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Clinical Characteristics and Therapies of Two Young Children with COVID-19: A Retrospective Review of Medical Records

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Abstract

New Coronavirus pneumonia (COVID-19) has been affecting many countries all over the world, while limited data have been available regarding COVID-19 infection in children. This case report retrospectively reviewed the epidemiological, clinical, laboratory, and radiological features, as well as treatment and clinical outcomes of two young children diagnosed with COVID-19.

Keywords: SARS-CoV-2; COVID-19; Pediatrics; Young children

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Introduction

The novel Coronavirus pneumonia (COVID-19) has been reported as a "public health emergency of international concern" by the World Health Organization (WHO), which is currently rapidly spreading all over the world. Up to May 7th, 2020, the number of globally confirmed cases has reached 3,634,450, and the number of mortality cases has reached 258,359. Many studies are focusing on COVID-19 and associated morbidity in special populations. Chen et al. [1] reported the clinical characteristics of 9 laboratory-confirmed pregnant women with COVID-19 and the possibility of intrauterine vertical transmission, which was published in The Lancet. Jin et al. [2] also reported the clinical features of chronic lymphocytic leukemia patients after infection with COVID-19. However, there have been few reports of COVID-19 in children. The clinical characteristics, therapeutic management, and treatment outcomes of 3 COVID-19 children over 4 years of age in Wuhan, China, were reported by Li et al. [3] Meanwhile, Park et al. [4] reported the clinical data of one 10-year old child infected with COVID-19 in Korea. However, the data regarding infection, morbidity, therapy, and treatment outcomes of younger children are still unknown. Therefore, there are multiple questions that still raise a significant concern to both healthcare providers and researchers: (1) will there be obvious symptoms in younger or weaker children? (2) Are there any serious complications? (3) What kind of treatments should be given? (4) How about the treatment effect? And (5) are there any short- or long-term sequela? These problems need to be timely clarified, which are significant for the prevention and control of COVID-19 infection in children. Therefore, we conducted the current study to examine the epidemiological data, clinical characteristics, treatment course, and prognosis of two children (<2 years old) who were diagnosed with COVID-19 at Gansu Province, China.

Methods

Study design and patients

The medical records of 2 children with COVID-19, who were treated at Lanzhou Pulmonary Hospital of Gansu province from January 28th, 2020, to February 10th, 2020, and the First People's

Hospital of Huating, Gansu province from February 17th, 2020, to February 17th, 2020, were retrospectively reviewed. COVID-19 was confirmed according to the diagnosis and treatment criteria for new coronavirus pneumonia, which was issued by the National Health Committee of the People's Republic of China (the Fourth Edition, [5] the Fifth Edition [6]). Based on the quantitative analysis of respiratory tract specimens through Reverse Transcriptase-Polymerase Chain Reaction (qRT-PCR), both children with COVID-19 were tested positive for new Coronavirus (SARS-CoV-2). The study was reviewed and approved by the medical ethics committee of Gansu maternal and child health care hospital (approval number 2020GSFY-3), and the written informed consent was obtained from each patient's legal guardian.

Data collection

The epidemiological data, medical records, laboratory examinations, and chest CT scans of the two infected children were traced and collected with a pre-designed data collection table. The data were collected independently and were cross-checked by two investigators (YW and JW). Researchers from the third party (LZU) have reviewed the data in case of any discordance. According to the WHO guidelines for qRT-PCR analysis [7-9], the throat swab specimens of the 2 children were collected, and SARS-CoV-2 was tested using the kit (BioGerm, Shanghai, China), which was recommended by the Chinese Center for Disease Control and Prevention (CDC). All specimens were processed at the municipal CDC and the provincial CDC at the same time, and COVID-19 infection was confirmed when the test results from both laboratories were positive.

Statistical analysis

Since only two children were involved, statistical analyses and software were not utilized in this study. Continuous variables and subtype variables presented the actual data.

Role of the funding source

The sponsors were not involved in research design, data collection, data analysis, and report writing. The corresponding author is responsible for all aspects of the study to ensure the proper investigation and resolution of the research for problems related to accuracy or completeness. The final version was approved by all authors.

