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CASE REPORT

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A case report on multisystem inflammatory syndrome in children (MIS-C) associated with COVID-19 infection

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Key Clinical Message

Early recognition and treatment of Multisystem Inflammatory Syndrome in Children (MIS-C) within the context of COVID-19 infection is crucial for improved outcomes. Prompt intervention with IVIG and steroids leads to significant improvement in a severe case of MIS-C. Clinicians should be vigilant for MIS-C symptoms and initiate timely management.

Abstract

We report a case involving a fourteen-year-old male with COVID-19 infection who developed multisystem inflammatory disease. A previously healthy child presented with a history of 10 days of fever and cough, along with diarrhea, and vomiting for 3 days. His COVID-19 infection was confirmed through Polymerase Chain Reaction (PCR), and the laboratory values were remarkable for high levels of C-reactive protein, D-dimers, B-type natriuretic peptide (BNP), and troponin I. He developed circulatory shock on the second day of the presentation and needed inotropic support. Steroids and intravenous immunoglobulin (IVIG) were started in light of Multisystem Inflammatory Syndrome in Children (MIS-C), which improved his condition. Thus, during the management of COVID-19 infection, early detection and a careful clinical characterization for MIS-C are essential.

KEYWORDS

COVID-19, immunoglobulin therapy, inflammation, multisystem inflammatory syndrome in children (MIS-C), pediatric COVID-19 management

1 | INTRODUCTION

MIS-C is a newly recognized spectrum in children associated with COVID-19 infection.[1] Fever, shock, abdominal pain, vomiting, and diarrhea are common presenting features.[2] Centers for Disease Control and Prevention (CDC) declared MIS-C to be a reportable illness as of May 14, 2020, and has recently provided a case definition as patients under 21 years of age with fever (>38.0°C for ≥24 h); laboratory evidence of inflammation; severe illness needing hospitalization; involvement of two or more organ systems, with positive testing for severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2); and no other alternative plausible diagnoses.[1] The treating physician should be tactful in early syndrome recognition for prompt intervention and treatment.

2 | CASE HISTORY AND EXAMINATION

A 14-year-old male child without prior co-morbidities presented to the Emergency Room (ER) with 10 days of fever (maximum temperature: 103 F) and acute dry cough associated with shortness of breath on exertion. He also complained of diarrhea and vomiting for 3 days. On examination, he was febrile (temperature: 100 F), tachycardic (heart rate: 120 bpm), tachypneic (respiratory rate: 30 breaths/min), and required oxygenation via Non-Invasive Ventilation (NIV) at 35% FiO2. Blood pressure (BP) during the presentation was 120/80 mmHg. Arterial Blood Gas (ABG) analysis revealed no significant abnormalities. Other systemic examinations revealed no abnormalities. Chest X-ray showed bilateral lower lobes patchy opacities.

3 | METHODS

Polymerase chain reaction (PCR) for COVID-19 was positive. He was admitted to intensive care unit (ICU) in view of severe COVID-19 infection for further evaluation and management and was started on: injection (inj.) ceftriaxone 1 gm intravenous (IV) 12 hourly, tablet (tab.) azithromycin 500 mg per oral once daily, inj. enoxaparin 40 U subcutaneously once daily, inj. dexamethasone 6 mg once daily, and inj. rabeprazole 20 mg once daily as per the standard treatment protocol.

On the second day of admission, he landed up in circulatory shock with the lowest BP reading of 80/60 mmHg. Consequently, he was started on Inj. nor adrenaline intravenous infusion at 0.10 mcg/kg/min and titrated accordingly as per the ICU protocol to improve peripheral vascular resistance and maintain blood pressure. His laboratory values were remarkable for high levels of C-reactive protein, D-dimers, B-type natriuretic peptide (BNP), and troponin I [as shown in Table 1].

