



Analysis and suggestions for the preview and triage screening of children with suspected COVID-19 outside the epidemic area of Hubei Province

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Background: Since December 2019, a number of patients infected with COVID-19 (SARS-CoV-2) have been identified in Wuhan, Hubei, China. As the epidemic has spread, similar cases have also been found in other parts of mainland China and abroad. The main reason for this spread is the highly contagious nature of the virus and the fact that children can also become infected during its incubation period. This has made the virus a substantial challenge for the outpatient triage staff of children's hospitals outside the epidemic area of the Hubei Province. It is very important for the preview and triage personnel to accurately grasp the epidemiology of the virus and identify children's symptoms in the fever clinic.

Methods: We performed an analysis of our early preview and triage of suspected COVID-19 in 36 children presenting at fever clinics. Two specialists either excluded suspected cases or referred cases to the isolation ward for new nucleic acid testing.

Results: All 14 children who were transferred to the isolation ward had a fever, and 71.43% of them had a cough. Their nucleic acid testing results were negative. The suspected cases and excluded suspected cases had similar epidemiology history as well as complete blood count results. With reference to the diagnostic criteria in existing pediatric guidelines, we have further improved the triage screening questionnaire for children with fever in our hospital.

Conclusions: According to the situation in our city and hospital, an evaluation questionnaire that is suitable for use with children in our hospital has been formulated to achieve the goals of early detection, isolation, diagnosis, and treatment. We provided an important basis for the next step in developing accurate preview and triage screening standards and appropriate guidelines for pediatric patients.

Keywords: SARS-CoV-2; COVID-19; children; preview and triage

Submitted Mar 03, 2020. Accepted for publication Mar 29, 2020.

doi: 10.21037/tp.2020.03.08

View this article at: <http://dx.doi.org/10.21037/tp.2020.03.08>

Introduction

Since December 2019, a number of new cases of pneumonia caused by a novel coronavirus, which has been identified as SARS-CoV-2 by the World Health Organization (WHO), have been confirmed in Wuhan, Hubei China. As the epidemic has spread, cases of this virus have been found in other parts of mainland China and internationally. A number of regions in China have launched a first-level response to this major public health emergency (1), as COVID-19 is highly infectious and has a long incubation period. The main source of infection in patients infected by COVID-19 and asymptomatic infected persons may also act as sources of infection. The main transmission route is through respiratory droplets and close contact (2). According to the latest statistics of the National Health Commission of the People's Republic of China, as of midnight on February 19, 2020, a total of 74,576 confirmed cases, 2,118 deaths, and 4,922 suspected cases had been reported in China (3). The government of Chongqing area attaches great importance to the prevention and control of pneumonia caused by COVID-19 and has taken action by initiating a first-level response to this major public health emergency. As Chongqing borders the Hubei Province and travel for the Spring Festival coincided with the outbreak of the virus, the close flow of people between the 2 places has led to a severe epidemic situation in Chongqing. As of midnight on February 19, The Health Commission of Chongqing announced a total of 560 cases of COVID-19 in this area (4).

As the largest grade A class 3 children's hospital in Western China, the Children's Hospital of Chongqing Medical University has an annual outpatient volume of over 3 million, with a wide range of sources and complicated flow of patients. The outbreak of the COVID-19 coincides with the high incidence of seasonal influenza in winter and spring, which is the peak period for pediatric outpatient visits. Children are the main population affected by infectious diseases, especially acute respiratory infectious diseases (5). This series of circumstances has greatly increased the difficulty of preview and triage, which is necessary for epidemic prevention and control. Outpatient preview and triage play an irreplaceable role in the processing of outpatients with fever (6). Effective preview and triage can screen and identify probable and suspected cases as early as possible; improve the working efficiency of the medical staff (7); achieve the goals of early detection, early isolation, and early reporting; and play a key role in

the reception and treatment of patients (8). A separate fever clinic was established in our hospital to diagnose and treat children suspected COVID-19. Outpatient preview and triage can be used to prevent the spread of the epidemic in the hospital.

