

University of New Mexico

UNM Digital Repository

Pediatrics Research and Scholarship

Pediatrics

9-1-2021

SHEA Pediatric Leadership Council commentary: Personal protective equipment during care of children with multisystem inflammatory syndrome in children (MIS-C)

Martha L. Muller

Latania K. Logan

Larry K. Kociolek

Judith A. Guzman-Cottrill

Allison H. Bartlett

See next page for additional authors

Follow this and additional works at: https://digitalrepository.unm.edu/peds_pubs

Authors

Martha L. Muller, Latania K. Logan, Larry K. Kociolek, Judith A. Guzman-Cottrill, Allison H. Bartlett, Joshua K. Schaffzin, Karen A Ravin, Lorry G Rubin, Jason Lake, Carolyn Caughell, Lynn Ramirez-Avila, and SHEA Pediatric Leadership Council

Commentary

SHEA Pediatric Leadership Council commentary: Personal protective equipment during care of children with multisystem inflammatory syndrome in children (MIS-C)

Martha L. Muller MD, MPH¹, Latania K. Logan MD, MSPH², Larry K. Kociolek MD, MSC³, Judith A. Guzman-Cottrill DO⁴, Allison H. Bartlett MD, MS⁵, Joshua K. Schaffzin MD, PhD^{6,7}, Karen A. Ravin MD^{8,9}, Lorry G. Rubin MD^{10,11}, Jason Lake MD, MPH¹², Carolyn Caughell RN, MSN, CIC¹³, and Lynn Ramirez-Avila MD, MSc¹⁴ for the SHEA Pediatric Leadership Council

¹Department of Pediatrics, University of New Mexico, Albuquerque, New Mexico, ²Section of Pediatric Infectious Diseases, Department of Pediatrics, Rush University Medical Center, Rush Medical College, Chicago, Illinois, ³Department of Pediatrics, Ann & Robert H. Lurie Children's Hospital of Chicago and Northwestern University Feinberg School of Medicine Chicago, Illinois, ⁴Department of Pediatrics, Oregon Health and Science University, Portland, Oregon, ⁵Section of Pediatric Infectious Diseases, The University of Chicago Medicine Comer Children's Hospital, Chicago, Illinois, ⁶Division of Infectious Diseases, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, ⁷Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati, Ohio, ⁸Division of Infectious Diseases, Nemours/Alfred I. duPont Hospital for Children, Wilmington, Delaware, ⁹Department of Pediatrics, Sidney Kimmel Medical College at Thomas Jefferson University, Philadelphia, Pennsylvania, ¹⁰Department of Pediatrics, Cohen Children's Medical Center, Northwell Health, New Hyde Park, New York, ¹¹Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, New York, ¹²Division of Pediatric Infectious Diseases, Department of Pediatrics, University of Utah School of Medicine, Salt Lake City, Utah, ¹³Hospital Epidemiology and Infection Prevention, Department of Quality, University of California San Francisco Health, San Francisco, California and ¹⁴Division of Pediatric Infectious Diseases and Global Health, University of California San Francisco, San Francisco, California

In April 2020, amid the coronavirus disease 2019 (COVID-19) pandemic, providers in the United Kingdom described a group of pediatric hospital admissions secondary to fever and multisystem inflammation which has subsequently been described in several countries, including the United States.^{1–4} Since then, several countries have described an epidemiologic association of severe acute respiratory coronavirus virus 2 (SARS-CoV-2) and this clinical presentation,⁵ with the development of cases noted a few weeks following peaks in community COVID-19 activity.¹ The condition has been named Multisystem Inflammatory Syndrome in Children (MIS-C) in the United States and Paediatric Inflammatory Multisystem Syndrome temporally associated with SARS-CoV-2 (PIMS-TS) in Europe.⁵