Results

Epidemiological history

Child 1 was a female patient with 1 year and 8 months of age, who lived in the Wuchang District of Wuhan City, Hubei province. Her father was a COVID-19 infected patient. He lived together with child 1 and her mother before the diagnosis (January 28th). Child 1 was diagnosed on January 29th, and her mother was diagnosed on February 8th (Figure 1A). On the other hand, child 2 was a female patient with 11 months of age, who lived in Shapingba District of Chongqing city. Her aunt and uncle were infected with COVID-19, who had close contact history with child 2 before diagnosis (February 3rd and February 7th). Child 2 was diagnosed on February 8th, and her mother was diagnosed on February 9th (Figure 1B).

Clinical and laboratory characteristics

The two children had no underlying diseases, and both had a history of contact with infected people. The clinical manifestations were not of the severe type. Child 1 presented with low-grade fever as the main presenting symptom (36.7°C to 38.0°C), while child 2 mainly presented with diarrhea. When admitted to the hospital, both children were in good mental condition, with normal thoracic cage, regular respiratory rhythm, normal intercostal space, and without chest wall tenderness or percussed pain in the sternum. Both children showed symmetric breasts, and no package block was touched. The chest breathings were observed with symmetric respiratory movement. There were no obvious abnormalities in the intercostal spaces. The vocal fremitus was normal, and neither pleural friction nor skin twisting sensation was found by touching. Bilateral lung percussion revealed a clear voice, and the sounds of bilateral lung breathing were clear, without dry or wet rales. The pleural frictions were unheard, and no significant abnormality was found regarding voice conduction. Both abdominal and nervous system examinations were normal (Table 1). The detection result of laboratory tests showed that child 1 had a higher level of AST, suggesting that the liver function might have been affected. The White Blood Cell (WBC) count in child 2 was increased, which might be related to viral infection. No abnormal observations were found except for the aforementioned observations (Table 1). Imaging findings revealed the typical characteristics of pneumonia in the chest CT scans of both children (Figure 2). The lung markings became thickened and distributed disorderly. Patchy and ground glass shadows were observed on the chest wall outside the lower lung.

Therapies and outcomes

Child 1 was evaluated as a mild COVID-19 case. After admission, she was given 2 mL lopinavir/ritonavir orally, twice a day. She also inhaled 250 g atomized interferon twice a day. The enteric microecological preparations were given orally with other symptomatic treatments. Symptoms disappeared after 9 days of treatment, and the results of two successive (February 6th and February 8th) SARS-CoV-2 nucleic acid tests of throat swabs were both negative. On February 10th, child 1 was discharged from the hospital for medical observation. No recurrence or sequela occurred during the 14-day observation. Child 2 was assessed as the common type. After admission, she was given 100 mg potassium sodium dehydroandrographolide succinate through an intravenous drip, once a day. She also inhaled 20 ugs atomized interferon twice a day with lopinavir/ritonavir tablets (Kaletra) and intestinal microecological regulation. Symptoms disappeared after 6 days of treatment, and SARS-CoV-2 nucleic acid tests of throat swabs were negative for two consecutive times (February 16th and February 16th). Eventually, child 2 was discharged from the hospital for medical observation on February 17th. No recurrence or sequela occurred during the 14-day observation.

Discussion

The clinical data of two cases of COVID-19 pneumonia under 2 years of age, who were diagnosed by throat swabs SARS-CoV-2 nucleic acid tests, were reported. The symptoms of both children were not typical. Child 1 had a low-grade fever, while child 2 presented with diarrhea. The common symptoms in adults such as dyspnea and cough were not found during the disease course in our population. The results of the laboratory examination indicated that the lymphocyte count of both children was normal, which was different from the previous report that a progressive reduction in peripheral blood lymphocytes was found in adults [10]. According to a recent report, this may be related to the incomplete development of children's innate immunity and the low level of the adaptive immune

