

Pediatric COVID-19

Clinical Presentation

Clinical symptoms of COVID-19 are milder in children compared to adults. Although rare, children can develop post-infectious complications associated with COVID-19 infection, including the Multisystem Inflammatory Syndrome (MIS-C).

Asymptomatic infection occurs in 15-25% of infected children,^{1,2} and among those who do develop symptoms, the mean time from exposure to illness presentation (incubation period) is 6 days (range: 1 to 14 days).³ However, because testing primarily targets those displaying symptoms, the full extent of pediatric COVID-19 infection may be underrepresented in epidemiological studies.⁴

The outcome of pediatric COVID-19 **respiratory** disease is more favorable than in adults. Children can develop pneumonia but acute respiratory distress syndrome is rare.^{16,17} Co-detection of other respiratory pathogens occurs in approximately 5% of patients and may be associated with a more severe clinical course.^{8,17,18} **Croup** has been reported in children with confirmed COVID-19 infection.¹⁵

Cardiac presentations are not frequent but have included heart failure, pericarditis, arrhythmias, hypotension/shock, chest pain, palpitations, syncope and fatigue.²⁰ Infants and children with pre-existing heart disease may have lower reserve and be more susceptible to cardiac injury, however, healthy children may also develop cardiac complications.²¹ These may occur on their own, as part of MIS-C, or in a severe respiratory presentation.^{20,21}

Multisystem Inflammatory Syndrome in Children (MIS-C) is a rare condition associated with COVID-19 affecting 2 in 100,000 children under 21 years of age.²² The median age of a patient with MIS-C is 9 years.²⁵ It is suspected that a heightened inflammatory response releases cytokines leading to organ and tissue damage. Symptoms of MIS-C overlap with those of Kawasaki disease, toxic shock syndrome, and macrophage activating syndrome.²²

A high degree of suspicion for MIS-C should occur in patients with any of:²²

- » Fever for ≥ 3 days with either hemodynamic instability, cardiovascular changes, or ill appearance
- » Prominent mucocutaneous signs (conjunctivitis, rash, lip/oral changes, extremity changes, lymphadenopathy) that either fully or partially meet Kawasaki criteria
- » Fever with severe GI (abdominal pain, vomiting, diarrhea) symptoms²⁶
- » Isolated fever > 5 days

GI symptoms are found in 80-97% of children diagnosed with MIS-C, while respiratory symptoms are rare.^{21,24,26,34,35}

Symptoms

- » Fever in 50%^{1,5,6,7,14}
- » Cough in 30-50%^{1,6,7,14}
- » Gastrointestinal (GI) manifestations in 5-25% - abdominal pain, vomiting and/or diarrhea^{7,8,14,18}
- » Non-specific symptoms in <10% - poor feeding, fatigue, nasal congestion/rhinorrhea, headache, myalgia and/or sore throat^{1,6,8,14}
- » Loss of taste or smell in <10%^{12,13}
- » Skin manifestations
 - Morbilliform rash
 - Urticarial rash
 - Vesiculobullous rash
 - Livido⁹
 - Chilblains or pernio-like rash may be a post-infectious finding^{10,11}

Center for Disease Control and Prevention (CDC) definition for MIS-C includes meeting all six criteria:

- » Serious illness leading to hospitalization
- » Age less than 21 years
- » Fever ($>38.0^{\circ}\text{C}$) or subjective fever lasting at least 24 hours
- » Laboratory evidence of inflammation
- » Multisystem organ involvement (i.e., involving at least two systems), and
- » Laboratory-confirmed SARS-CoV-2 infection (positive PCR or antibody test) or an epidemiologic link to a person with COVID-19.²³



Inflammatory markers such as C-reactive protein, ferritin, D-Dimer, fibrinogen, lactate dehydrogenase and neutrophils are often strikingly high;^{22,24} albumin and lymphocytes may be low.^{22,24}

Cardiac involvement is common and these children may present with hemodynamic instability or profound shock. Elevated troponin and N-terminal pro b-type natriuretic peptide (NTproBNP) as well as changes on ECG or echocardiogram may be found. Requirement for vasoactive support is frequent and planning for this should occur early in the patient encounter.^{24,25,26}

Alternate diagnoses such as sepsis or toxic shock should be considered and treated as appropriate.

