Original Research Article

COVID-19 convalescent plasma donor characteristics: correlation with blood group, age, gender, symptoms and their association with SARS CoV-2 antibody levels: A bi-centric study from India

Abstract

Background: Understanding demographics and collection characteristics of Convalescent Plasma (CP) donors is the corner stone for maintaining a viable inventory of high titre CP products in an acute-crisis setting. Specific objectives of this study were to find a correlation between SARS-CoV-2 antibody level with age, gender and blood group in CP donors.

Material and method: An observational, retrospective study was conducted at blood centres of two multispecialty hospitals in Delhi from 1st November 2020 to 31st January 2021.

Results: 400/ 750 (53.3%) CP donations were from centre A and 350/750 (46.7%) were from centre B. Majority were males (96.93%) and mean age was 35.09±8.7 years. 41-50 years showed higher median SARS-CoV-2 antibodies. Mean deferral rate was 19.87%. Commonest reason (15.05%) was absence of detectable/low SARS CoV-2 antibodies. Group-wise median antibody levels were AB>B>A>O at both centres. Moderate correlation between number of symptoms and SARS CoV-2 antibody levels was observed; high symptom scores showed high SARS CoV-2 antibodies values (correlation coefficient=0.721; $p < 0.00001$). The individual symptom-wise predictors like fever ($p= 0.002$), GE or GE-like syndrome ($p < 0.001$) were positive predictors for high SARS CoV-2 antibodies. Cold ($p = 0.006$) and absence of symptoms ($p = 0.060$) were negative predictors.

Conclusion: Awareness of CP donor characteristics, post-screening deferrals, and correlates of antibody values with age, symptoms and blood group will help improve collection outcomes and give better preparedness for future recurrent waves due to evolution of more virulent SARS-CoV-2 strains and fill treatment gap till availability of more specific treatment.

1. Introduction

Late December 2019, the world was introduced to this century's worst pandemic, "the COVID-19 pandemic", caused by the novel coronavirus - SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2). Healthcare systems across the globe crippled under this huge challenge and with no definitive standard or approved treatments for COVID-19. Passive immunisation using Convalescent plasma (CP) has long been used as a therapeutic tool in blood transfusion for achieving immediate short-term immunisation and shown therapeutic potential against infectious agents.[1] CP products, is obtained by collecting whole blood or plasma from a patient who has survived a previous infection and developed humoral immunity against the pathogen responsible for the disease in question, are a possible source of specific antibodies of human origin.[2] The plasma thus extracted containing pathogen-specific antibodies (in this case-SARS CoV-2 antibodies) and has become a well-recognized emergency or empirical therapy, [3] which has been successfully applied in the field of cell therapy and immunotherapy.[4]

US-FDA on April 13, 2020 authorized use of convalescent plasma as a potentially effective treatment of the patients, as an investigational drug.[5] The Ministry of Health and Family Welfare, Govt. of India on 13th June 2020, in their "Clinical Management Guidelines: COVID 19, Version 3", endorsed off-label use of convalescent plasma for COVID 19 patients with moderate disease who are not improving (oxygen requirement is progressively increasing) despite use of steroids.[6] As the COVID-19 pandemic continues to rage, so does its devastation and case counts continue to escalate steeply worldwide, CP currently remains the most

accessible viral- specific therapy for hospitalized patients.[7,8,9,10,11, 12] Measurements of antibody response among patients with COVID-19 show that the majority patients develop IgM and IgG within 2 weeks of symptom onset, with specificity towards receptor-binding domain (RBD) and spike protein viral epitopes correlating with virus neutralization.[13,14] Identifying, recruiting, selecting, collecting, and preparing plasma from convalescent patients with adequate SARS-CoV-2-neutralizing Ab titres in catastrophic situation like that faced in recent times has become the biggest challenge well within the remit of most blood transfusion services across the globe. Thus understanding demographics and other collection characteristics of donors who qualify for CP donation is the corner stone for maintaining a viable inventory of high titre CP products in an acute crisis setting. Recent interim recommendations issued by the AABB, who have endorsed not only safety of CP, but have also recommended use of high-titer CP as close to symptom onset as possible as the main predictors of its effectiveness.[15]

It is important not only to focus on the clinical endpoints of a CP therapy, but also to describe the impact of donor characteristics (age, gender, blood group, symptoms of COVID-19, interval between SARS-CoV-2 diagnosis and CP collection) on the antibody content in the CP products. CP collections might become more effective if donor characteristics correlating with higher functional antibody activity are better understood. This study is unique as till date, there is no study from India on COVID-19 convalescent plasma collection analysing major CP donor characteristics and SARS-COV-2 antibody response. Thus, our experience CP collection is relevant for future waves; including CP donor characteristics on the quality of CP product and our analysis of reasons for donor deferrals in Indian population.

