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Practice Forum

Experience in management of emergency and severe cases of non-COVID-19 during the outbreak of COVID-19

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In China, the COVID-19 epidemic has had a definite turning point under the nationwide efforts to combat it. The battle against the epidemic has lasted for more than one and a half months and will continue in the short term. Severe infectious risks, massive consumption of medical personnel and materials bring unprecedented challenges to the treatment of non-COVID-19 with emergency and severe cases. To improve the management of emergency and severe cases of non-COVID-19 during the epidemic period, attention should be paid not only to "cure" but also to "prevent." Through the prehospital triage and in-hospital buffer, this paper provides the admission and treatment experience for emergency and severe cases of non-COVID-19, expecting to provide a valuable reference for saving more patients during the outbreak of COVID-19.

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In December 2019, unexplained pneumonia occurred successively in Wuhan, Hubei province, China. Chinese scholars isolated the virus from the patient samples and completed the whole genome sequencing on January 10, 2020. On January 11, 2020, the World Health Organization (WHO) named it 2019 novel coronavirus (2019-nCoV). 1 2019-nCoV pneumonia, also known as NCP (novel coronavirus pneumonia, National Health Commission of the PRC, February 8, 2020),2 COVID-19 (corona virus disease-19, WHO, February 11, 2020),3 and SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2, International Committee on Viral Classification, February 11, 2020).4 This article is collectively called COVID-19.

The COVID-19 is highly contagious. In China, by mid-to-late January 2020, suspected or confirmed cases had been reported in many provinces, autonomous regions and municipalities, and scattered cases had also been reported in many countries around the world. In view of this, on January 20, 2020, the National Health Commission of the PRC included it into Class B infectious diseases and managed it as Class A infectious diseases.5 Subsequently, all provinces, autonomous regions and municipalities launched the first-level response to major public health emergencies in China. Internationally, the COVID-19 epidemic was listed as a Public Health Emergency of International Concern by WHO on January 31, 2020.6 In China, by March 1, 2020, a total of 79,971 new cases of COVID-19 had been diagnosed, of which 34,959 were confirmed and 7,365 were severe cases. The number of cured patients in the epidemic area of Hubei province has been increasing steadily under the condition that the whole country focuses on the support, but new confirmed cases still occur from time to time, and the epidemic is spreading in the global scope, which will still have a significant impact on production and life in the short term.

With the full use of designated hospitals and mobile cabin hospitals, the acceptance and treatment of patients with COVID-19 is currently being carried out in a systematic, standardized and orderly manner, but the treatment of non-COVID-19 patients are facing unprecedented challenges. On the one hand, the outbreak of COVID-19 consumed a large number of medical human resources and medical supplies; on the other hand, the incubation period of COVID-19 is long, and the population is generally susceptible, so it is difficult to prevent and control cross-infection between doctors and patients. Therefore, the admission and treatment of non-COVID-19 patients should not only face the complicated process of screening COVID-19, but also face the overall shortage of medical workforce and materials. The phenomenon of “one bed is difficult to obtain” has severely affected the treatment of non-COVID-19 with emergency and severe cases.

To alleviate the current problem of seeking medical treatment for non-COVID-19 patients, combined with the experience in the treatment of non-COVID-19; recently, this paper discusses the admission and treatment process for emergency and severe cases of non-COVID-19 during the outbreak of COVID-19.

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PRE-HOSPITAL TRIAGE FOR NON-COVID-19 PATIENTS

During the epidemic period, there will be a large number of suspected and confirmed cases of COVID-19 in the hospital outpatient service. It is difficult to effectively identify them in the specialized outpatient service, which is likely to cause the occurrence of cross-infection in the hospital, so they are forced to stay in the state of suspension. The hospital opened the fever clinic and the emergency department, and all patients who visited the hospital were triaged before the hospital. According to whether the patient’s body temperature is ≥37.3°C, the patient was triaged into the fever clinic and the emergency department, respectively.7,8

Management of triage in fever clinic

Patients with fever or temperature ≥37.3°C measured in the pre-examination triage will be admitted to the fever clinic. The primary task of the fever clinic is to determine whether the patient is the fever caused by the COVID-19, based on symptoms, previous history, contact history, blood routine and chest CT examination. If the diagnosis is confirmed as a COVID-19, the severe patients shall be sent to the designated hospital for treatment, while the mild patients shall be sent to the isolated treatment site for medical observation and treatment. Critically ill patients were rescued on the spot.