Diagnostic Testing

Diagnostic Imaging: There is no single feature on chest radiograph that confirms COVID-19. Findings may include ground glass opacities, unilateral or bilateral consolidation, or the x-ray may be normal.⁶ The use of chest radiography is not indicated routinely but should be ordered if there are significant findings on respiratory or cardiovascular exam.⁷ Point-of-care ultrasound may be more sensitive early in the clinical course at identifying lung abnormalities such as pleural thickening, pleural irregularities, loss of A-lines, increase in B-lines, white lung areas and/or subpleural consolidation.^{7,29}

Bloodwork: Lymphopenia may be seen in those with mild respiratory illness but bloodwork is not routinely recommended.

If MIS-C is suspected, the patient should have bloodwork including: CBC, CRP, Albumin, Ferritin, Fibrinogen, LDH, D-Dimer, Urea, Creatinine, Electrolytes, Glucose, AST, ALT, Troponin and pro BNP (if available).

Molecular Testing: Local public health/institutional guidelines dictate the need and route for either PCR for SARS-CoV-2 or antibody testing.

ECG and Echocardiogram: Indicated for those with suspicion of MIS-C, signs of cardiovascular dysfunction, or severe illness.

Treatment

Supportive management:

Appropriate PPE for all members of the health care team.

- » Airway: tracheal intubation and non-invasive ventilatory support may be required for a rapidly decompensating patient, but this is rarely required.
- » Breathing: oxygen delivery via non-rebreather or high flow nasal cannula, as clinically indicated.
- » Circulation: secure IV access and institute continuous cardiorespiratory monitoring in children with cardiovascular compromise. Carefully titrate IV fluids to ensure adequate perfusion, consider 5-10 mL/kg NS boluses, and closely monitor for signs of fluid overload (crackles/hepatomegaly). Initiate inotropic support as required. Make early contact with a Pediatric Referral Centre if there is any concern regarding cardiovascular involvement or severe illness.

Empiric antibiotics are not recommended unless there is suspicion of a bacterial process.

Emerging therapies such as antivirals and immunomodulatory agents in patients with COVID-19 are being studied but there are no large trials in pediatric patients.

Potential MIS-C patients need to be recognized quickly so that prompt transport to the Pediatric Referral Centre can be achieved for advanced monitoring, echocardiogram, consideration of intravenous immune globulin therapy, and COVID-19 antibody testing. Individualized treatment regimens involving anticoagulation, antivirals, corticosteroids, and immune modulators may be started at the Pediatric Referral Centre depending on the clinical features.



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Outcomes

Outcomes are generally favorable for children with COVID-19; the case fatality rate is 0.2-0.65%.^{4,18} A large study detailing outcomes for 135,794 US COVID-19 pediatric patients showed a hospitalization rate of 7%⁴ with 1.9% admitted to the intensive care unit.⁴

Patients at higher risk of PICU admission:

- » Under 1 year, especially < 1 month^{18,31}
- » Medical complexity/technologically-dependent²⁷
- » Other comorbidities (e.g. immune suppressed, cardiac disease, respiratory disease)^{18,28,30}
- » MIS-C

Discharge Instructions

- » As with other viral illnesses, children with mild/moderate symptoms who have normal vital signs and are able to maintain their hydration may be discharged home.
- » Provide complete discharge instructions reviewing home isolation, dosing of antipyretics, maintaining hydration, as well as the signs of more significant disease that would require returning to the ED.

Discharge Resource for Families:

Aim camera at QR code or:



- English: <https://youtu.be/CcnT2q4locU>
- French: <https://youtu.be/CE-d4xxolxl>

Additional Resources for Families:

VIDEO: What to expect at the emergency department (COVID-19 section): <https://youtu.be/J60NHcazBGk>

INFOGRAPHIC: What to expect at the emergency department (COVID-19 section): <http://echokt.ca/covidemergency/>



The purpose of this document is to provide healthcare professionals with key facts and recommendations for caring for children with COVID-19 in the ED. This summary was produced by the content advisors for the TREKK network, Drs Shannon MacPhee, Sarah Reid and Stephen Freedman, and uses the best available knowledge at the time of publication. However, healthcare professionals should continue to use their own judgement and take into consideration context, resources and other relevant factors. The TREKK Network is not liable for any damages, claims, liabilities, costs or obligations arising from the use of this document, including loss or damages arising from any claims made by a third party. The TREKK Network also assumes no responsibility or liability for changes made to this document without its consent.



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