Original Article

Clinical Characteristics and Treatment Outcomes of Mild COVID-19 Patients in Field Hospital: A Cross-Sectional Study

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Background: Hospital capacity management has been one of the main public health problems in many countries during the COVID-19 outbreak. Field hospitals were developed as a means of taking care of patients with limited resource utilization.

Objective: To demonstrate clinical presentations and treatment outcomes of patients infected with COVID-19 treated at a field hospital. Additionally, cost and utilization were also evaluated.

Materials and Methods: The present study was a retrospective study. Data from the medical records of the patients diagnosed with COVID-19 admitted and discharged from a field hospital between April 2021 and June 2021 were reviewed. Clinical presentation, treatment outcomes, cost, and utilization were analyzed, classified by disease severity.

Results: Seventy-two patients with a mean age (SD) of 30.2 (8.4) years were enrolled in the present study. Thirty-six patients (50.0%) were asymptomatic. Nasal congestion was the most common symptom of COVID-19 (30.6%). Patients with mild pneumonia had higher body mass index (BMI) and older age than asymptomatic cases, and symptomatic COVID-19 cases without pneumonia (p=0.014, 0.028, respectively). The two common final diagnoses were acute pharyngitis (27.8%) and pneumonia (26.4%). Asymptomatic pneumonia was found in 5.6%. The mortality rate was 0% in the field hospital. The average length of stay was 12 days, and the mean total cost of treatment was 48,396 THB per patient. The patients with mild pneumonia had significant higher total cost of treatment than asymptomatic cases and symptomatic COVID-19 cases without pneumonia.

Conclusion: Field hospitals could be the most efficient option for taking care of COVID-19 patients when healthcare resources in hospital are limited. COVID-19 patients' triage was important to determine the outcomes. Asymptomatic cases, symptomatic cases without pneumonia, and cases with mild pneumonia could be treated in a field hospital with cost-effective outcomes.

Keywords: SARS-CoV-2; COVID-19; Field hospital; Case management; Thailand

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The COVID-19 pandemic was a burden to healthcare resources in many countries across the world[1-3]. Hospital capacity management was one of the main public health problems in many countries during the COVID-19 outbreak[4-7]. Due to hospital space limitations, field hospitals were developed to take care of COVID-19 patients. In China, field hospitals were constructed rapidly in response to the COVID-19 pandemic[8]. There were many countries, such as USA[9], the Kingdom of Bahrain[10], Germany[11], Spain[12], England[13], and Italy[14], that used field hospitals to increase their hospital capacity.

Previous studies about field hospitals with varied healthcare facilities have been done, but the results of COVID-19 treatment and utilization in field hospitals were limited. One previous study showed the outcomes of COVID-19 treatment in field hospitals developed from orthopedic health services. The study reported on the prevalence of asymptomatic patients in field hospitals, which was 6.1% with a mortality rate of 6.8%[15]. Another study showed the mean field hospital stay was 8.3 days without mortality or mechanical ventilator use[9].

Focusing on COVID-19 case management in Thailand, the clinical practice guideline for COVID-19 case management was developed by the Department of Medical Services of the Ministry of Public Health. The patients were managed according

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to their disease severity. According to the literature review, there has been no previous study about the outcomes and cost-utilization of COVID-19 treatment with limited healthcare resources such as in a field hospital in Thailand.

The present study aimed to evaluate clinical presentation of COVID-19 patients initially and during admission to COVID-19 case management in a field hospital at a tertiary care public hospital. In addition, the treatment outcomes and cost were reviewed.

Materials and Methods

Study population

The medical record of patients diagnosed with COVID-19 admitted and discharged at a field hospital of the Bamrasnaradura Infectious Diseases Institute between April 2021 and June 2021 were retrospectively reviewed. The admission criterion was patients with SAR-CoV-2 infection confirmed through real time polymerase chain reaction (RT-PCR). Patients who were transferred to the COVID-19 ward in the tertiary hospital during admission were excluded from analysis. The discharge criteria were an improvement in clinical symptoms and at least 14 days having elapsed after the first positive RT-PCR. The present study was approved by the Institutional Review Board of Bamrasnaradura Infectious Diseases Institute (S018h/64_ExPD).