If the diagnosis of COVID-19 is excluded by preliminary screening and fever is considered to be caused by other diseases, medical observation and treatment should be conducted in the fever clinic observation room, and 2019-nCoV RNA should be further determined. 2019-nCoV RNA-positive patients were sent to designated hospitals for treatment or isolation; 2019-nCoV RNA negative patients with mild disease were given medical advice to go home for isolation and observation, and patients with severe disease were prepared for the next diagnosis and treatment process.

Management of triage in emergency department

The emergency department mainly deals with patients with emergency and severe cases but no signs of fever, which may include patients with COVID-19 but no symptoms of fever, and patients who are still in the incubation period of infection but have no clinical manifestations. In principle, only the emergency and severe cases requiring medical intervention should be treated during the epidemic period, and it is recommended to use the network platform for consultation and appointment for further treatment for general diseases that do not affect the condition control and the final treatment effect in a short period of time. The confirmation of emergency and severe cases shall be determined by the pre-examination and triage office of the emergency department.

The emergency department is a potential area of high infection. All patients entering the emergency area must have their body temperature checked, ask about their previous history and contact history in detail, and make a strict pre-examination triage. Patients with abnormal body temperature designated to fever clinic to continue treatment. Patients with normal body temperature and respiratory symptoms should complete blood routine and chest CT to exclude COVID-19, and then go to emergency observation ward for medical observation and treatment. If the patient’s condition requires hospitalization, a 2019-nCoV RNA assay is performed. Patients with normal body temperature and no respiratory symptoms can go directly to the emergency observation ward for medical observation and treatment. If the patient’s condition requires hospitalization, blood routine, chest CT, and 2019-nCoV RNA testing should be improved.

Classification management of emergency and severe case during prehospital triage

After the initial screening in the fever clinic and emergency department, non-COVID-19 patients with emergency and severe cases should be treated according to the specific conditions and medical resources. The primary physician in the fever clinic and emergency department should simultaneously observe and analyze the symptoms and signs outside the respiratory system during the process of excluding the COVID-19. Through contacting the relevant specialist for telephone consultation, when necessary, the specialist doctor personally to the site to participate in the diagnosis and treatment, for further specialist examination and treatment plan to give advice.

(1) Emergency and severe case that can be treated on an outpatient basis. Some emergency and severe cases can be improved by drugs or simple operation. After the initial elimination of COVID-19, these patients were given medication guidance by a specialist in the fever clinic or emergency department, or performed bedside surgery. After short-term observation in the fever clinic or emergency department and no abnormality, it is recommended to isolate the patient at home for follow-up treatment, and follow-up with the online platform.

(2) Emergency and severe case requiring further hospitalization. All inpatients were admitted and treated under the overall arrangement of the director of the department, first into the buffer ward. Before entering the buffer ward, blood routine, chest CT and 2019-nCoV RNA determination must be completed in the fever clinic or emergency department to exclude COVID-19.

(3) Emergency and severe case requiring immediate emergency rescue. Such patients may not be able to screen for COVID-19 at all, or may not be able to rule them out completely. Therefore, all operations should be carried out under 3-level protection, and if emergency operations are needed, they should be sent to the negative pressure surgery room by special channels. After successful rescue, further improve the detection of COVID-19, according to the test results transferred to the corresponding location for continued treatment.

Protective management of consultation specialists in prehospital triage

Considering that all patients are collected to the fever clinic and emergency department during the epidemic period, there may be more specialized patients requiring consultation, so it is suggested to set up specialized emergency department and fever clinic consultation personnel. From the point of view of doctor-patient cross-infection, the fever clinic and the emergency department are high-risk areas, and specialists should conduct self-isolation after consultation and operation in these areas. It is suggested to isolate special duty areas in the inpatient ward for the rest of the consultation doctors, so as to avoid the cross activities of the consultation doctors in the high-risk area and the living area, which may bring potential infection risk. The duty room carries out air disinfection according to requirements every day. The object surface of the duty room is wiped or sprayed with 1,000 mg/L chlorine-containing disinfectant, and the water is wiped clean after 30 minutes of action. The floor and walls are wiped or sprayed with 1,000 mg/L chlorine-containing disinfectant from inside out.8

