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Sentinel surveillance strategies for early detection of coronavirus disease in fever clinics: experience from China

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Abstract

Sentinel surveillance system plays a key role in screening and monitoring emerging and acute infectious diseases in order to identify the suspected cases in time. During SARS period in 2003, fever clinics emerged in many cities in mainland China with the purpose to screen the suspected SARS patients and to transfer the confirmed cases to designated hospitals for professional management. Shanghai city has reserved the fever clinics and the designated hospitals since then. Hence, clinicians in the front line are able to respond quickly to the emerging COVID-19 outbreak with their accumulated knowledge and experiences from the past. One hundred seventeen fever clinics distributed in various district areas in Shanghai have played a vital 'sentinel' role to fight against the COVID-19 epidemic. Most of suspected patients were identified in fever clinics and thereafter among these suspected patients the COVID-19 cases were confirmed and were isolated quickly to avoid the spread. We would like to share the sentinel roadmap for screening and diagnosis of COVID-19 to medical healthcare workers around the world, especially countries who are facing great challenges to cope with COVID-19 and meanwhile with limited medical resources. These sentinel surveillance strategies will certainly provide insight into the early detection and timely isolation of suspected cases from the others.

Short Paper

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The World Health Organization (WHO) declared coronavirus disease-19 (COVID-19) to be a global pandemic on 12 March 2020 [1]. Some countries are struggling with a shortage of medical resources. In late January 2020, 117 fever clinics distributed in various district areas of Shanghai have played a vital 'sentinel' role in the fight against the COVID-19 epidemic. Sentinel surveillance in fever clinics is different from routine surveillance. It is employed for discerning patients with suspected symptoms and signs, for timely isolation, for effectively blocking disease transmission during the early outbreak period before the pathogen has been identified, and for determining effective therapeutic methods; this strategy was used during the severe acute respiratory syndrome (SARS) epidemic in 2003 [2]. Information of patients with suspicious symptoms and imaging findings in the sentinel surveillance reporting system are reported to the Centers for Disease Control (CDC) to provide an early warning of emergent acute infectious diseases. We aim to share our sentinel surveillance protocol for the screening and diagnosis of COVID-19 patients with medical healthcare workers worldwide, especially with those in countries facing challenges in coping with the COVID-19 outbreak due to limited medical resources.

COVID-19, which was first reported in Wuhan, China, in December 2019, has spread rapidly [3]. The causative agent, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), can cause a severe respiratory syndrome similar to SARS and Middle East respiratory syndrome (MERS). The transmissibility and mortality of COVID-19 are high [3, 4]. A sentinel surveillance strategy was employed in fever clinics to ensure early detection and timely isolation of suspected cases. In the early stage of the outbreak, testing kits, supplies and effective medicines were unavailable. To efficiently and effectively control the epidemic and to minimise its negative economic impact, rapid screening and immediate isolation of suspected COVID-19 cases in fever clinics was important.

In the early outbreak period, the use of the sentinel surveillance strategy in fever clinics can provide benefits in terms of identifying patients with suspected symptoms, effectively blocking disease transmission, and protecting vulnerable populations. Under the sentinel protocol (Fig. 1), the typical symptoms of COVID-19 were fever, sore throat, dry cough and fatigue [5]. However, more than half of the patients are reported to present without fever on admission [6]. Therefore, patients with a normal body temperature (oral temperature <37.3 °C) but with respiratory symptoms and underlying disease; as well as those with an epidemiological

