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Multisystem Inflammatory Syndrome In Children (Mis-C) Post Covid Infection In Central India: A Prospective Observational Study

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Abstract

Aim Of Study: To evaluate clinical presentations and outcomes of patients with MIS-C in children
Method: It is a prospective observational study that will be conducted in the Department of Paediatrics, NKPSIMS Medical College, Nagpur. All children admitted with MIS-C at our Hospital, aged 1 month to 18 years, from March 2021 to October 2023 were recruited into the study.
Results: There were 20 children presented with MIS-C post covid infection. Age and gender-wise associations along with common symptoms seen with post-covid infection were studied. The majority of cases were mild to moderate cases which were treated according to the category of illness. There was one mortality in category 4.
Conclusion: In this study, we will highlight the clinical spectrum and outcome of MIS-C secondary to covid19 infection in children and summarise the available evidence to provide insights into current clinical practice and implications for future research directions.

Keywords: WHO, MIS-C, pandemic, covid-19, pediatric

INTRODUCTION

In May 2020, the World Health Organization (WHO) first characterised this MIS-C (COVID-19–Associated Multisystem Inflammatory Syndrome in Children) and offered a provisional clinical description. In general, children have a less chance of acquiring severe or severe COVID-19, however, like adults, some underlying factors render them more vulnerable to severe illness. Obesity, chronic lung illness (including asthma), cardiovascular disease, and immunosuppression are the most typically observed. MIS-C is a less common but fatal illness in which COVID-19-positive children develop inflammation in multi- organs. This condition requires special treatment and care, and children with it may need to be hospitalised in the pediatric intensive care unit (PICU). MIS-C is a serious fatal disorder, but it can be treated and children can recover with the correct medical treatment. (1)
Infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in children is considered to be milder than in adults, and children are mostly asymptomatic or just mild illnesses. (2,3,4)
The majority of cases of MIS-C include signs of hypotensive shock, including cardiac involvement, gastrointestinal symptoms, and raised inflammatory markers, along with positive SARS-CoV-2 laboratory test

results. All of the patients who were tested for SARS-CoV-2 had a positive RT-PCR or serology result. Pediatricians treating children and adolescents face a problem in identifying MIS-C from various viral or inflammatory diseases. As the COVID-19 infection is widespread throughout parts of India, health care providers' knowledge of MIS-C will help in early detection, diagnosis, and treatment. (5)
Early detection and treatment of pediatric MIS-C cases are critical for a positive result in this novel clinical condition that has received minimal research in relation to Covid 19 infection. Despite the fact that children's symptoms are often milder than those of adults, a less percentage of youngsters require hospitalisation and vast treatment. In recent times duration, there have been a rising number of reports from various parts of India reporting children and adolescents with COVID-19-related multisystem inflammatory disorders that appear after the infection rather than during the acute stage of COVID-19.
These paediatric examples include clinical conditions that are both related to and different from those of other well-known inflammatory syndromes in children, such as Kawasaki illness, Kawasaki disease shock syndrome, and toxic shock syndrome. (8,9) MIS-C may cause shock and multiple organ failure, requiring urgent medical attention. (12) The epidemiology, aetiology, clinical symptoms, and long-term effects of MIS-C are still not clear.
We report the clinical characteristics and therapy of MIS-C in children from Nagpur, a city in central India with a moderate to the high frequency of coronavirus illness (COVID-19).

