

# Clinical particularities of a new Coronavirus infection (COVID-19) in children

Irina M. Farber\*, Lusine G. Khachatryan, Natalya A. Geppe, Elena V. Kasanave

Department of Child Diseases of N.F. Filatov Clinical Institute of Child Health of Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russia.

**Correspondence:** Irina M. Farber, Department of Child Diseases of N.F. Filatov Clinical Institute of Child Health of Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russia. Email: imfarber@gmail.com

## ABSTRACT

The article presents a review of the literature examining the clinical features of the course of new coronavirus infection in children. Available literature data indicates that children are not only less vulnerable to being infected with the SARS-CoV-2 virus, but also experience the disease much easier, which is associated with certain features of the COVID-19 clinical pattern in children. Early diagnosis of COVID-19 in children contributes to timely treatment and prevention of the spread of infection. A clinical case of new coronavirus infection in a 12-year-old child is presented.

**Keywords:** Children, COVID-19, SARS-CoV-2, Diagnostics.

## Introduction

Over the past decades, up to a certain point in pediatric practice, coronaviruses have been found mainly as agents of seasonal viral infectious diseases in children, mostly affecting the upper respiratory tract. Thus, descriptions of a coronavirus infection are found in sources dated to the second half of the last century. However, A-general group-1 alpha-coronaviruses and group-2 beta-coronaviruses are referred to. The pandemic, which the world has been experiencing for several recent months, is caused by a new group-2 B-genera beta-coronavirus - SARS-CoV-2 [1, 2].

It is identified that children's vulnerability to the disease is significantly less pronounced than in adults. The data available indicates that pediatric-age patients account for 1-5% of the total patients with a new coronavirus infection. Publications are

reporting the cases of COVID-19 detection in newborns. During the pandemic period, there were isolated cases of deaths due to this disease in children. The researchers note that the major part of children reported with a new coronavirus infection is associated with the SARS-CoV-2 virus passing from adults [3-6]. Currently available data in the literature indicates that children are not only less vulnerable to SARS-CoV-2 virus infection, but also experience the disease much easier, which is associated with certain features of the COVID-19 clinical pattern in pediatric-age patients. These epidemiological and clinical features are presumably explained by many factors [7, 8]:

- Reduced epidemiological risk of being infected due to significantly lower network contacting, movement, and traveling;
- Presumable congenital immunity in children, which disappears within the ontogenetic process;
- Less affected respiratory mucosa due to lower exposure to environmental hazards (industrial air pollution, tobacco smoke, etc.);
- Less chronic diseases;
- A less-developed immune system, which leads to a decrease in the severity of destructive immune responses underlying

## Access this article online

Website: [www.japer.in](http://www.japer.in)

E-ISSN: 2249-3379

**How to cite this article:** Irina M. Farber, Lusine G. Khachatryan, Natalya A. Geppe, Elena V. Kasanave. Clinical particularities of a new Coronavirus infection (COVID-19) in children. *J Adv Pharm Educ Res.* 2020;10(4):135-9. Source of Support: Nil, Conflict of Interest: None declared.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

the development of respiratory and multi-organ insufficiencies in patients with COVID-19.

Despite all the above-mentioned facts showing a more favorable course of the disease in children, it should be noted that COVID-19 detection in this category of patients is of particular importance because children pose a risk to spread the infection among the middle-aged and older groups of people. Besides, recently there have been reports showing a shift in the middle age of people exposed to being affected by a new coronavirus infection towards the disease "rejuvenation", which, along with the uncertainty with the effective vaccine development, indicates the importance to determine peculiarities of the COVID-19 clinical course in children <sup>[9, 10]</sup>.

The work aims to establish the clinical features of a new coronavirus infection (COVID-19) in children for early disease detection and timely treatment.

## Materials and Methods

An analysis of scientific sources of domestic and foreign authors examining the clinical features of a new coronavirus infection (COVID-19) in children was carried out. The methodological basis of the study involved the following methods: theoretical methods (analysis & synthesis of scientific literature & sources, empiric material analysis), formal-based logical, system-based structural, as well as methods of analysis, synthesis, abstraction, comparison, induction, deduction, etc.

The article presents a clinical case of the course of COVID-19 in a 12-year-old child.