2. Aims and objectives

The aim of this study was to analyse the CP donor characteristics and SARS-COV-2 antibody response along with major reasons for donor deferral while recruiting donors for CP collection with specific objectives to find out the relationship of SARS-CoV-2 antibody level with age,

gender and blood group of donors. In one of the two centres we also analysed variation of antibody levels according to symptomatology, as we all know that efficacy of convalescent plasma therapy relies on robust antibody response in convalescent plasma donors.

3. Material and methods

This is an observational, bi-centric, retrospective, study done at blood centres of two multispecialty hospitals in Delhi, with dedicated COVID-19 management units. Donor characteristics data was retrieved from the blood bank donor management database and records from both the centres for a period of 3 months, from 1st November 2020 to 31st January 2021. The donor selection was based on standard blood bank donor selection requirements (Drugs and Cosmetics Second Amendment Rules, 2020)[16] and additional inclusion criteria as per the emergency release authorization issued by the Ministry of Health and Family Welfare(MOHFW), Govt. of India", for off-label use of convalescent plasma for COVID-19 in moderate disease[17] with the CP collection donor selection and collection guidelines released by the Indian Council of Medical Research (ICMR), New Delhi.[18] CP was collected from consenting COVID-19 recovered individuals meeting the above requirement.

3.1. Study Design and Setting

Study population was divided into two cohorts based on the collection centres where CP was collected:

Centre A- Blood centre (Department of Transfusion Medicine) of BLK Super Speciality Hospital, New Delhi, India.

Centre B –Blood centre (Department of Transfusion Medicine) of Max Super Speciality Hospital, New Delhi, India

3.2. Ethical Approval

The study was approved by the institutional ethics committees (IEC) of involved hospitals. As a convalescent plasma donor screening and registration protocol of both the blood centres,

informed consent had been obtained prior to plasma donation for any additional testing on the plasma and samples collected and its subsequent use for study/ research purposes from all donors and the same are in place. In view of retrospective study design, and no risk of disclosure of the donor identity involved in this study, the requirement to obtain the blood donors' consent to review the donor records was waived off by the IECs. Confidentiality of the data was maintained, and the study procedures were performed in compliance with the 1964 Helsinki declaration and its later amendment.

3.3. Donor selection

All CP donors meeting traditional allogeneic blood donor criteria per the standard blood bank donor selection requirements (Drugs and Cosmetics Second Amendment Rules, 2020) the following addition selection criteria as defined by MOHFW were included:

- Men or nulliparous women who were aged between 18 and 60 years
- Body weight greater than 55 kg.
- Prior diagnosis of COVID-19 documented by a confirmed by a rRT-PCR test or a Rapid antigen test (RAT) by an ICMR approved assays. Additionally, the symptoms must have completely resolved for 28 consecutive days before donation or a period of 14 days before donation with rRT-PCR negative test results for SARS-CoV-2 from oro and nasopharyngeal swabs. In case of repeat CP donation and interval of at least 2 weeks of the first plasma donation was ensured.

Donors fulfilling these requirements underwent a medical interview, with routine donor medical examination, and explained about donation of plasma via plasmapheresis.

Data captured by Centre A, additionally included details pertaining to onset of disease, duration and type of symptoms [fever; cough; non-specific symptoms (body ache or headache); runny nose or cold; shortness of breath (SOB); acute gastroenteritis (GE) (GE-like syndrome): nausea, vomiting, or abdominal pain; anosmia or ageusia].

3.4. CP donor screening

All routine screening tests, including ABO blood grouping; Rhesus phenotype; complete blood counts (including Hemoglobin (Hb), Platelet count, Total and differential leucocyte count), antibody screening for clinically significant antibodies (Extended Rh, Kell, Duffy, Kidd, MNS) and serum protein estimation. Donors with Hb >12.5g/dl, platelet count >1.5x 10^9/L, TLC within normal limits, total serum protein > 6gm/dl and antibody screening negative were accepted. Screening for HIV, hepatitis B or C virus, syphilis, and malaria were conducted according per regulatory guidelines [Drugs and Cosmetics (Second Amendment) Rules, 2020][12].

3.5. SARS-CoV-2 antibody test

Neutralizing antibodies levels have been shown to correlate best with anti-S1 IgG and anti-S1 total Ig levels.[19,20,21]

At center A, donors were tested for Anti-SARS-CoV-2 IgG (S1) antibodies on VITROS-3600 chemiluminescent immunoassay (CLIA) in accordance with manufacturer instructions. CP was collected from donors. Institutional cut-off of 5 S/Co was taken for donor selection and titer of 12 S/Co was considered as high titer CP.[22,23,24]

Centre B Tested the donors on the LIAISON® XL Analyzer (DiaSorin S.p.A., Saluggia, Italy) applying the manufacturer's cut-off >15.0 AU/mL (borderline results 12.0 – 15.0, required a re-test algorithm)[25]