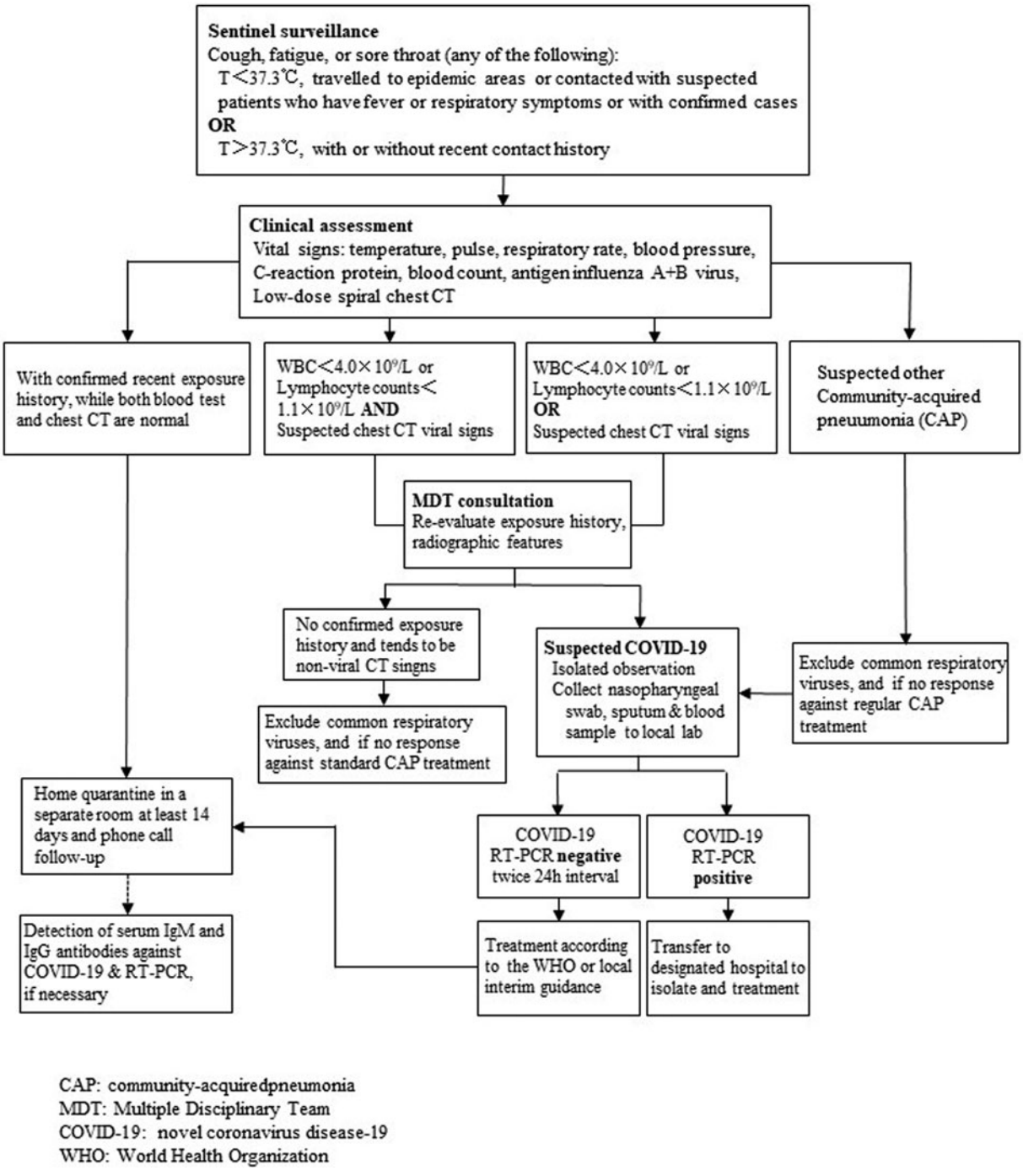

Fig. 1. Flow chart of sentinel surveillance for early detection of coronavirus disease.

history, including a history of travel to epidemic areas and contact with COVID-19 patients are recommended to visit fever clinics. Patients with an oral temperature >37.3 °C are also advised to visit fever clinics, regardless of their contact history. In fever clinics, the following clinical assessments are performed: evaluation of vital signs, C-reactive protein measurements, complete blood count, testing for influenza A + B viral antigens and low-dose spiral chest computed tomography (CT). The screening results are usually obtained within 30 min. Usually, a further 30 min are required for specialists from a multi-disciplinary team (MDT) to re-evaluate the results of lymphocytopaenia and/or suspicious chest CT findings as well as the epidemiological history; this MDT contains specialists from the departments of infectious disease, respiratory disease, emergency medicine and intensive care. If the patient confirms recent contact with a COVID-19 case and has an abnormal blood count and/or abnormal chest radiologic findings, the patient is assigned an isolated room, and nasopharyngeal swabs and sputum and blood samples are sent to the Shanghai CDC. Upon obtaining two negative results of reverse transcription polymerase chain reaction (RT-PCR) for SARS-CoV-2 within an interval of ≥24 h, the patient is asked to home quarantine in a separate room for at least 14 days, and a

