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Original Research Article

SEROLOGICAL RESPONSES AND POST-COVID SEQUELAE IN BANGLADESHI CHILDREN FOLLOWING SARS-COV-2 INFECTION: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Humoral immunity in Post-SARS CoV 2 infection is not fully characterised, especially in low and middle income countries. The timing, the magnitude and the stability of antibody responses are also needed in order to interpret the sero surveillance data as well as to plan vaccination strategies in children.

Materials and Methods: We did cross sectional study on 96 paediatric survivors of COVID 19, confirmed by RT PCR and who came to follow up at Chittagong Medical College Hospital, Bangladesh 14 or more days after diagnosis. Data on demographic profile, clinical presentation and treatment received were extracted on case records; total anti SARS CoV 2 immunoglobulin in venous blood was measured by a commercial ELISA. The interval since positivity by RT PCR was also correlated with antibody titres (ELISA ratio).

Results: Median age was 8.2 years (IQR 4.3–12.6); 55.2 % were female. Fever (97.9 %) and cough (77.1 %) predominated during the acute phase; 21.9 % experienced dyspnoea and the same proportion required hospitalisation. Follow up occurred a median 5 weeks after diagnosis. All participants were seropositive; mean ± SD ELISA ratio was 5.77 ± 3.41 (range 0.02–10.69). Forty seven per cent generated detectable antibodies between weeks 2–4, 47 % between weeks 4–8 and 9 % beyond week 8. Antibody magnitude showed a weak, non significant inverse correlation with time since infection ($r = -0.04$, $p = 0.72$). Fatigue (57.7 %), shortness of breath (40.4 %) and weight loss (38.5 %) were the leading post COVID complaints.

Conclusion: Bangladeshi children mount robust ELISA detectable antibody responses after mild or moderate COVID 19, with peak seroconversion occurring within eight weeks. Although titres begin to wane thereafter, seropositivity persists in all patients during early convalescence. These data provide a local benchmark for interpreting paediatric sero epidemiological surveys and support the inclusion of children in forthcoming vaccine effectiveness studies.

Keywords: SARS CoV 2; paediatrics; antibodies; ELISA; Bangladesh; seroprevalence.

INTRODUCTION

Since its initial description in December, coronavirus disease 2019 (COVID 19) triggered by severe acute respiratory syndrome coronavirus 2 (SARS CoV 2) has created the largest global health crisis in modern history.[1,2] Children account for only 1–2 % of laboratory confirmed infections,[3] are less likely to develop severe pneumonia and show markedly lower case fatality rates than adults.[4,5] Nevertheless, paediatric infections contribute to household and community transmission because viral shedding may

persist despite mild or absent symptoms.[6] Defining the humoral immune profile of children is therefore critical for modelling transmission dynamics and guiding vaccination policies. Immunologically, nearly all infected adults seroconvert within three weeks,[7] however, titres may decline rapidly, especially after asymptomatic infection.[8] Data in children are sparser and heterogeneous. Small cohorts suggest that paediatric seroconversion is similar in timing and magnitude to adults, yet long term persistence and functional neutralising capacity remain uncertain.[9] On 8 March 2020, Bangladesh first reported a paediatric case, and, currently, the country records > 50 000 confirmed infections among people < 18 years (Ministry of Health, May 2025). There are no published investigations regarding antibody responses in Bangladesh children, although the number of identified cases is rather large. The present study addresses this gap by analysing serological and clinical data from RT PCR confirmed paediatric COVID 19 survivors at Chittagong Medical College Hospital (CMCH), Chattogram the largest tertiary centre in south eastern Bangladesh. Our hypothesis was that (i) That nearly all children become seropositive (detectable anti SARS CoV 2 antibodies), (ii) the seroconversion period occurs during the first eight weeks after infection, and (iii) that their antibody titres are upside down proportionate to the time since infection, a reflection of rapid waning. Acute clinical presentations, patterns of treatment and 3months short-term sequelae are mentioned to provide the context of the serological results. By providing rigorously collected local data, our work complements international reports and informs both national sero surveillance and vaccine implementation strategies for the paediatric population.

MATERIALS AND METHODS

Study design and setting: Our study was a descriptive cross sectional study conducted in Paediatric Medicine outpatient department, CMCH, Chattogram, in a period of November 2020 to March 2021.

Participants: Eligible subjects were < 18 years, had RT PCR confirmed SARS CoV 2 infection at the CMCH Microbiology laboratory, and presented for follow up ≥ 14 days after the positive test. Children with chronic immunodeficiency or recepient of immunoglobulin therapy were excluded.