3.6. Plasma Collection:

At centre A, CP was obtained by apheresis using Amicus ™ (Fresenius Kabi) or Trima Accel ® (Terumo BCT, Lakewood, CO) cell separators and at Centre B Apheresis was performed using Haemonetics MCS + LN90 00-220E blood cell separator (Haemonetics, Boston, MA, USA). 400-450 ml plasma was collected from each donor and divided into two 200-225-ml aliquots and stored at less than -30˚C. Units were thawed at 37˚C for

issue. The mean volume of plasma collected was 405.34±14.09ml. Average time taken was 30.49±6.49minutes. Only 5 donors suffered mild adverse reactions during the procedure. There were 2 small hematomas and 3 experienced minor citrate reactions in the form of mild dysesthesias, resolved by adjustment of the inlet pump flow rate and oral calcium supplements.

3.7. *Statistical Analysis:* Summarized data are generally expressed as means ± SD or medians and overall ranges (minimum–maximum). Linear regression between 2 parameters was quantified by goodness of fit with r2. Correlations between 2 data sets were calculated using Pearson's correlation coefficient and the t distribution with n-2 degrees of freedom. p values < 0.05 were considered to indicate statistical significance, p values < 0.0001 were considered to indicate highly statistical significance. Statistical analysis was done using IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.

4. Results

4.1. Donor characteristics

Donor characteristics data was retrieved from the blood bank donor management database and records from both the centres. 936 consenting COVID-19 recovered individuals were screened for eligibility for Convalescent plasma donation from both blood centres, of which 750 qualified for CP collection. Deferral rate was defined as the total number of donors deferred at time of collection out of total number of presenting donors.

400/ 750 (53.3%) CP donations were from centre A and 350/750 (46.7%) were from centre B. Majority of the donors were males (96.93%) and the mean age of donors was 35.09±8.7 years with a median age of 34 (20-60) years. Female donors were younger than male donors (p = 0.0001). 606/750 (80.8%) of the donors were replacement donors. 19.2% voluntary

donors were either hospital staff or walk in regular blood donor who had recovered from COVID-19 infection and volunteered to donate CP.

Most of the donors were into professional service (35.5%), followed by semi-professional /self-employed (27.1%), government service (15.8%), student (11.6 %), and10% into other activities. Of those involved in professional services and government services, 11.8% of them were healthcare workers and 3.2% were policemen. Among different blood groups, B donors were most common (44.13%). Other blood groups were O -24.8%, A positive-22%, AB 9.07%. Further demographic and clinical characteristics are presented in Table 1.

4.2. Deferral

Of the 936 donors screened 186 donors got deferred due to various reasons, resulting in a mean deferral rate of 19.87%. The characteristics of deferred donors are shown in Table 2. On a gender basis, the deferral rate was higher in male donors (79.57% compared to 20.43% female donors, $p < 0.0001$). Commonest deferral reason was absence of detectable/low SARS CoV-2 antibodies (15.05%), inadequate time gap from last plasma donation (9.68%), low Hb (9.14%), low platelet count (8.60%), high blood pressure (7.53%) and poor venous access (5.91%). 5.37 % donors tested reactive for transfusion transmissible infections (HIV 1&2, HBV, HCV or Syphilis). 13.44% donors were rejected during screening as they not have a diagnostic test report (ICMR approved test) for COVID-19 infection (i.e. diagnostic evidence of COVID-19 infection) described in section 1.2 above.

4.3. Median SARS CoV-2 IgG (S1)levels comparative by blood donor characteristics: gender, age and blood group

Among the 750 donors who donated, donors with blood group AB compared with other groups had higher median levels of SARS CoV-2 antibodies at both centres [Figure 1 (a) & (b)]. Centre A: 48.59 S/Co for group AB, 41.2 S/Co for group B and 39 S/Co for group A and 35.5 S/Co for group O; similar trend was seen at Centre B. Centre B: 76 AU/ml for

group AB, 69.1 AU/ml for group B and 58.6 AU/ml for group A and 47.4 AU/ml for group O. At Centre A, median levels of SARS CoV-2 antibody levels were higher in females compared to males (49.32 S/Co vs 38.09 S/Co) and similar trend was observed in the donors who donated at Centre B (female 63 AU/ml vs males 52.9 AU/ml) [Figure 2 (a) & (b)]. Age group of 41-50 years showed higher median SARS CoV-2 antibody levels at both the centres (Centre A: 51.36 S/Co for age group 41-50 vs 45.15 S/Co for age group 31-40years, 38.5 S/Co for 51-60 years and 37.1 S/Co for 20-30 years and at Centre B: 82.1 AU/ml in 41-50 years, 59.9 AU/ml in 31-40 years, 54.85 AU/ml in 51-60 years and 44.9 AU/ml in 20-30 years age group) (Figure 3a & 3c). However, antibody levels showed weak correlation with age of the donors (coefficient of linear regression between donor and SARS CoV-2 antibody level in Centre A r2=0.0245; correlation coefficient =0.49; Centre B r2 = 0.004; correlation coefficient =0.06 Fig. 3b & 3d).

