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Case Series

Clinical characteristics and short-term outcomes of children with severe acute respiratory syndrome coronavirus 2-associated multisystem inflammatory syndrome treated with methylprednisolone and/or intravenous immunoglobulin

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ABSTRACT

In this case series, we evaluated the clinical profiles and short-term outcomes of four pediatric patients diagnosed with SARS-CoV-2-associated multisystem inflammatory syndrome (MIS-C), treated with Methylprednisolone and/or intravenous immunoglobulin (IVIg). All cases were managed at a tertiary care hospital in the Rohilkhand region and met the WHO diagnostic criteria for MIS-C. The study period spanned from May to December 2021, with the primary outcome being the resolution of fever. Secondary outcomes included the length of hospital stay, mortality, duration of respiratory or inotropic support (if applicable), and the time to normalization of inflammatory markers. The four cases presented with varying degrees of MIS-C involvement: two patients had significant cardiac involvement, one displayed neurological symptom, and another had systemic inflammatory manifestations. All patients received IVIg (2 g/kg) and Methylprednisolone (2 mg/kg/day). Fever resolved within 3-5 days of treatment, and inflammatory markers normalized within a median of 5 days. Two cases required inotropic support for shock, and one required high-flow nasal cannula (HFNC) oxygen for respiratory distress. No mortality was observed in this cohort. In conclusion, treatment with IVIg and Methylprednisolone was associated with favorable outcomes in these MIS-C cases.

Keywords: SARS-COV2, MIS-C, Immunomodulation, Outcome

INTRODUCTION

Multisystem inflammatory syndrome in children (MIS-C) associated with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a serious complication more frequently observed in children than in adults.[1] While most pediatric SARS-CoV-2 infections are mild or asymptomatic, a small subset develops MIS-C, a severe post-infectious inflammatory condition resembling Kawasaki disease shock syndrome.[2] Early pandemic data indicated a cumulative COVID-19-related hospitalization rate among individuals under 18 years of age in 14 U. S. states of 8.0 per 100,000.[3] By January 2022, the WHO reported over 38 million confirmed COVID-19 cases and nearly half a million deaths worldwide.[4]

Initial reports from London in May 2020 described severely ill children with hyperinflammatory shock and multi-organ involvement similar to Kawasaki disease shock syndrome.[5] Subsequently, increasing cases were reported globally, highlighting MIS-C as a post-infectious phenomenon rather than a manifestation during the acute phase of COVID-19.[6] Clinically, MIS-C shares similarities with Kawasaki disease, Kawasaki disease shock syndrome, and toxic shock syndrome but also presents distinct features.[6]

Various health organizations have established criteria for diagnosing MIS-C. The UK utilizes paediatric inflammatory multisystem syndrome temporally associated with SARS-CoV-2 (PIMS-TS), while the U. S. centers for disease control and prevention (CDC) emphasizes clinical presentation, multisystem organ involvement, and evidence of SARS-CoV-2 infection or exposure.[7-9] WHO has also provided a preliminary case definition and a case report form for MIS-C.[10]

This case series aims to describe the clinical profile and short-term outcomes of children with SARS-CoV-2-related MIS-C treated with immunomodulatory therapies at a tertiary care hospital in Bareilly, India.

Case 1

A 9-year-old boy, AB, was admitted with a three-day history of high fever, vomiting, and abdominal pain. Four weeks earlier, he had mild COVID-19 symptoms, though no test was done. On examination, he had a fever of 102.5°F, tachycardia (125 bpm), tachypnea (35 breaths per minute), and hypotension (85/50 mmHg). His oxygen saturation was 92%, and he presented with conjunctivitis, a rash, and mild hand and foot swelling.

Lab results showed elevated inflammatory markers, including a CRP of 14 mg/L, D-dimer of 5000 ng/mL, and ferritin of 3500 ng/mL. He had low platelets (85,000/µL) and lymphopenia (18% lymphocytes). Echocardiography revealed mildly reduced cardiac function with an ejection fraction of 50%. A positive SARS-CoV-2 antibody test confirmed prior infection.

Outcome were-diagnosed with MIS-C, AB received IVIg, methylprednisolone, antibiotics, and inotropic support. His fever subsided in 48 hours, and inflammatory markers gradually normalized. He was discharged after 11 days with plans for cardiac monitoring.