When visiting the fever clinic or the emergency room, the consultant should strictly implement the standard prevention, and wear protective equipment according to the second-level protection standard, including work clothes, N95 surgical mask, disposable round hat, goggles, double-layer medical gloves, and disposable protective clothing. Three levels of protection are adopted for high-risk operations. After contact with patients, patients' body fluids or
contaminated substances, medical staff should change gloves in a timely manner, and when removing protective equipment, they should strictly abide by the relevant provisions of the hand hygiene code for medical staff.9

Prehospital triage is the first line of defense against hospital cross-infection, which is the most important procedure for the treatment of non-COVID-19 patients during the outbreak. Scientific triage can help make rational use of limited medical resources to complete the management of COVID-19 patients, and at the same time allow the timely treatment of non-COVID-19 patients with critical illness, so as to reduce secondary injuries caused by the epidemic. The basic point is to identify and isolate COVID-19 and non-COVID-19 patients as quickly as possible, and provide necessary specialized treatment for emergency and severe cases of non-COVID-19 on the premise of ensuring the safety of consultation specialists that from the hospital ward.

**IN-HOSPITAL BUFFER FOR NON-COVID-19 PATIENTS**

In-hospital buffering is designed to reduce the risk of nosocomial transmission caused by undetected COVID-19. Studies have reported that false negative results of 2019-nCoV RNA testing are not uncommon, and blood routine and chest CT of preclinical patients and early infected patients are not obviously abnormal, but they are infectious.10 These patients, who cannot be detected by existing tests during prehospital triage, may show symptoms during the in-hospital buffering process. Through medical observation and retesting, the detection rate can be improved, thus reducing the risk of nosocomial cross-infection.

The in-hospital buffer is set to 2 stages, including buffer-ward and inpatient-ward buffer.

**Management of buffer zone in buffer-ward**

Buffer-ward is a comprehensive buffer area specially set up during the outbreak and managed by special personnel. The buffer-ward is a primary buffer zone that is mainly responsible for medical observation of inpatients and further screening of COVID-19. Patients with suspected or confirmed COVID-19 during the buffer period shall be transferred to the designated hospital for further treatment.

The doctors on duty in the buffer-ward are selected from various clinical specialties and put under the unified management of the buffer-ward. The on-duty doctor is responsible for the observation of the patients’ condition in the whole buffer-ward, and responds to the patients’ condition to the on-duty doctor of relevant specialty by telephone. According to the arrangement of the director of the buffer-ward, the screening test of COVID-19 should be further improved. Report the patient’s condition to the buffer ward director, who decides whether the patient is suitable for transfer to the inpatient ward. The criteria for the transfer of the buffer-ward to the specialized inpatient ward was the second negative 2019-nCoV RNA test, and patients with respiratory symptoms were required to undergo a second blood routine and chest CT, which did not support the diagnosis of COVID-19.

**Management of buffer zone in inpatient-ward**

The inpatient-ward buffer zone is the part of the original specialist ward that is isolated for a secondary buffer. The original ward was divided into buffer zone and common area/ward according to “one department two zones,” and unified management according to the original personnel planning. The buffer zone shall be set up with a physical isolation barrier that limits the range of movement of the patient and shall be posted with a prominent buffer zone logo. All patients transferred from the buffer-ward first enter the inpatient-ward buffer zone. As the last isolation barrier for the infection of COVID-19, the buffer zone in the inpatient-ward after receiving patients, in addition to further improve the specialized diagnosis and treatment according to the condition, the patient’s temperature and respiratory symptoms should be closely observed, and blood routine and chest CT should be reviewed if necessary. According to the condition and resource allocation, after further eliminating the potential infection risk of COVID-19, generally 3-5 days, transferred to the common ward or arrange surgical treatment and then return to the common ward.

**Management of emergency and severe cases during the in-hospital buffer**

All hospitalized patients need to be observed in the two-stage buffer zone for about a week before entering the common ward. This period of time should be further screening COVID-19, at the same time, according to the patient's condition, perform for timely diagnosis and treatment. Essentially, 2-stage buffer zone is part of the inpatient ward, an inpatient ward set up specifically to protect against COVID-19 transmission during an outbreak.

Buffer-ward buffer as a primary buffer, its primary function is buffer, not treatment. Each specialty treats its own patients, including arranging regular rounds of rooms, perfecting relevant specialized examinations or carrying out specialized treatment, and dealing with emergencies of specialized diseases. The critical cases of some specialties need to be timely followed up after they enter the buffer-ward, so as not to delay the optimal treatment time due to waiting for the screening of COVID-19. Some patients who have completed treatment in the buffer-ward are discharged directly.