4.4. Additional characteristics of CP donors from Centre A

At centre A additional data regarding disease onset and symptoms experienced by the donors at the time of infection were captured. 94% of the donors had been symptomatic and 6 % were asymptomatic at the time when they were rRT- PCR positive.

Donors were categorized as mild, moderate and sever categories on symptomatology as per NIH guidelines[26].

1. Mild Disease: Individuals with signs and symptoms of COVID-19 viz. fever, cough, sore throat, malaise, headache, muscle pain, nausea, vomiting, diarrhea, loss of taste and smell but who do not have shortness of breath, dyspnea, or abnormal chest imaging.

2. Moderate Disease: Individuals who show evidence of lower respiratory disease during clinical assessment or imaging and who have an oxygen saturation (SpO2) ≥94% on room air at sea level.

3. Severe Disease: Individuals who have SpO2 <94% on room air at sea level, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO2 /FiO2) <300 mm Hg, respiratory frequency >30 breaths/min, or lung infiltrates >50%.

Overall, 73 % (292/400) of donors had mild symptoms, 27 % (108/400) had moderate symptoms and none had severe symptoms. 4 donors were known hypertensives under control on medication, 3 had diabetes mellitus controlled on medication and others did not have any co-morbid conditions. During the period of rRT-PCR positivity, most participants (89%) got home management. The rest of them were managed at COVID-19 dedicated hospitals (4% manged in wards and 7% at dedicated quarantine centres). No donors needed ICU management.

Data captured by Centre A, also included details pertaining to onset of disease, duration and type of symptoms [fever; cough; non-specific symptoms (body ache or headache); runny nose or cold; shortness of breath (SOB); acute gastroenteritis (GE) or (GE-like syndrome): nausea, vomiting, or abdominal pain; anosmia or ageusia). A symptom scoring was done according to number of symptoms. Each symptom was given a score of 1. Fever, cough, sore throat, rhinorrhoea& nasal congestion, GE or GE-like syndrome, non-specific symptoms (body ache or headache) were the most common symptoms. 18% of the donors experienced 4 or more symptoms. The number of COVID-19 symptoms (symptom score) reported by the CP donors showed a moderate linear correlation with the SARS Cov-2 antibody levels ($r2 = 0.5193$; correlation coefficient $=0.721$; $p < 0.00001$) [Table 3 & Figure 4].

4.5. Correlates of SARS CoV-2 Antibody levels symptom-wise

Multivariable analysis performed on the subset of donors from Centre A for whom data on details of symptom experienced during COVID-19 infection was available. Table 4 shows the results of multiple linear regression analysis for the outcome of SARS CoV-2 IgG(S1) antibodies in S/CO units (on day of donation) and the following independent variables: No symptoms or symptoms like fever, cough/ sore throat/ shortness of breath, cold, symptoms GE or GE-like syndrome, headache/bodyache, anosmia, ageusia. Results of the multiple linear regression indicated that there was a collective significant effect between the symptoms and antibody levels, ($F(8, 391) = 20.50$, $p < 0.001$, $R2 = 0.295$). The individual predictors were examined further and indicated that fever ($t = 3.085$, $p= 0.002$), GE or GE-like syndrome ($t = 10.433$, $p < 0.001$), cold ($t = -2.757$, $p = 0.006$) and no symptoms ($t = -1.888$, $p = 0.060$) were significant predictors in the model. Presence of fever as a symptom predicted a mean S/CO increase by 16.87 (6.12 - 27.62), p=0.002. Donors with GE or GE-like syndrome had very high antibody levels and presence of GE or GE-like symptoms predicted a mean S/CO increase by 66.69 (54.13 - 79.26), p<0.001. Absence of symptoms predicted a mean S/CO decrease by 16.58 (0.69 - 33.85), p=0.060. Cold as a symptoms predicted a mean S/CO decrease by 15.80 (5.53 - 27.07), p=0.006.

No significant correlation was seen when anosmia or ageusia as symptoms were analysed.