## Results and Discussion

According to the data provided by the majority of authors, the most frequent symptoms that make up the COVID-19 clinical picture in children over 1 month are hyperthermia and non-productive cough. In addition, intoxication manifested in the overall weakness of various intensity, nausea and myalgia appear to be frequent disease markers. In some cases, nasal stuffiness and rhinorrhea are observed. Quite rare symptoms of the disease are the signs of gastrointestinal damage, such as vomiting, diarrhea, and abdominal pain. At the same time, however, the majority of authors note that diarrhea in children infected with COVID-19 is observed more often than in adults <sup>[9-11]</sup>.

There is evidence that children tend to recover in 1-2 weeks. In more than 25% of cases, COVID-19 in pediatric-aged children shows no symptoms. It has been established that roughly 10% of COVID-19 cases in children require hospital treatment. Herewith, in 1% of cases, a severe form of the disease is observed, characterized by the development of complications, which mostly are associated with severe concomitant pathology <sup>[12, 13]</sup>. Clinical manifestations of the disease are characterized by

the form of its course (or a combination of forms), the most common of which are <sup>[14, 15]</sup>:

- 1) Non-complicated acute respiratory viral infection;
- 2) Pneumonia with no respiratory failure;
- 3) Pneumonia concomitant with acute respiratory failure;
- 4) Acute Respiratory Distress Syndrome (ARDS);
- 5) Sepsis;
- 6) Septic shock.

The disease clinical course classification by its severity in children is based on COVID-19 division into mild, moderate, and severe forms. When determining the severity of new coronavirus infection, most authors indicate the need to identify if there are such criteria as the development of pneumonia, acute respiratory failure, ARDS, acute cardiovascular failure, and multiple organ dysfunction. The mildest, asymptomatic, a form of the disease and the most severe, critical, are singled out <sup>[15, 16]</sup>. Asymptomatic COVID-19 form implies a positive take in children when carrying out laboratory research on SARS-CoV-2 RNA at the same time, clinical and radiological symptoms of the disease are defined. The mild form is characterized by the signs of damage to the upper respiratory tract manifested by sore throat, cough, nasal congestion, rhinorrhea, and sneezing, as well as clinical manifestations of intoxication: overall weakness, hyperthermia, and myalgia. At the same time, there are, as a rule, characteristic changes in the oropharynx mucosa manifested by hyperemia. In some cases, symptoms of gastrointestinal tract damage are observed: abdominal pain, nausea, vomiting, diarrhea <sup>[16, 17]</sup>.

The moderate course of the disease implies the child's cough, which is usually non-productive and dry, and hyperthermia concomitant with pneumonia. There are no manifestations of acute respiratory failure and no shortness of breath and hypoxemia. The change in normal auscultatory lung pattern with wet or dry rales. In some cases, this clinical form of the disease is not associated with significant lung damage manifestations, but in this case, it is characterized by indolent infiltrative changes in the pulmonary tissue during an X-ray chest organ examination <sup>[18, 19]</sup>.

In the majority of cases, severe COVID-19 form in children starts with the onset signs of acute respiratory infection with characteristic symptoms of temperature rise, coughing, and nasal congestion. The signs of gastrointestinal damage including nausea, vomiting, diarrhea, and abdominal pain can be also manifested. This form is characterized by gradual disease progression. Over a week, signs of acute respiratory failure are shown, such as shortness of breath, diffuse cyanosis, a decrease in blood oxygen saturation indicated by pulse oximetry to 92% and lower. X-ray examination (radiography or computed tomography) detects pneumonic infiltration of pulmonary tissue, which is usually extensive <sup>[20-22]</sup>.

The most severe is the critical form of COVID-19 in children, which is characterized by rapid progression of the disease, accompanied by the development of ARDS against the

background of severe pneumonia. Signs of acute respiratory failure prevail in the clinical picture, which requires respiratory support. A frequent complication of the critical COVID-19 form is the development of multiple organ dysfunction, which may include not only respiratory failure, but also cardiovascular, cerebral, hepatic, and renal failure, and coagulopathy as well [22, 23].

Researchers point to many risk factors causing severe forms and complications of the disease in children, the most significant of which are [20, 21, 23]:

- Immunodeficiency-related conditions;
- Comorbid pathology (malformations, lung and/or cardiovascular diseases, etc.);
- Simultaneous infection with another virus (e.g. influenza virus).

