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Original Research Article

Study of Seroprevalence of SARS CoV2 antibodies in children in a diagnostic centre of Central India-a retrospective study

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ABSTRACT

Introduction: It is said that children are less affected by SARSCoV2 infection because of their young immune system, so they have relatively milder symptoms as compared to adults. So the true incidence of SARSCoV2 is not known in this age group. Serosurveys in the paediatric age group can give a much better estimate of the incidence of SARSCoV2 infection in asymptomatic and symptomatic children.

Objectives: The present study was undertaken to study the seroprevalence of SARSCoV2 antibodies in children below 18 years of age, by measuring the S1RBD domain of spike protein neutralizing IgG antibody levels.

Materials and Methods: This was a retrospective study carried out from August 2020 to August 2021 in a private diagnostic centre of Central India. 539 children of both genders from newborn babies upto 18 years of age were included in the study. US FDA Emergency Use Authorized [EUA], Atellica Solution SARS-CoV-2 IgG assay that detects anti S1-RBD antibodies including neutralizing IgG against SARS-CoV-2 was used for antibody estimation. Antibody level ≥ 1 was termed reactive or seropositive and below 1 were considered to be non reactive or seronegative

Results: There were 321 males and 218 females with a male to female ratio of 1.47 :1. 57% male children were seropositive while 61.9% female children showed seropositivity with an overall positivity rate of 58.99%.

Conclusion: The findings of our study suggest that children below 5 years and adolescents exhibit higher antibody responses as compared to children between 5-10 years of age. The results of our study would be of help in formulating surveillance and vaccination strategies for children and in implementing public safety guidelines.

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1. Introduction

An unknown respiratory illness causing severe acute respiratory syndrome was first identified in Wuhan, China in December 2019, later named as SARSCoV2.¹ This later spread to all parts of the world causing a global pandemic with two major peaks of infection in India causing considerable morbidity and mortality, both in

adults as well as in paediatric population. However, exact data of paediatric population is still unclear. The SARSCoV2 disease has an incubation period of 5.2 days.² The symptoms include fever, cough, breathlessness, easy fatigability and sometimes severe viral pneumonia and multiorgan failure. These symptoms may not be evident in children, specially in infants and toddlers. Asymptomatic or mildly symptomatic patients may not seek medical advice, so the true prevalence in this population is underestimated.³ It is said that children are less affected by SARSCoV2

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infection because of their young immune system, so they have relatively milder symptoms as compared to adults.⁴⁻¹⁰ Because of the milder symptoms and also due to difficulty in taking nasopharyngeal and oropharyngeal swabs in children, the true incidence of SARS-CoV-2 is not known. Moreover, the sensitivity of the kit as well as the timing of sample collection also plays a major role. Hence, Serosurveys in the paediatric age group can give a much better estimate of the incidence of SARS-CoV-2 infection in asymptomatic and symptomatic children.

The present study was undertaken to study the seroprevalence of SARS-CoV-2 antibodies in children below 18 years of age, by measuring the S1RBD domain of spike protein neutralizing IgG antibody levels in children. Children under 18 years of age are still to be vaccinated in India due to ongoing studies on the efficacy of vaccines in this age group.

2. Materials and Methods

This was a retrospective study carried out from August 2020 to August 2021 in a private diagnostic centre of Central India. 539 children of both genders from newborn babies upto 18 years of age were included in the study. The patients were divided into < 5 years, 5-10 and 11-18 years of age. Blood was collected with thorough aseptic precautions, following standard blood collection protocols in serum separator tubes and processed within 2 hours of collection for Spike protein IgG antibodies.

US FDA Emergency Use Authorized [EUA], Atellica Solution SARS-CoV-2 IgG assay that detects anti S1-RBD antibodies including neutralizing IgG against SARS-CoV-2 was used for antibody estimation.

Antibody level ≥ 1 was termed reactive or seropositive and below 1 were considered to be non reactive or seronegative. Dilution protocol as per the kit insert was used for Specimens that crossed measuring range of the assay.

3. Results

539 children from newborns upto 18 years of age of both genders were included in the study. There were 164 (30.4%) children under 5 years of age, 126(23.37%) between 5-10 years and 249(46.19%) between 11-18 years of age. The youngest child was a 2 days old newborn and the eldest was 18 years of age. There were 321 males and 218 females with a male to female ratio of 1.47:1. Table 1 shows the demographic data of patients.

33.8% males below 5 years of age were seropositive, followed by 25.6% between 5-10 years of age and 40.4% in 11-18 years age group. Similarly in females below 5 years of age, 29.6% were seropositive, followed by 24.4% in 5-10 years of age, and 45.9% in 11-18 years of age group.

57% male children(183/321) were seropositive while 61.9% female children(135/218) showed seropositivity with

an overall positivity rate of 58.99%.(Table 2)

The mean antibody level below 5 years of age was 10.37 and 10.04 in males and females respectively. The mean antibody level in 5-10 years of age group was 5.92 in males and 6.34 in females. In 11-18 years age group, the mean antibody level was 9.38 in males and 4.52 in females.(Table 3)

The mean antibody level in seropositive patients below 5 years of age was 16.97, between 5-10 years age group was 8.24 and 16.34 in 11-18 years of age group.(Table 4)

Seropositive Data analysed month wise showed an increasing trend from August to December 2020 coinciding with First peak of SARS-CoV-2 infection with 44.4% seropositive rate in November 2020 and 68.2% in December 2020. The second rising trend was seen from May 2021 lasting upto July 2021 with 74%, 72.9% and 79.6% seropositivity rate in May, June and July respectively. (Table 5)

4. Discussion

Susceptibility of children to SARS-CoV-2 is still unclear but has important health policy implications and the decision to reopen the schools after a long time is largely based on the serosurveillance studies in different areas. Moreover, it has been predicted that a probable third wave of SARS-CoV-2 infection would affect the paediatric population the most. However, only a few serosurvey data are available in India in the paediatric population.