5. Discussion

Convalescent plasma is a simple immunologic therapy for the COVID-19 pandemic. Blood centres with plasmapheresis can implement a CP collection program, following basic recommendations. Here, we report a series of 750 convalescent plasma collections across two centres in Delhi. Of the 936 donors screened during this period, 13.44% got deferred as they did not have diagnostic laboratory report for confirming COVID-19 infection as per regulatory

requirement. Majority (52%) of the donors were first-time donors. Our findings are similar to those reported by Lasky B et. al who is their study too reported high number of first time donors and also a high deferral rate in CP donors.[27] Highest deferral rate (15.05%) was due to absence of detectable/low SARSCoV-2 antibodies, followed by parity (9.68%) in potential female donors. Wendel S et. al. have reported absence of neutralizing antibodies at the time of screening in 21 of the 271 (7.75%) donor screened for CP donation in Brazil.[28] Dhiman Y et.al. in their study have cited multiparity (38%) as one of the main reasons for deferral among potential female CP donors.[29]

Donors with blood group AB had higher median levels of SARS CoV-2 antibodies compared to other blood groups. Group-wise median antibody levels were AB>B>A>O at both centres. (Centre A: 48.59 S/Co group AB vs 41.2 S/Co group B vs 39 S/Co group A vs 35.5 S/Co group O; Centre B: 76 AU/ml group AB vs 69.1 AU/ml group B vs 58.6 AU/ml group A vs 47.4 AU/ml group O). Female donors showed a higher median SARS CoV-2 antibody levels at both the centres. (Centre A: 49.32 S/Co female vs 38.09 S/Co males; centre B 63 AU/ml female vs 52.9 AU/ml male). Though antibody levels were higher in females than males, the number of female donors was very small 23(3.07%) and difference was not statistically significant. Our findings are similar to those reported by Mehew J et.al in their study on association of gender, age and hospitalisation with neutralising antibody levels. They reported higher median levels of neutralising antibodies with blood group AB compared with other groups (1:148 vs 1:104 for group B, 1:70 for group A and 1:47 for group O). However, contrary to our observation on gender association, they observed that median levels of neutralising antibodies to be higher in men compared to women (1:97 vs 1:47).[30] Singh P et.al. from India, have reported similarly observations on blood group association with neutralizing antibodies and have found neutralising antibodies in significantly higher percentage of people with blood group AB (0.36), followed by B (0.31), A (0.22) and lowest in people with blood group O (0.11).

Difference between blood group AB versus O was highly significant (p p<0.001). [31] Some studies have reported that non-O blood group individuals are at higher risk of developing COVID-19 in comparison to O blood group and they have postulated that this is either due to natural antibodies against blood group antigens acting as a part of innate immune response to neutralize viral particles or alternatively, blood group antigens maybe acting as additional receptors for the virus and individuals who are capable of expressing these antigens on epithelial cells, would possibly have a high propensity to be affected by SARS-CoV-2.[32, 33,34]

In our study we found a higher median SARS CoV-2 antibody levels in donors in age group of 41-50 years compared with other age groups in both the centres however levels showed weak correlation with age of the donors (centre A correlation coefficient=0.49; centre B correlation coefficient =0.06). Other studies however suggest that people of male gender,[35] older age,[36] have higher SARS CoV-2 antibodies indicating that they may have higher susceptibility to SARS CoV-2 infection.

Many studies have reported that titers of neutralizing antibodies are associated with disease severity.[37, 38,39] We could not analyse this in our CP donors since none of the donors had severe COVID-19. Our study is in line with other studies which have also had similar cohort of CP donors and predominantly represent patients who had mild or moderate disease without hospitalization coming forward to donate CP.[11,40,41] . However, when the patients with mild or moderate disease were given scoring according to the number of reported COVID-19 symptoms, we observed a correlation between number of symptoms and SARS Cov-2 antibody levels and found that a high symptom scores goes with high SARS CoV-2 antibodies values with moderate linear correlation (r2 = 0.5193; correlation coefficient=0.721; p < 0.00001). Koper S. et. al. too reported a positive correlation of neutralization titres with the number of reported COVID-19 symptoms and with the time from SARS-CoV-2 diagnosis to plasmapheresis.[42] Our results of the multiple linear regression indicated that a collective

significant effect exists between the symptoms and antibody levels. The individual predictors examined indicated that donors who had fever (t = 3.085, p= 0.002) and GE or GE like syndrome (t = 10.433, p < 0.001) showed significantly higher SARS Cov-2 antibodies and absence of symptoms (t = -1.888, p = 0.060) or cold as a symptom (t = -2.757, p = 0.006) and were significant negative predictors in the model. Association of higher SARS Cov-2 antibody levels with fever and GE or GE like syndrome have not been reported in any other study except a recent study by Amjadi MF et. al. who too demonstrated for the first time that COVID-19 symptoms- fever, abdominal pain, diarrhea and low appetite, correlated consistently with higher anti-SARS-CoV-2 antibody levels. Our results and those reported by Amjadi MF et. al. provide new insights into anti-SARS-CoV-2 antibodies development based on these symptoms.[43]

There are some limitations to this study. Our analysis for correlates of SARS CoV-2 antibody values are retrospective only and single point evaluation and further follow-up needs to be done to evaluate the dynamics of antibody levels and their symptom-wise dynamics and also to reassess those cases who were deferred due to absence of detectable/low SARS CoV-2 antibodies. Collection and usage of CP is currently waning with increasing vaccination rates and availability of alternative early-stage treatments. Nevertheless, our data on CP donor characteristics, post-screening deferrals, and clinical correlates of antibody values and their correlation with age, symptoms and blood group will help blood centres to better prepare for future recurrent waves of COVID-19 infection due to evolution of more virulent SARS-CoV-2 strains and fill the gap till more specific treatment lines become available.