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telephonic follow-up is arranged. If the symptoms persist and worsen, rapid detection of serum immunoglobulin M (IgM) and IgG antibodies against SARS-CoV-2 is necessary. COVID-19 should also be considered in patients with community-acquired pneumonia showing no response to standard antibacterial treatment. If the RT-PCR test for SARS-CoV-2 shows positive results, the patient is transferred to a designated hospital for isolation and further treatment. Patients presenting with respiratory symptoms during the 14-day quarantine undertaken due to obvious epidemic history are strongly recommended to visit a fever clinic and undergo rapid tests for the detection of serum IgM and IgG antibodies against SARS-CoV-2 or viral nucleic acids. This helps in controlling transmission and in monitoring disease progression and deterioration.

During the SARS epidemic in 2003, fever clinics emerged in many cities in mainland China for screening suspected SARS patients and to transferring confirmed cases to designated hospitals for professional management [2]. Shanghai city has learnt to respond to an outbreak, and to reserve the fever clinics and designated hospitals since then. Hence, front-line clinicians in fever clinics are able to respond to the emerging COVID-19 outbreak owing to their accumulated knowledge and past experiences. In daily life, fever clinics are used for screening influenza cases and seasonal epidemics. If patients tested positive for influenza A/B, they were prescribed oral antivirals and were required to home quarantine for at least 3 days after resolution of the fever. Early symptoms of SARS, MERS, COVID-19 and influenza are similar, fever, cough, sore throat and rhinorrhoea or nasal congestion. SARS, MERS and COVID-19 have a longer incubation period than influenza [7]. The proportion of symptomatic patients requiring hospitalisation was higher in COVID-19 patients than in influenza patients [8]. The differential diagnosis mainly relies on the detection of viral nucleic acids or serum antibodies. COVID-19 concurrent with influenza has also been reported, especially in the epidemic period [9].

An increasing number of countries have been affected by this pandemic worldwide, and the mortality rate is increasing [1]. All affected countries are looking for a balance between protecting peoples' health and minimising the negative economic impact of this pandemic [1]. Effective public health measures, such as contact tracing, social distancing and communal surveillance, have been implemented to prevent transmission at a community level [10]. In patients with symptoms like fever, dry cough, sore throat or fatigue, rapid screening, isolation and diagnosis in the sentinel departments, such as fever clinics, is crucial. Lymphocytopaenia and bilateral/peripheral ground-glass opacities were considered as early indicators of COVID-19 in the early outbreak period. The final diagnosis can be confirmed by real-time RT-PCR assays or by viral gene sequencing. However, resources for diagnosis are important in the early outbreak period, and unfortunately, these resources are still lacking in some countries. To date, there are no effective specific treatments for COVID-19.

Fever clinics play a role in sentinel surveillance in the fight against COVID-19. Fever clinics are independent of emergency clinics. In the early outbreak period, the clinicians in fever clinics are responsible for rapid screening, identification and isolation. It is important to isolate suspected cases as soon as possible and confirm the diagnosis accordingly. However, this strategy has limitations. With this protocol, the suspected patients of having influenza were required to undergo low-dose chest CT to rule out atypical pulmonary infections, which was not necessary in the past. Radiologic features on chest CT are useful in the early period to rule out bacterial aetiologies, although they are limited ability to distinguish viral infections. Tests for antigen influenza A + B are also necessary. The short-term mortality rate is fairly high in critical cases. Hence, this strategy not only helps in providing timely treatment to affected patients so as to decrease or delay the disease progression but also helps in efficiently isolating suspected cases in a short time period to protect public health. We hope that sentinel screening protocol will serve as an operating protocol for the first-line clinicians.

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