Brief Report

Practice and experience of regional medical center entrance linkage and closed-loop management under the wartime situation of the COVID-19 in China

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Abstract: On 28 July 2021, the first indigenous case of novel coronavirus pneumonia (COVID-19) emerged in Yangzhou, marking the beginning of a public health crisis caused by the new coronavirus pneumonia. It is a significant challenge for hospitals to carry out prevention and control measures to ensure the safety of medical professionals and patients when facing the changes in an epidemic situation. Subei People's Hospital, as one of the first group of "Grade III-class A" hospitals in Jiangsu Province and the Yangzhou Regional Medical Centre, responded quickly and scientifically to prevent and control the disease. A closed-loop management system was implemented at the hospital entrance (consisting of the outpatient clinic, emergency clinic, fever clinic, and buffer ward) and an epidemic prevention and control group was established with the assistance of multiple departments. This group optimized the pre-screening and triage system, standardized the fever clinic consultation process, and improved the construction of an information-based prevention and control network so that patients were detected, diagnosed, isolated, and treated early. The emergency management capability was improved to achieve zero missed consultations of patients attending for COVID-19 and to effectively maintain medical order during this critical period. This current report systematically summarizes the operational practices and the effectiveness achieved by implementation of the entrance closed-loop management in the hospital and analyzed the key operational issues for future reference by medical institutions and management departments.

Keywords: Novel coronavirus pneumonia (COVID-19); entrance linkage; closed-loop management; medical emergency management system

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Introduction

On July 28, 2021, the first local case of the novel coronavirus pneumonia (COVID-19) occurred in Yang Zhou, Jiangsu Province and since then, the province has been in a state of public health emergency. As of 24:00 on August 26, Yang Zhou had a total of 570 confirmed cases of COVID-19.

Tertiary hospitals in China are generally over-crowded and have pre-existing structural defects that limit the effective prevention and control of infectious diseases, especially respiratory diseases. As such, hospitals in epidemic areas face enormous challenges. One of the defining features of COVID-19 is the intense pressure placed on health systems and health care workers by the large proportion of COVID-19 patients who require quality clinical care (1). Closed-loop management is a management method formed by integrated information system, closed-loop system, management control and management closure principle. It can be effectively used in epidemic prevention and control. Subei People's Hospital is a "Grade III-class A" hospital and is also the Yangzhou

regional medical center. As such, it responded quickly to infection prevention and control during the epidemic by implementing a strict closed-loop management at the entrance of the hospital (including the outpatient department, emergency department, fever clinic, and buffer ward), and building an effective and closely coordinated medical treatment network to achieve early detection, early reporting, early isolation, and early treatment, while avoiding iatrogenic cross-infection, and maintaining medical order in this time of crisis. On the one hand, tertiary hospitals have to undertake heavy epidemic prevention and control tasks, as well as heavy general outpatient diagnosis and treatment tasks. However, the emergency response system of hospitals facing public health emergencies still needs to be improved. Therefore, it is of great significance to reasonably build a medical emergency management system under COVID-19.

This current report summarizes the relevant experience and analyzed the key issues so as to assist in further constructing and perfecting the medical emergency management system under crisis conditions (2-4).

The closed-loop management mode at the entrance of the hospital

A group consisting of the main leaders of the hospital was established to manage and coordinate the prevention and control of COVID-19. Special sections were set up, including an outpatient pre-examination and triage, an emergency pre-examination and triage, a fever clinic, and a buffer ward. In response to the sudden epidemic, the hospital immediately set up a leading group for epidemic prevention and control, which is fully responsible for the management of the outbreak. After the implementation of closed-loop management, the flow of people between buildings and disease areas should be strictly controlled to avoid unnecessary personnel flow. The emergency disinfection and disposal process in the hospital was established, and the hospital environment was completely sterilized for 24 h according to the layout of the hospital building. The hospitalization building is divided according to the three-district management system, and protective measures are strictly implemented. In addition, give full play to modern information and science and technology, promote the Internet hospital platform, improve the efficiency of hospital medical services, effectively reduce the gathering and stay of hospital crowds, and reduce the possibility of cross-infection in hospital.