Echocardiography showed the features of cardiogenic shock-dilated left ventricle (LV), moderate LV systolic dysfunction (ejection fraction: 30%–35%), mild tricuspid regurgitation (TR) with tricuspid regurgitation pressure gradient (TRPG) 20 mmHg with normal right ventricle (RV) systolic function and no pericardial effusion. There were no signs of coronary artery aneurysm during the evaluation. Cardiology and infectious disease departments were consulted. As he had multisystem involvement in the background of COVID-19 infection and was meeting the CDC criteria for MIS-C,[1] a strong possibility of MIS-C was considered. Consequently, inj. IV immunoglobulin (IVIG) at 2 g/kg and inj. methylprednisolone (125 mg once daily) were started. After the initiation of immunoglobulin therapy, his condition gradually improved. On the fifth day of ICU admission, he was hemodynamically stable- thus, weaned off the ionotropic support, and oxygenation was maintained at room air. An ejection fraction of 60% was achieved in echocardiography, and the patient was afebrile and free from respiratory and gastrointestinal symptoms. He was shifted to the general ward and discharged on oral medications after 3 days.

TABLE 1 Laboratory Investigations on the second day of admission.

Laboratory investigations (normal values/normal range)	Obtained results/values
SARS-CoV-2 testing (RT-PCR)	Positive
Leucocytes (K/μL) (4.5–13.5)	14.5
Platelets (K/μL) (140–440)	241
Neutrophils (K/μL) (1.30–9)	8.82
Lymphocytes (K/μL) (1.90–7.5)	2.26
C-reactive protein (mg/L) (<9.9)	225
Erythrocyte sedimentation rate (mm/hour) (0–20)	30
B-type natriuretic peptide (pg/mL) (1–100)	1500
Troponin (ng/mL) (0.00–0.030)	1.26
Creatinine (mg/dL) (0.6–1.3)	0.71
D-dimers (mcg/mL) (≤0.5)	12.36
Fibrinogen (mg/dL) (183–503)	436
Ferritin (ng/mL) (13–145)	510
Albumin (g/dL) (3.8–5.4)	2.5

4 | DISCUSSION

MIS-C in pediatric patients is a novel syndrome that appears to be linked to previous exposure to SARS-CoV-2. MIS-C is thought to be related to a post-viral immune-mediated inflammatory process, although the pathogenesis of the syndrome remains largely unclear.[1] Children with MIS-C may present with a continual fever for 3–5 days on average; fatigue; signs and symptoms of systemic inflammation, including laboratory-confirmed elevated inflammatory markers and involving multiorgans signs and symptoms: respiratory, cardiac, GI, renal, hematologic, dermatologic, and neurologic system involvement.[3,4] Not all patients present with the same symptoms and signs, and in some cases patients may exhibit symptoms not mentioned above.[4]

In our case, the patient, with the background of COVID-19 infection, had involvement of respiratory, gastrointestinal, and cardiac systems, thus indicating a diagnosis of MIS-C, and showed improvement in condition with IVIG and Steroids. To date, there are no definitive

guidelines regarding the treatment of MIS-C, and the CDC indicates that no studies have examined the efficacy of various treatment options.[4] However, IV immunoglobulin and supportive care have been common approaches, according to a representative of the American Academy of Paediatrics Committee on Infectious Diseases.[5]

5 | CONCLUSION

Clinical presentation of MIS-C with multiorgan involvement and elevated inflammatory markers may be confusing during COVID-19 therapy. Thus, clinicians should maintain a high level of awareness of the possibility of MISC in pediatric COVID-19 patients, especially when faced with clinical deterioration and multiorgan involvement. However, as the full spectrum of MIS-C remains largely unknown, further research into MIS-C is needed regarding its pathogenesis in COVID-19, prevention and treatment.

AUTHOR CONTRIBUTIONS

Roshan Bhandari: Conceptualization; data curation; investigation; supervision; visualization; writing – original draft; writing – review and editing. **Richa Paudyal:** Conceptualization; formal analysis; investigation; resources; writing – original draft; writing – review and editing. **Abhigya Paudyal:** Resources; writing – original draft; writing – review and editing. **Shreya Singh Beniwal:** Resources; writing – original draft; writing – review and editing.

FUNDING INFORMATION

None.

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

The data used in the case report are available on reasonable request.

ETHICS STATEMENT

This study did not include experiments on animals or humans.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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