

## Clinical profile of Covid-19 in children: Study from a Medical College Hospital in Mangalore, Karnataka, India

Rhea Suzanne John<sup>1</sup>, K Shreedhara Avabratha<sup>2</sup>, \*Sweta Shanbhag<sup>3</sup>

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### Abstract

**Introduction:** India reported its first case of coronavirus disease 2019 (Covid-19) on 30th January 2020. During the first wave, it was noted that older individuals with comorbidities were mainly affected and in the second wave younger people including children were also affected.

**Objectives:** To assess the clinico-epidemiological profile, investigations and outcomes in children admitted with Covid-19 to a Medical College Hospital in Mangalore, Karnataka, India and to compare the first and second waves.

**Method:** In this ambispective descriptive study, all patients below 18 years of age with a confirmed diagnosis of Covid-19 or Multisystem Inflammatory Syndrome in Children (MIS-C), admitted to a Medical College Hospital in Mangalore, Karnataka, India from April 2020 to July 2021 were included. Epidemiological data, symptoms, clinical management and outcomes were noted and the differences between the two waves were assessed.

**Results:** A total of 64 children (27 from the first wave and 37 from the second wave) were included; 25 (39%) children were exposed to a Covid-19 suspect with parents being the major source. The age groups mainly affected were 1-5 years (30%) and 11-18 years (27%); 56 (87%), 3 (5%) and 5 (8%) had mild, moderate and severe Covid-19 respectively and there was one death; 39 (61%) had fever, 13 (20%) had febrile convulsions and 3 were co-infected with dengue; 25 (40%) children were admitted to the intensive care unit (ICU), of whom 9

had MIS-C, with 5 being severe. Among the admissions, a significantly higher female incidence (OR 2.9, 95% CI 1.02-8.28, p=0.04) was noted in the second wave. ICU admissions were also higher in the second wave (OR-1.7, 95% CI 0.45-4.7, p=0.31) but this was not statistically significant.

**Conclusions:** Majority of children had no known contact with a Covid-19 suspect and had mild disease. More children were affected in the second wave compared to the first. Fever was the most common complaint with seizures and gastrointestinal complaints being next. The most common age groups affected were 1-5 years and 11-18 years.

(Key words: Covid -19, MIS-C, Children, CB-NAAT, SARS-CoV-2)

### Introduction

Coronavirus disease 2019 (Covid-19) was first reported in Wuhan, China, in December 2019<sup>1</sup> and India reported its first case on 30<sup>th</sup> January 2020<sup>2</sup>. Genetic sequencing of the virus suggested that it is a beta coronavirus closely linked to the Severe-Acute-Respiratory-Syndrome (SARS) virus<sup>1</sup>. The World Health Organisation (WHO) declared Covid-19 a pandemic on 12<sup>th</sup> March 2020<sup>2</sup> and in India there was a nationwide lockdown from 24<sup>th</sup> March to 3<sup>rd</sup> May 2020<sup>2</sup>. During the first wave of Covid-19 it was noted that older individuals with comorbidities and males were mainly affected and children rarely<sup>3</sup>. Thereafter, mutations to the virus led to the second wave peaking around March 2021 in India<sup>4</sup>. This was a deadlier wave spreading faster with a higher mortality and involving younger people including children<sup>4</sup>. There was also widespread speculation about the emergence of a third Covid-19 wave which would mainly affect children as this was the population that was not yet vaccinated<sup>5</sup>.

**Objectives** To assess the clinical features, investigations and outcomes in children admitted with Covid-19 in a Medical College Hospital in Mangalore, Karnataka, India from April 2020 to July 2021 and to compare the clinical profile between the first and second Covid -19 waves.

### Method

In this ambispective descriptive study, all patients below 18 years, with a confirmed diagnosis of

<sup>1</sup>Post Graduate, <sup>2</sup>Professor and Head, <sup>3</sup>Senior Resident, Department of Paediatrics, Father Muller Medical College, Mangalore, Karnataka, India

\*Correspondence:

drswetashanbhag@fathermuller.in



<https://orcid.org/0000-0002-5825-763X>

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Covid-19 or Multisystem Inflammatory Syndrome in Children (MIS-C), admitted in our hospital from April 2020 to July 2021 were included. A few cases of MIS-C who were Covid -19 negative and only antibody positive. were also included. Epidemiological data, symptomatology, investigations, management, severity of Covid-19 and outcomes were noted and differences between the two waves assessed. Data were collected from medical records and also during treatment.

