

Clinical and Epidemiological Profile of Children with COVID-19 in a Tertiary Care Center in Tamil Nadu

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ABSTRACT

Introduction: Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) infection, leading to Corona Virus Disease-2019 (COVID-19) has been a recent pandemic and has spread all over India. Many children with SARS-CoV-2 infection were referred to our tertiary care center from April 2020 to till date. COVID-19 has been an extremely severe infectious disease. However, very few studies have focused on the epidemiological characteristics of this disease in children.

Aim: To identify the clinical and epidemiological profile of children with COVID-19 in a tertiary care centre in South India.

Materials and Methods: During the recent pandemic of COVID-19, in Chengalpattu district, Tamil Nadu, this cross-sectional study was done in children with SARS-CoV-2 infection, from March 2020 to June 2021 at Paediatric Department, Chengalpattu Medical College Hospital, Tamil Nadu. A total of 191 children who were tested positive for SARS-CoV-2 were admitted to the isolation ward of our institution, as per the Indian Council of Medical Research (ICMR) guidelines and was monitored till discharge or death. The clinical features including fever, cough, diarrhoea, respiratory distress were noted with mean duration of symptoms. Laboratory parameters like leucocytosis/leucopenia, thrombocytosis/thrombocytopenia,

c-reactive protein (CRP), D-dimer (D fragments of protein fibrin) and serum ferritin were noted.

Results: Among the total study population of 191 children, 108 (56.54%) children were of age group between 5 years to 12 years. Majority of children, 136 (71.2%), were asymptomatic and the disease has more incidence in boys than girls {104 (54.45) % vs. 87 (45.55%)}. Eight (4.19%) children had comorbid illness. A total of 166 (86.91%) children were infected with SARS-CoV-2 during first wave and 25 (13.09%) children were infected during second wave. Among the study population of 55 (28.8%) symptomatic children, fever was the predominant symptom in 27 (14.14%) children followed by fever with cough in 10 (5.23%) children. Mean duration of symptoms were 4.5±1.3 days. The CRP was elevated in 13 (6.80%) of children. Out of 11 (5.79%) children who required oxygen and ventilator support, 6 (3.14%) required only oxygen. Three children had features suggestive of Multisystem Inflammatory Syndrome in Children (MIS-C) of which one child died.

Conclusion: In the present study, most of the children were asymptomatic. The prevalence of symptomatic COVID-19 was low in children. The incidence of severe COVID-19 infection in this study was very low. The most severe form of the disease was MIS-C. Mortality is low in the present study group and it occurs in patients with underlying disease or morbid obesity.

Keywords: Comorbidity, Coronavirus Disease-2019, Multisystem inflammatory, Obesity, Severe, Systemic syndrome

INTRODUCTION

COVID-19 that broke out in December 2019 and has been spreading globally; the causative pathogen was isolated and was named as SARS-CoV-2; which was initially presenting as typical pneumonia. Due to rapid spread of COVID-19, the World Health Organisation (WHO) has declared the disease as a public health emergency of international concern [1]. The main symptoms were fever and cough, followed by myalgia, headache, fatigue, and laboratory tests usually showing leucopenia and leucocytosis. Most of the infected people were mildly ill, but severely ill patients can deteriorate and develop various serious complications and might even lead to death [2].

As on 6th November 2020, total of 64,193 children aged below 12 years had tested positive for SARS-CoV-2 in Tamil Nadu, and < 5% of the paediatric population had tested positive for SARS-CoV-2. As on 14th June 2021, Tamil Nadu has recorded 85,116 COVID-19 cases in the age group of 0 to 12 years [3].

The severity of COVID-19 in children is rare. Most SARS-CoV-2 infected children has been asymptomatic or with mild symptoms, most commonly with fever and cough, followed by myalgia, headache, fatigue, pharyngitis, gastrointestinal symptoms, and odour or taste changes [4]. Large epidemiological studies show that only 1-2 percent of children are affected by SARS-CoV-2 [5].