Patients present variably along a spectrum, including fever, conjunctival injection, rash, abdominal pain, and vomiting.^{1,2,4} Laboratory evidence of inflammation is routinely present.^{1,4} The clinical presentation in patients has been similar to other pediatric inflammatory conditions, to include Kawasaki disease, toxic shock syndrome, bacterial sepsis, and macrophage activation syndrome.^{1,3,4,6–9} Although MIS-C has been compared to Kawasaki disease, several symptoms are more notable in MIS-C disease: presentation in older aged children, a predominance of abdominal symptoms, frequent lymphopenia, increased incidence of left ventricular systolic dysfunction, and acute heart failure.^{3,4,10,11} MIS-C is likely a rare complication of SARS-CoV-2 infection,^{1,4,12} with a

reported incidence of ~2 in 100,000 persons <21 years of age.¹⁹ Reported mortality is ~1%–2%.^{23–25}

The pathogenesis of this syndrome is not completely delineated.^{19–22} However, it is thought to be a post-SARS-CoV-2 infection inflammatory syndrome based on the following (1) MIS-C incidence generally reaches its peak ~1 month after a region's peak in acute COVID-19 cases; (2) preceding symptoms consistent with acute COVID-19 are noted in certain children; and (3) many of the affected children demonstrate the presence of SARS-CoV-2 antibody in the setting of negative RT-PCR testing.^{19,22}

Role of SARS-CoV-2 testing in MIS-C for personal protective equipment (PPE) considerations

Several case reports and case series describing pediatric patients with MIS-C have been published, and some of these include information about the SARS-CoV-2 infection status.^{1–4,6,9,13} In these studies, SARS-CoV-2 reverse-transcriptase polymerase chain reaction (RT-PCR) positivity ranged from 13% to 70% of patients, and evidence of serologic conversion was noted in 73%–100%.^{1–4,6,9,13} The presence of IgG in many of the patients with MIS-C suggests a postinfectious syndrome occurring outside the primary infection.⁸ However, the demonstration of SARS-CoV-2 virus RT-PCR positivity in these patients potentially suggests that the syndrome may occur in a later stage of primary infection.⁸

Testing strategy and validity play important roles in PPE determination. Several factors influence the outcome of viral detection with RT-PCR, including intermittent viral shedding,¹⁴ low viral levels in the upper respiratory tract,¹⁵ and sampling error.¹⁵ However, Greninger et al¹⁶ reported only 3.5% of a cohort of patients who initially tested negative for SARS-CoV-2 RT-PCR

Author for correspondence: Martha L. Muller, Email: mlmuller@salud.unm.edu
Cite this article: Muller ML, et al. (2021). SHEA Pediatric Leadership Council commentary: Personal protective equipment during care of children with multisystem inflammatory syndrome in children (MIS-C). *Infection Control & Hospital Epidemiology*, <https://doi.org/10.1017/ice.2021.242>

Table 1. Admission and De-escalation Recommendations for SARS-CoV-2 Isolation Precautions in Children with Suspected MIS-C

Clinical Scenario	Recommendation
SARS-CoV-2 RT-PCR positive	Continue isolation with discontinuation according to CDC recommendations: either time-based or testing-based
SARS-CoV-2 RT-PCR negative ^a	Discontinue isolation
Patient has a history of positive SARS-CoV-2 RT-PCR in the last 90 d and has completed isolation ^b	Isolation not indicated
No SARS-CoV-2 RT-PCR testing performed	Continue isolation with discontinuation according to hospital policy

Note. MIS-C, multisystem inflammatory syndrome in children; RT-PCR, reverse-transcriptase polymerase chain reaction.

^aSome institutions may require ≥ 2 consecutively negative SARS-CoV-2 RT-PCR testing.

^bSome institutions may require repeat SARS-CoV-2 RT PCR testing if admission presentation concerning for active COVID-19 infection.

developed a positive test within 7 days, while most of those necessitating additional testing for any reason within the 7-day period remained negative for any additional testing.

Much remains unknown regarding the infectivity of patients with MIS-C who demonstrate SARS-CoV-2 RT-PCR positivity upon hospital admission. In light of current evidence, this article provides guidance on potential strategies for managing PPE in pediatric patients diagnosed with MIS-C.