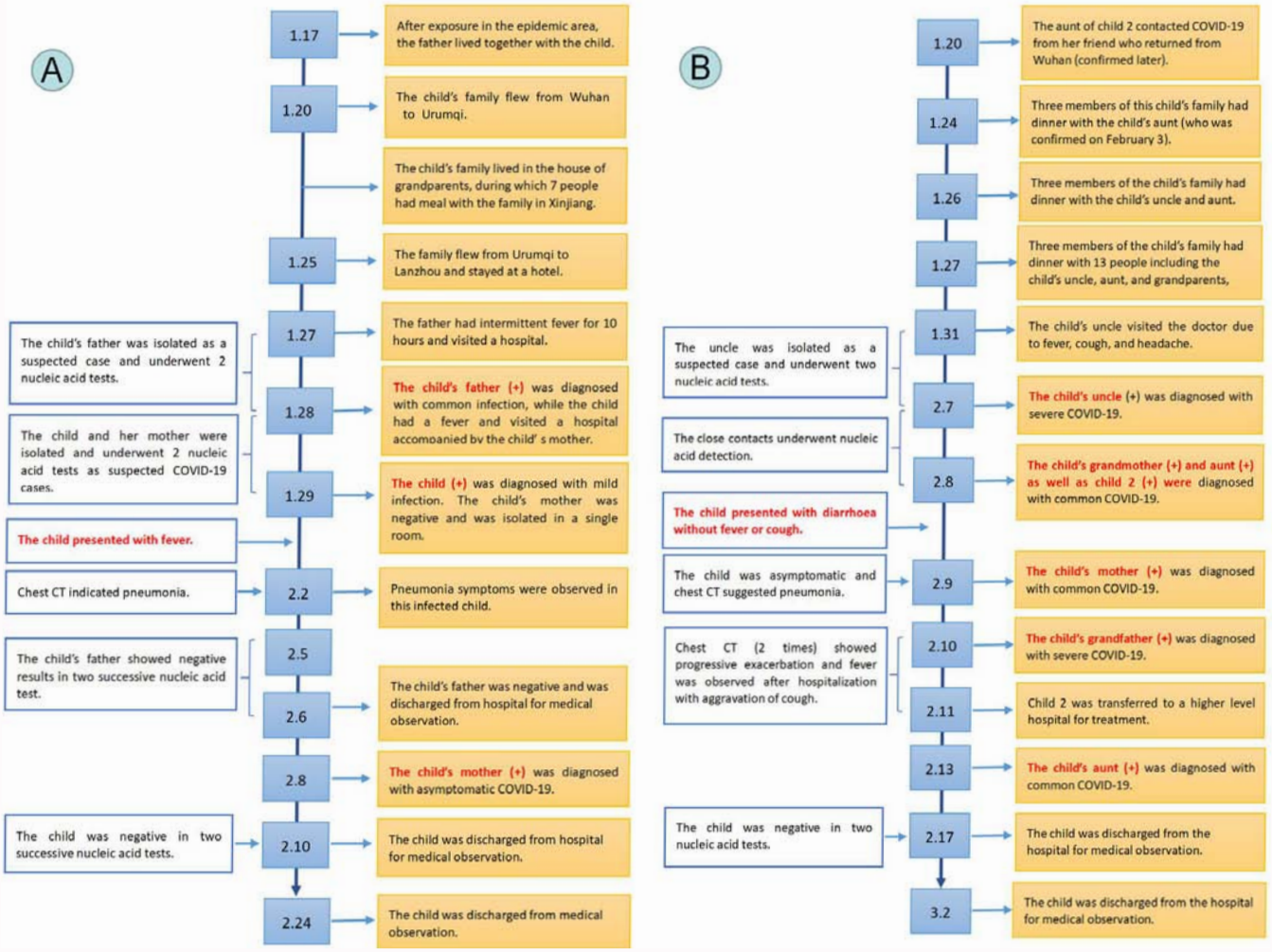

Figure 1: Epidemiological history of child 2 with new coronavirus infection (SARS-CoV-2). (A) Child 1; (B) Child 2.

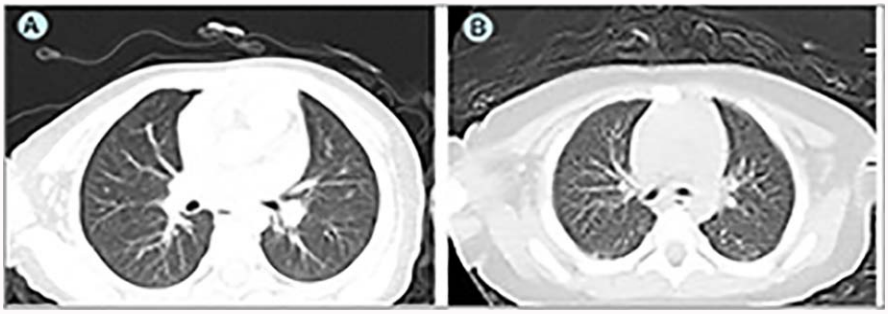

Figure 2: Chest CT scans (transverse plane) of the two children. (A) Child 1: The markings of bilateral lungs were thick, and a few ground-glass opacities were observed in the lower lobe of the right lung; (B) Child 2: Patchy and ground-glass opacities were observed below the outer chest wall of both lungs.