Sampling and ethics: Using convenient sequential recruitment, 96 consecutive eligible children were enrolled after written informed consent from guardians. The CMCH Ethics Review Committee approved the protocol (memo #CMCH ERC 2020 Paed 15).

Data collection: Trained physicians reviewed hospital charts and interviewed caregivers. Collected variables included age, sex, residence, socioeconomic status, clinical manifestations, treatment received, hospitalisation need, and post COVID symptoms.

Serological testing: The blood samples of venous blood with volume 5 mL and centrifuging them took place; the sera were examined using the WANTAI SARS CoV 2 total antibody ELISA (Beijing Wantai Biological Pharmacy Ltd, China) following the manufactures instructions. Expressions of the results were in the form of ratios of sample to cut offs (S/CO); where S/CO was 1.0 or higher, it was said to be reactive.

Statistical analysis: Data were coded into a SPSS v25. The continuous variables are expressed as mean SD or median (IQR), whereas the categorical variables are expressed as frequencies and percentages. The correlation between ELISA ratio and the weeks of being RT PCR positive was evaluated by Pearson. Statistical significance was referred to as a p value of < 0.05.

RESULTS

The study comprised 96 children (female 55.2 %, rural residence 68.8 %). Median age was 8.2 years; 68.8 % were > 5 years, 18.8 % aged 1–5 years and 12.4 % < 12 months. Nearly half belonged to lower middle income households (Table 1). Eighty percent of the participants reported history of close contact with a confirmed or suspected case of COVID 19. Fever (97.9 %) and cough (77.1 %) dominated the clinical picture; dyspnoea and sore throat each occurred in 21.9 %. Gastro intestinal symptoms were less common. Twenty one children (21.9 %) required hospitalisation; mean time from symptom onset to admission was 4.8 ± 2.0 days. Paracetamol (83.2 %), oral antibiotics (64.2 %) and bronchodilators (48.4 %) were the main therapies; oxygen supplementation was needed in 12.6 % (Table 2). At follow up (median 5.0 weeks), fatigue (57.7 %), shortness of breath (40.4 %) and weight loss (38.5 %) were prominent. Altered taste or smell persisted in one quarter of participants [Table 3]. All 96 children were seropositive. Mean ELISA ratio was 5.77 ± 3.41. The majority (90.7 %) achieved seroconversion within eight weeks [Figure 1]. ELISA ratio displayed a weak, non significant negative correlation with time since RT PCR positivity ($r = -0.04$; $p = 0.72$) [Figure 2].

Table 1: Socio demographic profile of the cohort

Variable	Category	n (%)
Age (years)	< 1	12 (12.5)
	1–5	18 (18.8)
	> 5	66 (68.8)
Sex	Male	43 (44.8)
	Female	53 (55.2)
Residence	Rural	66 (68.8)
	Urban	30 (31.2)
Monthly family income	Low (< Tk 15 k)	10 (10.4)
	Lower-middle	47 (49.0)
	Upper-middle	38 (39.6)
	High	1 (1.0)

Table 2: Acute clinical features and treatments

Feature/Therapy	n (%)	Feature/Therapy	n (%)
Fever	94 (97.9)	Paracetamol	79 (83.2)
Cough	74 (77.1)	Oral antibiotic	61 (64.2)
Sore throat	21 (21.9)	Bronchodilator	46 (48.4)
Dyspnoea	21 (21.9)	Oxygen therapy	12 (12.6)

Table 3: Post COVID sequelae at follow up

Symptom	n (%)	Symptom	n (%)
Fatigue	30 (57.7)	Palpitation	10 (19.2)
Shortness of breath	21 (40.4)	Weight loss	20 (38.5)
Loss of taste/smell	13 (25.0)	Psychological issues	4 (7.7)

Table 4: Mean ELISA antibody ratios in selected sub groups (n = 96)

Characteristic	Category	n	Mean ± SD ELISA ratio	p-value*
Age (years)	< 1	12	6.1 ± 3.6	0.82
	1 – 5	18	5.9 ± 3.4	
	> 5	66	5.6 ± 3.3	
Sex	Male	43	5.9 ± 3.5	0.71
	Female	53	5.6 ± 3.3	
Weeks since RT-PCR positivity	2 – 4	45	6.1 ± 3.2	0.27
	4 – 8	42	5.8 ± 3.5	
	> 8	9	4.4 ± 3.0	
Hospitalisation during acute phase	Yes	21	6.2 ± 3.7	0.55
	No	75	5.6 ± 3.3	