Data collection

Medical data from paper and electronic medical records were retrospectively reviewed. The data included age, gender, weight, height, body mass index (BMI), underlying diseases, nationality, symptoms, and signs before and during admission, oxygen saturation, day of hospital stay, initial diagnosis, final diagnosis, antiviral medicine usage, and hospital cost. The laboratory results included SAR-CoV-2 RT-PCR detection day and cycle threshold. Plain chest radiography was categorized into three groups. Firstly, the characteristic group consisted of those displaying bilateral patchy or confluent, bandlike ground-glass opacity or consolidation in a peripheral and mid- to lower-lung zone distribution. Secondly, those displaying pleuropulmonary abnormality other than the characteristic abnormalities were defined as non-specific. Thirdly, radiography without any perceived pleuropulmonary abnormality was defined as negative[16].

Risk factors for severe disease

Patients who had at least one of the following conditions: aged 60 years or older, chronic obstructive pulmonary disease, chronic kidney disease, coronary arterial disease, congenital heart disease, cerebrovascular disease, diabetes mellitus, obesity with body weight of more than 90 kg or BMI of more than 30 kg/m^2, liver cirrhosis, immunocompromised host, or lymphocyte count of less than 1,000 cell/cm^3 were defined as patients with risk factors[17,18].

Patient severity

Each patient's severity was classified according to the COVID-19 clinical practice guideline of the Department of Medical Services of the Ministry of Public Health, Thailand (Version 17 April 2021) into four groups. Group one was asymptomatic patients. Patients who had at least one of following symptoms: anosmia, ageusia, nasal congestion, sore throat, dry cough, productive cough, chest pain, shortness of breath, nausea/vomiting, diarrhea, abdominal pain, fever, myalgias, fatigue, chills/rigors, headache[19] were defined as symptomatic patients. The patients who did not have any of these presenting symptoms were defined as asymptomatic patients. Symptomatic cases without pneumonia and without risk factors for severe disease were put into group two, while symptomatic patients with either risk factors for severe disease or co-morbidity or patients with mild pneumonia were defined as group three. Lastly, group four were those with either COVID-19 pneumonia and hypoxemia with a resting oxygen saturation of less than 96% or COVID-19 pneumonia with exercise-induced hypoxemia or COVID-19 pneumonia with pulmonary infiltration progression.

Set up and COVID-19 cases management flow in field hospital

The indoor sport stadium in the hospital was renovated into a field hospital. Sixty cardboard beds were used and were separated into 30 beds for female patients and 30 beds for male patients. Nurse stations were set up in the storage room of the stadium. Electric fans were used to manage air flow direction in the stadium. Contaminated suit containment, garbage, food, and a self-vital-sign measurement station was prepared for individual patient (Figure 1, 2).

COVID-19 case management flow started from confirmed RT-PCR detection. Patients were triaged by disease severity according to risk factors for severe disease and initial clinical findings. All patients received chest radiography at their initial hospital admission. The healthcare team responsible for taking care of the patients during admission to the

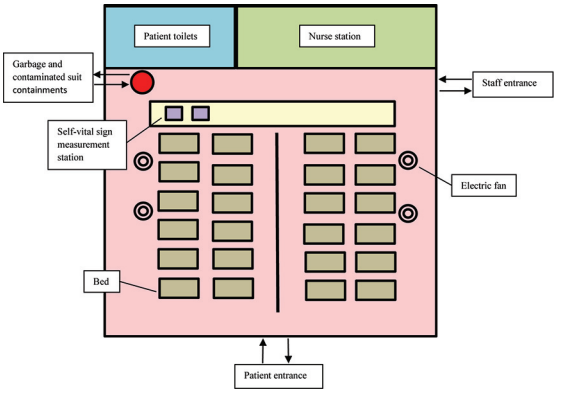

Figure 1. Diagram of the field hospital.

