Clinical Pearls

Multiple small pneumatoceles as a complication of a SARS-CoV-2 infection in a child from Myanmar

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Short running header: Pneumatoceles in a COVID-19 child

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Highlight

During the COVID-19 pandemic, pneumatoceles caused by 2019-nCoV are easily neglected, particularly in children. which may potentially increase the risk of pneumothorax and pulmonary infection, we need to pay special attention to the management of population migration, especially for children.

Introduction

Coronavirus Disease 2019 (COVID-19) is pneumonia caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Typical CT manifestations of COVID-19 include bilateral pulmonary ground glass opacities, consolidative lung opacities and linear opacities. Cavities, cysts and pneumatoceles lesions are rare with only 0.7% cases reported[1]. Herein, we report the first case of a COVID-19 re-positive child with multiple small pneumatoceles.

Case presentation

On July 22, 2021, an 8-year-old girl presented to Tengchong County Hospital of Traditional Chinese Medicine, Baoshan City, Yunnan, China with a positive COVID-19 nucleic acid test by real-time reverse transcriptase polymerase chain reaction(rRT-PCR) after returning from Myanmar. The patient complained of an intermittent dry cough. The body examination showed her temperature was 36.5℃, pulse rate was 120 beats per minute, breathing rate was 26 times per minute, her weight was 23 kilograms. CT scan (Scan parameter:100-120kVp, 65mAs, thickness2mm) showed a micro nodular shadow in the right lower lobe and a chronic inflammation in the right middle lobe (Figure1). Laboratory examination showed that the white blood cell count was 6.19×10^9/L, the absolute lymphocyte count was 2.63×10^9/L, and the lymphocyte ratio was 42.50%. Crea33.80μmol/L, ALP167.80U/L, CK-MB3.56ng/ml, troponin I101ng/ml (Table1). Considering the COVID-19 family cluster exposure and the overseas residence history, the patient was diagnosed as mild COVID-19 pneumonia, then was admitted for a rigorous quarantine observation and received the general

treatment which included bed rest, monitoring vital signs, strengthening supportive treatment, ensuring sufficient calories, maintaining homeostasis such as water, electrolytes, and acid-base balance, and maintaining an unobstructed respiratory tract. IFN-α nebulization was given for 6 days as an antiviral therapy, IFN-α 46μg, 2mL of normal saline, atomization inhalation, 2 times per day. After 8-day treatment, the dry cough disappeared. She had a fever only on July 23 with a maximum temperature of 38.0℃. After giving oral antipyretic treatment with 8ml ibuprofen suspension, her fever did not occur.

After three negative COVID-19 nucleic acid tests which were performed at 24-hour intervals on August 20 and 21, the patient was discharged from the hospital and sent to a hotel for quarantine observation on August 23.

On September 11, the patient coughed again. The COVID-19 nucleic acid test on September 12 returned positive. CT scan found multiple small pneumatoceles in bilateral lower lung (Figure1). She was then readmitted to hospital and received same treatment. On September 13, a laboratory examination was conducted (Table1). The symptoms and the COVID-19 nucleic acid tests timeline were listed (Table 2). The CT scan on October 16 showed decreased transparency of bilateral lung (Figure1).

After a long period of treatment, the patient had no special symptoms or discomfort, three consecutive COVID-19 nucleic acid tests from three independent institutions were performed on October 19 and all returned negative. Reaching the clinical cured standard, the patient was discharged from the hospital and sent to a designated site for further quarantine observation on October 20.

The child cooperated well and was in good psychosocial condition after long-term quarantine observation due to meticulous care and patient company of medical staffs.