PPE and testing recommendations

PPE, testing strategy, and de-escalation should generally be guided by local COVID-19 and MIS-C hospital policy. Pediatric patients admitted with concerns for MIS-C without a previous history of SARS-CoV-2 testing should have initial SARS-CoV-2 RT-PCR testing to help guide isolation precautions and to assist in establishing a diagnosis. Because MIS-C most likely represents a postinfectious, inflammatory disease process, the need for repeated SARS-CoV-2 RT-PCR in patients with confirmed disease is unclear. The Infectious Diseases Society of America (IDSA) does not recommend repeat SARS-CoV-2 RT PCR testing if there is a low clinical suspicion for COVID-19.²⁶ Even in the setting of a positive SARS-CoV-2 PCR, most patients with MIS-C would not require isolation according to current recommendations by the Centers for Disease Control and Prevention (<https://www.cdc.gov/coronavirus/2019-ncov/hcp/disposition-hospitalized-patients.html>). Additionally, although SARS-CoV-2 RNA has been identified in upper respiratory tract specimens of infected patients for as long as 90 days after illness starts, viral infectiousness is reduced as patients begin to demonstrate clinical improvement (<https://www.cdc.gov/coronavirus/2019-ncov/hcp/disposition-hospitalized-patients.html>).

Most patients admitted with suspected MIS-C have symptoms that may also be consistent with other systemic viral syndromes (ie, respiratory tract symptoms, gastrointestinal symptoms, etc). These patients should have SARS-CoV-2 RT-PCR tests, even if they present within 90 days of a previously positive SARS-CoV-2 RT-PCR test result.

At admission and pending additional evaluation, N95 respirator (or N99 or PAPR), eye protection, gloves, and gowns should be donned during the care of patients requiring aerosol-generating procedures. For care of patients not requiring aerosol-generating procedures, the minimum level of PPE that should be used includes surgical mask, eye protection, gloves, and gown to care for patients. Notably, specific hospital policy should be followed because some hospitals may require N95 or similar type of respirator for all persons under investigation for COVID-19.

Acknowledgments.

Financial support. No financial support was provided relevant to this article.

Conflicts of interest. Dr Kociolek has received a grant from Merck & Co unrelated to this work. All other authors have no conflicts of interest to disclose.

References

- Feldstein LR, Rose EB, Horwitz SM, *et al*. Multisystem inflammatory syndrome in US children and adolescents. *N Engl J Med* 2020;383:334–346.
- Whittaker E, Bamford A, Kenny J, *et al*. Clinical characteristics of 58 children with a pediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2. *JAMA* 2020;324:259–269.
- Ramcharan T, Nolan O, Lai CY, *et al*. Paediatric inflammatory multisystem syndrome: temporally associated with SARS-CoV-2 (PIMS-TS): cardiac features, management and short-term outcomes at a UK tertiary paediatric hospital. *Pediatr Cardiol* 2020;41:1391–1401.
- Godfred-Cato S, Bryant B, Leung J, *et al*. COVID-19-associated multisystem inflammatory syndrome in children—United States, March–July 2020. *MMWR* 2020;69:1074–1080.
- Simpson JM, Newburger JW. Multisystem inflammatory syndrome in children in association with COVID-19. *Circulation* 2020;142:437–440.
- Ng KF, Kothari T, Bandi S, *et al*. COVID-19 Multisystem inflammatory syndrome in three teenagers with confirmed SARS-CoV-2 infection. *J Med Virol* 2020. doi: 10.1002/jmv.26206.
- Rauf A, Vijayan A, John ST, Krishnan T, Latheef A. Multisystem inflammatory syndrome with features of atypical Kawasaki disease during COVID-19 pandemic. *Indian J Pediatr* 2020;87:745–747.
- Galeotti C, Bayry J. Autoimmune and inflammatory diseases following COVID-19. *Nat Rev Rheumatol* 2020;16:413–414.
- Chiotos K, Bassiri H, Behrens EM, *et al*. Multisystem inflammatory syndrome in children during the coronavirus 2019 pandemic: a case series. *J Pediatric Infect Dis Soc* 2020;9:393–398.
- Pouletty M, Borocco C, Ouldali N, *et al*. Paediatric multisystem inflammatory syndrome temporally associated with SARS-CoV-2 mimicking Kawasaki disease (KAWA-COVID-19): a multicentre cohort. *Ann Rheum Dis* 2020; 79:999–1006.
- Ebina-Shibuya R, Namkoong H, Shibuya Y, Horita N. Multisystem inflammatory syndrome in children (MIS-C) with COVID-19: insights from simultaneous familial Kawasaki disease cases. *Int J Infect Dis* 2020;97: 371–373.
- Panupattanapong S, Brooks EB. New spectrum of COVID-19 manifestations in children: Kawasaki-like syndrome and hyperinflammatory response. *Cleveland Clin J Med* 2020. doi: 10.3949/ccjm.87a.ccc039.
- Cheung EW, Zachariah P, Gorelik M, *et al*. Multisystem inflammatory syndrome related to COVID-19 in previously healthy children and adolescents in New York City. *JAMA* 2020;324:294–296.
- Beeching NJ, Fletcher TE, Beadsworth MBJ. COVID-19: testing times. *BMJ* 2020;369:m1403.
- Fang FC, Naccache SN, Greninger AL. The laboratory diagnosis of COVID-19: frequently asked questions. *Clin Infect Dis* 2020;71:2996–3001.