Method:
We discovered an increasing number of children with signs of Multisystem Inflammatory Syndrome post COVID-19 reached our country in March 2021. We suggested a cross-sectional observational study, which was carried out at NKPSIMS Medical College Nagpur's pediatrics ward and pediatric intensive care unit.
This study included all children aged 1 month to 18 years who had clinical symptoms indicative of MIS-C and met WHO criteria and were hospitalized in the paediatric ward and Paediatric Intensive Care Unit at NKPSIMS Medical College Nagpur between March2021 and October 2023.
They were recruited for the research after receiving written and informed permission from the child's parent, as well as assent from older children. In the case record sheet, the participants' demographic data, admissions complaints, thorough history, and examination were all filled out. According to hospital policy and standard guidelines, the individual was examined and treated. Once enrolled, the subjects were monitored until they were released from the hospital or died.
All important events as well as clinical indications were documented.
To identify symptomatology, a thorough history was collected. At the time of admission, a predesigned proforma was used to record the results of a detailed clinical examination that comprised vitals, general, and systemic examination findings.
Skin rash, non-purulent conjunctivitis, alterations in lips, oral mucosa, and extremities changes were all identified, as indicated by prior standards and MIS-C. Nausea, vomiting, abdominal discomfort, and diarrhoea were all reported as gastrointestinal symptoms. All patients had their haematological parameters checked, including total leucocyte count, haemoglobin levels, N/L ratio, and platelet count. If clinically required, a liver function test, coagulation profile, blood sugar with electrolytes, ultrasonography abdomen, and chest radiography were conducted. Renal and liver function tests, as well as acute phase reactants (CRP, ferritin, D-dimer, ESR, Ferritin) done in all patients. Coagulation parameters such as PT-INR were tested. In comparison to age-specific normal ranges, laboratory values were labelled as raised or depressed.
On echocardiography, clinical myocarditis was described as cardiac dysfunction with a low left ventricular ejection fraction (LVEF). Cardiogenic shock was defined as patients who presented with shock and had left ventricular (LV) dysfunction on echocardiography. The diameters of the coronary arteries were measured using established standards and indexed using Z scores. Dilated coronary arteries were defined as those with a Z score of more than 2.5. According to the Indian Council for Medical Research, SARS-CoV-2 infection was identified using a nasopharyngeal swab real-time reverse transcription-polymerase chain reaction (RT-PCR) and/or a fast antibody test for SARS-CoV-2 (Vitros Anti Sars Cov IgG antibody kit, Ortho Clinical Diagnostics). In addition, according to WHO guidelines, previous interaction with a COVID19 positive patient was also declared positive. The outcome was either discharged or death.
The patients were categorized and treated according to the amended WHO guidelines. The usage of blood products and the need for crystalloids or colloids were also documented.

Inclusion criteria - Children aged one month to eighteen years will be enrolled in this research if they meet the MIS-C defining requirements.

Exclusion criteria- Age less than 1 month at the time of admission, Any child who does not meet the MIS-C defining requirements, and Those who refuse to engage in the research.
Our hospital's institutional ethics committee gave its approval. The information was put into a Microsoft Excel spreadsheet. Demographics, the existence of a positive SARS-CoV-2 antigen or antibody test or a history of contact with a positive patient, clinical symptomatology, laboratory values, the therapy administered, and prognosis were among the variables investigated.
Statistical analysis was carried out with the help of SPSS version 26. (IBM, USA). To compare categorical variables, the Chi-square test was employed, the Student-t-test was used to compare normally distributed data, and the Mann-Whitney U test was used to compare data that were not normally distributed.

RESULTS AND DISCUSSION

Table 1: Age and gender distribution of children with MIS-C (n=20)

Age-group	Male (%)	Female (%)	Total (%)
0 – 5	6 (75)	2 (25)	8 (40)
6 – 10	3 (60)	2 (40)	5 (25)
>10	2 (28.57)	5 (71.43)	7 (35)
Total	11 (55)	9 (45)	20 (100)

Table 1 gives data about the total number of male and female children suffering from MISC as per the age group category. There were 6 males and 2 females in the age group 0-5 years of age, while 3 males and 2 females in the age group 6-10 years of age group, and 2 males and 5 females in the age group more than 10 years ago. The total percentage of males was 55 % and females were 45 % of the total sample.

Table 2: History of COVID infection or COVID contact in children MIS-C (n=20)

COVID Infection	Present (%)	Absent (%)	Total (%)
Male	5 (25)	6 (30)	11 (55)
Female	4 (20)	5 (25)	9 (45)

Table 2: The above table gives a percentage of covid infection or covid contact in children with MIS-C. It was found that 55% of male children with covid infection or covid contact suffered from MIS-C.

Table 3: Association of Vitals with Category of disease in children with MIS-C (n=20)

Vitals	Category of disease			
	I	II	III	IV
Blood Pressure				
Normal	3	3	3	5
Hypotension (B P <5 th centile)	0	0	2	4
Heart Rate				
Increased	1	1	4	9
Normal	2	2	0	1
Respiratory Rate				
Increased	0	1	4	8
Normal	3	2	0	2
Oxygen levels				
>94	3	3	4	4
94 - 90	0	0	0	5
< 90	0	0	0	1

Table 3: the above table shows the association of vitals with category in children with MIS-C.
In categories 1 and 2, all children were normotensive, one child had increased heart rate while the other two were normal, the respiratory rate of all children was normal, and oxygen levels were more than 94 % which was in the normal range.
In Category 3, three children were normotensive, two were hypotensive, four children had increased heart rate, and four children had increased respiratory rate with oxygen levels of more than 94 %.
In Category 4, five children were normotensive, four were hypotensive, nine children had increased heart rate, eight children had respiratory rate and two normal respiratory rates, four children had normal oxygen levels, five had between 90-94% saturation, and one child less than 90.