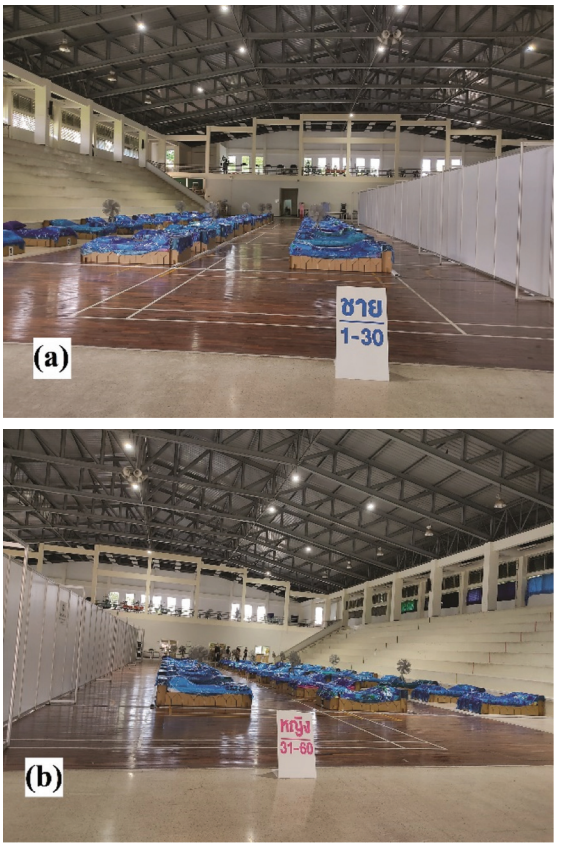

Figure 2. Pictures of inside the field hospital and general organization of the field hospital. (a) male patients' area (b) female patients' area.

field hospital consisted of one general physician and two nurses. The two nurses would monitor and follow the course of COVID-19 infection among the cases. There was one doctor who was responsible for the worsening cases management and bed management in the field hospital. Oxygen saturation and vital signs

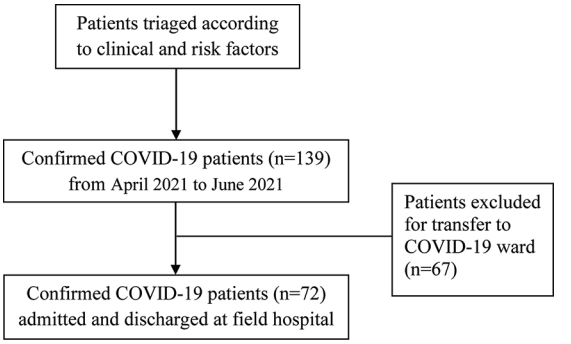

Figure 3. Flow of subjects enrollment.

were monitored four times a day. Telephone or social media mobile applications were used to communicate with medical staff. The patients who were categorized according to severity into groups. Groups 1 to 3 were admitted into the field hospital, while patients who developed COVID-19 pneumonia (group 4) during treatment in field hospital were transferred to the COVID-19 isolation ward in the tertiary hospital for intensive care.

Statistical analysis

Descriptive analysis such as mean values with standard deviations or a median with interquartile ranges was used for analysis. A chi-square test was performed to compare categorical data between groups. One-way analysis of variance (ANOVA) was performed in normal distribution data. Kruskal-Wallis test was used to analyze non-normal distribution data. All data were analyzed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). A p-value of less than 0.05 was considered statistically significant.

Results

Demographic and clinical characteristics

One hundred thirty-nine patients were admitted to the field hospital. Sixty-seven cases (48.2%) were transferred to the isolation ward during admission, 15 patients (10.8%) were transferred to the COVID-19 cohort ward because of severe disease progression, and 52 patients (37.4%) were transferred to private recovery rooms. Therefore, only 72 patients admitted and discharged at the field hospital were included in the present study analysis (Figure 3). All patients had no underlying diseases. The mean age (SD) was 30.2 (8.4) years, with 45.8% being females. Thirty-six patients (50%) were asymptomatic at admission, four cases had asymptomatic pneumonia, and 19 cases developed symptoms such as nasal congestion

Table 1. Demographic characteristics following initial patient screening

Characteristic	Initial patient severity			
	Asymptomatic group (Group 1) (n=32)	Symptomatic without pneumonia or risk factors group (Group 2) (n=27)	Mild pneumonia without risk factors group (Group 3) (n=13)	p-value
Age (year); mean±SD	28.3±8.4	29.8±7.2	35.5±9.0	0.028
Sex; n (%)				0.466
Female	17 (53.1)	10 (37.0)	6 (46.2)	
Male	15 (46.9)	17 (63.0)	6 (53.8)	
Nationality; n (%)				0.193
Thai	7 (21.2)	5 (18.5)	0 (0.0)	
Non-Thai	25 (78.1)	22 (81.5)	13 (100)	
BMI (kg/m^2); median (P25, P75)	21.9 (19.1, 24.3)	21.2 (19.1, 23.0)	24.2 (21.9, 25.8)	0.014
Oxygen saturation (%); median (P25, P75)	98.0 (97.0, 99.0)	98.0 (97.0, 99.0)	98.0 (97.0, 98.0)	0.556
Chest radiography results; n (%)				<0.001
Negative	15 (46.9)	12 (44.4)	0 (0.0)	
Non-specific	17 (53.1)	15 (55.6)	1 (7.7)	
Characteristic	0 (0.0)	0 (0.0)	12 (92.3)	
Day of RT-PCR detected (days); median (P25, P75)	4 (1, 10)	1 (1, 1)	1 (1,1)	0.003
RT-PCR cycle threshold; n (%)	(n=30)	(n=24)	(n=11)	
COBAS® SARS-CoV-2	26.7±7.7	23.0±5.1	26.9±7.0	0.111