A uniform pre-examination and triage standard was established for the whole hospital. This was divided into the following three categories: patients with a negative epidemiological survey or low-risk (green); patients with medium-risk or COVID-19 symptoms (yellow); and high-risk patients (red). Patients in the green category should go to the outpatient (emergency) department, and patients in other categories with the "ten symptoms" of COVID-19 should go to the fever clinic first. Patients with critical grade I, II, and emergency "five centers" are immediately directed to the isolation room in the emergency rescue area.

Trict implementation of the initial diagnosis

The initial diagnosis is one of the basic components of the hospital management system and includes the isolation and control of infectious diseases, epidemiological investigations, scientific diagnosis, and effective treatment.

Epidemiological investigation and triage are performed under the "Operation Table of Pre-examination and Triage in Medical Institutions in Jiangsu Province" guidelines by the outpatient (emergency) pre-examination and triage staff. Furthermore, a special fixed route should be set up to guide patients to the fever clinic. When critical patients from grade I and II hospitals and the five major medical centers arrive at the emergency department, the doctors will complete epidemiological investigations and nucleic acid sampling as soon as possible while protecting themselves and actively treating patients.

Patients should be admitted to the fever clinics as soon as possible, followed by verification and recording of the patient's address, contact information, identifying data, etc. Furthermore, a detailed medical history should be obtained (especially epidemiological history and action trajectory) followed by nucleic acid testing as soon as possible. A preliminary diagnosis can then be made in conjunction with the necessary physical examinations and auxiliary examinations. Appropriate diagnosis and treatment should be recorded according to the requirements of the "The Specification of the Documentation of the Medical Record". The condition and treatment should be discussed with the patient. For critical patients whose disease condition changes abruptly, the first physician and/or medical leader shall organize on-site resuscitation and safe transport to the emergency room for further treatment if necessary.

Strict closed-loop management of patients in the region

The entrance to the outpatient (emergency) department

Routine electronic body temperature monitoring and health code inspections are performed to prevent personnel gathering, maintain the 1-meter distance, strictly limit the number of accompanying persons, ensure all personnel wear masks, and strengthen the control of admitted vehicles. Artificial access is provided for the elderly patients without smartphones.

Fever clinic

Fully enclosed management is implemented while meeting fire safety requirements

A complete functional area is set up to achieve the "Six processes do not need to go out" protocol to ensure closed-loop management. The six processes are pre-inspection, diagnosis, treatment, inspection, administration of medication, computed tomography (CT) scan, and observation.

Fever clinics implement the partitioned patient management protocol

During the triage process, patients are divided into two groups according to the epidemiological exposure risk, namely at-risk patients (identified by yellow markers) and high-risk patients (identified by red markers). Patients in the yellow category are directed to wait in the low-risk diagnosis area (area A), and patients in the red category are directed to wait in the high-risk diagnosis area (area B). This procedure substantially improves the triage efficiency and significantly prevents nosocomial cross-infection in the treatment process.

Improve observation of suspected patients, referral of confirmed patients, and community transfer of excluded patients

The epidemiological history, routine blood results, nucleic acid results, and chest CT scans are reviewed by the fever clinic physician who then triages the patient according to "The Novel Coronavirus Diagnosis and Treatment Plan (Trial Eighth Edition)" (5). Patients diagnosed-contact 120 are transfer to a designated hospital for treatment within 2 h. Patients suspected to have COVID-19 are isolated in a single room, nasal (pharyngeal) swabs are taken (sampling interval at least 24 h), and nucleic acid examination is repeated. For patients who are highly suspected to have COVID-19, the expert group in the hospital is consulted to determine the diagnosis and treatment plan. Patients who were initially excluded, but subsequently must be hospitalized or surgically treated should be transported strictly according to the designated route and placed in a single room in the transition ward to prevent crossflow of people, logistics, and air with other personnel. Patients who are excluded can return to the community for home observation (5).

Formulate an out-patient management system for fever clinics

Special personnel will check the patient's "Notification of Leaving the Hospital" form, the number of accompanying persons, medical advice, whereabouts, and other information.

Strengthen the closed-loop management of staff in the region

Set up the entryway for all staff independently

To avoid crossing the entrance passages for outpatient (emergency) patients, an independent entryway was set up for all hospital staff. Staff should enter and exit with "passes" and maintain a two-point line for commuting.