response. Thus, most child cases showed mild clinical symptoms [11]. From the epidemiological data of the two children, it could be seen that children are also susceptible to SARS-CoV-2. Close contact with infected family members is the main way for children to get infected with COVID-19, which was similar to the main mode of transmission in cases of Severe Acute Respiratory Syndrome Coronavirus (SARS) and Middle East Respiratory Syndrome Coronavirus (MERS) in children, as demonstrated in previous reports [12,13]. The report of the WHO-China Joint Mission on COVID-19 points out that the age distribution of COVID-19 ranges from 2 days to 100 years of age [14], indicating that SARS-CoV-2 has a strong transmission capability in children. However, since the symptoms of children are not obvious, it is easy to cause missed diagnosis and misdiagnosis. Therefore, it is necessary to combine epidemiological investigation with the diagnosis. In terms of treatment, children were administered atomized interferon inhalation, oral treatment of Kaletra, as well as potassium sodium dehydroandrographolide succinate. Currently, no specific and effective antiviral drugs have been available for the new coronavirus infection [15], and thus, the elimination of the virus depends mainly on the antiviral immune function in human bodies.

Table 1: Clinical and laboratory characteristics.

	Child 1	Child 2
Clinical characteristics		
Date of admission	Jan 29	Feb 8
Age (Months)	20	11
Epidemiological history	Yes (contact with infected person)	Yes (contact with infected person)
Other family members affected	Yes (parents)	Yes (mother)
Complications	None	None
Signs and symptoms		
Fever on admission	Yes	No
Myalgia	No	No
Malaise	No	No
Rigor	No	No
Cough	No	No
Dyspnea	No	No
Sore throat	No	No
Diarrhea	No	Yes
Chest pain	No	No
Laboratory characteristics		
White blood cell count (× 10^9 cells per L)	6.1	9.72
Low or normal leukocyte count (<9·5 × 10^9 cells per L)	Yes	No
Lymphocyte count (× 10^9 cells per L)	3.7	7.62
Lymphopenia (<10^9 cells per L)	No	No
C-reactive protein concentration (mg/L)	4	3.5
Elevated C-reactive protein (>10 mg/L)	No	No
Elevated ALT (>45 U/L) or AST (>35 U/L)	Yes	No
ALT (U/L)	10	21
AST (U/L)	44	35
Confirmatory test done (SARS-CoV-2 quantitative RT-PCR)	Yes	Yes
CT evidence of pneumonia		
Typical signs of viral infection	Yes	Yes

ALT: Alanine Transaminase; AST: Aspartate Transaminase; COVID-19: 2019 Novel Coronavirus Disease. C-section: Caesarean Section; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus

Interferon is the first barrier of natural immune defense against viral infection, which can inhibit virus replication in many pathways. After being infected with the virus, the production capability of interferon is poor in children. Hence, it is suitable to employ exogenous interferon to perform antiviral treatment. Kaletrais used for the treatment of acquired immunodeficiency disease. According to the diagnosis and treatment plan of COVID-19 (trial version 6), which was issued by the National Health Committee of the People's Republic of China [16], Kaletra was recommended for COVID-19 therapy. However, its side effects in children, such as nausea, vomiting, and liver damage, still warrant further investigation. Some treatment recommendations and guidelines [17-20] suggested that pediatric patients should mainly receive symptomatic treatment for upper respiratory tract infection, together with strengthened nursing care. This study described the epidemiological history, clinical characteristics, therapeutic management, and treatment outcomes of children with COVID-19 in detail. This study adds a significant reference value for the prevention and treatment of infected children with COVID-19. However, the findings of our study are significantly limited by the small number of recruited children, and thus, it was difficult to reflect the overall situation of children patients with COVID-19. The detailed epidemiology, clinical features, treatment regimens, and the transmission of asymptomatic and mild infectious patients in different age groups should be further studied and recognized.

Conclusion

Children are susceptible group to SARS-CoV-2. Close contact with family members is the main route for infection in children. The symptoms of COVID-19 children under two years of age might be not as typical as those in adults. No reduction in lymphocyte count was observed. Although this conclusion is limited by the small sample size, it provides a significant reference value for understanding the clinical characteristics of children with COVID-19 as well as preventing and controlling COVID-19.

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