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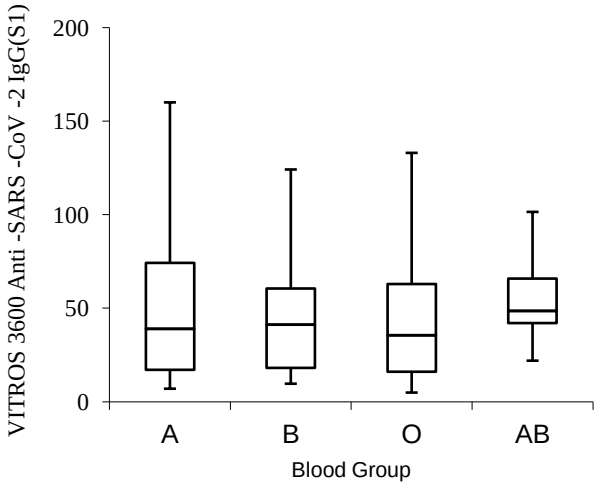
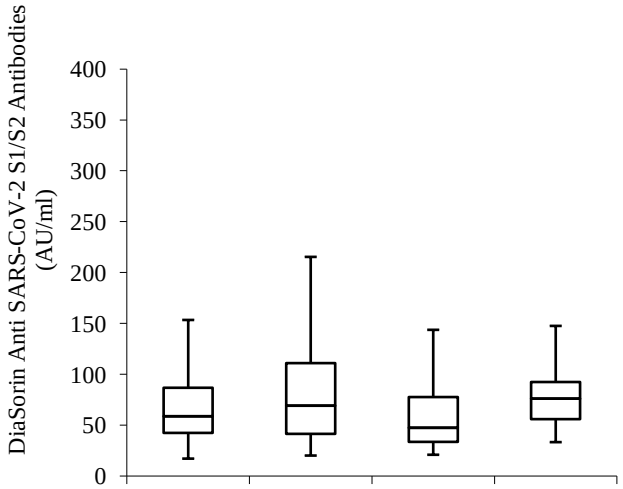
Figure 1: Median SAR CoV-2 antibody levels, by blood donor blood group