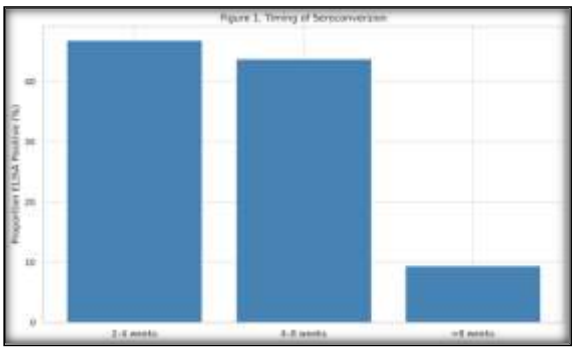

Figure 1: Timing of Seroconversion

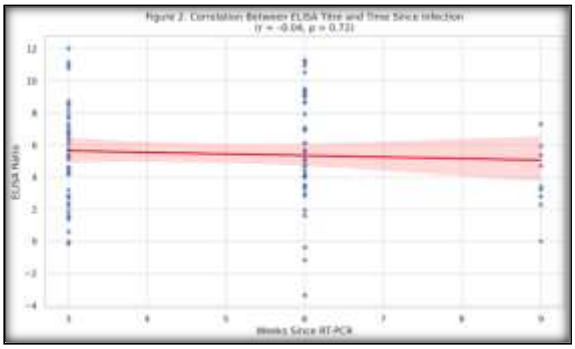

Figure 2: Correlation Between ELISA Titre and Time Since Infection

DISCUSSION

This cross sectional study has further shown that the infected children with SARS CoV 2 generate the recognizable antibodies at short period and the kids can be seropositive at the time period of two months. All participants were seropositive, aligning with Chinese and European paediatric studies reporting seroconversion rates of 95–100 % within three weeks.[9,10] The mean ELISA ratio of 5.8 exceeds the manufacturer's threshold more than five fold, indicating vigorous humoral responses despite predominantly mild disease. Our observation that half of the cohort seroconverted by week 4 and > 90 % by week 8 confirms the temporal dynamics described in multicentre meta analyses of adult populations.[7] Paediatric data, however, have been inconsistent; Buonsenso and colleagues documented seropositivity in only 52 % of exposed Italian children at a median 77 days post exposure,[9] whereas Shirin et al. found rates ≥ 90 % by day 30 in Bangladeshi adults.[11] Differences may reflect assay sensitivity, timing of sampling and disease severity. Importantly, the weak inverse association between ELISA ratio and post infection interval suggests early waning, echoing reports of declining IgG titres in

adults as soon as eight weeks after mild infection.[8,12] Long term longitudinal follow up will clarify whether cellular immunity compensates for diminishing antibody levels in children. Clinically, the high burden of post COVID fatigue and dyspnoea parallels "long COVID" descriptions in adults, reinforcing the need for structured paediatric follow up clinics.[13] Fortunately, only one in eight children required oxygen therapy, corroborating global data that severe paediatric COVID 19 remains uncommon.[4,5] Socio demographically, infection clustered in rural, lower middle income families, consistent with the predominant catchment of CMCH and potential under testing in remote areas. Our study has several limitations. The convenience sample may not capture asymptomatic children who never presented for testing, potentially inflating seroconversion estimates. We did not measure neutralising activity, which correlates more closely with protection. Finally, cross sectional design precludes assessment of antibody durability beyond 11 weeks. Strengths include a well defined cohort with laboratory confirmation, systematic data collection and use of a commercially validated ELISA. In Bangladesh, paediatric COVID 19 vaccination began only in late 2023; baseline serological data such as ours are pivotal for interpreting post vaccination immune responses and for designing sero epidemiological surveys. Policy makers should note that nearly 10 % of children seroconvert after two months, emphasising that single time point serosurveys may underestimate recent infections. Future research should incorporate longitudinal sampling, functional neutralisation assays and evaluation of T cell responses to delineate comprehensive immunity in Bangladeshi children.

CONCLUSION

In this Bangladeshi cohort, every child mounted a measurable antibody response after SARS CoV 2 infection, with most seroconverting within eight weeks. Although titres displayed early decline, universal seropositivity persisted during early convalescence, and no severe post COVID complications were observed. These findings provide crucial baseline data for paediatric sero epidemiology and vaccine effectiveness studies in South Asia and underscore the need for longitudinal monitoring to define the durability of naturally acquired immunity in children.

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