**Severity definitions:**

- *Mild Covid-19 infection:* upper airway symptoms, normal pulmonary examination and child may have other symptoms, like gastrointestinal or seizures<sup>6</sup>.
- *Moderate Covid-19 infection:* clinical signs of pneumonia, oxygen saturation (SpO<sub>2</sub>) ≤94% in room air, requiring oxygen and having lung infiltrates on imaging<sup>6</sup>.
- *Severe Covid-19 infection:* respiratory distress with SpO<sub>2</sub> ≤90% in room air, requiring mechanical ventilation or High Flow Nasal Cannula (HFNC) and having lung infiltrates on imaging<sup>6</sup>.
- MIS-C: Children and adolescents 0-18 years of age with fever ≥ 3 days, and any 2 of the following:
  1. Rash or bilateral non-purulent conjunctivitis or muco-cutaneous inflammation signs (oral, hands or feet)
  2. Hypotension or shock
  3. Features of myocardial dysfunction, pericarditis, valvulitis, or coronary abnormalities including echocardiographic findings or elevated troponin / N-terminal pro-B-type natriuretic peptide (NT-proBNP)
  4. Evidence of coagulopathy (by prothrombin time/activated partial thromboplastin time/D-dimer)
  5. Acute gastrointestinal problems (diarrhoea, vomiting, abdominal pain)

AND elevated markers of inflammation (erythrocyte sedimentation rate, C-reactive protein, procalcitonin)

AND no other obvious microbial cause of inflammation, including bacterial sepsis, staphylococcal or streptococcal shock syndromes

AND evidence of Covid-19 [Reverse transcription-polymerase chain reaction (RT-PCR), antigen test or serology positive] or likely contact with patients with Covid-19<sup>7</sup>.

All children admitted with a diagnosis of Covid-19 as confirmed by RT-PCR, rapid antigen test (RAT), cartridge-based nucleic acid amplification test (CB-NAAT), isothermal nucleic acid amplification test (INAAT) or diagnosis of MIS-C as confirmed by immunoglobulin G (IgG) antibody test were included. Suspected cases of Covid-19 who tested negative for Covid-19 antigen or antibody were excluded.

**Ethical issues:** Ethical clearance was obtained from the Father Muller Institutional Ethics Committee, Mangalore, Karnataka, India (Ref. No. FMIEC/CCM/56/2021, dated 19/01/2021). Written informed consent was obtained from the parents of the children participating in the study.

**Statistical analysis:** The categorical data were expressed in terms of frequency and percentage, Continuous data was expressed in terms of mean and standard deviation, Pearson Chi Square test and independent t-test were done to find whether the difference between the two waves was significant.

**Results**

A total of 64 participants were included over a period of 16 months (April 2020 to July 2021), 27 in the first wave and 37 in the second wave. The female to male ratio was 40:24 (1.7:1); 39 (61%) children had no history of exposure to suspects, whilst 25 (39%) children were exposed to a Covid-19 suspect with parents being the major contact; 57 (89%) children were symptomatic and 7 (11%) were asymptomatic. Out of our entire population, 56 (87%), 3 (5%) and 5 (8%) children had mild, moderate and severe forms of Covid-19 respectively, of which 1 (1.6%) death was recorded. The clinical features of the 57 symptomatic children are shown in Table 1. Of the 13 children with convulsions, 9 were febrile convulsions. Three were co-infected with dengue and 9 (14%) were surgical cases who were incidentally found to be Covid-19 positive.

**Table 1**  
*Clinical features of children with Covid-19 (n=57)*

Symptom	*Number (%)
Fever	38 (59)
Convulsions	13 (20)
Vomiting	12 (19)
Abdominal pain	09 (14)
Cough, coryza	09 (14)
Breathlessness	04 (06)
Rash	04 (06)
Throat pain	03 (05)
Diarrhoea	02 (03)

\*More than one response was possible

Of the 64 children, 23% were less than one year of age, 30% were 1-5 years of age, 20% were 6-10 years of age and 27% were 11-18 years of age. The modes of testing were RT-PCR in 38 (59%), CB-NAAT in 20 (31%), INAAT in 1 (2%) and SARS antibody test in 5 (8%) children.

