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Epidemiological Spectrum of SARS-COV-2 and Co-Infections in Children in Mysuru, India

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ABSTRACT

Background and Objective: The SARS-CoV-2 virus has affected people of all ages. Children with SARS-CoV-2 infections are not a widely explored area, but they are important in prognosticating COVID-19 infections. The aim of this study was to investigate the clinical epidemiological traits of SARS-CoV-2-affected children and their correlation with comorbidities.

Methods: A single-centre retrospective study was done among 81 COVID-19-confirmed children from April to August 2023 in Mysuru, India. Data on epidemiological characteristics, outcome status, and systemic co-infections was analyzed using IBM SPSS 26. The relationship between categorical variables was established using the chi-square test/Fisher's exact test. The level of statistical significance was set at a p-value < 0.05.

Findings: The maximum COVID-19-positive children belonged to the age group of 0-2 (34.6%). Neurological co-infections were the most prevalent at 47.6%, presenting with axial hypotonia, febrile seizures, hypoglycemia, and cerebral encephalopathy. Neurological co-infections were the most prevalent at 47.6%, presenting with axial hypotonia, febrile seizures, hypoglycemia, and cerebral encephalopathy. There was a significant association between outcome status and cardiovascular system involvement (P value = 0.003).

Conclusion: Since most of the children had a co-infections and the most common cause was bactrial infection, children should be monitored for at least one month after hospitalization. The goal is early detection to stop co-infections or empirical treatment in high-risk cases.

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Introduction

COVID-19, an infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), is a highly contagious disease that first emerged in Wuhan, China, in December 2019 and was declared a pandemic by the WHO in March 2020 [1- 3]. Globally, there were more than six confirmed COVID-19 cases [4], of which India has 0.42 million [5]. 18% of the globally reported cases involve adolescents and children below the age of 20 [6, 7] There have been 3.5 million COVID-19 deaths worldwide, and 0.4% of these occurred in children and adolescents [8]. Fever, cough, exhaustion, dyspnea, pneumonia, and other symptoms of the respiratory system are its defining characteristics [9]. In extreme circumstances, it may result in death. Children typically experience neurological co-infections, which can manifest as axial hypotonia, drowsiness, or moaning, indicating encephalopathy [10]. Recent studies have also shown that 20% of children had associated diarrhea [11]. It is crucial to understand the co-infections associated with SARS-CoV-2 in order to decrease its clinical impact. The majority of COVID-19 studies have focused on adults [12-14], but few have examined pediatrics. Since there is insufficient research in India concerning children with Covid-19, we propose this study. The study's goals were to look at the clinic epidemiological characteristics of children who had been infected with SARS-COV-2 and to see if there was a relationship between the outcome status of SARS-COV-2 and other health problems in children between the ages of 2 months and 18 years.

Methods

A retrospective study was done at JSS Hospital, Mysuru, involving 81 children diagnosed with COVID-19 over 5 months (from April to August 2023). The study encompassed asymptomatic and symptomatic children with SARS-CoV-2 aged from 2 months to 18 years. The study excluded children with chronic illnesses, HIV, syndromes, seizures, or significant deformities. Participants were chosen by purposive sampling. The research commenced following approval from the institutional ethics committee. The required sample size for this survey was calculated based on a study conducted by Wu et al. in 2020, which stated that 71.62% of the children admitted to the hospitals had some sort of clinical manifestation and 27.03% of the cases were completely asymptomatic [14]. At a confidence interval of 95% and an absolute precision of 10%, the minimum sample size required was calculated as 79. However, a total of 81 children's data were collected and analyzed for this study (Table 1) [15].

All children aged between 2 months and 18 years presenting to the screening clinic with onset of fever and cough were tested for SARS-CoV-2. This study included all real-time reverse-transcription (RT-PCR) positive cases admitted to the inpatient department. Details regarding socio-demographic characteristics (age, sex), clinical characteristics (travel history, clinical features, comorbidities), and laboratory data (serum CRP, CBC, ferritin, D-dimer, coagulation profile (aPTT, PTT), CK, SGPT, urea, creatinine, plain chest X-ray) of children were collected and analyzed.

Statistical Analysis

The collected data was analyzed using SPSS 26 (Statistical Package for Social Science) for Windows, Version 26.0 (IBM Corporation, Released 2019, IBM SPSS Statistics for Armonk, New York, USA). The demographic characteristics are expressed using the arithmetic mean, standard deviation, and percentages. The data distribution was explained using suitable tables and figures. The relationships between outcome status and systemic co-infections were determined using the Chi-square test or Fisher’s exact test. A p-value <0.05 was considered statistically significant.

Results

The current study analyzed 81 COVID-19 RT-PCR test-positive samples admitted to the JSS hospital in Mysuru, Karnataka.

The male-to-female ratio among the samples was 13:14. The majority of participants were in the 0-2-year age group (34.6%), followed by the > 10 years age group (28.4%). The mean age for the 0-2 years age group was 0.765±0.560 years, and that of the 2-4 years age group was 2.769±1.033 years (Figure 1 and Figure 2).