Fig 1a

N	88	182	87	43
Median	39	41.2	35.5	48.59



Centre A



Centre B

Fig 1b

N	77	149	99	25
Median	58.6	69.1	47.4	76

Figure 2: Median SAR CoV-2 antibody levels, by gender

Fig 2 a

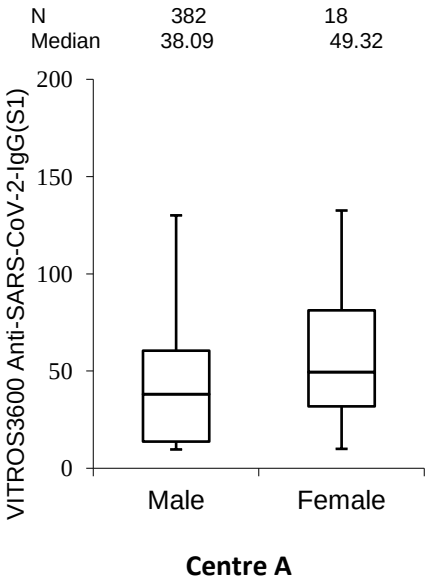


Fig 2 b

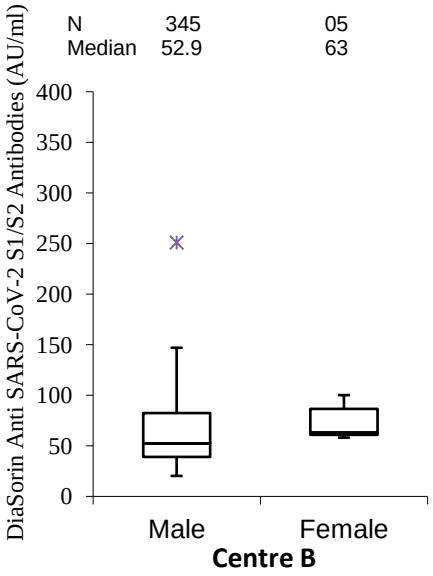
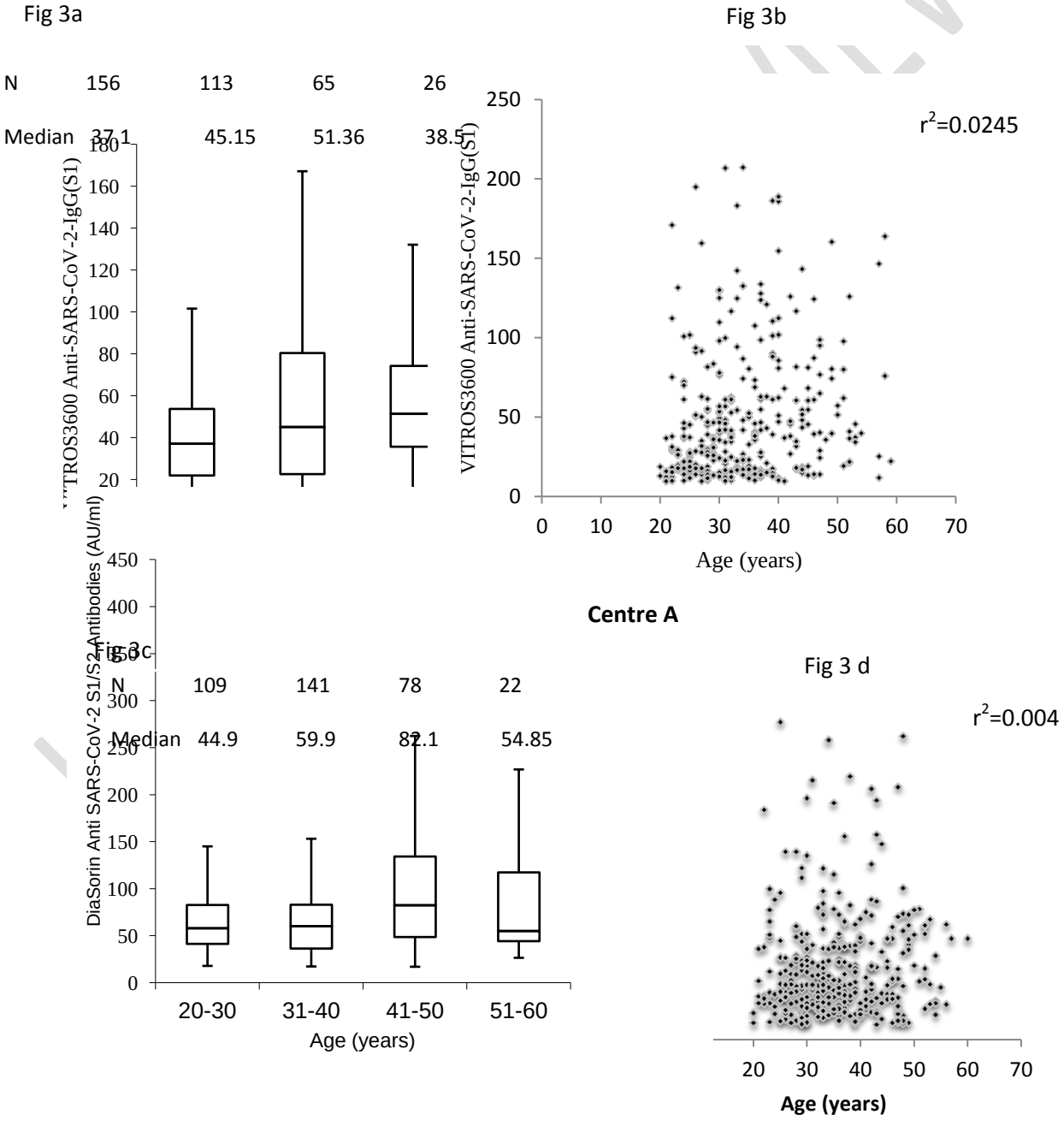
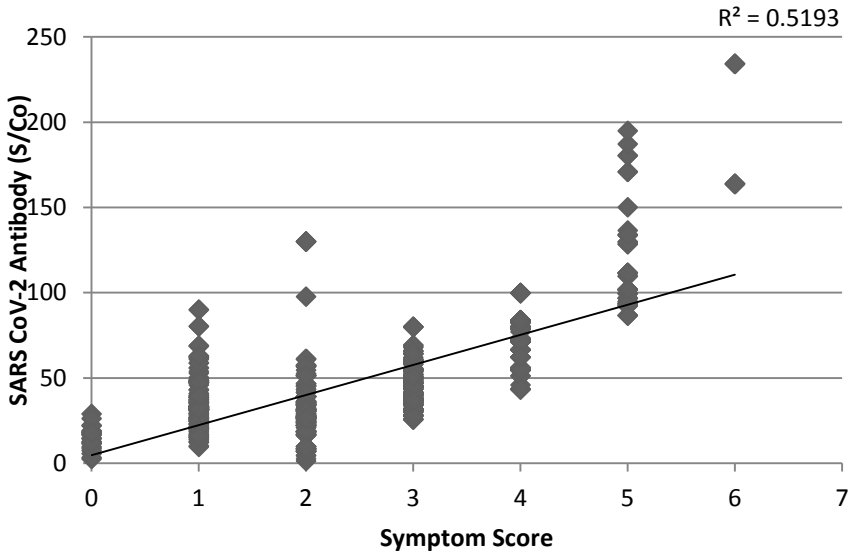


