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Original Research Article

A study of antibody response to Covid-19 infection

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ABSTRACT

Background: The Coronavirus disease 2019 is a disease caused by the etiological agent severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was a newly identified β-coronavirus that had spread rapidly around the world, resulting in a very high number of infections and deaths, threatening public security, and placing a heavy burden on global healthcare systems and economy. The present study was done to study antibody response in COVID-19 infection.

Materials and Methods: The study was carried out in the Department of Respiratory Medicine, R.D. Gardi Medical College, Ujjain, India after approval by ethics committee. The post COVID-19 cases attending respiratory medicine OPD were included in the study.

Results: The present study was conducted in 122 patients. The mean age of the patients was 51.20±14.21 years, median age was 54.5 years, the minimum age was 14 years and the maximum age was 80 years, the most number of COVID-19 infection cases was in the elderly age group of more than 50 years. The severity of disease was seen in those above 50 years of age (57.3%) with p>0.05. Among the severe cases mean age of the cases was 49±17 years, in moderate cases mean age 52±14 and among mild group of cases mean age was 51±15 years.

In the present study there were 73.8% males and females were 26.2% Among COVID-19 cases who reported in the OPD the maximum that is 86 (>70%) patients had moderately severe disease, while severe cases were only about 14 %. Mild cases were 15.6%.

In the present study RT-PCR were negative in 36(29.5%) as against 86 (70.5%) were confirmed cases of COVID-19 and among positive cases 40 % cases became negative between 6-10 days

Among severe disease cases mean SARS COV2 antibody 650.06±240.47 was significantly higher as compare to moderate cases 461.49±331.41 and mild cases 404.11±240.47.

Conclusions: India has the world's largest vaccination program. COVID-19 antibodies estimation are important tests carried out to determine the response of the body against COVID-19 infection.

Our results show a significant association between SARS COV2 antibody and the severity of disease.

1. Introduction

The coronavirus disease or the COVID-19 is a disease caused by the etiological agent severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) It was a newly identified β-coronavirus that had spread rapidly around the world, resulting in a very high number of infections and deaths, threatening public security, and placing a heavy burden on global healthcare systems and economy.[1] The disease is still active with the Omicron variants like BA4, BA5, XBB1.5 etc., in many parts of the world like China, Germany, America which continue to see cases requiring hospitalization and intensive care.[2]

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India too faced the pandemic with resultant morbidity and mortality however at present the disease is under control with the sporadic cases occurring including the XBB variant.

India has the world's largest vaccination program and 95% has received the first dose and 88% (12+) population is fully vaccinated till now.[3] ICMR and other surveys carried out before vaccination drive had started had shown that asymptomatic infection had occurred in large number of the population including children.[3] Thus the COVID-19 pandemic control in our country is contributed to hybrid immunity which has been actively and passively acquired. Antibody titres against COVID-19 infection was the method for evaluating the response to infection. The dynamics of humoral immune response determined the speed of viral elimination. Faster viral clearance is associated with earlier antibody responses.

Overall, the distribution and variation of IgM, IgG and IgA antibody dynamics may be associated with the patient's age, gender, co-morbidities, viral load, and other factors that influence disease severity.

Nabs (neutralizing antibodies) which are crucial for virus clearance and to achieve the protection against SARS-CoV-2. They may achieve this in several ways—including interfering with virion binding to receptors, blocking virus uptake into host cells, and preventing uncoating of viral genomes in endosome or causing aggregation of virus particles. In the case of COVID-19, however, their roles remain less defined, e.g. the predictive value of neutralisation with regard to disease outcome.[4–6]

Serological tests of antibodies for infectious agents have two important and separate applications: firstly, to diagnose chronic infections, and secondly, to determine prior infection or immunisation status which may be used to predict immunity against future infection.

A follow-up study of survivors of COVID-19 showed decreasing seropositivity of neutralising antibodies and immunoglobulin (IgG) titres over time.

Our study collected data from R.D. Gardi Medical College, Ujjain, to better understand the significance of SARSCoV-2 serological tests. In this study, we aimed to evaluate the immune status against SARS-CoV-2.

Globally, as on February 2023, there have been 753,651,712 confirmed cases of COVID-19-19, including 6,813,845 deaths, reported to WHO. In India from 3^{rd} January 2020 to till now there have been 44,682,895 confirmed cases of COVID-19-19 including 530,740 deaths.[7]

2. Materials and Methods

2.1. Source of data

The study of evaluation of SARS-CoV-2 antibody levels in post COVID-19 follow-up cases was carried out in the department of Respiratory Medicine, R.D. Gardi Medical College, Ujjain, after approval by ethics committee. The post COVID-19-19 cases attending respiratory medicine OPD were included in the study.

