Turkish Archives of Pediatrics

SCIENTIFIC LETTER
DOI: 10.5152/TurkArchPediatr.2022.21317

MIS-C Case Presented with Acute Appendicitis and Successfully Treated by Plasmapheresis

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Multisystem inflammatory syndrome in children (MIS-C) is a new and severe clinical entity related to coronavirus disease 2019 (COVID-19). It is not yet known whether MIS-C is an infectious immune reaction that occurs with the abnormal development of acquired immunity or a new disease. MIS-C can cause multiorgan failure and lead to mortality and serious consequences.[1] Especially, gastrointestinal symptoms may come to the fore in patients with MIS-C. Even in some patients, the clinical picture mimics acute abdomen.[2] Medical and extracorporeal treatments can be applied as an anti-inflammatory. Here, we wanted to share a MIS-C case who presented to the clinic with acute appendicitis, resistant to medical anti-inflammatory treatments and, responded well to plasmapheresis.

A 15-year-old female was admitted with fever and abdominal pain and operated with a preliminary diagnosis of acute appendicitis due to the presence of physical examination findings consistent with acute abdomen. In the radiological imaging, the appendix was normal but the terminal ileum was widely edematous. On the second day after the operation, the patient was transferred to the pediatric intensive care unit (PICU) due to persistent fever, rash, tachycardia, and hypotension. Medical history revealed that she had COVID-19 contact 4 weeks ago in the family. Laboratory tests have revealed increased infectious markers. MIS-C was considered in the patient with physical examination, history, and laboratory tests. High flow nasal cannula oxygen therapy was started to the patient whose oxygen saturation was 92% on room air. Fluid replacement applied by central venous catheter. Adrenaline and milrinone infusions were started in the patient, who was hypotensive and whose ejection fraction (EF) was found to be 45% on echocardiography. Broad-spectrum antibiotics were started. IVIG (2 gram/kg/day), pulse steroid (30 mg/kg/day), and acetylsalicylic acid applied as first-line anti-inflammatory therapy. Anakinra treatment was added on the 24th hour at PICU because of the resistant fever, increased infectious parameters, and hemodynamically unstable condition in the patient despite the IVIG and high-dose steroid. Plasmapheresis was applied as rescue therapy for 5 days to the patient whose infectious parameters were high, EF decreased to 40% and was still hemodynamically unstable during 48 hours of treatment. Continuous renal replacement therapy was applied for fluid overload. After the first plasmapheresis application, her fever dramatically decreased. In the follow-up, infectious markers regressed day by day and systolic functions were improved. The patient was transferred to the pediatric ward on the 10th day of treatment. A timeline for the clinical course of the patient is given in Table 1.

MIS-C is a still poorly understood illness that can present with severe multiorgan failure in the pediatric age group.[3] Case reports with different clinical pictures from the first case to the present day are presented in the literature.[4] Gastrointestinal involvements are particularly prominent in these cases.[5,6] Acute appendicitis may be triggered by common viruses, including severe acute respiratory syndrome coronavirus 2. In the literature, 8 pediatric cases from the UK presenting with atypical appendicitis have been reported; however, those patients did not require surgical management.[2] Our patient was initially admitted with a

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Received: November 9, 2021
Accepted: December 10, 2021

Cite this article as: Aslan N, Acari C, Çiçek T, Berk E. MIS-C case presented with acute appendicitis successfully treated by plasmapheresis. *Turk Arch Pediatr.* 2022;57(2):239-240.

Table 1. A Timeline for Clinical Course of Patient	
Admission day	- Operation for acute appendicitis diagnosis - Post-operative follow-up at pediatric surgery ward
Post-operative second day at ward PICU transfer	- MIS-C diagnosis - IVIG (2 g/kg/day), pulse steroid (30 mg/kg/day), and acetylsalicylic acid
24th hour at PICU	- Anakinra - Resistant fever, increased infectious markers
48th hour at PICU	- Plasmapheresis therapy - EF decreased to 40% - Increased need for vasoactive/inotrop/inodilator drugs
MIS-C, multisystem inflammatory syndrome in children; PICU, pediatric intensive care unit; EF, ejection fraction.	

diagnosis of appendicitis and had an appendectomy prior to further diagnosis of MIS-C.

Early diagnosis and multidisciplinary management of the disease are extremely important.[7] Although there is not yet a complete treatment protocol for MIS-C seen in children, treatment is usually arranged by the clinician depending on the severity of the disease.[8] In cases with MIS-C, a rapid response can be obtained with anti-inflammatory treatments started in the acute period. Children with MIS-C can respond to IVIG, steroids, and biological agents (interleukin (IL)-1 receptor antagonist and IL-6 receptor inhibitor), which are usually administered in the early period. However, in patients with severe symptoms, treatment options in addition to medical treatment should be evaluated. Therapeutic plasma exchange may be a treatment option in children with MIS-C to rapidly suppress the inflammatory response and eliminate inflammatory cytokines.[9,10] Haslak et al[9] reported clinical features and outcomes of 76 MIS-C patients. They reported that 2 patients in their cohort were diagnosed with acute appendicitis and they performed plasmapheresis in 14 medically resistant patients.[9] In our patient, the inflammation could not be controlled with medical anti-inflammatory treatment including IVIG, pulse steroid, and Anakinra. A dramatical response was obtained with plasmapheresis, which was applied as a rescue treatment.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – N.A, T.C; Design – N.A.; Supervision – N.A.; Resources – N.A., T.C.; Materials – N.A., C.A.; Data Collection and/or Processing – N.A., E.B.; Analysis and/or Interpretation – N.A., E.B., C.A.; Literature Search – N.A.; Writing Manuscript – N.A; Critical Review – N.A.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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