Discussion

COVID-19 is a pulmonary infectious disease caused by SARS-CoV-2. Compared with adults, children are susceptible to have milder clinical symptoms and CT manifestations. The most common chest CT manifestations of children were normal images and pulmonary ground glass opacities, accounting for 41% and 36%

respectively[2], pneumatoceles have not been reported in COVID-19 re-positive children yet. In this case, the long duration of the disease and the repeated positive COVID-19 nucleic acid tests suggest persistent SARS-CoV-2 infection, increasing the incidence of pneumatoceles. Cystic lung lesions and cavities in COVID-19 patients can be caused by infectious, neoplasm, vasculitis and congenital factors. The child was healthy previously and had no relevant medical history. Clinical manifestations and laboratory results did not indicate the combination of other microbial infections while neoplasm and congenital factors can also be excluded. SARS-CoV-2 may cause vasculitis, leading to focal hemorrhage and lung tissue necrosis which can leave cavities or pneumatoceles after the drainage through bronchioles[3]. The specific mechanism remains to be further studied. The limitation is that bacterial and fungal cultures were not conducted, we cannot exclude bacterial and fungal infection completely.

Pneumatoceles caused by COVID-19 can potentially increase the risk of pneumothorax and pulmonary infection[4], and the formation of pneumatoceles may cause potential damage to child patients, so long-term follow-up is particularly necessary. Some researchers consider initial low-dose CT(LDCT) in paucisymptomatic cases could be helpful to better assess lung lesions development after recovery, also they regard LDCT as probably the best option especially for child which has parallel high sensitivity to RT-PCR testing with much faster results availability, also helps identify different disease with similar clinical symptoms[5].

As a COVID-19 positive traveler returning from Myanmar, the child poses a certain threat to the prevention of the infection, reminds that countries must focus on the management of population migration, especially for children, during the COVID-19 epidemic era. They should adopt precise and differentiated epidemic control strategies, set relevant travel restrictions to prevent the epidemic from spreading across borders. Amid domestic infection resurgence, China currently continues a dynamic zero-case policy for controlling and preventing COVID-19, imposing strict pandemic protocols, and taking proactive actions to eradicate COVID-19, like ensuring a seamless and hermetic process for managing the quarantine and monitoring of travelers arriving

in China. Besides, persistent quarantine observation may affect the child's mental health, timely psychological counseling is required.

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References

1. Adams HJA, Kwee TC, Yakar D, et al. Chest CT Imaging Signature of Coronavirus Disease 2019 Infection: In Pursuit of the Scientific Evidence. *Chest*. 2020;158(5):1885-95.

2. Cui X, Zhao Z, Zhang T, et al. A systematic review and meta-analysis of children with coronavirus disease 2019 (COVID-19). *J Med Virol*. 2021;93(2):1057-69.

3. Chen J, Peng S, Zhang B, et al. An uncommon manifestation of COVID-19 pneumonia on CT scan with small cavities in the lungs: A case report. *Medicine (Baltimore)*. 2020;99(28):e21240.

4. Jolobe OMP. Air leaks, pneumatoceles, and air spaces in Covid-19 pneumonia. *Am J Emerg Med*. 2021;46:785.

5. Castelli M, Maurin A, Bartoli A, et al. Prevalence and risk factors for lung involvement on low-dose chest CT (LDCT) in a paucisymptomatic population of 247 patients affected by COVID-19. *Insights Imaging*. 2020;11(1):117.

Figure Legend:

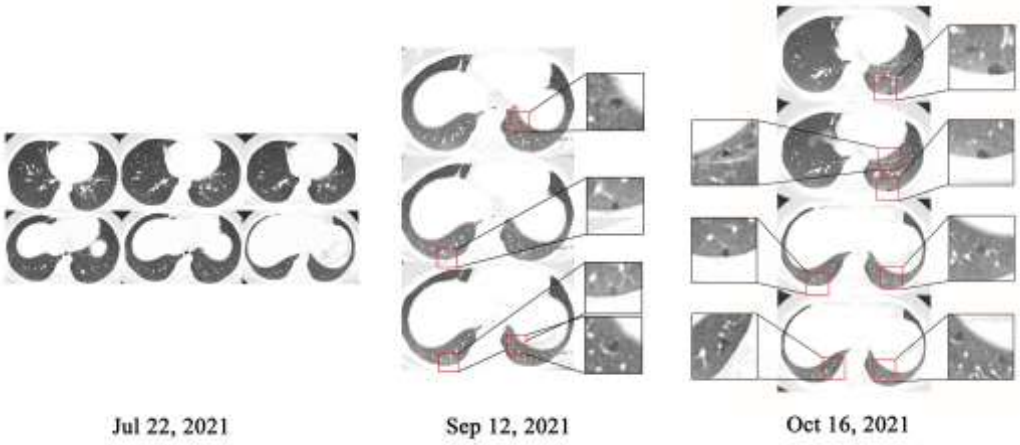

Figure 1. Chest CT scans of the patient

Chest CT scan on July 22, 2021 showed a micro nodular shadow in the right lower lobe and a chronic inflammation in the right middle lobe. Chest CT scan on September 12, 2021 showed multiple small pneumatoceles in bilateral lower lung. CT scan on October 16 showed decreased transparency of bilateral lung.

Table 1 Clinical laboratory results

Measure	**Reference range***	**July22,2021**	**Sep13,2021**
White-cell count ($\times 10^9$/L)	5-12	6.19	5.29
Lymphocyte count ($\times 10^9$/L)	0.8-4	2.63	2.66
Lymphocyte ratio (%)	20-40	42.50	50.30
Absolute neutrophil count ($\times 10^9$/L)	2-7	3.00	2.12
Neutrophil ratio (%)	50-70	48.40	40.00
Red blood cell count($\times 10^{12}$/L)	3.8-5.1	5.16	5.67
Hemoglobin concentration(g/L)	120-140	136.00	150.00
Mean corpuscular volume (FL)	80-100	78.30	78.70
Mean corpuscular hemoglobin (PG)	27-34	26.40	26.50
Platelet count ($\times 10^9$/L)	100-300	358.00	331.00
Plateletcrit (%)	0.108-0.282	0.33	0.32
Erythrocyte sedimentation rate (mm/h)	0-15	13.00	NE
C-reactive protein (mg/L)	0-10	2.80	<5
Creatinine(μmoI/L)	45-84	33.80	35.70
Uric acid (μmoI/L)	155-357	307.00	369.00
Alkaline phosphatase (U/L)	40-150	167.80	145.80
Procalcitonin (ng/mL)	0-0.5	0.10	0.20
Creatine kinase isoenzyme (ng/ml)	0-2.88	3.56	2.89
Troponin I(ng/ml)	0-100	101.00	40.00

*, local LAB; NE, not evaluated.

Table 2 The symptoms and the novel coronavirus nucleic acid tests timeline

Date	Jul22	Jul23	Jul24	Jul25	Jul26	Jul27	Jul28	Jul29	Jul30	Jul31
Symptom										
Dry Cough										
Fever										
Novel Coronavirus Nucleic Acid Test	+									+

Date	Aug01	Aug02	Aug03	Aug04	Aug05	Aug06	Aug07	Aug08	Aug09	Aug10	Aug11	Aug12	Aug13	Aug14	Aug15	Aug16	Aug17	Aug18	Aug19	Aug20	Aug21	Aug22	Aug23
Symptom																							
Dry Cough																							
Fever																							
Novel Coronavirus Nucleic Acid					+							+				+				−	−		*

Test																					
Date	Sep 11	Sep 12	Sep 13	Sep 14	Sep 15	Sep 16	Sep 17	Sep 18	Sep 19	Sep 20	Sep 21	Sep 22	Sep 23	Sep 24	Sep 25	Sep 26	Sep 27	Sep 28	Sep 29	Sep 30
Symptom																				
Dry Cough																				
Fever																				
Novel Coronavirus Nucleic Acid Test		+	+				−	−	+						+					

Date	Oct 01	Oct 02	Oct 03	Oct 04	Oct 05	Oct 06	Oct 07	Oct 08	Oct 09	Oct 10	Oct 11	Oct 12	Oct 13	Oct 14	Oct 15	Oct 16	Oct 17	Oct 18	Oct 19	Oct 20
Symptom																				
Dry Cough																				*
Fever																				
Nov			+							−	−	+					−	−	−	

el Coronavirus Nucleic Acid Test							

*, the patient was discharged.