20 (52.6)	
Unknown	14 (25.5)	5 (29.4)	9 (23.7)	
Alcohol consumption, n (%)				.92
Daily	9 (16.4)	3 (17.6)	6 (15.8)	
Occasional	9 (16.4)	2 (11.8)	7 (18.4)	
None	26 (47.3)	8 (47.1)	18 (47.4)	
Unknown	11 (20.0)	4 (47.1)	7 (18.4)	
Comorbidities, n (%)				
Hypertension	20 (36.4)	5 (29.4)	15 (39.5)	.80
Hyperlipidemia	2 (3.6)	0	2 (5.3)	
Diabetes mellitus	7 (12.7)	1 (5.9)	6 (15.8)	.66
Cardiac disease	9 (16.4)	2 (11.8)	7 (18.4)	>.99
Cerebral infarction	4 (7.3)	1 (5.9)	3 (7.9)	>.99
Liver disease	0	0	0	
Chronic lung disease	1 (1.8)	1 (5.9)	0	.27
Cancer	5 (9.1)	1 (5.9)	4 (10.5)	.69
Chronic kidney disease	2 (3.6)	0	2 (5.3)	>.99
Dementia	3 (5.5)	1 (5.9)	2 (5.3)	>.99
Location of treatment, n (%)				.65
Home	49 (89.1)	15 (88.2)	34 (89.5)	
Assisted living residence	6 (10.9)	2 (11.8)	4 (10.5)	
Activities of daily living, n (%)				.46
Independent	46 (83.6)	15 (88.2)	31 (81.6)	
Minimum assistance	7 (12.7)	2 (11.8)	5 (13.2)	
Maximum assistance	2 (3.6)	0	2 (5.3)	
Cohabitants, n (%)				.98
Present	42 (76.4)	13 (76.5)	29 (76.3)	
Not present	7 (12.7)	2 (11.8)	5 (13.2)	
Assisted living residence	6 (10.9)	2 (11.8)	4 (10.5)	
Hospital attendance situation, n (%)				.40
Visits a hospital or clinic regularly	36 (65.5)	14 (82.4)	22 (57.9)	
Home-visit medical care	6 (10.9)	1 (5.9)	5 (13.2)	
No medical care	12 (21.8)	2 (11.8)	10 (26.3)	
Unknown	1 (1.8)	0	1 (2.6)	
Days from symptom onset to consultation, median (IQR)	6 (3–9)	6 (1–8)	7 (4–9.8)	.22
Hospital admission, n (%)	40 (72.7)	12 (70.6)	28 (73.7)	.81
Days from consultation to hospital admission	2 (2–4.5)	2 (1–2)	3 (2–5)	.01
Death	9 (16.4)	3 (17.6)	6 (15.8)	>.99

AHHC = after-hours house-call, IQR = interquartile range.

3.3. Vital signs, symptoms, and test findings at consultation

There were no differences in vital signs between the 2 groups except for temperature and SpO$_2$. The median temperature was 36.7°C (IQR, 36.4–37.5) and 37.5°C (IQR, 36.8°C –38.2°C) in the Moderate I and II groups, respectively. SpO$_2$ at consultation was 95% (IQR, 94%–96.5%) in the Moderate I group and 91% (IQR, 89.8%–93%) in the Moderate II group.

The major symptoms were shortness of breath or difficulty breathing, fever or chills, fatigue or tiredness, and cough. The proportion of patients with shortness of breath or difficulty

Vital signs and symptoms of patients at consultation.

	Total (N=55)	Moderate I (N=17)	Moderate II (N=37)	*P*-value
Vital signs, median (IQR)				
Temperature, ℃	37.3 (36.7–38)	36.7 (36.4–37.5)	37.5 (36.8–38.2)	<.001
Heart rate, beats/min	87 (80–92)	87 (80–92.5)	87 (77.5–93.5)	.95
Mean arterial pressure, mm Hg	95.5 (82.7–102.9)	87 (80–92.5)	87.5 (77.8–92.8)	.96
SpO$_2$ (%) under room air	92 (90–94)	95 (94–96.5)	91 (89.8–93)	<.001
Nasal cannula oxygen support (L/min)	1.5 (0.5–3)	0 (0–2)	2 (1–3)	.008
SpO$_2$ (%) after 1 h of oxygenation	96 (95–97)	96.5 (95.3–97.8)	95 (94–97)	.13
Japan Coma Scale, n (%)				.66
Clear	48 (87.3)	14 (82.4)	34 (89.5)	
Delirium	7 (12.7)	3 (11.8)	4 (10.5)	
Symptoms, n (%)				
Shortness of breath or difficulty breathing	38 (69.1)	8 (47.1)	30 (78.9)	.02
Fever or chills	36 (65.5)	7 (41.2)	29 (76.3)	.03
Fatigue or tiredness	32 (58.2)	8 (47.1)	24 (63.2)	.52
Cough	29 (52.7)	10 (58.8)	19 (50.0)	.53
Diarrhea	12 (21.8)	4 (23.5)	8 (21.1)	.73
Muscle pain or body aches	11 (20.0)	4 (23.5)	7 (18.4)	.70
Headache	9 (16.4)	1 (5.9)	8 (21.1)	.25
Vomiting	9 (16.4)	3 (17.6)	6 (15.8)	1
Sore throat	8 (14.5)	2 (11.8)	6 (15.8)	1
Change in, or loss of, taste or smell	7 (12.7)	2 (11.8)	5 (13.2)	.86
Nasal congestion or rhinitis	2 (3.6)	0	2 (5.3)	1
No symptom	0	0	0	
Portable chest radiography finding, n (%)				
No abnormality	55 (100)	17 (100)	38 (100)	
Electrocardiogram, n (%)				
No abnormality	55 (100)	17 (100)	38 (100)	

