

Mobile field hospitals, an effective way of dealing with COVID-19 in China: sharing our experience

Zhi Chen^{1,§}, Shan He^{2,§}, Fan Li³, Junxiang Yin⁴, Xiaoliang Chen^{4,*}

¹ Critical Care Medicine, Jiangxi Provincial People's Hospital Affiliated to Nanchang University, Nanchang, China;

² Pediatrics, The First People's Hospital of Yunnan Province, Kunming, China;

³ Pulmonary and Critical Care Medicine, Jiangxi Provincial People's Hospital Affiliated to Nanchang University, Nanchang, China;

⁴ Hepatobiliary Surgery, Jiangxi Provincial People's Hospital Affiliated to Nanchang University, Nanchang, China.

SUMMARY During the COVID-19 outbreak, China made great progress in controlling the epidemic, and the number of confirmed and suspected cases continues to decrease thanks to the various efforts employed. Mobile field hospitals have played a huge role in the centralized management of patients and they have effectively reduced transmission. This article describes some of our experiences operating mobile field hospitals in order to provide a reference and to better inform countries that are dealing with this crisis.

Keywords coronavirus, epidemic, COVID-19, mobile field hospital, patient management

1. Introduction

A novel coronavirus has caused severe pneumonia in Wuhan, China since December 2019. In order to better describe the global spread of this severe respiratory infection (SARI), the condition was designated COVID-19 (1) by the World Health Organization on February 12, 2020. Thus far, COVID-19 has infected more than 120,000 people and led to more than 3,500 deaths globally (2,3), and those numbers are still increasing.

China was the first place affected by this disease, and Chinese medical personnel and the local government were initially caught off guard and overwhelmed by this sudden event (4). In Wuhan, a labor shortage and a lack of medical facilities presented major obstacles. In response, numerous medical personnel from the rest of China were dispatched; mobile field hospitals also arrived to build temporary hospitals, 2 for patients in critical condition and 15 for patients with mild symptoms. During the outbreak, mobile field hospitals played a great role in epidemic control. This article describes some of our experience operating mobile field hospitals in the City of Wuhan, China.

2. The configuration of a mobile field hospital

2.1. The general characteristics of a mobile hospital

Mobile field hospitals were located at sites with good

ventilation, abundant space, and convenient patient transport. The medical staff consisted of a medical team from a regional hospital, two emergency medical teams from the national government, one local medical assistance team, and one biosafety level 3 (BLS-3 or P3) mobile laboratory (Figure 1A). There were approximately 1,000 medical personnel and 1,000-1,500 beds in each mobile field hospital (5).

In terms of their specialties, personnel comprised four teams that were respectively in charge of managing information, providing medical care, controlling nosocomial infections, and managing logistics.

The information management group is responsible for formulating plans, deciding work flows, dividing and coordinating work, gathering, processing, announcing, and reporting information, coordinating patient transfer and admission, managing personnel schedules, and handling problems.

The medical team is responsible for deciding treatment plans, devising and implementing core regulations, allocating physicians and nurses, summarizing medical information, and arranging the schedules of medical personnel.

The nosocomial infection control team is responsible for devising and implementing nosocomial infection control regulations, providing protective equipment and training, and inspecting and supervising nosocomial infection control.

The logistics team is responsible for distributing resources, providing daily essentials, maintaining