Based on the facts presented above, it should be noted that the clinical course of COVID-19 in children generally corresponds to the disease manifestations in adults; in the majority of cases, it is characterized by hyperthermia development and the signs of respiratory tract damage. It is indicated that the clinical picture in children shows more favorable disease development, accompanied by less severe symptoms [24, 25].

Starting from April 2020, there have been indications on a fairly large number of children reported to suffer from a new multisystem inflammatory disease, which was associated with positive SARS-CoV-2 takes. Some patients were noted to show laboratory signs of a new coronavirus infection sometime after clinical symptoms manifestation. Multisystem inflammatory disease is manifested by atypical Kawasaki syndrome, the clinical signs of which are symptoms of the gastrointestinal tract and cardiovascular system damage. In addition, infectious-toxic shock development is common for the multisystem inflammatory disease [26]. In May 2020, S. Riphagen et al. published data describing the treatment of 8 children aged 4 to 14 years admitted to the intensive care unit in April for Kawasaki-like syndrome development [27]. The main clinical signs of the disease in all children were: temperature rise to 40 ° C, edema, rashes of various morphologies, conjunctivitis, marked gastrointestinal tract damage (nausea, vomiting, diarrhea & abdominal pain), and limb pain. The authors noted the rapid development of acute cardiovascular failure based on the type of Vasoplegic Syndrome refractory to infusion therapy, which required the use of vasopressor support. Despite the lack of acute respiratory failure, seven out of eight patients were provided with invasive respiratory support due to the extreme instability of hemodynamic parameters. Other clinical manifestations of the disease in this group of children included pleurisy, ascites, and pericarditis. In one of the patients, the development of severe arrhythmia with refractory shock was noted, which required the use of extracorporeal membrane oxygenation (ECMO). All patients showed elevated markers of myocardial injury, indicating its damage due to systemic

inflammation. A peculiar feature of the Pediatric Multisystem Inflammatory Syndrome development (PMIS) is that this pathological condition develops 2-3 weeks after infection, that is, during laboratory diagnostics when the virus RNA in the majority of cases is not detected.

Most authors point out that the main sign due to which the syndrome can be detected is a temperature rise to 38°C and higher, which persists for at least 24 hours. Recent literature indicates that all children suffering from multisystem inflammatory syndrome show signs of gastrointestinal disorders; in 76% of cases the myocarditis pathological process was detected and 57% were diagnosed with acute cardiovascular failure [28-30].

Below, we present a clinical case of a moderate form of the disease in a 12-year-old patient. The patient was admitted to the emergency room complaining of overall weakness, the temperature rises to 38.8°C and dry non-productive cough. These complaints appeared 3 days before the admission to the hospital and worsened during this period. No marked chronic diseases were detected. An epidemiological anamnesis indicated close contact with a COVID-19-infected person the father of the child was hospitalized for bilateral pneumonia against the background of a new coronavirus infection a week earlier before his daughter showed the signs of the disease. At the time of examination, the patient's condition was satisfactory. The mind was bright and completely focused. The skin showed no changes, physiological color, and humidity. The temperature was 38.3°C at admission. Breathing was autonomous, effective, and respiratory rate was 18 times per minute. SpO<sub>2</sub> was 98% against the background of atmospheric air-breathing. Auscultatory: breathing was slightly harsh, and somewhat weakened above the back basal areas of lungs. Hemodynamic parameters were stable: BP was 104/62 mm Hg., heart rate was 92 per minute. Cardiac sound was distinct and rhythmic. Pulse was satisfactory, non-tensile, and rhythmic. The abdomen was soft and painless when palpating. No altered defecation pattern was detected. Peristaltic was active, urination was autonomous and painless.

Immediately upon being admitted to the hospital, a chest organ computed tomography was carried out, based on which infiltrative changes were detected in four areas of the right lung and three areas of the left lung. As a result of the oropharynx and pharynx swab study, SARS-CoV-2 was diagnosed. No significant deviations from norms were detected in the results of other laboratory tests. The patient was diagnosed with: "New coronavirus COVID-19 infection and viral bilateral multisegmental pneumonia, DN-0".