COVID-19 affects children of all ages. Clinical manifestations of COVID-19 are rare or absent in children and adolescents [6]. The average incubation period in children is about 6.5 days, which is slightly longer than the 5.4 days reported in adults. There is no significant difference between the genders in paediatric patients [7]. It has been suggested that children and adolescents have similar viral loads and as a result, they are as like as adults in transmission of SARS-CoV-2 [8,9]. More recent studies report that children are less likely to get infected after having contact with a SARS-CoV-2 positive individual [10]. Serological surveys has demonstrated that, case-based surveillance may lead to underestimation of disease, prevalence of SARS-CoV-2 infection among children and therefore it remains crucial to establish whether there exists a significant role for children in disease transmission [11].

Since SARS-CoV-2 is a newer disease, the clinical and epidemiological profile may be varied in different geographical locations. As this study was done in a peripheral tertiary care centre, which caters to children from at least four nearby districts with poor socio-economic background, this study will throw a light on clinical features, severity and outcome in children, so that we will have a clear picture about the need for further detailed studies on the effect of this pandemic in children and also the preparation needed to tackle a possible

third wave. Hence, this study was conducted to describe the clinical and epidemiological characteristics of children who are tested positive for SARS-CoV-2 infection and got admitted in our hospital.

MATERIALS AND METHODS

Study site: This prospective observational study was done, after obtaining approval from Institutional Ethical Committee meeting held on 18.08.2020 at Chengalpattu Medical College, Tamil Nadu, India (Ref.No.5945), in children who got admitted in Paediatric Department, Chengalpattu Medical College Hospital from March 2020 to June 2021.

Reverse Transcriptase -Polymerase Chain Reaction (RT-PCR) was performed in all patients as mentioned below:

1. All children having contact with COVID-19 positive patients
2. All patients having symptoms consistent with severe acute respiratory infection like fever, cough, respiratory distress, sore throat and myalgia.

During this study period, children who were tested positive by RT-PCR for SARS-CoV-2, based on the inclusion criteria, a total of 191 children were admitted to the isolation ward at the Department of Paediatrics and were enrolled in to the study.

Inclusion criteria: All children of age group between 1 month to 12 years who were tested positive for SARS-CoV-2 and got admitted in our hospital were included in the study after obtaining the informed consent from their parents.

Exclusion criteria: Children those were tested positive for SARS-CoV-2 and opted for home quarantine by parent /caregiver and those children whose parents who did not give consent to participate in the study.

The symptom status, co-morbid illness, date of onset symptoms, date of admission and discharge were recorded and were considered as primary outcome variables while age and gender were considered as secondary variables. All children were monitored till discharge or death.

STATISTICAL ANALYSIS

Data obtained were entered into the excel sheet, cleaned and coded for the analysis. Descriptive analysis was carried out by frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like pie diagram and bar charts. Categorical outcomes were compared between study groups using the Chi-square test/Fisher's Exact test (If the overall sample size was <20 or if the expected number in any one of the cells is <5, Fisher's-exact test was used). Data was also represented using appropriate diagrams like a cluster bar chart. The p-value <0.05 was considered statistically significant. International Business Management (IBM) Statistical Package for Social Sciences (SPSS) version 22.0 was used for statistical analysis.

RESULTS

Among the study population of 191 children, 108 (56.54%) children were in age group between 5 to 12 years, 58 (30.37%) children between >1 to ≤ 5 years and 25 (13.09%) children were between 1 month to ≤ 1 year. 104 (54.45%) children were boys. 136 children were asymptomatic whereas 55 children were symptomatic (71.2% vs.28.80%). A total of 8 (4.19%) children had a co-morbid illness. 166 (86.91%) children were infected during 1st wave (occured from Mar 2020 to Oct 2020) and 25 (13.09%) were infected during 2nd wave (occured from Apr 2021 to June 2021). Fever alone was the predominant symptom in 27 (14.14%) children followed by fever with cough 10 (5.23%), fever, cough and respiratory distress in 7 (3.66%), fever and diarrhoea in 4 (2.09%) and fever with respiratory distress in 2 (1.05%). Mean duration of symptoms was 4.5±1.3 days [Table/Fig-1].