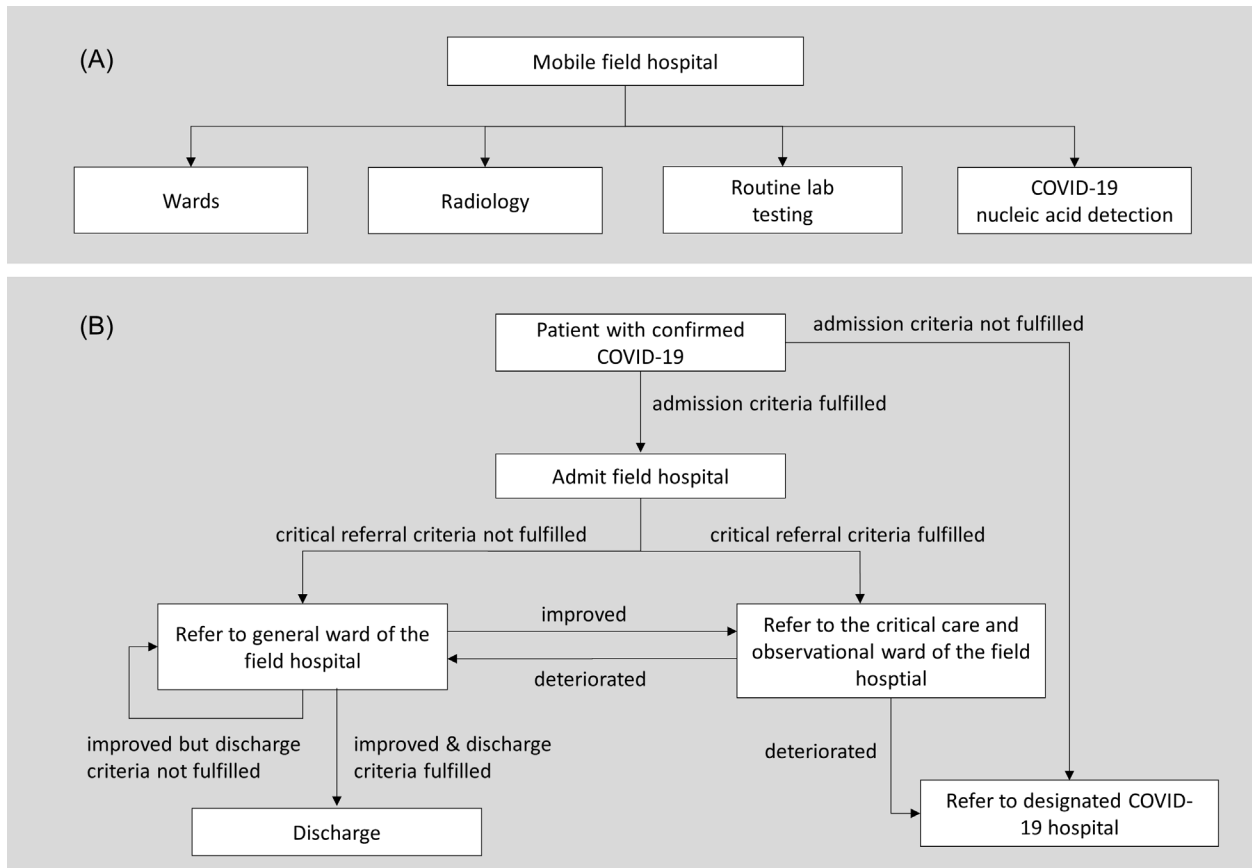


Figure 1. (A) Organization of a mobile field hospital. (B) Flow chart for patient management in a mobile field hospital.

facilities, preparing medication, environmental sanitation, medical waste management, and sewage.

The mobile field hospital was divided into four sections based on function: wards, Radiology, routine lab testing, and SARS-CoV-2 nucleic acid detection. Wards were designed for patient care and observation and were equipped with one critical care and observation unit and three infectious isolation units. Radiology consists of several mobile imaging vehicles performing radiography, computed tomography, and ultrasonography. Routine lab testing consists of several mobile laboratories providing routine lab testing such as blood tests and blood biochemical panels. Nucleic acid detection consists of a BLS-3 mobile lab that is responsible for SARS-CoV-2 nucleic acid detection and confirming the diagnosis of COVID-19.

2.2. Principles for management of a mobile field hospital

The general rules: Specialized admission, centralized quarantine, modular management, standardized treatment, and two-way referral of patients. A flow chart for patient management is shown in Figure 1B.

Admission criteria: Based on *Chinese Guidelines for the Diagnosis and Management of COVID-19*, version 5.0 (6), patients with confirmed COVID-19 must fulfill all criteria in Table 1A.

Discharge criteria: The patient must fulfill at least 3

criteria in Table 1B.

Criteria for admission to the critical care and observation unit. Any of the criteria in Table 1C must be fulfilled.

Criteria for referral to a hospital specializing in critical care. Any of the criteria in Table 1D must be fulfilled.