Figure 3: (a) Median SAR CoV-2 antibody levels, by age, centre A; (b) Linear regression between age and SARS CoV-2 antibody levels, Centre A; (c) Median SAR CoV-2 antibody levels, by age, centre B; (b) Linear regression between age and SARS CoV-2 antibody levels,



Centre B

Figure 4 Correlation between symptom score and SAR CoV-2 antibodies



COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation

but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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Table 1: Convalescent plasma donor characteristics (Combined Centre A & B)

Total screened *n* (%)	
Male	875 (93.48)
Female	61 (6.52)
Total deferred n (%)	P < 0.0001
Male	148 (79.57)
Female	38 (20.43)
Total Donated n (%)	
Female	23 (3.07)
Male	727 (96.93)
Type of Donor	
Voluntary	144(19.2)
Replacement	606(80.8)
First time	390 (52)
Repeat	360(48)
Age, years	
Mean ±SD (Range)	P = 0.0001
All	35.09± 8.7 (20-60)
Female	27.8± 3.86 (21-36)
Male	34.8± 8.74 (20-60)
Weight, kg	
Mean ±SD (Range)	*p* < 0.001
All	73.32± 14.10
Female	60.22± 9.75
Male	74.38± 13.86

Blood group, *n* (%)	
A	165 (22)
B	331(44.13)
AB	68 (9.07)
O	186 (24.8)
Hemoglobin g/dl(Mean ±SD)	14.92± 1.42
Platelet Count ($x10^9$/l) (Mean ±SD)	236.9±63.1
Total leukocyte count ($x10^9$/l) (Mean ±SD)	7.62 ±2.62
Occupation %	
Professional service	36
Government service	16
Semi-professional /self-employed	27
Students	12
Other	10
Interval between rRT-PCR/RAT positive test and plasma donation (days)-mean ±SD (min-max)	63.93 (21.52) (15-119)
SARS CoV-2 Antibody	Mean ±SD(range)
Centre A	
Antibody S/CO	50.21 ±41.52 (9.59-207.2)
Centre B	
Antibody AU/ml	84.01±76.31(16-400)
SARS CoV-2 Antibody from rRT-PCR positive result	**n (%) Mean ±SD**
Centre A	P = 0.2336

45 days and less	49	45.13±33.93 S/Co
More than 45 days	351	52.49±41.27 S/Co
Centre B	P = 0.1218	
45 days and less	101	73.55±80.34 AU/ml
More than 45 days	249	88.25±80.34 AU/ml

Table 2: Deferred donor details (Combined Centre A & B)

Reason for deferral	**N=186**	**%**
Overage/underage	5	2.69
Low platelet count	16	8.60
Anaemia/Low haemoglobin	17	9.14
Underweight	5	2.69
Poor venous access	11	5.91
High blood pressure	14	7.53
High blood Sugar	2	1.08
Absence of detectable/Low SARS CoV-2 antibodies	28	15.05
On Medication	5	2.69
Skin allergy	1	0.54
Minor/ Major Surgery	5	2.69
Inadequate time gap	18	9.68
Hepatitis B	3	1.61
Hepatitis C	4	2.15

Syphilis positive	3	1.61
Coronary Artery Disease	4	2.15
H/o parity	18	9.68
No COVID-19 positive diagnostic test result	25	13.44
Anxiety before donation	2	1.08

Table 3 Correlation between symptom score and SAR CoV-2 antibodies (Centre A)

Score	**n*(%)**	**Median (Range)**	**p < 0.00001**
0	24(6)	16.95(9.31-79.5)	r2=0.5193
1	115(28.75)	32.09 (9.6-90)	
2	103(25.8)	27.9 (9.59-130	
3	86(21.5)	44.6(25.73-79.93)	
4	40(10)	71.8 (12.89-99.8)	
5	26(6.5)	101.85(28.9-194.9)	
6	6(1.5)	163.8 (63.8-234.21)	

*The majority of donors had several symptoms

Table 4: Symptom wise multivariable analyses for correlates SARS CoV-2 antibody levels (Centre A)

Multivariable analysis			
Symptoms	**n**	**β (SE)**	**p-value**
Asymptomatic	24.00	-0.10 (8.78)	0.06

Fever	332.00	0.16 (5.47)	**0.000**
GE or GE-like syndrome	33	0.46(66.69)	**0.000**
Anosmia	32.00	0.05 (11.45)	0.49
Ageusia	23.00	-0.10 (13.32)	0.21
Headache/Body ache	28.00	0.00 (6.68)	0.94
Cough/ Sore Throat/ SOB	179.00	0.06 (3.85)	0.23
Cold	49.00	-0.13 (5.73)	**0.01**

Significant correlates are shown in bold