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Children's clinical severity ranged from asymptomatic (50.3%), critical (8.6%), acute upper respiratory tract infection (32%), and mild cases (30%), indicating that the majority of the cases were asymptomatic, followed by acute upper respiratory tract infection.

Approximately 49.3% of confirmed cases had a co-infection with SARS-CoV-2. Most co-infections were reported within 3 weeks post-SARS-CoV-2 infection.

The most common pathogen responsible for co-infections was bacterial with a percentage of 56.7%, followed by viral at 37.2%. Most kids who had more than one infection had neuronal symptoms like axial hypotonia, febrile seizures, low blood sugar, and cerebral encephalopathy (47.6%). Reports also indicated a high incidence of febrile seizures.

Based on systemic infections, the co-infections were divided into five columns in the present study.

Out of 81 samples analyzed, 5 (6.1%), 4 (4.9%), 20 (24.6%), 10 (12.3%) and 3 (3.7%) had the cardiovascular system, renal system, the central nervous system, gastrointestinal system and endocrine system disorders, respectively. The remaining cases (41) were either asymptomatic or diagnosed with diseases that do not fall into the category of infections. (Table 2, Figure 3, Figure 4).

When assessing the outcome status and systemic co-infections of the COVID-19 infected children, a statistically significant association was observed only with cardiovascular disease (CVD) with a p-value of 0.003, i.e. 2 (40%) of the 5 children with cardiovascular system involvement died compared to other systemic co-infections (Table 3).

Table 1: Diagnosis of clinical types of COVID-19 in children was done based on guidelines by WHO

Clinical types of COVID-19	Clinical Manifestations and Diagnostic Findings
Asymptomatic	Positive RTPCR for sars-cov-2
	Without manifestations of clinical symptoms
	Without abnormal chest imaging findings
Acute upper respiratory tract infection	Symptom fever, cough pharyngeal pain, nasal congestion, fatigue, headache, and Myalgia
	Without signs of pneumonia by chest imaging or sepsis
Mild cases	Without symptoms (sub-clinical type) or with fever or respiratory symptoms such as cough (clinical type)
	Chest imaging indicating pneumonia
Severe cases	Inc respiratory rate;>70times\min(1year) or >50 times/min(>1yr)
	Oxygen saturation 92%
	Hypoxia-assisted breathing (moans, nasal flaring, cyanosis)
	Feeding difficulty with signs of dehydration
Critical cases	Respiratory failure requiring mechanical ventilation
	Septic shock
	Organ failure
RT-PCR- Real-time reverse transcriptase polymerase chain reaction	

Table 2: Categorization of children based on age group

Characteristics	Age group (in years)	
	</=1 years (%)	>1 year (%)
Number of children	28 (59.5)	53 (51.4)
≥1 conditions	6 (12.7)	19 (18.4)
≥3 conditions	0 (0)	1 (0.9)
Diabetes	0 (0)	2 (1.9)
Respiratory distress	2 (4.2)	10 (9.7)
Kidney disease	2 (4.2)	7 (7.1)
Neural Disorders	4 (9.8)	11 (10.6)
Cardiovascular disease	5 (10.6)	0 (0)

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Table 3: Association between the outcome status and systemic co-infections

Characteristics		Outcome		Chi-square	P-Value
		Alive (%)	Dead (%)		
CVS	Yes	3 (60)	2 (40)	31.17	0.003 #
	No	76 (100)	0 (0)		
CNS	Yes	20 (100)	0 (0)	0.672	0.412
	No	59 (96.7)	2 (3.3)		
Renal	Yes	4 (100)	0 (0)	0.107	0.744
	No	75 (97.4)	2 (2.6)		
GIT	Yes	10 (100)	0 (0)	0.289	0.465
	No	69 (97.1)	2 (2.9)		

CVS- Cardiovascular system, CNS-Central nervous system, GIT- Gastrointestinal tract