3. Conclusion

The biggest advantage of a mobile field hospital is its convenient centralized management of patients with mild symptoms. Those patients are able to walk and mingle with healthy people; without centralized management, they could spread the infection rapidly in the community and impede control of the disease. After mobile field hospitals were set up, regular hospitals were spared and patients with confirmed COVID-19 were isolated and treated in a centralized location, greatly helping to control the epidemic. More than 12,000 patients with COVID-19 have been treated by 15 mobile field hospitals over the past 30 days, and the rate of referral to a designated hospital has been around 35%. The mobile field hospitals were literally "a field of life". This article has described our experiences operating mobile field hospitals to deal with COVID-19 in China. Topics described here include the location of the hospital, regulations for patient management, and principles for patient admission and referral. The hope is that this information can serve as

Table 1. Rules for patient management at a mobile field hospital**(A): Admission criteria**

1. Mildly symptomatic patients.
2. Nucleic acid testing is positive and/or a pulmonary CT scan is indicated.
3. Capable of independent living, older than 18 and younger than 65.
4. No severe underlying cardiopulmonary, neurological, or renal condition.
5. No history of a mental disorder.
6. SaO₂ greater than 93% and a respiratory rate less than 24 breaths per minute at rest.
7. Able to walk without assistance.

(B): Discharge criteria

1. Afebrile for at least 3 days.
2. Respiratory symptoms have improved significantly.
3. Pulmonary inflammation has decreased markedly according to Radiology.
4. Nucleic acid testing is negative two consecutive times (with at least 1 day between tests).

(C): Admission to the critical care and observation unit.

1. Tachypnea or a respiratory rate greater than 30 breaths per minute at rest.
2. SaO₂ less than 93% at rest.
3. PaO₂/FiO₂ < 300.
4. Other potentially fatal underlying risk factors.

(D): Criteria for referral to a hospital specializing in critical care.

1. Patients in the critical care and observation unit whose condition fails to improve or deteriorates after initial interventions.
2. Persistent hyperthermia for two days with a body temperature higher than 38.5 °C after proper treatment.
3. Younger than 18 or older than 65.
4. Has a severe underlying cardiopulmonary, neurological, or renal condition, including the need to undergo dialysis.
5. Living with others.
6. Has a mental disorder like hypomania.
7. Other specific reasons (to be noted).

a reference and better inform countries that are dealing with COVID-19.

Acknowledgement

This research was supported by a grant from the Jiangxi Provincial Commission of Health and Family Planning, China (project number 20181004).

References

1. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, Iosifidis C, Agha R. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg.* 2020; 76:71-76.
2. Wu YC, Chen CS, Chan YJ. The outbreak of COVID-19: An overview. *J Chin Med Assoc.* 2020; 83:217-220.
3. Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Di Napoli R. Features, Evaluation and Treatment Coronavirus (COVID-19). In: *StatPearls (Treasure Island (FL), 2020.*
4. Guan WJ, Ni ZY, Hu Y, *et al.* Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.* 2020; doi: 10.1056/NEJMoa2002032.

5. The Novel Coronavirus-related Pneumonia Emergency Response Team for Protection and Disinfection of Key Locations, Chinese Center for Disease Control and Prevention. Health protection guidelines of mobile field hospitals during the outbreak of novel coronavirus -related pneumonia. *Zhonghua Yu Fang Yi Xue Za Zhi.* 2020; 54:E006. (in Chinese)
6. Lin L, Li TS. [Interpretation of the "Guidelines for the Diagnosis and Treatment of Novel Coronavirus (2019-nCoV) Infection from the National Health Commission (Draft Version 5)"]. *Zhonghua Yi Xue Za Zhi.* 2020; 100:E001. (in Chinese)

Received March 15, 2020; Revised March 26, 2020; Accepted March 27, 2020.

§These authors contributed equally to this work.

*Address correspondence to:

Xiaoliang Chen, Hepatobiliary Surgery, Jiangxi Provincial People's Hospital Affiliated to Nanchang University, Nanchang, China.

E-mail: chenxiaoliang99@163.com

Released online in J-STAGE as advance publication April 1, 2020.