Parameters	Frequency (Percentage)
Age	
1 month to ≤1 year	25 (13.09%)
>1 year to ≤5 years	58 (30.37%)
>5 years to 12 years	108 (56.54%)
Gender	
Boys	104 (54.45%)
Girls	87 (45.55%)
Symptom	
Symptomatic	55 (28.80%)
Asymptomatic	136 (71.20%)
Co-morbidity	
Present	8 (4.19%)
Obesity	2 (1.05%)
Recurrent respiratory illness	6 (3.14%)
Absent	183 (95.81%)
Wave	
1 st wave	166 (86.91%)
2 nd wave	25 (13.09%)
Single Symptom	
Fever only	27 (14.14%)
Cough only	3 (1.57%)
Respiratory distress only	1 (0.52%)
Diarrhoea only	1 (0.52%)
Constellation of symptoms	
Fever and cough	10 (5.23%)
Fever, cough and respiratory distress	7 (3.66%)
Fever and diarrhoea	4 (2.1%)
Fever and respiratory distress	2 (1.05%)
Nil symptoms	136 (71.2%)

[Table/Fig-1]: Details of baseline parameters in the study population (N=191).
*Children with single symptom and constellation of symptoms have been categorised separately without overlapping of data

A total of 45 (41.6%) children aged between >5 to 12 years were symptomatic, 28 (25.92%) boys were symptomatic. The difference in proportion between age group and symptom status was statistically significant (p-value 0.005). No statistical significance was observed between gender and symptom status (p-value 0.532). 3 (2.78%) boys aged between > 5 to 12 years and 5 (5.75%) girls had co-morbid illness. The difference in proportion for age group and gender between co-morbid statuses was not statistically significant (p-value 0.110 and 0.472 respectively).

Majority of children, in age group of 5 to 12 years, were infected during 1st wave, 99 (59.64%) when compared to 9 (36%) children infected during 2nd wave. In age group between >1 to ≤ 5 years 52 (31.33%) were infected during first wave and 6 (24%) children during 2nd wave. On the contrary, majority of children, 10 (40%), aged between 1 month to ≤1 year were infected during second wave. The difference in proportion for the age group between waves was statistically significant (p-value <0.001). A total of 90 (54.22%) boys and 76 (45.78%) girls were infected during first wave and 14 (56%) boys and 11 (44%) girls were infected during second wave. This difference in proportion, for the gender, between two waves was not statistically significant (p-value 0.867) [Table/Fig-2].

Leucocytosis was present in 42 (21.9%) and leucopenia in 13 (12%) children. Thrombocytosis was observed in 46 children (24.08%) followed by thrombocytopenia in 9 (4.71%) children. CRP was elevated in 13 (6.80%) children. D-dimer was elevated in 5 (2.61%) children. Ferritin was elevated in 8 (4.18%) children [Table/Fig-3].