Methods

Study population

The following analysis was performed with 36 children who were referred to the fever clinic in our hospital after triage screening between January 21, 2020, and February 10, 2020. After diagnosis and treatment in the fever clinic by a doctor from the infectious disease department and further expert consultation, 14 suspected COVID-19 cases were screened out, who were sent to the isolation ward for nucleic acid testing. Among them, 7 patients had chest X-rays indicating possible pulmonary infection, and 1 patient underwent a computed tomography (CT) scan that showed the presence of small glabrous nodules. The nucleic acid testing results of all those patients were negative. Other 22 patients were diagnosed and treated in the fever clinic by doctors from the infectious disease department and without diagnosis of suspected COVID-19 after expert consultation. Among them, chest X-rays showed the possibility of pulmonary infection in 13 patients.

Results

Clinical manifestations of the 36 children sent to the fever clinic after preview and triage screening

From January 21, 2020, to February 10, 2020, all 36 children sent to the fever clinic after preview and triage screening in the hospital had fever or cough to different extent. All 14 children who were transferred to the isolation ward for nucleic acid testing after expert consultation had a fever, and 71.43% of them had a cough (*Table 1*).

Epidemiology history analysis of the 36 children sent to the fever clinic after preview and triage screening

As can be seen from *Table 2*, among the 36 children, 2 lived in a residential area with Wuhan residents but had no obvious direct contact with them, and both of the children were found to not be infected with SARS-CoV-2 after outpatient testing. Furthermore, 7 children lived outside Hubei Province, and there were confirmed cases in the

Table 1 Preview and triage screening: analysis of symptoms and signs in the 36 children

Case classification	Suspected cases (n=14) (%)		Excluded suspected cases (n=22) (%)	
	Yes	No	Yes	No
Fever	14 (100.00)	0 (0.00)	20 (90.91)	2 (9.09)
Cough	10 (71.43)	4 (28.57)	19 (86.36)	3 (13.64)
Symptoms such as nasal congestion, sneezing, vomiting, or abdominal pain	13 (92.86)	1 (7.14)	14 (63.64)	8 (36.36)
Tonsils are swollen	4 (28.57)	10 (71.43)	8 (36.36)	14 (63.64)

Table 2 Preview and triage screening: the epidemiological history of the 36 children

Case classification	Suspected cases (n=14) (%)	Excluded suspected cases (n=22) (%)
There are people from Wuhan living in the patient's community, but they had no obvious, direct contact with the patient	0 (0.00)	2 (9.09)
The patient had a confirmed case in a residential community outside Hubei but lives in a different building and has no obvious direct contact with any confirmed cases	3 (21.43)	4 (18.18)
The patient ate at a restaurant outside Hubei Province and might have been exposed to confirmed cases	2 (14.29)	0 (0.00)
The patient lived outside of Wuhan, Hubei Province, and returned to Chongqing	5 (35.71)	2 (9.09)
The patient lived in Wuhan, Hubei Province, and returned to Chongqing	1 (7.14)	0 (0.00)
Patients or family members have a history of contact with people outside Wuhan, Hubei Province	1 (7.14)	4 (18.18)
The patient had contact with people who were in Wuhan and returned home to Chongqing	1 (7.14)	5 (22.73)
The patient had no obvious contact history with people from other provinces or cities or confirmed cases	0 (0.00)	1 (4.55)
The patient returned to Chongqing from other provinces and cities outside Hubei Province and had no history of contact with confirmed cases	1 (7.14)	4 (18.18)

residential area, but these people were not in the same building as the patients, and there was no obvious direct contact between the children and the confirmed cases; 4 of these 7 patients were excluded from the fever clinic after treatment, and the remaining 3 patients were suspected of infection after expert consultation. Next, 2 children might have been exposed to confirmed cases while eating in restaurants outside Hubei Province, and they were suspected after expert consultation. In addition, 7 children lived in Hubei but not in Wuhan but had visited and then returned to Chongqing, among whom 5 were treated as being suspected of infection after expert consultation. Moreover, 1 child had been living in Wuhan but returned to