Case 2

XY, a 14-year-old girl, presented with a three-day history of fever, cough, shortness of breath, and lethargy. She had a mild case of COVID-19 two months earlier. On examination, she had a fever of 101.5°F, tachypnea (40 breaths/min), tachycardia (140 bpm), hypotension (85/50 mmHg), and a rash on her lower limbs. Her oxygen saturation was 88% on room air.

Blood tests showed elevated CRP (20 mg/L), D-dimer (7000 ng/mL), ferritin (3200 ng/mL), and BNP, indicating inflammation. An echocardiogram revealed decreased heart function with an ejection fraction of 45%. She was diagnosed with MIS-C with significant cardiac involvement.

Kavya was treated with IVIg and methylprednisolone. High-flow nasal oxygen and inotropic support were provided for hypoxia and shock.

Outcome were-her shock resolved by day 3 of treatment, and inflammatory markers showed a 50% reduction in D-dimer and CRP levels by day 5. XY was discharged after 12 days with normalized cardiac function.

Case 3

MN, a 10-year-old girl, had mild COVID-19 two months ago and presented with a three-day history of fever, body aches, chest discomfort, and mild difficulty breathing. She also exhibited fatigue, bilateral conjunctivitis, a rash on her trunk and extremities, and mild hand and foot swelling. Her heart rate was elevated at 130 bpm, but her blood pressure was normal (105/65 mmHg).

Blood tests showed elevated CRP (12.5 mg/L), D-dimer (5200 ng/mL), ferritin (3100 ng/mL), and troponin I, along with lymphopenia (15%). An echocardiogram revealed mild pericardial effusion with normal cardiac function, and her SARS-CoV-2 antibody test was positive. She was diagnosed with MIS-C involving cardiovascular and systemic inflammation.

MN received IVIg (2 g/kg), intravenous methylprednisolone (2 mg/kg/day), and aspirin to prevent clotting. Cardiac function was closely monitored due to the risk of myocarditis

Outcome were chest discomfort resolved within 48 hours, inflammatory markers, including troponin, decreased steadily and MN was discharged after 10 days with advice for follow-up cardiac evaluation, including echocardiography.

Case 4

ST, a 12-year-old boy with no history of COVID-19 but with parents who had mild cases 5 weeks earlier, presented with a three-day history of high fever, severe headache, neck stiffness, vomiting, non-purulent conjunctivitis, and a rash on his face and trunk. He had low blood pressure (85/45 mmHg) and was confused.

Blood tests showed elevated CRP, D-dimer, ferritin, and procalcitonin, with mild pleocytosis in his cerebrospinal fluid but no bacterial infection. He tested negative for SARS-CoV-2 via RT-PCR but positive for antibodies. A brain MRI was normal, ruling out encephalitis. Diagnosed with MIS-C and aseptic meningitis, ST was treated with IVIg, methylprednisolone, and fluids, along with inotropes for hypotension. Broad-spectrum antibiotics and antivirals were initially given but stopped after negative cultures**.**

Outcome were fever and altered mental status improved by day 3, inflammatory markers showed significant improvement by day 5 and ST was discharged after 12 days, with recommendations for follow-up neurological evaluation

DISCUSSION

In this case series, we discussed the clinical characteristics, management, and outcomes of four pediatric patients diagnosed with MIS-C associated with SARS-CoV-2, treated at a tertiary care center in the Rohilkhand region, Uttar Pradesh as per the guidelines provided by Government of India.[11] All patients met the WHO criteria for MIS-C. The cohort included two males and two females, ranging in age from 10 to 14 years. These patients presented with a variety of clinical manifestations, primarily cardiac, neurological, and systemic inflammatory involvement.

In contrast to other studies, the mortality rate in our case series was 0%, highlighting the favorable outcomes observed with timely treatment using a combination of IVIg and methylprednisolone.

Fever resolution occurred within 3-5 days for all patients, and inflammatory markers normalized within a median of 5 days, consistent with findings from studies such as Feldstein et al which also emphasized the importance of early intervention in MIS-C management.[12]

Cardiac involvement was noted in two patients, both of whom exhibited myocardial dysfunction and hypotension, requiring inotropic support. This aligns with previous research by Alkan et al and Mahmoud where ventricular dysfunction and hypotension were significant findings in children with MIS-C.[13,14]

Similarly, the study by Davies et al demonstrated that most MIS-C patients were seropositive for SARS-CoV-2 antibodies, further supporting the hypothesis that MIS-C is a post-COVID immunological syndrome.[15]

In terms of respiratory support, one patient required HFNC oxygen, and all cases demonstrated improvement within a short period. Our findings align with studies suggesting that combined IVIg and steroid therapy leads to favorable outcomes in patients with MIS-C, reducing the need for prolonged respiratory or inotropic support.