Parameter	Symptom status		Chi-square	p-value
	Symptomatic	Asymptomatic		
Age				
1 Month to ≤1 year (N=25)	14 (56%)	11 (44%)	10.745	0.005
>1 year to ≤5 years (N=58)	16 (27.59%)	42 (72.41%)		
>5 years to 12 years (N=108)	25 (23.15%)	83 (76.85%)		
Gender				
Boys (N=104)	28 (26.92%)	76 (73.08%)	0.391	0.532
Girls (N=87)	27 (31.03%)	60 (68.97%)		
Parameter	Co-morbidity		Chi-square	p-value
	Yes	No		
Age				
1 month to ≤1 year (N=25)	3 (12%)	22 (88%)	4.416	0.110
>1 year to ≤5 years (N=58)	2 (3.45%)	56 (96.55%)		
>5 years to 12 years (N=108)	3 (2.78%)	105 (97.22%)		
Gender				
Boys (N=104)	3 (2.88%)	101 (97.12%)	0.967	0.472
Girls (N=87)	5 (5.75%)	82 (94.25%)		
Parameter	Wave		Chi-square	p-value
	1 st wave (N=166)	2 nd wave (N=25)		
Age				
1 month to ≤1 year	15 (9.04%)	10 (40%)	18.447	<0.001
>1 year to ≤5 years	52 (31.33%)	6 (24%)		
>5 years to 12 years	99 (59.64%)	9 (36%)		
Gender				
Boys	90 (54.22%)	14 (56%)	0.028	0.867
Girls	76 (45.78%)	11 (44%)		

[Table/Fig-2]: Comparison of age and gender across symptom status, co-morbidity and wave (N=191).

S. no	Laboratory parameters	Mean±SD	Laboratory abnormalities	Frequency (Percentage)
1	WBC (White blood cell count) (μL)	10018±592	Leukopenia (<4000/μL)	13 (6.8%)
			Leukocytosis (≥5000/μL)	42 (21.9%)
2	Haemoglobin (Normal-12-14 gm/dL)	11.18±4.51 gm/dL	Decrease in haemoglobin	55 (28.7%)
3	Platelet (μL)	300331.21±145581.31	Thrombocytosis (≥450000/μL)	46 (24.1%)
			Thrombocytopenia (≤150000/μL)	9 (4.7%)
4	CRP (mg/dL)	21±1.2	> 6 mg/dL	13 (6.81%)
5	D dimer (g/L)	0.7±0.2	>0.5	5 (2.62%)
6	Ferritin (ng/mL)	600.21±23.21	500	8 (4.2%)

[Table/Fig-3]: Laboratory profile in COVID-19 affected children (N=191). CRP: C-Reactive Protein; D-dimer: D fragments of protein fibrin- dimer

Of 191 children, only 6 (3.14%) required oxygen, 2 (1.04%) required Non Invasive Positive Pressure Ventilation (NIPPV) and 3 (1.57%) required mechanical ventilation [Table/Fig-4]. Most common antibiotic used were oral Azithromycin (18.1%), oral Doxycycline (4.71%) [Table/Fig-5]. All children were monitored till discharge and the mean±SD duration of hospital stay was 3 days±2 SD. Of total 191 admissions, only 3 (1.57%) had features suggestive of MIS-C and they were treated with supportive management along with Intravenous Immune Globulin (IVIG), mechanical ventilation of which 1 (0.52%) child died and other 2 children got survived.

Modality	Frequency (Percentage)
Oxygen	6 (3.14%)
NIPPV (Non invasive positive pressure ventilation)	2 (1.04%)
Mechanical ventilation	3 (1.57%)

[Table/Fig-4]: Cases managed with Oxygen and ventilation (N=11). *% values calculated out of 191

S. no.	Antibiotics	Frequency (Percentage)
1	(Oral) Azithromycin	35 (18.3%)
2	(Oral) Doxycycline	9 (4.7%)
3	(iv) Ceftriaxone	8 (4.18%)
4	(iv) Meropenem	4 (2.09%)
5	(iv) Vancomycin	4 (2.09%)

[Table/Fig-5]: Cases managed with Antibiotics (N=60). *% values calculated out of 191; i.v.: Intravenous

DISCUSSION

In the present study, among 191 children, most of them were asymptomatic and 96% of children do not have any co-morbidity. Children are infected, but lesser than adults, (37.3% vs. 51.4%) by the SARS-CoV-2 virus as reported by Jones T et al., [12]. Fortunately, the disease COVID-19 is very mild in the vast majority of infected children according to the study done by Brodin P; [13]. A recent study by Moraleda C et al., states that despite the mild COVID-19 infection in children, severe hyper inflammatory disorders appearing 1-2 months after an acute infection are a cause for concern [14]. Some studies by Shekerdemian L et al., and Gotzinger F et al., revealed that adolescents of age between 10 to 13 years were more likely to develop severe COVID-19 [15,16].