In addition to symptomatic treatment, the patient was injected with alpha-2b recombinant interferon intranasally, 2 drops in each nasal passage, 4 times a day. Within 7 days after admission to the hospital, the disease sign regression was noted, due to which the patient was discharged to continue outpatient treatment. According to the chest organ control computed tomography before discharging from the hospital, no lung infiltrative changes were detected.

## Conclusion

The data presented in the article indicates that children are significantly less likely to show clinical manifestations common to COVID-19 than adults. At the same time, there is a reason to believe that children are much more likely to be asymptomatic carriers of new coronavirus infection. This fact indicates a key role of measures to comply with hygienic measures and preserve social distancing among children, which will effectively prevent the spread of the disease not only among their peers but also among the adult population, which is more vulnerable to clinically marked COVID-19 forms.

In the vast majority of cases, the disease in children is mild showing minor clinical manifestations with no risk factors, which, in most cases, does not require hospital treatment. At the same time, even moderate COVID-19 forms in the same category of patients proceed favorably and are not accompanied by severe complications, like in the presented clinical case. However, such comorbidities as diabetes mellitus, obesity, and diseases associated with the increased production of clotting factors can be accompanied by a severe, clinically marked new coronavirus infection.

The extremely rare but the most severe COVID-19 manifestation in children is multisystem inflammatory syndrome, the timely detection of which is critical for improving disease outcomes. The syndrome treatment requires comprehensive intensive care measures, often using extracorporeal detoxification and ECMO methods.

It should be noted that as the pandemic progresses, the flow of information associated with the clinical course of COVID-19 in children increases. In this context, pediatricians should constantly monitor the evolution of knowledge accumulated in this area, which is going to improve the diagnosis and treatment quality.

## References

- Ogimi C, Kim YJ, Martin ET, Huh HJ, Chiu CH, Englund JA What's New With the Old Coronaviruses? *J Pediatric Infect Dis Soc.* 2020;9(2):210-217.
- WHO technical guidance. disease caused by coronavirus (COVID-19) and viral pathogen [serial on the Internet]. 2020 Sept. Available from:[https://www.who.int/ru/emergencies/diseases/novel-coronavirus-2019/technicalguidance/naming-the-coronavirus-disease-\(covid-2019\)-and-thevirus-that-causes-it](https://www.who.int/ru/emergencies/diseases/novel-coronavirus-2019/technicalguidance/naming-the-coronavirus-disease-(covid-2019)-and-thevirus-that-causes-it).
- Shen K, Yang Y. Diagnosis and treatment of 2019 novel coronavirus infection in children: a pressing issue. *World J Pediatr.* 2020;1-3.
- Lu X, Zhang L, Du H, Zhang J, Li YY, Qu J, Zhang W, Wang Y, Bao S, Li Y, Wu C. SARS-CoV-2 infection in children. *New England Journal of Medicine.* 2020 Apr 23;382(17):1663-5.
- Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, Xing F, Liu J, Yip CC, Poon RW, Tsoi HW. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *The Lancet.* 2020 Feb 15;395(10223):514-23.
- Shaoshuai W, Lili G, Ling C, Weiyong L, Yong C, Jingyi Z, Ling F. A case report of neonatal COVID-19 infection in China. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America.* 2020.
- Worcester S. COVID-19 characteristics differ in children vs adults. 2020. Available from: <https://www.medscape.com/viewarticle/926805>
- Xu Y, Li X, Zhu B, Liang H, Fang C, Gong Y, Guo Q, Sun X, Zhao D, Shen J, Zhang H. Characteristics of pediatric SARS-CoV-2 infection and potential evidence for persistent fecal viral shedding. *Nature medicine.* 2020 Apr;26(4):502-5.
- Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatr.* 2020;109(6):1088-1095.
- Shen K, Yang Y, Wang T, Zhao D, Jiang Y, Jin R, Zheng Y, Xu B, Xie Z, Lin L, Shang Y. Diagnosis, treatment, and prevention of 2019 novel coronavirus infection in children: experts' consensus statement. *World J Pediatr.* 2020;16(3):223-231.
- Karimi A, Rafiei Tabatabaei S, Rajabnejad M, Pourmoghaddas Z, Rahimi H, Armin S, Mansour Ghanaie R, Kadivar MR, Fahimzad SA, Sedighi I, Mirrahimi B. An algorithmic approach to diagnosis and treatment of coronavirus disease 2019 (COVID-19) in children: Iranian expert's consensus statement. *Archives of Pediatric Infectious Diseases.* 2020 Apr 30;8(2).
- Alder Hey Children's Hospital: Clinical management of children admitted to hospital with COVID-19. March 2020. Version 1. Available from: [https://alderhey.nhs.uk/application/files/1815/8422/1173/COVID\\_19\\_IN\\_CHILDREN\\_CLINICAL\\_GUIDANCE\\_v1.pdf](https://alderhey.nhs.uk/application/files/1815/8422/1173/COVID_19_IN_CHILDREN_CLINICAL_GUIDANCE_v1.pdf)
- She J, Liu L, Liu W. COVID-19 epidemic: Disease characteristics in children. *J Med Virol.* 2020;92(7):747-754. DOI:10.1002/jmv.25807
- Sankar J, Dhochak N, Kabra SK, Lodha R. COVID-19 in Children: Clinical Approach and Management. *Indian J Pediatr.* 2020;87(6):433-442.
- Brodin P. Why is COVID-19 so mild in children? *Acta Paediatr.* 2020;109(6):1082-1083.
- Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatr.* 2020;109(6):1088-1095.
- Balasubramanian S, Rao NM, Goenka A, Roderick M, Ramanan AV. Coronavirus Disease 2019 (COVID-19) in Children - What We Know So Far and What We Do Not. *Indian Pediatr.* 2020;57(5):435-442.