2.2. Sample size calculation-sample size

To calculate the sample size based on the estimating sensitivity and specificity with 95% confidence level, we used the following information:

Formula used

Estimate sensitivity

$$Sample\ size\ for\ sensitivity\ n = \frac{Z^2_{1-\alpha/2} * sensitivity * (1-sensitivity)}{d^2 * prevalence}$$

Estimate specificity

$$Sample\ size\ for\ specificity\ n = \frac{Z^2_{1-\alpha/2} * specificity * (1-specificity)}{d^2 * (1-prevalence)}$$

Where z = standard normal variable=1.96

d= estimation error=1

2.3. Methodology

The patient and/or relatives were explained about procedure and informed consent was taken from the patient and/or relatives.

Study was conducted in following steps:

Steps 1-Demographic variables, detailed history of patient, history of COVID-19 disease, History of contact with COVID-19 patient, general examination of patient, systemic examination of patient.

Step 2-Investigations:-CBC CRP, SARS CoV 2 antibody via CLIA TECHNIQUE (Chemi-luminescence Immuno Assay), LDH, D-dimer, HbA_1C, chest X-ray.

Step 3-Study the formation of SARS CoV 2 antibody according to severity of disease in post COVID-19-19 follow up cases.

Step 4-Analysis of investigations and data will be done, descriptive data will collected and studied accordingly, significant statistical test were applied.

2.4. Procedure

This study was be conducted in following steps:

1. Post COVID-19-19 patients attending respiratory medicine OPD
2. Recruitment of the patient according to the inclusion and exclusion criteria
3. Written consent was taken from the participants prior to enrolling in the study
4. A pre-structured proforma was used to collect base line data, detailed history with clinical examination was done.
5. Basic routine investigations done
6. Data collected, compiled and analysed

2.5. Statistical analysis plan

On the basis of the observations recorded, the result were critically analysed. All statistical analysis was done by the help of appropriate statistical software. For quantitative variables measures of frequency distribution, central tendency, dispersion and graphical representation was applied. For qualitative variables, frequency distribution, percentage and various diagrammatic representations was applied. Appropriate statistical test like parametric and non-parametric test was performed. Value of P less than 0.05 was considered significant.

3. Observations and Results

In the study conducted on 122 patients the mean age of the patients was 51.20±14.21 years, median age was 54.5 years, the minimum age was 14 years and the maximum age was 80 years.Tables 1 and 2

In the present study there were73.8% males and the females were 26.2%.

Table 1: Distribution of severity of disease

Severity	Frequency	Percent
Mild	19	15.6
Moderate	86	70.5
Severe	17	13.9
Total	122	100.0

Among COVID-19 cases the severity the maximum 86 (>70%) patients had moderately severe disease, while severe cases were only about 14%. Mild cases were 15.6%.

The SARS-CoV-2 antibody levels were done in post COVID-19 follow-up patients revealed the following levels.

Table 2: SARS-CoV-2 antibody levels

SARS-CoV-2 Antibody(s/c)	Frequency (No: of Patients)	Percent
Nil detected	3	2.5
1 – 250	30	24.6
251 – 500	30	24.6
501 – 750	29	23.8
751 – 1000	17	13.9
>1000	13	10.7
Total	122	100.0

In our study there was significant mean SARS-CoV-2 difference was observed between severity of disease of the cases with P<0.05. Hence, severe disease cases groups mean SARS-CoV-2 antibody 650.06±240.47 was significantly higher as compare to moderate cases 461.49±331.41 and mild cases 404.11±240.47. Table 3

Out of 122 cases 37(30.3%) had DM, 27(22.1%) had HTN, 4(3.3%) had thyroid disease, 8(6.6%) had TB, 11(9.0%) had COPD and 3(2.5%) had asthma. Table 4

4. Discussion

Our study is an observational study of SARS-Co-V antibodies in 122 post COVID-19 patients coming to respiratory medicine OPD of R.D Gardi Medical College hospital, Ujjain, Madhya Pradesh, India a tertiary care dedicated COVID-19 hospital.

In the present study the mean age of the cases was 51.20±14.21 years, median age 54.5 years, minimum age was14 years and maximum age was 80 years. As was seen in COVID-19 all the age groups study COVID-19 infection was more prevalent 38(31.1%) in 51-60 years age groups followed by 32(26.2%) in above 60 years age groups, 26(21.3%) in 41-50 years age groups, 14(11.5%) in 31-40 years age groups and 12(9.8%) in less than 30 years age groups. Efdal et al. (2022),[8] revealed that the mean age of 100 people with COVID-19 infection included in the study was 44.65 ± 12.15 (years) and 42 (42%) were in the 45–54 age group. Zhao et al. (2021),[9] showed that the mean age of the cases was 48.11 years, and 40 (42.55%) of them were females.

Disease was more common among males (74%) and 32(26.2%) in females. Efdal et al. (2022),[8] revealed that 54 (54%) were female and 46(46%) were male. Zhao et al.(2021),[9] showed that 40 (42.55%) of them were females and 54(57.45%) were males.

Present study RT-PCR negative cases were (29.5%) as against 70.5% were confirmed cases of COVID-19-19. Among COVID-19 patients 86(70.5%) were moderate in severity, 19(15.6%) had mild severity and 17(13.9%) had severe disease.