Table 4: Age-wise distribution of symptoms in children with MIS-C (n=20)

Symptoms	Age group			
	0 – 5 years (%)	6 – 10 years (%)	>10 years (%)	Total (%)
Fever	8 (44.44)	5 (27.78)	5 (27.78)	18 (90)
Conjunctivitis	3 (33.33)	3(33.33)	3(33.33)	9 (45)
Skin Rash	3 (42.86)	3 (42.86)	1 (14.29)	7 (35)
GIT symptoms	6 (42.84)	5 (35.71)	3 (21.43)	14 (70)
Others	4 (44.44)	3 (33.33)	2 (22.22)	9 (45)

Table 4: shows the age-wise distribution of symptoms in children with MIS-C. Fever was the predominant symptom present in 90% of children, conjunctivitis was present in 45% children, Skin Rash was present in 35 %, GIT symptoms were in 14 %, and other nonspecific symptoms were present in 45 % of children.

Table 5: Echocardiographic Findings in children with MIS-C

Echocardiographic Findings	Frequency	Percentage
ECHO		
Normal	8	40
Abnormal	12	60
Total	20	100

Table 5: shows echocardiographic findings in children with misc. there were 60% abnormal findings in echocardiography in children with MIS-C, and 40% were echoed normal.

Table 6: Association of Severity of disease with outcome in children with MIS-C

	Death (%)	Discharge (%)	Total (%)
Category I	0 (0)	3 (100)	3 (15)
II	0 (0)	3 (100)	3 (15)
III	0 (0)	4 (100)	4 (20)
IV	1 (10)	9 (90)	10 (50)

Table 6: It Shows the association of severity of disease with outcome in children with MIS- C. In Category 1, 2 there were 15 % each were discharged, 20% were in Category 3 discharged, and 50 % were discharged in Category 4.

SUMMARY AND CONCLUSION

Post covid infection was really challenging for pediatricians to handle and MIS-C was an important clinical condition associated with Covid Infection. The study was done on 20 children suffering MIS-C at our center. There were 11 male and 9 female children in the study. There was a male predominance of Covid Infection or contact in children with MIS-C.

In category 1,2 of disease with MIS-C vitals were mostly in the normal range. In Category 3, blood pressure was on the lower side in two children, while increased heart rate and respiratory rate, and normal oxygen levels were in all children in category 3.

While in Category 4, four children were hypotensive, nine had increased heart rate, eight had increased respiratory rate, and one had an oxygen level less than 90.

It was found that fever was a predominant symptom, followed by GIT symptoms, other nonspecific complaints, conjunctivitis, and skin rash.

Echocardiography was an important tool in the diagnosis of MIS-C as 60% of cases had abnormal findings in ECHO with MIS-C

In category 1,2 children with MIS-C, 15% each were discharged, 20% from Category 3,

50% from Category 4. One death (5%) was reported from Category 4 in this study.

LIMITATION OF STUDY

The sample available for the study was limited as the Second Covid wave lasted for 3 months

The sample size could not be collected as there was a sudden decline in cases in covid cases in India so less number of children with MIS-C were admitted to our center.

The sample size was less hence results and observations may vary accordingly in different regions.

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CONFLICT OF INTEREST:

The authors declare that they need no conflict of interest.

REFERENCES:

1. WHO issues guidelines on the treatment of children with multisystem inflammatory syndrome associated with COVID-19: World Health Organisation: 23 November 2021 . Available from: https://www.who.int/news/item/23-11-2021-who-issues-guidelines-on-the-treatment-of-children-with-multisystem-inflammatory-syndrome-associated-with-covid-19 assessed on 13-3-2022
2. Belhadjer Z, Meot M, Bajolle F, et al. Acute heart failure in multisystem inflammatory syndrome in children (MIS-C) in the context of global SARS-CoV-2 pandemicexternal icon. Circulation 2020.
3. Liu W, Zhang Q, Chen J, Xiang R, Song H, Shu S, Chen L, Liang L, Zhou J, You L, et al.. Detection of COVID-19 in children in early January 2020 in Wuhan, China.**N Engl J Med**. 2020; 382:1370–1371.
4. Xu Y, Li X, Zhu B, Liang H, Fang C, Gong Y, Guo Q, Sun X, Zhao D, Shen J, et al.. Characteristics of pediatric SARS-CoV-2 infection and potential evidence for persistent fecal viral shedding.**Nat Med**. 2020; 26:502–505. doi: 10.1038/s41591-020-0817-4
5. Godfred-Cato S, Bryant B, Leung J, et al. COVID-19–Associated Multisystem Inflammatory Syndrome in Children — United States, March–July 2020. MMWR Morb Mortal Wkly Rep 2020;69:1074–1080. DOI: http://dx.doi.org/10.15585/mmwr.mm6932e2external icon.
6. Jain S, Sen S, Lakshmivenkateshiah S, Bobhate P, Venkatesh S, Udani S, Shobhavat L, Andankar P, Karande T, Kulkarni S. Multisystem Inflammatory Syndrome in Children With COVID-19 in Mumbai, India. Indian Pediatr. 2020 Nov 15;57(11):1015-1019. doi: 10.1007/s13312-020-2026-0. Epub 2020 Aug 11. PMID: 32788432; PMCID: PMC7678602.
7. Whittaker E, Bamford A, Kenny J, Kaforou M, Jones CE, Shah P, Ramnarayan P, Fraisse A, Miller O, Davies P, Kucera F, Brierley J, McDougall M, Carter M, Tremoulet A, Shimizu C, Herberg J, Burns JC, Lyall H, Levin M; PIMS-TS Study Group and EUCLIDS and PERFORM Consortia. Clinical Characteristics of 58 Children With a Pediatric Inflammatory Multisystem Syndrome Temporally Associated With SARS-CoV-2. JAMA. 2020 Jul 21;324(3):259-269. doi: 10.1001/jama.2020.10369. PMID: 32511692; PMCID: PMC7281356.
8. Balasubramanian S, Nagendran TM, Ramachandran B, Ramanan AV. Hyper-inflammatory Syndrome in a Child With COVID-19 Treated Successfully With Intravenous Immunoglobulin and Tocilizumab. Indian Pediatr. 2020 Jul 15;57(7):681-683. doi: 10.1007/s13312-020-1901-z. Epub 2020 May 10. PMID: 32393681; PMCID: PMC7387261.
9. Bhat CS, Gupta L, Balasubramanian S, Singh S, Ramanan AV. Hyperinflammatory Syndrome in Children Associated With COVID-19: Need for Awareness. Indian Pediatr. 2020 Oct 15;57(10):929-935. doi: 10.1007/s13312-020-1997-1. Epub 2020 Jul 15. PMID: 32683336; PMCID: PMC7605487.
10. Acharyya BC, Acharyya S, Das D. Novel Coronavirus Mimicking Kawasaki Disease in an Infant. Indian Pediatr. 2020 Aug 15;57(8):753-754. doi: 10.1007/s13312-020-1924-5. Epub 2020 May 22. PMID: 32441271; PMCID: PMC7444159.
11. Dhanalakshmi K, Venkataraman A, Balasubramanian S, Madhusudan M, Amperayani S, Putilibai S, Sadasivam K, Ramachandran B, Ramanan AV. Epidemiological and Clinical Profile of Pediatric Inflammatory Multisystem Syndrome - Temporally Associated with SARS-CoV-2 (PIMS-TS) in Indian Children. Indian Pediatr. 2020 Nov 15;57(11):1010-1014. doi: 10.1007/s13312-020-2025-1. Epub 2020 Aug 6. PMID: 32769230; PMCID: PMC7678572.
12. Lu X, Zhang L, Du H, Zhang J, Li YY, Qu J, Zhang W, Wang Y, Bao S, Li Y, Wu C, Liu H, Liu D, Shao J, Peng X, Yang Y, Liu Z, Xiang Y, Zhang F, Silva RM, Pinkerton KE, Shen K, Xiao H, Xu S, Wong GWK; Chinese Pediatric Novel Coronavirus Study Team. SARS-CoV-2 Infection in Children. N Engl J Med. 2020 Apr 23;382(17):1663-1665. doi: 10.1056/NEJMc2005073. Epub 2020 Mar 18. PMID: 32187458; PMCID: PMC7121177.
13. Castagnoli R, Votto M, Licari A, et al. Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in Children and Adolescents: A Systematic Review. *JAMA Pediatr.* 2020;174(9):882–889. doi:10.1001/jamapediatrics.2020.1467

14. Parri N, Lenge M, Buonsenso D; Coronavirus Infection in Pediatric Emergency Departments (CONFIDENCE) Research Group. Children with Covid-19 in Pediatric Emergency Departments in Italy. N Engl J Med. 2020 Jul 9;383(2):187-190. doi: 10.1056/NEJMc2007617. Epub 2020 May 1. PMID: 32356945; PMCID: PMC7206930.
15. Riphagen S, Gomez X, Gonzalez-Martinez C, et al. Hyperinflammatory shock in children during COVID-19 pandemic. Lancet 2020;395:1607–8.
16. Verdoni L, Mazza A, Gervasoni A, 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. doi:10.1016/S0140-6736(20)31103-X