IQR = interquartile range.

breathing and fever or chills was lower in the Moderate I group than in the Moderate II group (47.1% and 41.2%, respectively, vs 78.9%, and 76.3%, respectively). All patients had symptoms. Portable chest radiography and electrocardiography did not detect any abnormal findings.

4. Discussion

4.1. General findings

In this study, we found that: the AHHC medical service treated a total of 55 patients who needed oxygen therapy but could not be admitted to a hospital; approximately 30% of patients were treated out-of-hospital until oxygen therapy was not required; the proportion of patients with shortness of breath or difficulty breathing and fever or chills was higher in patients with Moderate II than in those with Moderate I; and the total mortality was 16.4%.

Previous studies have discussed the at-home or in-facility management of patients without risk factors for severe disease, without dyspnea, and without oxygen therapy.[11,12] However, to our knowledge, there are no reports on how to manage patients who require oxygen therapy when there is a shortage of hospital beds.

4.2. Mortality rate

We found that the total mortality rate was 16.4%, and patients aged over 80 years comprised the majority of patients treated by the AHHC medical service. Previous studies reported that the risk of death among patients aged 80 years or older was high,[13,14]

and 80% of deaths occurred in those aged ≥65 years.[15] Compared to a previous study in Japan where the case fatality rate was 14.6% in patients (including those with Moderate I and Moderate II infection) who needed oxygen and were treated in a hospital,[16] our study of patients treated by the AHHC medical service showed a slightly higher mortality rate. It is possible that without oxygen administration, the case fatality rate may have been higher.

There were no differences between the 2 groups regarding basic characteristics, the proportion of patients admitted to a hospital, and the interval from symptom onset to consultation. The interval from consultation to hospital admission was longer for patients with Moderate II than Moderate I. This may be attributed to a greater lack of intensive care beds than general ward beds and the longer amount of time taken to admit patients.

4.3. Priority of hospital admission

At present, hospital admission priority is determined by the severity of symptoms based on the COVID-19 treatment guidelines developed by the Japanese government[5] or the US Centers for Disease Control and Prevention.[6]

Tools for the early prediction of serious illness developed at hospital admission have been reported,[17–19] and the COVID-19 Health Hazard Score has recently been developed in Japan. However, models that can predict the likelihood of critical illness in hospitalized COVID-19 patients are still being developed, and none have been validated for the evaluation and management of outpatients.[19] In addition, the AHHC medical service doctor does not check blood results until the next day because the

AHHC medical service provides treatment at night; thus, these models cannot work in an outpatient situation.

In this study, we found that the proportion of patients with shortness of breath or difficulty breathing and fever or chills was higher in patients with Moderate II than in those with Moderate I. The proportion of patients with symptoms, including dyspnea, may increase as the infection progresses in severity. Therefore, a score that can predict the severity of illness outside the hospital or the priority of hospital admission, combining current criteria, symptoms, and well-known risk factors (eg, cancer, cerebrovascular disease, chronic kidney disease, chronic obstructive pulmonary disease, type 1 and type 2 diabetes mellitus, and smoking)[1,14,20–23] may be useful in determining the priority of patient admission.

4.4. Role of an AHHC medical service in the COVID-19 pandemic

Unlike Europe, Japan has no official assigned-general practitioner healthcare system. Thus, many people in Japan do not have a personal house-call or family physician who can provide outpatient (at-home or in-facility) treatment.[24] At present, the number of patients who are unable to receive inpatient treatment, due to hospital space limitations, and who are also unable to obtain outpatient treatment, due to the lack of house-call or family physicians, is rapidly increasing. Until an acute outpatient health care system can be established, the AHHC medical service should fill the gap in outpatient care for patients who require treatment and oxygen support. By providing treatment, as well as frequent monitoring to determine the need for hospitalization, the service should effectively reduce the burden on public health centers and local healthcare facilities.

4.5. Limitations

There were some limitations to the current study. First, our study focused on a single AHHC medical service in Japan with a small number of patients, resulting in potential selection bias. However, this particular AHHC service provides more than 20,000 out-of-hours visits annually and is the largest after-hours emergency service in Japan. Second, we did not have data on whether patients underwent intubation or extracorporeal membrane oxygenation after hospitalization because the family was unaware of this information; thus, we could not accurately report this information.

5. Conclusion

We found that the case fatality rate was slightly higher among patients treated by the AHHC medical service than in patients treated in hospitals during the fourth wave. The results of this study may provide the future management of patients requiring oxygen in situations where hospital beds are in short supply.

Author contributions

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