Of the 64 children, 9 (14%) had a diagnosis of MIS-C. Among these, 5 (56%) were severe and presented with shock, of which 1 also had dengue co-infection. The remaining 4 had mild disease, of which one was a known case of cyanotic heart disease, the other was a known case of bronchial asthma and the other 2 had Kawasaki disease like features. It was seen that out of 64 children, 18 (28%) had some underlying comorbidity, such as bronchial asthma, seizure disorder or cancer. Out of the 18 children with comorbid conditions, 5 had associated MIS-C, 1 had moderate and 2 had severe Covid-19.

Of the 64 children, 38 (59%) had a chest x-ray taken of which, 11 (29%) showed some abnormality; 9 chest x-rays showed opacities, 1 showed pleural effusion alone and 1 showed a syn-pneumonic

effusion; 2 high resolution computed tomography (HRCT) scans were done and both had low Covid-19 reporting and data system (CORAD) scores.

Twenty-six (40%) of the cases required ICU care; 6 (23%) cases required oxygen support and 3 (12%) required ventilatory support. Of these 6 patients, 1 was diagnosed as MIS-C, 3 were moderate in severity and 2 were suffering from severe Covid-19. All 9 MIS-C patients received steroids and 3 among the severe ones received intravenous immunoglobulin.

**Comparing the two waves**

Second wave accounted for 58% of admissions with a female preponderance and with more children hailing from rural localities. The number of children with a positive contact history were more in the 2<sup>nd</sup> wave as compared to the 1<sup>st</sup> wave. Majority of affected children belonged to the age group of 1-5 years in 1<sup>st</sup> wave and ≤ 1 year during the 2<sup>nd</sup> wave. More children had abnormalities in chest x-ray during the 2<sup>nd</sup> wave as depicted in Table 2.

**Table 2: Clinico-epidemiological characteristics of Covid-19 in first and second waves in children**

Variable	Categories	First wave* n (%)	Second wave** n (%)	Total	OR	95% CI	p value
Age group	< 1 year	03 (20.0)	12 (80.0)	15	-	-	0.15 NS
	1-5 years	09 (47.0)	10 (53.0)	19			
	6-10 years	08 (61.5)	05 (38.5)	13			
	11-18 years	07 (41.0)	10 (59.0)	17			
Gender	Female	13 (32.5)	27 (67.5)	40	2.9	1.02-8.28	0.04 sig
	Male	14 (58.0)	10 (42.0)	24			
Locality	Rural	13 (38.0)	21 (62.0)	34	1.4	0.52-3.82	0.49 NS
	Urban	14 (47.0)	16 (53.0)	30			
Contact history	Positive	09 (35.0)	17 (65.0)	26	1.7	0.6-4.75	0.31 NS
	Negative	18 (47.0)	20 (53.0)	38			
Severity of Covid-19 on presentation	Mild / moderate	23 (42.0)	32 (58.0)	55	1.11	0.26-4.6	Fisher exact - 1 NS
	Severe	04 (44.0)	05 (56.0)	09			
Chest x-ray findings#	Abnormal	04 (36.0)	07 (64.0)	11	1.4	0.33-5.93	Fisher exact - 0.72 NS
	Normal	12 (44.0)	15 (56.0)	27			

\*n1=27, \*\*n2=37 NS: not significant, sig: significant # Chest X ray was needed and done only for 16 children in the first wave and 22 children in the second wave

Investigations revealed that 33% had elevated C-reactive protein (CRP), 47% had elevated D-dimer, 18% had high ferritin levels and 10% had high lactate dehydrogenase (LDH) levels. The mean value of CRP was 31mg/L, D-dimer was 755.8ng/mL, ferritin was 622ng/mL and LDH was

204 IU/L. Independent t-test was done to compare the inflammatory markers between the two waves and it was found that there were no significant difference between the two groups as depicted in Table 3.