In our study most of the patients were discharged within 15 days 100(82%), 10(8.2%) were discharge within 16-20 days and 12(9.8%) got their discharge in more than 20 days. Zhao et al.(2021),[9] showed that the overall duration of hospital stay was (15.08 ± 5.71) days.

In present study out of 122 cases 37(30.3%) had DM, 27(22.1%) had HTN, 4(3.3%) had thyroid disease, 8(6.6%) old treated TB, 11(9.0%) had COPD and 3(2.5%) had asthma. Zhao et al. (2021),[9] showed that the most common comorbidity was hypertension (16 cases, 17.02%), followed by diabetes mellitus (9 cases, 9.57%), chronic heart disease (4 cases, 4.26%), and asthma (2 cases, 2.13%)

Present study out of 122 cases, the most common symptom was weakness in 91(74.6%) cases followed by breathlessness in 86(70.6%), cough in 70(57.4%), fever in 59(48.4%), expectoration in 37(30.3%) and chest pain in 15(12.3%). Pereira et al. (2021),[10] showed that the most common was fatigue (57%), followed by loss of smell (29%), breathlessness (24%), and difficulty concentrating (24%).

Present study no significant association was found between age groups of the cases and severity of disease with P>0.05. Hence disease severity was similarly distributed to all age groups of the cases. In our study there was no

Table 3: Comparison of mean SARS-CoV-2 antibody between severities of disease

On Follow-up	Severity						F	P-Value
	Mild		Moderate		Severe			
	Mean	SD	Mean	SD	Mean	SD		
SARS-CoV-2 Antibody	404.11	164.55	461.49	331.41	650.06	240.47	3.490	0.034

Table 4: Distribution of comorbidities of the cases

Comorbidities	N	Percentage (%)
DM	37	30.3%
Hypertension (HTN)	27	22.1%
Thyroid	4	3.3%
TB (Old)	8	6.6%
COPD	11	9.0%
Asthma	3	2.5%

Table 5: Comparison of mean SARS-CoV-2 antibody between comorbidities

		SARS-CoV-2 Antibody		t	P-value
		Mean	SD		
DM	Yes	377.83	248.31	2.449	0.016
	No	522.80	320.29		
Hypertension (HTN)	Yes	373.38	257.55	2.052	0.042
	No	508.80	314.00		
Thyroid	Yes	426.75	250.95	0.344	0.731
	No	480.60	309.10		
TB (old)	Yes	559.88	324.37	0.772	0.442
	No	473.15	306.07		
COPD	Yes	624.14	302.92	1.659	0.100
	No	464.43	304.60		
Asthma	Yes	487.00	243.67	0.047	0.963
	No	478.63	308.90		

significant age difference was observed between disease severity with p>0.05. Hence, among severe cases mean age of the cases was 49±17 years, in moderate cases mean age 52±14 and among mild group of cases mean age was 51±15 years.

In our study there was no significant mean SARS Cov2 antibody difference was observed between age groups and gender of the cases with P>0.05. However Boonyaratanakornkit et al. (2020)[11] showed that higher antibody levels in the elderly age group.

In our study there was significant mean SARS cov2 difference was observed between severity of disease of the cases with p<0.05. Hence severe disease cases groups mean SARS COV2 antibody 650.06±240.47 was significantly higher as compare to moderate cases 461.49±331.41 and mild cases 404.11±240.47. Amjadi et al. (2021),[12] 113 blood samples in the 5th week and 79 blood samples in the 3rd month were collected from COVID-19-19 patients to determine the level of anti-SARS-CoV-2 IgG antibody. They reported that greater disease severity consistently correlates with higher antibody titers. Zhao et al.(2021),[9] showed that significant difference was observed between the mild/moderate and severe/critical groups (P < 0.05) on their antibody levels. Caturegli et al. (2020),[13] revealed that patients with COVID-19-19 infection who developed ARDS had significantly higher antibody titres. In the study of Wang et al. (2020)[14] evaluating the antibody response and neutralizing effects, it was observed that antibody levels were lower in patients with mild symptoms than those with symptoms of a moderate and severe infection.

In our study there was significant lower mean SARS-CoV-2 levels was observed in patients with comorbidities like diabetes and HTN compared to patients without them. However patients with TB, asthma, and COPD had higher mean antibody levels compared to those without them.

In our study there was significant mean SARS-CoV-2 difference was observed between comorbidities of the cases with P<0.05. Hence DM cases groups mean SARS COV2 antibody 377.83±248.31, HTN cases 373.38±257.55 was significantly lower as compare to who had no comorbidities.

Present study found significant positive correlation between SARS-CoV-2 antibody and CRP, LDH, D-dimmer with P<0.05. SARS-CoV-2 antibody was positively correlated to CRP level, LDH level, and D-dimer level

5. Conclusions

India has the world's largest vaccination program, COVID-19 antibodies estimation are important tests carried out to determine the response of the body against COVID-19 infection. Our results show a significant association between SARS-CoV-2 antibody and the severity of disease.

6. Source of Funding

None.

7. Conflict of Interest

Authors declare no conflict of interest.

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None.

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