Chongqing and was treated as being suspected of infection after expert consultation. Next, 5 children or their parents had a history of contact with people from outside Wuhan, 1 of whom was regarded as being suspected of infection after expert consultation. Additionally, 6 children were in contact at home with individuals who traveled from Wuhan to Chongqing, and 1 of these children was treated as being suspected of infection after expert consultation. Furthermore, 1 patient had no obvious contact history with individuals from other provinces and cities and was excluded from suspicion of infection after treatment. Finally, 5 children returned to Chongqing from other provinces and cities outside Hubei; they had no contact history with

Table 3 Preview and triage screening: complete blood count results of the 36 children

Case classification	Suspected cases (n=14) (%)			Excluded suspected cases (n=22) (%)		
	Normal	Increase	Decrease	Normal	Increase	Decrease
White blood cell count	11 (78.57)	2 (14.29)	1 (7.14)	19 (86.36)	2 (9.09)	1 (4.55)
Percentage of lymphocytes	4 (28.57)	0 (0.00)	10 (71.43)	7 (31.82)	1 (4.55)	14 (63.64)
Percentage of neutrophils	5 (35.71)	9 (64.29)	0 (0.00)	8 (36.36)	13 (59.09)	1 (4.55)
C-reactive protein	8 (57.14)	6 (42.86)		12 (54.55)	10 (45.45)	

confirmed cases, and 1 of these patients was treated as being suspected of infection after expert consultation.

Complete blood count (CBC) analysis of the 36 children sent to the fever clinic after preview and triage screening

As seen in *Table 3*, the CBC showed that, of the 14 children treated as being suspected of infection after expert consultation, 85.71% of them had normal or decreased white blood cell counts, and 71.43% of the children had decreased percentages of lymphocytes. After expert consultation, these patients were transferred to the isolation ward for nucleic acid testing. All the nucleic acid testing results were negative.

Discussion

Our preview and triage screening, according to the Diagnosis and Treatment of Novel Coronavirus Pneumonia (Trial Version), has been optimized to improve clinical effects, as these clinical effects are considered in the selection criteria. The clinical manifestations of children with suspected COVID-19 identified during preliminary screening conform to the guidelines provided in the Diagnosis and Treatment of Novel Coronavirus Pneumonia (Trial Version 5), Article 1 Clinical Manifestations of Suspected Cases Outside Hubei Province. In addition to clinical manifestations, epidemiological history is also very important in the screening of children suspected of infection with COVID-19 outside Hubei Province. According to the pneumonia diagnosis and treatment guidelines for infection with the SARS-CoV-2, the epidemiological history of suspected cases should meet at least 1 of the following 3 criteria: (I) travel history or residence history in Wuhan and surrounding areas within 14 days prior to the onset of the disease, or in other communities where cases

have been reported; (II) contact with COVID-19-infected patients (positive nucleic acid test) within 14 days prior to illness onset; (III) contact with patients from Wuhan or surrounding areas or from communities with reported clusters of cases of fever or respiratory symptoms within 14 days prior to the onset of the disease. According to the results of the analysis of 36 patients who underwent preview and triage screening in our hospital, the epidemiological history was analyzed, and the relevant guidelines for pediatric patients (9-11) were combined with this history to improve the preview and triage screening table for children outside the epidemic area in Hubei province (*Figure 1*). The questions related to the epidemiological history on the preview and triage questionnaire in our hospital were assigned to 3 categories according to the comprehensive weighted value: high-, medium-, and low-risk. A weighted value ≥ 10 was classified as high risk, a weighted value 4–9 was classified as medium risk, and a weighted value 1–3 was classified as low risk. A weighted score of 0 would not be consistent with the epidemiological history. The establishment of this screening list has certain value as a reference for the subsequent development of new guidelines for pediatric coronavirus patients, but the specific conclusions remain to be further demonstrated.