Fisher's exact test

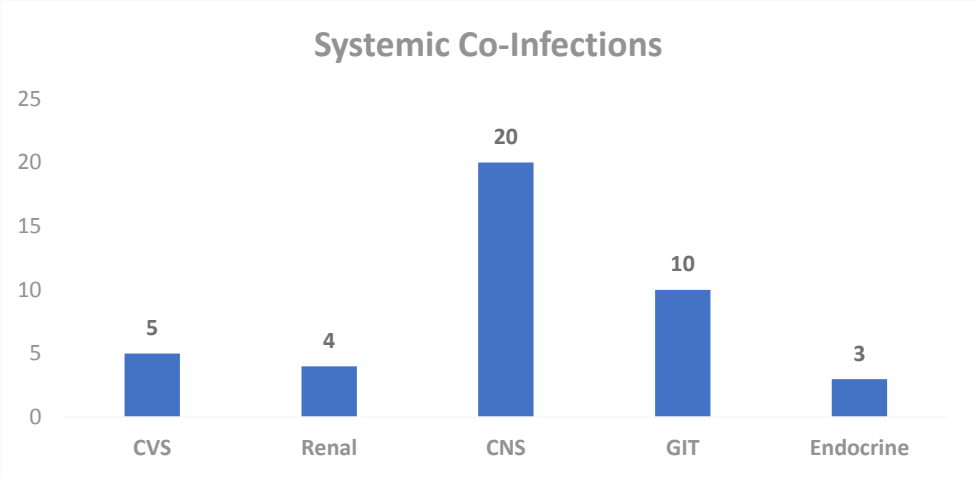

Figure 3: Incidence of systemic co-infections in covid-19 confirmed cases

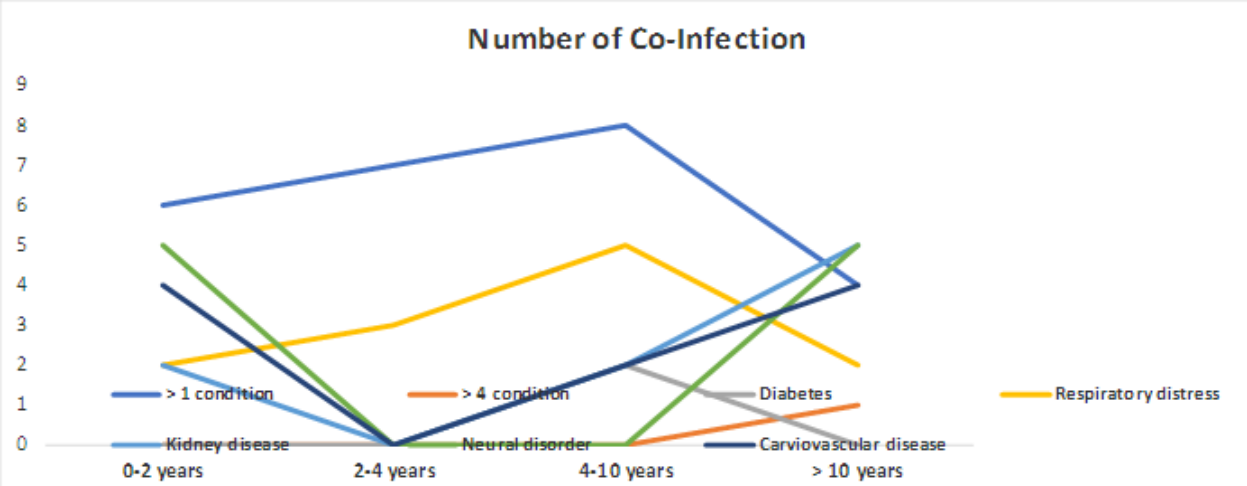

Figure 4: Mean number of co-infections in confirmed COVID-19 cases for age

Discussion

The current study demonstrated that the highest number of confirmed COVID-19 infection cases was in the age group of 0-2 years. A comparable study conducted in China by Dong Y et al. indicated that the most affected age range of children was between 2 and 13 years [16].

The present study also revealed that the epidemiological characteristics of children affected by SARS-CoV-2 exhibit no significant gender

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associations, with a male-to-female ratio of 13:14. This finding aligned with a study by Dong Y et al. [16], representing that the child's sex did not significantly influence disease causation.

The ongoing study suggested that approximately 49.3% of confirmed cases exhibited co-infection with SARS-CoV-2, predominantly reported within three weeks following the initial SARS-CoV-2 infection. In a comparable study conducted by Zhu X et al., the co-infections occurred within 1-4 days of the onset of COVID-19, which was significantly earlier than in our study [13]. This shows how important it is to keep an eye on patients after they've been released from the hospital to lower the number of cases, deaths, and illnesses related to multiple infections. The association of SARS-CoV-2 and co-infections in the current study was significant only for the cardiovascular system. Most of the children with co-infections in the present study had neuronal manifestations. This agrees with the results of a study by Lin et al. [10], indicating that encephalopathy, cerebellar ataxia, and peripheral neuropathy were very common in children who had been infected with SARS-CoV-2.

This study also has a few limitations. Only a small portion of the population could participate in the study, which prevented us from assessing the gender predictions. Furthermore, the findings might not apply to other regions or countries. Future research should evaluate the COVID-19 virus outbreak's long-term effects as well as the changes in children's and adolescents' activity patterns.

Conclusion

The lack of knowledge about the prevalence of SARS-CoV-2 in children and co-infections led to the conduct of this study. Adequate data on the disease will contribute to better management and consequently reduce the morbidity and mortality of the infected children. Based on the results, it is recommended to monitor the children for at least 1 month after discharge from the hospital, as most of the co-infections reported in this study occurred acutely. Early diagnosis to prevent concomitant infections or empiric treatment in high-risk cases is the goal. In addition, hospitals should be equipped with more testing facilities so that systemic examinations can be carried out.

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Ethical Considerations

The study was approved by the Institutional Ethics Committee (JSSMC/IEC/050722/ 54 NCT/ 2022-23).

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Conflict of interest

There is no conflict of interest.

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