The inpatient-ward buffer serves as a secondary buffer, a continuation of the primary buffer, and the risk of transmission of COVID-19 is gradually reduced. The space is divided by “one department two zones,” and the diagnosis and treatment in the “two zones” are managed by the same specialized medical staff according to the condition. The diagnosis and treatment that can finish in buffer zone, do not turn into common ward, deal with discharge directly.

**Protective management of medical personnel in the in-hospital buffer zone**

The buffer zone in the hospital shall be considered as a potential contaminated area. To strengthen the protection of buffer zone, the relevant provisions of prehospital triage should be strictly implemented and the screening of inpatients should be done well. In order to prevent accidental outbreak of nosocomial infection, single room isolation was adopted in the buffer ward. In addition, attention should be paid to the specific protection management within the hospital’s 2-stage buffer zone, including: medical personal protection, access control, stay and visit management and ward environment disinfection.

1. **Medical personal protection.** Medical staff shall take standard precautions when entering the buffer zone, and the buffer zone shall be protected according to the potential high-risk exposure. General ward rounds shall include working clothes, disposable round cap and medical protective N95 mask (the buffer zone in the inpatient-ward can be protected with medical surgical mask), and disposable surgical isolation clothing. In case of close contact with patients and high-risk operations, secondary protection shall be applied, that is, goggles/face screen shall be worn, disposable protective clothing shall be worn, double rubber gloves shall be worn, and tertiary protection shall be applied when necessary, such as endotracheal intubation, etc. Diagnosis and treatment in the buffer zone and taking off personal protective equipment strictly implement hand hygiene.8,9
(2) **Access control.** Irrelevant personnel are strictly prohibited to enter the ward, patients are not allowed to leave the ward, staff documents to enter. For all personnel entering the ward, the on-duty nurse should be arranged at the entrance of the ward to take the temperature, and those with elevated temperature should be refused to enter the ward and instructed to go to the fever clinic.

(3) **Stay and visit management.** In principle must not arrange to stay with and visit, according to the needs of the patient’s condition must stay with, each bed is only limited to stay with 1 person, and must be relatively fixed, not optional replacement. The accompanying personnel must be accompanied by the patient at the time of admission for CT and blood routine examination, the result is negative, no fever, no history of close contact with the patient with COVID-19, can be accompanied by the patient into the ward. The accompanying personnel shall receive daily temperature monitoring, prepare, and wear masks by themselves, and shall not leave the ward without permission during the accompanying period. Once the fever occurs during the stay, visit the fever clinic as soon as required and do not re-enter the ward.

(4) **Ward environment disinfection.** The buffer zone is specially designated for environmental hygiene, and air disinfection is carried out every day. The surface of the object is wiped with 1,000 mg/L chlorine-containing disinfectant, and clean water is wiped after 30 minutes of action. The floor and walls are wiped or sprayed with 1,000 mg/L chlorine-containing disinfectant from the inside out.

The 2-stage in-hospital buffer is a special setting in the hospital ward during the epidemic period, which is a supplement and improvement to the prehospital triage process. Unlike prehospital triage, which can be rapidly identified based on clear indicators, in-hospital buffering is primarily targeted at patients with potential transmission risk, which requires longer time and more detailed medical observation. Data showed that in the 15 days of operation in one of the buffer-wards, a total of 137 hospitalized patients were treated, 9 patients with latent infection were screened out, 2 patients were found to be COVID-19 positive, and 89 patients were rescued in critical condition. In other words, 8.0% of patients who may cause in-hospital transmission were isolated in time, and 65.0% of patients requiring urgent medical assistance were treated in time.

In summary, by strengthening the management of prehospital triage and in-hospital buffer, as a designated treatment unit for non-COVID-19 patients in the epidemic area, we gradually standardized and programmed the treatment of emergency and severe cases (Fig 1). Through the continuous discovery and isolation of COVID-19 cases in the buffer-wards, we are more aware that scientific management of emergency and severe cases during the epidemic is an effective way to ensure doctor-patient safety and avoid the outbreak of nosocomial infection. Therefore, in practice under the epidemic situation, by optimizing the management of prehospital triage and in-hospital buffer, the limited medical resources can be utilized more reasonably and efficiently, and timely medical assistance can be provided for more emergency and severe cases of non-COVID-19.

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