**Table 3: Mean, standard deviation and p-values of inflammatory markers**

Investigation	Wave	Total number	Mean	Standard deviation	p-value
C-reactive protein	1	27	24.31	68.73	0.60 NS
	2	37	34.34	78.13	
d-Dimer	1	27	1456.81	6447.37	0.30 NS
	2	37	244.27	310.30	
Serum ferritin	1	27	324.21	1027.51	0.34 NS
	2	37	839.48	2659.64	
Lactate dehydrogenase	1	27	152.44	269.65	0.20 NS
	2	37	241.95	278.05	

NS: not significant

Children requiring ICU admissions were more in the 2<sup>nd</sup> wave but requirement of ventilatory support was higher in 1<sup>st</sup> wave, but this was not statistically significant. The proportion of children with MIS-C was more in the 1<sup>st</sup> wave as compared to 2<sup>nd</sup> wave,

although absolute number of cases were more in the 2<sup>nd</sup> wave. One death was recorded in the 1<sup>st</sup> wave whereas no deaths occurred during the 2<sup>nd</sup> wave as depicted in Table 4.

**Table 4: Clinical outcomes among children with Covid-19 in both waves**

Outcome variable	Categories	First wave* n (%)	Second wave** n (%)	Total	OR	95% CI	P value
ICU admission	Required	09 (35.0)	17 (65.0)	26	1.7	0.45-4.7	0.31 NS
	Not required	18 (47.0)	20 (53.0)	38			
Need for mechanical ventilator	Not required	02 (67.0)	01 (33.0)	03	0.34	0.024-4.04	Fisher exact - 0.56 NS
	Required	25 (41.0)	36 (59.0)	61			
MIS-C	Developed	04 (44.0)	05 (56.0)	09	0.89	0.21-3.71	Fisher exact - 1 NS
	Not developed	23 (42.0)	32 (58.0)	55			
Mortality	Yes	1	0	1			Fisher exact- 0.42 NS
	No	26 (41.0)	37 (59.0)	63			

\*n1=27, \*\* n2=37 ICU: intensive care unit, MIS-C: Multisystem inflammatory syndrome in children, NS: not significant

### Discussion

In our study, 38 (60%) children presented with fever, 13 (21%) with convulsions (9 of which were febrile convulsions), 9 (14%) had coryza and cough, 3 (5%) had no symptoms at all, 3 were co-infected with dengue and 9 (14%) were surgical cases who were incidentally found to be Covid-19 positive. In a study by Li B, *et al*<sup>8</sup>, the most prevalent presenting symptoms were fever (64%) and cough (59%). Bhuiyan MU, *et al*<sup>9</sup> found the most prevalent presenting symptom to be fever. Cabraal MNS, *et al*<sup>10</sup> noted that the most prevalent presenting symptoms were dry cough (63%) and fever (33%). Nallasamy K, *et al*<sup>11</sup> also found fever to be the commonest symptom (32%) with cough and hurried breathing being the next common complaints, which were not so frequent in our study. Patel NA, *et al*<sup>12</sup> found cough to be the most common symptom (48%) in their population which was around 14% in our study. It was seen that 30% of toddlers (1-5 years), 27% of teenagers (11-18 years), 24% of infants and only 2 (3%) newborns were affected in our study, which is in agreement with the study by Cabraal MNS, *et al*<sup>10</sup> where the most affected age group were 1-5 years and 10-14 years. However, Bhuiyan MU, *et al*<sup>9</sup>, in their systematic review and meta-analysis of 1,964 articles from all over the world found that 50% of the young population affected were infants and that 5 out of 139 newborns born to Covid-19 positive mothers were positive for Covid-19.

Out of our entire study population, 56 (87.5%), 3 (4.7%) and 5 (7.8%) of children had mild, moderate and severe forms of Covid-19 respectively, of which 1 (1.6%) death was recorded. Yasuhara J, *et al*<sup>13</sup> found most children with Covid-19 to be asymptomatic or mild and there were no deaths reported in their review. Bhuiyan MU, *et al*<sup>9</sup> discovered from their meta-analysis that more than half of their 1214 subjects, were asymptomatic and

the majority were suffering from a mild form of the illness and recorded one death. Severe illness was seen in about 9% of children in our study, whereas in a study by Nallasamy K, *et al*<sup>11</sup>, it was almost double. Sahana KS, *et al*<sup>14</sup> found that 25% of children had some comorbidity, which was almost similar to our study (28%) and this may be partly attributed to the fact that both studies were conducted in the same geographical area. Nallasamy K, *et al*<sup>11</sup> found that severe illnesses were more in infants with comorbidities. Kumar R, *et al*<sup>15</sup> noted that children with a pre-existing comorbidity were at risk for the severe form of the disease.