For the pediatric outpatient services outside the epidemic area in Hubei, when the preview and triage is performed, high-risk children with a consistent epidemiological history should be referred to the COVID-19 fever clinic even if they have no symptoms. Likewise, middle- and low-risk children with any clinical manifestations (*Figure 1*) should be referred to the COVID-19 fever clinic. Children with no epidemiological history but with a fever should be referred to the general fever clinic, but children with fever lasting more than 3 days should be monitored, and careful inquiry should be made regarding their medical history and epidemiological history, which should be recorded. If

Preview and triage screening table							
Clinical manifestations	1	The child has a fever (body temperature ≥ 37.3 °C)	Yes	No			
	2	The child continues to have a fever (temperature ≥ 37.3 °C) for more than 3 days	Yes	No			
	3	Child is coughing	Yes	No			
	4	The child has 1 or more of the following symptoms (chills, stuffy nose, runny nose, sore throat, headache, fatigue, muscle pain, joint pain, shortness of breath, dyspnea, chest tightness, diarrhea, and others)	Yes	No			
Epidemiological history	1	The child or the child's parents had contact with people with a history of residence or traveled in Hubei within 14 days	Wuhan (2 points)	Other cities in Hubei (1 point)	No (0 points)		
	2	The child or his/her parents had a travel history or residence history in Wuhan and the surrounding area within 14 days	Wuhan (3 points)	Other cities in Hubei (2 points)	Cities outside Hubei (1 point)	No (0 points)	
	3	The child or his/her parents had a history of travel or residence in a community with reported cases within 14 days	On the same floor (5points)	In the same building (4 points)	In the same neighborhood (3 points)	In the same community (2 points)	No (0 points)
	4	Within 14 days, the child had been exposed to patients with fever or respiratory symptoms from Wuhan and surrounding areas or from communities where cases were reported	Yes (5points)	No (0 points)			
	5	The child was in contact with individuals infected with COVID-19 within 14 days (positive nucleic acid test)	Yes (10 points)	No (0 points)			
	6	There was confirmed or highly suspected cases in the child's family	Yes (10 points)	No (0 points)			
	7	Child's nursery institutions or schools and other care units have aggregated incidence of COVID-19 (more than 2 people)	Yes (5 points)	No (0 points)			
Epidemiological history score: <input type="checkbox"/> high-risk (≥ 10) <input type="checkbox"/> medium-risk (4–9) <input type="checkbox"/> low-risk (1–3)							

Figure 1 Preview and triage screening table.

necessary, COVID-19 fever clinic doctors can be consulted regarding the correct referral for these children.

It is extremely important to accurately identify the clinical manifestations and epidemiological history of patients with COVID-19 infections during preview and triage, and it is important to have a clear definition of close contact (12). The preview and triage nurses need consistent training and evaluation so that each preview and triage nurse can be proficient in the appropriate screening standards and accurately and quickly identify every child who has the epidemiological history and clinical manifestations of a suspected case.

Conclusions

As the first step in the screening of suspected COVID-19 in the fever clinic, preview triage plays an important role in the rapid and accurate assessment of a patient's condition and epidemiological history, in addition to the timely and effective screening of suspected cases and subsequent referral to the fever clinic for treatment. The evaluation questionnaire for the preview and triage of patients with suspected COVID-19 infections also needs to be further optimized according to the diagnosis and treatment plan that is constantly updated by the National Health Commission of the People's Republic of China. According to the situation in our city and hospital, an evaluation questionnaire that is suitable for use with children in our hospital has been formulated to achieve the goals of early detection, isolation, diagnosis, and treatment.

Acknowledgments

Funding: This study was supported by the construction and popularization of the standardized model of pediatric integration outpatient service (cstc2018jcsx-msybX0081), National Clinical Research Center for Child Health and Disorders (Children's Hospital of Chongqing Medical University, Chongqing, China) (NCRCCHD-2020-EP-01), and the fourth batch of "Special Project of Science and Technology for Emergency Response to COVID-19" of Chongqing Science and Technology Bureau.

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/tp.2020.03.08>).

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. The study was approved by institutional review board of Children Hospital of Chongqing Medical University (No. 2020-4).

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Cite this article as: Zhang N, Deng Y, Li W, Liu J, Li H, Liu E, Zheng X. Analysis and suggestions for the preview and triage screening of children with suspected COVID-19 outside the epidemic area of Hubei Province. *Transl Pediatr* 2020;9(2):126-132. doi: 10.21037/tp.2020.03.08