Children with co-morbidity may get hospitalised for their chronic ailments, are to be evaluated in more detail as they have been diagnosed incidentally to have COVID-19 infection. A study by Kim L et al., showed that asthma, immunosuppression, congenital heart disease, kidney disease and obesity are some of the common co-morbidities reported in children with COVID-19 infection, which are similar to findings of the present study [17].

Fewer children have been affected by the COVID-19 pandemic, than adults and children have different clinical manifestations when compared to adults [18]. The prognosis for COVID-19 pneumonia is good in children with no underlying diseases [19]. In the present study, of 1 year 3 months duration, a total of 191 children were admitted, of which 108 (56.5%) children were in the age group of > 5 to 12 years. In United States, up to 5% of total infected patients were children but < 1% of admitted cases was children [20,21]. Similar incidence was reported in our institution (data not presented here). In the study by Dong Y et al., 731 children were positive for COVID-19, of whom more than 90% were asymptomatic or with mild to moderate symptoms whereas in the present study 71.2% were asymptomatic; 40% of children were aged under five years whereas in the present study 30.37% were under five years [23].

Among symptomatic children in the present study, fever was the predominant symptom 27 (14.14%) children, like other studies [24,25], followed by fever with cough 10 (5.23%), fever, cough with respiratory distress in 7 (3.66%), fever and diarrhoea in 4 (2.09%) and fever and respiratory distress in 2 (1.05%). In the study done by Shahbaznejad L et al., mean duration of symptoms prior to admission was 5:53±3:97 days whereas in the present study mean duration of symptoms was 4.5±1.3 days [26].

Elevated acute phase reactants indicated by CRP test were common in this study; although leucopaenia and thrombocytopenia were seen in a considerable number of the patients, where these abnormalities were also reported in other studies [27,28]. In the

present study, 31.4% of patients required antibiotics. Although, other researchers also treated COVID-19 patients with antibiotics [29,30], there is no strong data about the effectiveness of such drugs in the management of COVID-19.

In the study done by Shahbaznejad L et al., 14% of the patients had comorbid diseases and the mortality rate was 4% while 4.18% had comorbid illness in the present study and our mortality rate was 1.5% [26]. Chao JY et al., reported one mortality out of 67 patients (1.49%) in their study [31]. The mortality of COVID-19 in children was low, as in other studies [32-35]. The presence of co-morbidity is a risk factor for the development of critical illness [36]. In the present study, eight children had co-morbidities; of them three children required oxygen and invasive ventilation. One (0.52%) death was reported in the present study, had occurred during the second wave of COVID-19 pandemic and that child, who died, had underlying diseases in addition to thrombocytopenia, septic shock and pulmonary haemorrhage.

The exact Pediatric Intensive Care Unit (PICU) admission rate in children with COVID-19 remains unknown. Götzinger F and Tagarro A et al., reported an 8% PICU admission rate in their study in Europe and in Spain, 16% of children were admitted to the PICU whereas in the present study, PICU admission rate was 1.57% [16,37]. Although most studies done in adults showed a higher rate of critical illness, its prevalence in children is less [27,38].

Limitation(s)

As time duration of the present study was fixed, sample size was small. As our institution being a referral center, follow-up of the discharged patients could not be done.

CONCLUSION(S)

The prevalence of symptomatic COVID-19 in children is low and the most common indication for admission was fever. The most severe form of the disease is MIS-C. Mortality is low in this age group and it occurs in patients with underlying disease or morbid obesity. Future larger multi-centre studies are recommended for generalisability of the results.

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