Our study showed that 38 (60%) children had undergone RT-PCR, 20 (32%) had CB-NAAT done, 1 (2%) had INAAT done and 5 (8%) had done SARS antibody test. Wu Q, *et al*<sup>16</sup> noted that 46% patients had nucleic acid testing and 13.5% children underwent RT-PCR with faecal specimens. Bhuiyan MU, *et al*<sup>9</sup> had used only RT-PCR method of screening, for any sort of fluid specimen, to detect the Covid -19 infection.

Laboratory investigations in our study revealed that 33% had elevated CRP, 47% had elevated D-dimer, 18% had high serum ferritin levels and 10% had high LDH levels. Yasuhara J, *et al*<sup>13</sup> found that their main laboratory findings were lymphopenia (33%), elevated D-dimer (52%) and elevated CRP (40%). Wu Q, *et al*<sup>16</sup> found abnormalities in leucocyte count in 23 (31%) children, and abnormal lymphocyte count in 10 (13.5%) children. In our study the mean value of CRP was 31mg/L, D-dimer was 755.8ng/mL, serum ferritin was 622ng/mL and LDH was 204IU/L. Li B, *et al*<sup>8</sup> noted mildly elevated mean CRP level of 11.22 and ESR of 18.8 in their 22 patients. Wu Q, *et al*<sup>16</sup> and Qiu H *et al*<sup>17</sup> noted that 96% and 89% of children were household contacts of adults respectively. Nallasamy K, *et al*<sup>11</sup> found that 74% of the children were exposed to a

household contact whereas in our study, a little more than one third of the population were exposed to a household contact.

Our study had identified 9 (14%) children with a diagnosis of MIS-C, out of which 5 (56%) were severe and presented with shock and 1 had dengue co-infection. The remaining 4 had mild disease, of whom 2 had Kawasaki disease like features. Yasuhara J, *et al*<sup>13</sup> identified 17 (15%) patients with MIS-C manifesting with symptoms overlapping with, but distinct from, Kawasaki disease, including gastrointestinal symptoms, left ventricular systolic dysfunction, shock, and marked elevated inflammatory biomarkers. In our study, 40% of the cases required ICU care, half of them for initial observation, which was similar to a study by Sahana KS, *et al*<sup>14</sup> (34%), whereas Yasuhara J, *et al*<sup>13</sup> found that 12% of their patients, including 65% of the MIS-C cases required intensive care because of hypotension. In our study out of 64 children, 11 (29%) chest x-rays showed some abnormality; similarly, Kumar R, *et al*<sup>15</sup> noticed that 30% of their population had abnormal chest radiological findings.

Comparison between the 1<sup>st</sup> and 2<sup>nd</sup> wave in our study showed the 2<sup>nd</sup> wave accounting for more admissions with case fatality rate in 2<sup>nd</sup> wave being lower than that in 1<sup>st</sup> wave, which was in agreement with a Spanish study by Iftimie S, *et al*<sup>18</sup>. The severity of cases was more in 1<sup>st</sup> wave in our study, similar to another Indian study by Jain VK, *et al*<sup>19</sup>. The number of children with a positive contact history were less in the 1<sup>st</sup> wave in our study, quite similar to that found in a cross-sectional study done by Chua GT, *et al*<sup>20</sup> in Hong Kong.

Our study belongs to the very few studies that have been done on paediatric Covid-19 in South India which have included and compared both waves. The limitations were that there were fewer subjects and long term follow up was not done after discharge. Furthermore, asymptomatic cases were neither tested nor admitted, hence findings might have been missed.

### Conclusions

Our study found that majority of the children who had Covid-19 infection had no contact with a Covid-19 suspect case and most had mild infections. Although the numbers of children affected in the second wave were more, there was no mortality.

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