18. Pavone P, Ceccarelli M, Taibi R, La Rocca G, Nunnari G. Outbreak of COVID-19 infection in children: fear and serenity. *Eur Rev Med Pharmacol Sci.* 2020;24(8):4572-4575.
19. Zhou MY, Xie XL, Peng YG, Wu MJ, Deng XZ, Wu Y, Xiong LJ, Shang LH. From SARS to COVID-19: What we have learned about children infected with COVID-19. *International Journal of Infectious Diseases.* 2020 May 7.
20. Dhochak N, Singhal T, Kabra SK, Lodha R. Pathophysiology of COVID-19: Why Children Fare Better than Adults? *Indian J Pediatr.* 2020;87(7):537-546.
21. Green P. Risks to children and young people during covid-19 pandemic. *BMJ.* 2020;369:m1669. Published 2020 Apr 28.
22. Haggmann SHF. COVID-19 in children: More than meets the eye. *Travel Med Infect Dis.* 2020;34:101649.
23. Kotecha RS. Challenges posed by COVID-19 to children with cancer. *Lancet Oncol.* 2020;21(5):e235.
24. Stower H. Clinical and epidemiological characteristics of children with COVID-19. *Nat Med.* 2020;26(4):465.
25. de Souza TH, Nadal JA, Nogueira RJN, Pereira RM, Brandão MB. Clinical manifestations of children with COVID-19: A systematic review. *Pediatr Pulmonol.* 2020;55(8):1892-1899.
26. Xu S, Chen M, Weng J. COVID-19 and Kawasaki disease in children. *Pharmacol Res.* 2020;159:104951.
27. Riphagen S, Gomez X, Gonzalez-Martinez C, Wilkinson N, Theocharis P. Hyperinflammatory shock in children during COVID-19 pandemic. *Lancet.* 2020;395(10237):1607-1608.
28. Moreira A. Kawasaki disease linked to COVID-19 in children. *Nat Rev Immunol.* 2020;20(7):407.
29. Panupattanapong S, Brooks EB. New spectrum of COVID-19 manifestations in children: Kawasaki-like syndrome and hyperinflammatory response [published online ahead of print, 2020 Jun 3]. *Cleve Clin J Med.* 2020;10.3949/ccjm.87a.ccc039.
30. Ronconi G, Teté G, Kritas SK, et al. SARS-CoV-2, which induces COVID-19, causes kawasaki-like disease in children: role of pro-inflammatory and anti-inflammatory cytokines [published online ahead of print, 2020 Jun 1]. *J Biol Regul Homeost Agents.* 2020;34(3):10.23812.