SD=standard deviation; P25=25th percentile; P75=75th percentile; BMI=body mass index; RT-PCR=real time polymerase chain reaction

Table 2. Patient symptoms and signs detected at initial admission and during field hospital stay

Patient symptoms	Initial admission; n (%)	During hospital stay; n (%)	Total; n (%)
Asymptomatic	36 (50.0)	17 (23.6)[a]	19 (26.4)
Anosmia	7 (9.7)	2 (2.8)	9 (12.5)
Ageusia	4 (5.6)	1 (1.4)	5 (6.9)
Nasal congestion	7 (9.7)	15 (20.8)	22 (30.6)
Sore throat	9 (12.5)	9 (12.5)	18 (25.0)
Dry cough	10 (13.9)	7 (9.7)	17 (23.6)
Productive cough	9 (12.5)	11 (15.3)	20 (27.8)
Chest pain	1 (1.4)	7 (9.7)	8 (11.1)
Shortness of breath	5 (6.9)	9 (12.5)	14 (19.4)
Nausea/vomiting	0 (0.0)	0 (0.0)	0 (0.0)
Diarrhea	2 (2.8)	5 (6.9)	7 (9.7)
Abdominal pain	0 (0.0)	5 (6.9)	5 (6.9)
Fever	4 (5.6)	1 (1.4)	5 (6.9)
Myalgias	6 (8.3)	3 (4.2)	9 (12.5)
Fatigue	4 (5.6)	6 (8.3)	10 (13.9)
Chills/rigors	0 (0.0)	0 (0.0)	0 (0.0)
Headache	8 (11.1)	10 (13.9)	18 (25.0)

[a] Remaining asymptomatic patients

Characteristic chest radiography results included bilateral patchy or confluent, bandlike ground-glass opacity or consolidation in a peripheral and mid- to lower-lung zone distribution.

Nonspecific chest radiography results were pleuropulmonary abnormality other than the characteristic abnormalities.

during admission. According to disease severity at admission, 32 patients (44.4%) were asymptomatic (group one), 27 cases (37.5%) were symptomatic without pneumonia or risk factors (group two), and 13 cases (18.1%) had mild pneumonia without risk factors (group three). The BMI and age in group three patients were higher than in other groups (p=0.014, 0.028, respectively) (Table 1). A dry cough was found in 13.9%, which was the most common symptom at baseline, while nasal congestion was the most common symptom at discharge (30.6%) (Table 2).

Treatment outcomes and cost

Among the 72 cases who were admitted and discharged from the field hospital, the mortality rate was 0% and no oxygenation was required. The final diagnoses were common cold (16.7%), acute pharyngitis (27.8%), and pneumonia (26.4%). The median length of stay at the field hospital was 12 days. Favipiravir was prescribed in 27.8% of cases. The mean of the total cost of treatment was 48,396 THB per patient. The patients in group three had a significantly higher total cost of treatment than group one or two (Table 3).

Discussion

Field hospitals were set up in many countries to increase hospital capacity during the COVID-19 pandemic. The clinical characteristics and outcomes of COVID-19 patients in field hospitals were varied.