The staff in the emergency and outpatient department should include respiratory and infectious diseases doctors

The staff in the pre-examination and triage of the outpatient (emergency) department should include doctors from the respiratory department and the infection diseases division who have sufficient clinical experience to serve as team leader and perform business guidance functions. The outpatient department performs the function of territorial management, and the core members remain relatively consistent and are equipped with a fixed telephone shift.

Improve the internal management of fever clinic staff

The hospital established a committee to manage the fever clinic, which includes staff from multiple departments. The committee holds meetings as needed to facilitate the transmission and learning of relevant documents for epidemic prevention and control, internal work coordination and communication, training and assessment of nosocomial infection knowledge, as well as

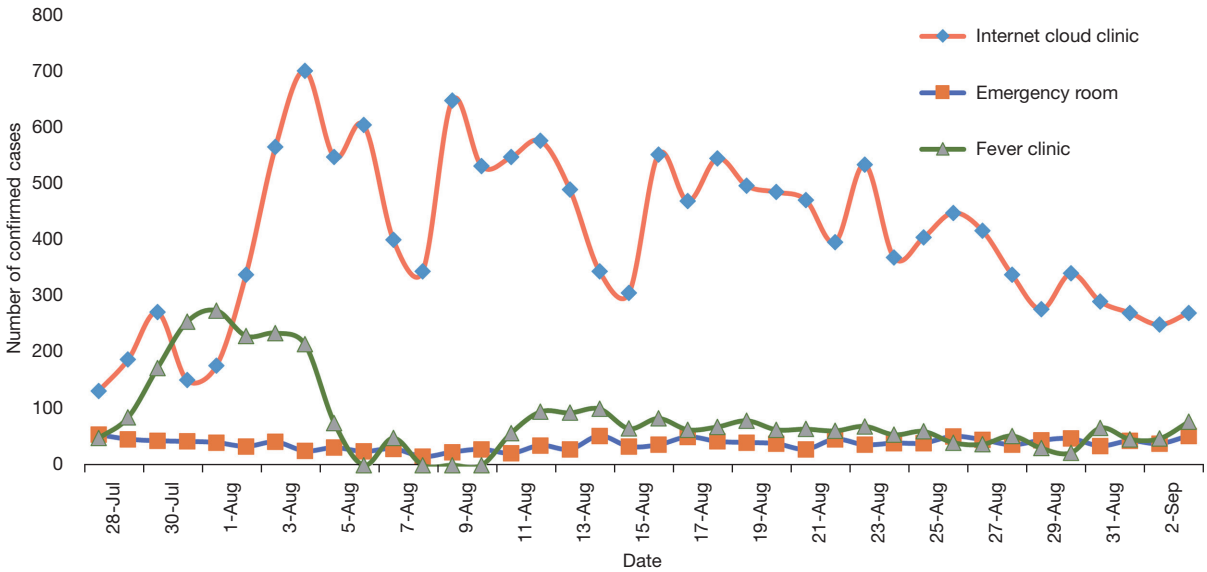

Figure 1 The number of visits in our hospital during the crisis period of the COVID-19 epidemic.

personal health status declaration, nucleic acid collection management, and implementation assessment of the centralized residential management system.

Effectiveness

The crisis state of the epidemic lasted more than one month (from July 28 to September 3). Our hospital achieved zero missed diagnosis of patients with COVID-19, zero infection of medical staff, and firmly the hospital infection-control department's red line and bottom line. On this basis, smooth medical operation was maintained in the hospital to the greatest extent.

From July 28 to September 3, the number of daily presentations to the fever clinic of our hospital ranged from 22 to 275 patients, with a median of 64 patients and a total of 3,130 patients. The first confirmed case was screened on July 29. There was a maximum of 14 confirmed cases per day, and there were no confirmed cases as of August 17. A total of 72 people were diagnosed with COVID19, representing a positive rate of 2.3%. The peak time for consultation and diagnosis was from July 30 to August 5. The daily number of visits in the internet outpatient clinic of the hospital ranged from 132 to 702, with a median of 403 and a total of 15,509 people. The total number of emergency consultations in the hospital was 17,629, and the emergency room had a maximum of 54 people and a minimum of 15 people per day, with a median of 58 and a total of 1,427 people (*Figure 1*).