The prompt resolution of symptoms and the overall favorable prognosis in our patients underscore the efficacy of combined immunomodulatory treatment.

CONCLUSION

In conclusion, our case series reinforces the growing body of evidence that IVIg and Methylprednisolone are effective in managing MIS-C, leading to rapid clinical improvement and recovery. Further research is needed to compare the efficacy of both treatments with each other.

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REFERENCES

1. Verdoni L, Mazza A, Gervasoni A, Laura M, Maurizio R, Matteo C, et al. An outbreak of severe Kawasaki-like disease at the Italian epicentre of the SARS-CoV-2 epidemic: An observational cohort study. Lancet. 2020;395(10239):1771-8.
2. Ahmed M, Advani S, Moreira A, Zoretic S, Martinez J, Kevin C, et al. Multisystem Inflammtory Syndrome in Children: A Systemic Review. E-Clin Me. 2020;26:100527.
3. Garg S, Kim L, Whitaker M, Alissa O'H, Charisse C, Rachel H, et al. Hospitalization rates and characteristics of patients hospitalized with laboratoryconfirmed coronavirus disease 2019-COVID-NET, 14 States, March 1-30, 2020. MMWR Morb Mort Week Rep. 2020;69(15):458-64.
4. India. Available at: https://www.who.int/countries/ind/. Accessed on 12 January 2024.
5. Riphagen S, Gomez X, Gonzalez-Martinez C, Nick W, Paraskevi T, et al. Hyper inflammatory shock in children during COVID-19 pandemic. The Lancet. 2020;395(10237):1607-8.
6. Jones VG, Mills M, Suarez D, Catherine AH, Debra Y, Bradley JS, et al. COVID-19 and Kawasaki disease: novel virus and novel case. Hosp Pediatr. 2020;10(6):537-40.
7. European Centre for Disease Prevention and Control. Rapid risk assessment: paediatric inflammatory multisystem syndrome and SARS-CoV-2 infection in children. 2020. Available at: https://www.ecdc.europa.eu/ en/publications-data/paediatric-inflammatory-multisystemsyndrome-and-sars-cov-2-rapid-risk-assessment. Accessed on 12 January 2024.
8. The Royal College of Paediatrics and Child Health. Guidance-paediatric multisystem inflammatory syndrome temporally associated with COVID-19 (PIMS). 2020. Available at: https://www.rcpch.ac.uk/resources/guidance-paediatric-multisysteminflammatory-syndrome-temporally-associated-covid-19-pims. Accessed on 12 January 2024.
9. Centers for Disease Control and Prevention. Multisystem inflammatory syndrome. 2020. Available at: https://www.cdc.gov/mis-c/hcp/. Accessed on 12 January 2024.
10. Available at: https://www.who.int/news-room/commentaries/detail/multisystem-inflammatory-syndrome-in-children-and-adolescents-with-covid-19. Accessed on 12 January 2024.
11. Guidelines for management of COVID 19 in children. Ministry of Family and Health welfare, Government of India; 2021, June.
12. Feldstein LR, Rose EB, Horwitz SM, Jennifer PC, Margaret MN, Mary Beth FS, et al. Multisystem inflammatory syndrome in U.S. children and adolescents. N Engl J Med. 2020;383(4):334-46.

13. Alkan G, Sert A, Oz SK. MIS-C in children during the COVID-19 pandemic. J Paediatr Child Health. 2021;57(5):668-75.
14. Mahmoud S, Lutfi R, McCaffrey P. Cardiac dysfunction in MIS-C: prevalence and outcomes. J Am Coll Cardiol. 2021;77(22):2872-84.
15. Davies P, Evans C, Kanthimathinathan H. Intensive care admissions of children with paediatric inflammatory multisystem syndrome temporally associated with SARSCoV-2 (PIMS-TS) in the UK: A multicentre observational study. Lancet Child Adolesc Health 2020;4(9):669-77.

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