16. Greninger AL, Gombar S, Hogan CA, *et al.* Occurrence and timing of subsequent SARS-CoV-2 RT-PCR positivity among initially negative patients. *Clin Infect Dis* 2021;72:323–326.
17. Lynch, JB, Davitkov P, Anderson DV, *et al.* Infectious Diseases Society of America guidelines on infection prevention for healthcare personnel caring for patients with suspected or known COVID-19. *Clin Infect Dis* 2020. doi: [10.1093/cid/ciaa1063](https://doi.org/10.1093/cid/ciaa1063).
18. Weber DJ, Babcock H, Hayden MK, *et al.* Universal pandemic precautions—an idea ripe for the times. *Infect Control Hosp Epidemiol* 2020;41:1321–1322.
19. Chiotos K, Hayes M, Kimberlin DW, *et al.* Multicenter interim guidance on use of antivirals for children with COVID-19/SARS-CoV-2. *J Pediatr Infect Dis Soc* 2021;10:34–48.
20. Bautista-Rodriguez C, Sanchez-de-Toledo J, Clark BC, *et al.* Multisystem inflammatory syndrome in children: an international survey. *Pediatrics* 2021. doi: [10.1542/peds.2020-024554](https://doi.org/10.1542/peds.2020-024554).
21. Pang J, Boshier FAT, Alders N, Dixon G, Breuer J. SARS-CoV-2 polymorphisms and multisystem inflammatory syndrome in children. *Pediatrics* 2020;146(6):e2020019844.
22. Jiang L, Tang K, Levin M, *et al.* COVID-19 and multisystem inflammatory syndrome in children and adolescents. *Lancet Infect Dis* 2020;20:e276–e288.
23. Shields K, Atlas K, Strohm Farber J, Lebet R. Multisystem inflammatory syndrome in children: a review. *Am J Nurs* 2021;121:26–37.
24. Ramaswamy A, Brodsky NN, Sumida TS, *et al.* Postinfectious inflammatory disease in MIS-C features elevated cytotoxicity signatures and autoreactivity that correlates with severity. *medRxiv* 2020. doi: [10.1101/2020.12.01.20241364](https://doi.org/10.1101/2020.12.01.20241364).
25. Kwak JH, Lee SY, Choi JW, Korean Society of Kawasaki Disease. Clinical features, diagnosis, and outcomes of multisystem inflammatory syndrome in children associated with coronavirus disease 2019. *Clin Exp Pediatr* 2021;64:68–75.
26. Hanson KE, Caliendo AM, Arias CA, *et al.* The Infectious Diseases Society of America guidelines on the diagnosis of COVID-19: molecular diagnostic testing. *Clin Infect Dis* 2021. doi: [10.1093/cid/ciab048](https://doi.org/10.1093/cid/ciab048).
27. Belay ED, Abrams J, Oster ME, *et al.* Trends in geographic and temporal distribution of US children with multisystem inflammatory syndrome during the COVID-19 pandemic. *JAMA Pediatr* 2021. doi: [10.1001/jamapediatrics.2021.0630](https://doi.org/10.1001/jamapediatrics.2021.0630).
28. Feldstein LR, Tenforde MW, Friedman KG, *et al.* Characteristics and outcomes of US children and adolescents with multisystem inflammatory syndrome in children (MIS-C) compared with severe acute COVID-19. *JAMA* 2021;325:1074–1087.