Summary and suggestions

The closed-loop management of the entrance is based on unified leadership at the hospital level, clarifying their respective functional position and reaching consensus

Under normal circumstances, the outpatient, emergency, and fever clinic channels are the responsibility of different functional departments. The role of each specific department is often different, and the implementation of policy standards is likely to vary, leading to inconsistencies and disputes. Under emergency pandemic conditions, it is necessary to make overall planning at the whole hospital level. The hospital leader should manage and clarify the respective functional position of each department, unify the triage standards, revise the protocols according to the epidemic prevention and control situation, and develop policy requirements to facilitate the implementation and scientific prevention and control of disease.

The closed-loop management of the entrance is not isolated but is effectively linked and closely coordinated to build a complete patient treatment process

Based on their respective functional roles, it is necessary to establish a working relationship for the fever clinic,

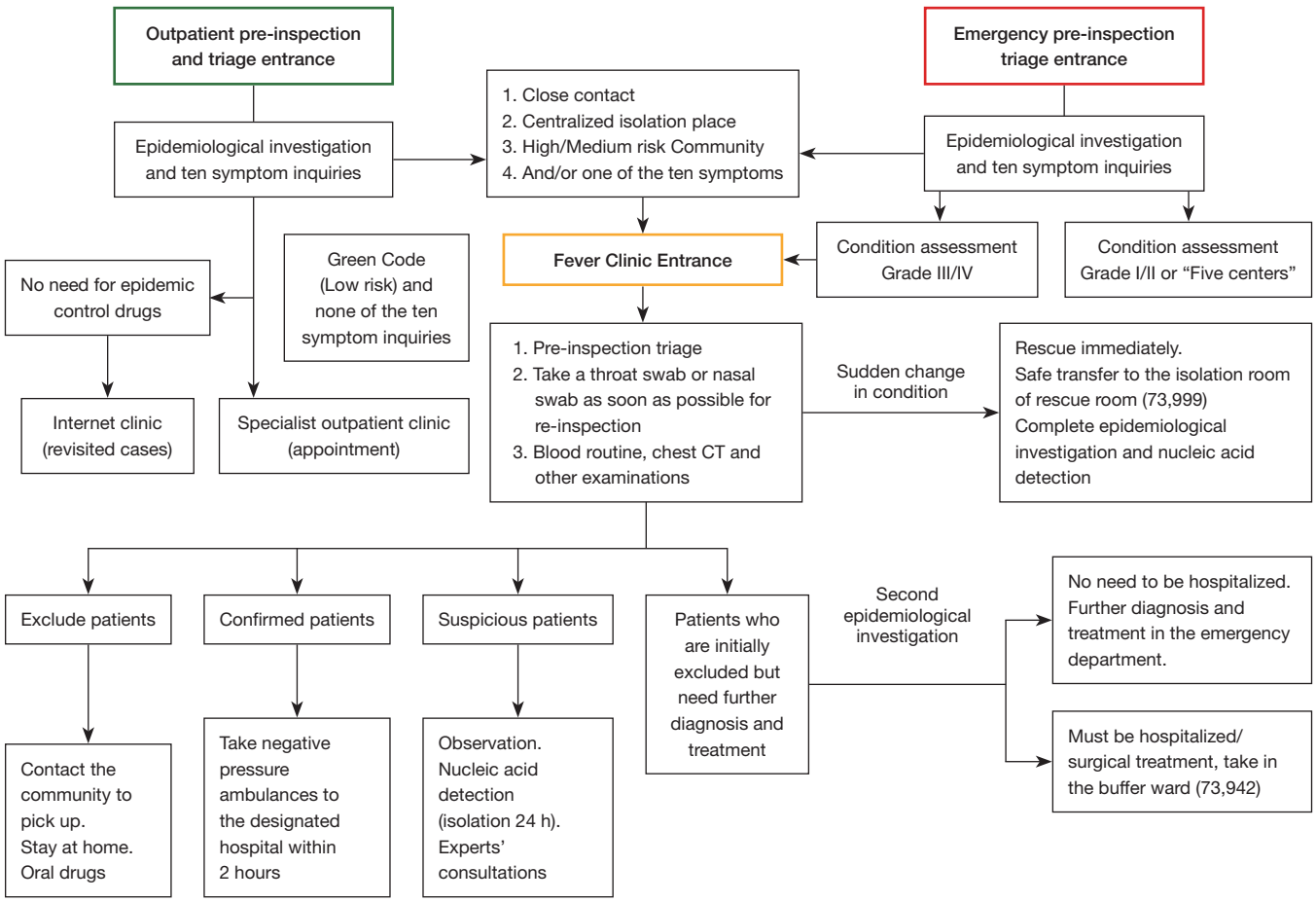

Figure 2 Linkage mechanism between hospital entrances. Outpatient pre-inspection and triage entrance was denoted in green block diagram, emergency pre-inspection triage entrance was denoted in red block diagram, and fever clinic entrance was denoted in yellow block diagram.

outpatient (emergency) pre-examination and triage department, and the buffer ward. Online diagnosis and treatment should also be closely coordinated with the emergency and first-aid systems to facilitate a coordinated medical treatment network. Timely screening of suspected COVID-19 patients and the implementation of the prevention and control of hospital infections is necessary to effectively maintain order in the health system during times of pandemics (*Figure 2*).

Pay attention to the coordinated management role of public security, hospital security, and volunteers

During the crisis phase of the epidemic, special attention should be given to the coordinated management of public security, hospital security, and volunteers. Hospital security measures at the entrance of the hospital should be heightened. The deployment and duty of security personnel should be strengthened, as should the management of hospital vehicles. Electronic body temperature monitoring and health code inspections should be performed on all patients and accompanying persons. Volunteers should actively maintain the 1-meter distance. Epidemic prevention and control policies should be introduced and patients should be counselled and encouraged to cooperate. Security personnel should promptly deal with individuals who refuse to accept epidemic prevention and control measures, cause the risk of spreading infectious diseases, and are suspected of violating the "Law on the Prevention and Control of Communicable Disease". If necessary, the public security department or the police should be contacted to handle difficult non-compliant cases.

Rely on informatization to support closed-loop management of the entrance