Table 3. Treatment and clinical outcomes

Results	Initial patient severity			
	Asymptomatic group (Group 1) (n=32)	Symptomatic without pneumonia or risk factors group (Group 2) (n=27)	Mild pneumonia without risk factors group (Group 3) (n=13)	Total (n=72)
Initial diagnosis				
Asymptomatic	32 (100)	0 (0.0)	0 (0.0)	32 (44.4)
Other symptomatic	0 (0.0)	3 (11.1)	0 (0.0)	3 (4.2)
Common cold	0 (0.0)	11 (40.7)	0 (0.0)	11 (15.3)
Acute pharyngitis	0 (0.0)	13 (48.1)	0 (0.0)	13 (18.1)
Pneumonia	0 (0.0)	0 (0.0)	13 (100)	13 (18.1)
Final diagnosis				
Asymptomatic	15 (46.9)	0 (0.0)	0 (0.0)	15 (20.8)
Other symptomatic	3 (9.4)	2 (7.4)	0 (0.0)	5 (6.9)
Common cold	6 (18.8)	6 (22.2)	0 (0.0)	12 (16.7)
Acute pharyngitis	6 (18.8)	14 (51.9)	0 (0.0)	20 (27.8)
Acute bronchitis	0 (0.0)	1 (3.7)	0 (0.0)	1 (1.4)
Pneumonia	2 (6.2)	4 (14.8)	13 (100)	19 (26.4)
Antivirus usage				
Favipiravir				
• Yes	2 (6.2)	5 (18.5)	13 (100)	20 (27.8)
• No	30 (93.8)	22 (81.5)	0 (0.0)	52 (72.2)
LOS (days); median (P25, P75)	11.0 (3.3, 12.0)	12.0 (12.0, 12.0)	12.0 (12.0, 12.0)	12.0 (8.0,12.0)
Total cost (Thai Baht); mean±SD	38,197±22,177	51,431±16,314	67,197±10,646	48,396±21,130

SD=standard deviation; P25=25th percentile; P75=75th percentile; LOS=length of stay

The present study showed effective treatment outcomes of COVID-19 patients in a field hospital in a tertiary care public hospital setting with efficient resource utilization.

BMI of 30 kg/m² or more and aged 60 years or older were risk factors for developing severe disease[17]. The present study reported no patients with risk factors admitted into field hospital. However, this present study demonstrated that patients with mild pneumonia had a higher BMI and older age than asymptomatic patients and symptomatic cases without pneumonia. These present results supported the relationship between BMI, age, and diseases severity.

A wide range of clinical manifestations was reported in COVID-19 patients. The previous study reported that the prevalence of symptomatic patients was 15.6% and that the prevalence of patients who developed symptoms after admission (pre-symptomatic infection) was 48.9%[19]. The prevalence of asymptomatic patients in the present study was 50% at initial admission. Four patients (5.6%) had asymptomatic pneumonia. In addition, the pre-symptomatic infection of the present study was 52.8%. A severity classification based only on risk factors may not be sufficient. Chest X-rays should be performed for every patient to assess disease severity.

The mortality rate of the present study was 0%. As a result, the case management flow involved patient transfer to a higher hospital facility according to disease progression. Appropriate patient selection according to patient severity was the major contributor to treatment outcomes of the present study. Patients who had mild symptoms and those with mild pneumonia without risk factors could be treated in a field hospital with good outcomes.

From a previous study, the total cost per person in the COVID-19 isolation ward was 205,604 THB[20]. In the present study, the mean total hospital cost per person in the field hospital was lower than the mean total hospital cost per person in the COVID-19 isolation ward at 48,396 THB versus 205,604 THB with a 2% mortality rate[20]. A field hospital may be an efficient option for taking care of COVID-19 patients, especially in mild cases, with good outcomes.

The limitations in the present study were due to its nature as a retrospective study, so data such as disease duration were missing or incomplete. Data about virus variance and COVID-19 vaccination history, which may affect disease severity and clinical presentation, were not collected in the present study. Further studies may need to clarify the effect of COVID-19 vaccination on the outcomes of patients

in field hospitals.

Conclusion

The present study showed the clinical presentation and treatment outcomes of COVID-19 patients in a field hospital. Triaging COVID-19 patients and employing appropriate case flow management can help to overcome hospital healthcare resource limitations. Mild COVID-19 cases can be treated in a field hospital with promising outcomes. Patients with high BMI or elderly should be carefully evaluated for severe disease.

What is already known on this topic?

Field hospitals were used worldwide to increase hospital capacity during COVID-19 pandemic. Treatment outcomes were varied and depended on case management and facilities.

What this study adds?

Triaging and case management were key factors leading to cost-effective outcomes. Mild COVID-19 cases could be treated in a field hospital with favorable outcomes. Patients with high BMI or elderly should be cautiously looked for pneumonia.

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Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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