Our study showed an overall seropositivity rate of 58.99% in children upto 18 years of age. The youngest patient was a 2-day-old newborn. Males were more affected than females with a seropositivity rate of 57.5% in males and 42.5% in females out of the total seropositive children. The mean antibody level below 5 years and in 11-18 years age did not show much difference. However, the seropositivity in 5-10 years of age was less compared to under 5 years and in 11-18 years of age. The reason for this is unclear and needs further studies to arrive at a conclusion.

In a study conducted by Thomas Waterfield et al. in United Kingdom from April to July 2020, they reported that the presence of antibody and the mean antibody titre was not influenced by age.¹¹ They concluded that the children demonstrated similar antibody titre in response to SARS-CoV-2 irrespective of age. Similarly, Silvia Bloise et al. in their study also did not find any significant difference in IgG levels related to age, gender and other clinical manifestations.¹² However, in their study they reported significantly lower antibody levels in children as compared to adults.

In the study by Brittany K. Smith et al. in Missouri USA, the authors reported an overall positivity rate of 1.71% in paediatric population with a significantly lower seropositivity rate in children below 5 years of age.¹³ Danilo B et al. conducted a study in the household contacts

Table 1: Demographic data of patients

Age (Years)	Male	Female	Total	%
<5	107	57	164	30.40%
5-10	72	54	126	23.37%
11-18	142	107	249	46.19%
Total	321	218	539	100%

Table 2: Total seropositive & seronegative patients in different age groups

Age (Years)	Male		Female		Total
	Reactive	Non Reactive	Reactive	Non Reactive	
<5	62	45	40	17	164
5-10	47	25	33	21	126
11-18	74	68	62	45	249
Total	183	138	135	83	539

Table 3: Mean & median antibody level in different age groups

Age (Years)	Male		Female	
	Mean	Median	Mean	Median
<5	10.4	4.34	10.0	5.71
5-10	5.92	3.56	6.34	2.27
11-18	9.38	1.61	4.52	1.89

Table 4: Mean reactive & non-reactive antibody in different age group

Age (Years)	Male		Female	
	Reactive	Non-Reactive	Reactive	Non-Reactive
<5	17.0	0.1	14	0.2
5-10	8.75	0.12	9.84	0.13
11-18	16.32	0.15	6.91	0.43

Table 5: Month wise trend of antibody levels

Month	Sero Positivity	seroNegativity
Aug 20	10.0%	90.0%
Sept 20	33.3%	66.7%
Oct 20	40.7%	59.3%
Nov 20	44.4%	55.6%
Dec 20	68.2%	31.8%
Jan 21	30.8%	69.2%
Feb 21	57.1%	42.9%
Mar 21	47.1%	52.9%
Apr 21	35.7%	64.3%
May 21	74.0%	26.0%
Jun 21	72.9%	27.1%
Jul 21	79.6%	20.4%
Aug 21	57.1%	42.9%

of known SARSCoV2 infected patients and found that 52.3% of the paediatric contacts had detectable level of IgG antibodies.¹⁴ Similarly Ludwig Knabl et al demonstrated a seropositivity rate of 27.1% in children below 18 years of age.¹⁵ In a large multicentric population based seroepidemiological study in India, the interim result of serological prevalence of SARSCoV2 antibody among children 2-17 years of age, between 15th March 2021 to 10th June 2021, showed an overall prevalence rate of

55.7%.¹⁶ Our study correlated with this study. He S. Yang et al studied the association of age with SARSCoV2 antibody response and found that adolescents showed higher median antibody levels.¹⁷

Understanding the pathophysiology behind the response to SARSCoV2 in paediatric population as compared to adults is much needed. The exact mechanism is still under study but possibility of an attenuated immune response in children resulting in better tolerance to

SARSCo2 virus cannot be ruled out.¹⁸ Some studies have proposed that children may show milder disease manifestations as compared to adults as they are less exposed to environmental pollutants and have few comorbid conditions.¹⁹ Few other studies have postulated that innate immune memory may be generated on exposure to SARSCoV2 in children who have taken live attenuated vaccines such as Measles, Mumps, Rubella etc. which may play a protective role against the SARSCoV2 virus.²⁰ In a few studies from China, USA and other countries, it has been suggested that young children and adolescents especially children below 10 years of age may have milder symptoms as compared to adolescents.^{19–21}

Our study has certain limitations as this was a retrospective study and relied mainly on the data available to us. We did not have sufficient data on the symptoms as children may not be able to elucidate their symptoms as clearly as adults. Another limitation is that the sample size is small. Moreover, we cannot definitely state that the seronegative children are true seronegative or the antibody has waned or that some children may be able to fight the virus infection due to innate immunity without mounting a detectable level of antibody response which might have affected the results of the study.

5. Conclusion

The findings of our study suggest that children below 5 years and adolescents exhibit higher antibody responses as compared to children between 5-10 years of age. The results of our study would be of help in formulating surveillance and vaccination strategies for children and in implementing public safety guidelines. Large multicentric population based studies in children including those without any overt symptoms or contact history are required as schools have started reopening after a long gap and safety of children is of utmost concern for parents as well as for all the stakeholders. This will also help in curbing the impending probable third wave.

6. Source of Funding

None.

7. Conflict of Interest

None

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