All entrances use the electronic pre-examination and triage system to complete the registration of patient information as required. This data is then shared with the electronic medical records throughout the hospital and this avoids the need to repeat inquiries and obtain the same information. It also ensures that the patient's location in the hospital is clear and traceable, allowing the closed-loop management of patients with the "ten symptoms" of COVID-19.

Each entrance establishes a liaison mechanism for managing patients with the "ten symptoms" of COVID-19, with medical isolation points, pre-hospital emergency agencies, and community work contacts through WeChat groups, phone calls, and other forms of communication. This strengthens the reporting, transfer, diagnosis, and treatment of patients with the "ten symptoms". The whole process of receiving and returning is managed to ensure a timely response, rapid diagnosis and treatment, and rapid transfer.

Fever clinics should be able to obtain the data quality management and hospital infection monitoring information automatically, such as patient waiting time, nucleic acid report time, time from the end of patient diagnosis and treatment to the departure from the fever clinic, and patient treatment data.

The internal functional area of the fever clinic is clearly visible. After the renovation of the fever clinic in the hospital, monitoring was added to the functional areas, especially in important areas such as the consulting room, resuscitation room, observation room, buffer room, and patient entrance, which significantly facilitates the internal and external communication of information. The management staff can assess the internal operational status through video playback in the clean area to continuously optimize the process and supervise the implementation of various hospital infection prevention and control measures at various locations. The hospital immediately set up a leading group for epidemic prevention and control, which is fully responsible for the management of the sudden epidemic, the rational deployment of outpatient human resources, and effectively improve the efficiency of prevention and control work. Closed-loop management is implemented for febrile patients and staff participating in treatment, and closed management for hospitalized patients and accompanying nurses to control the source of infection at the source. Improve the quality of pre-examination and triage work and promote the Internet hospital platform, improve the efficiency of hospital medical services, effectively reduce the gathering and stay of hospital crowds, and reduce the possibility of cross-infection in hospital.

As the source of infection of COVID-19 will exist for a long time, the route of transmission is difficult to be completely cut off, and there are many touching people, so the epidemic situation of COVID-19 may last for a long time. Hospitals must constantly strengthen the capacity building of emergency management and bring the management of public health emergencies into their daily management in order to solve the crisis in an orderly manner.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-61/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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