SEROPREVALENCE OF HUMAN PARVOVIRUS B19 AMONG VOLUNTARY BLOOD DONORS IN CHENNAI- A CROSS SECTIONAL STUDY

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ABSTRACT

Background

The transfusion transmitted emerging infectious agents has become a real threat to the transfusion safety. Human parvovirus B19 is one of the common viral infection worldwide with a potential threat of transfusion transmission through blood and its products particularly affecting the high risk groups. Introduction of screening test for detecting Human parvovirus B19 antibodies for blood donors needs further evaluation for its potential risk and cost effectiveness.

Aim

To find out the seroprevalence of Human parvovirus B19 among voluntary blood donors in Chennai.

Materials and Methods

106 blood samples from voluntary blood donors were collected in one year period from July 2015 to June 2016 and were subjected to IgM and IgG serological tests using NovaLisa Human parvovirus B19 ELISA kits. Data analysis was done using SPSS software and Chi-square test was used to find statistical significance.

Results

Among 106 voluntary blood donors, 44.3% of the donors were positive for anti-B19V IgG and none were positive for anti-B19V IgM. There was a statistically significant difference (p=0.018) in IgG positivity among different age group. Percentage of IgG B19V seropositivity gradually increases along with increase in age of the donors. Statistically significant difference (p=0.001) in IgG positivity in different socioeconomic groups affecting lower socioeconomic group more than the middle and higher groups. There was a statistically significant difference (p=0.019) in IgG positivity during different months in a year. Among 47 donors positive for IgG B19V, one was positive for HBsAg and two were positive for anti-HCV.

Conclusion

The seroprevalence of anti-B19V IgG in blood donors is 44.3%. All donor samples in this study were seronegative for IgM. Further larger studies are needed to confirm the possibility of transfusion transmission of Human parvovirus B19, to estimate clinical impacts on recipients and to justify the introduction of donor screening for Human parvovirus B19. Till then it is imperative to screen blood components at least for high risk recipients.

Keywords

Blood donors, Human parvovirus B19, transfusion transmission, immunoglobulin M, immunoglobulin G, screening, ELISA test.

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- Donor Form
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- ELISA Kit Clarification – email copy

LIST OF ABBREVIATIONS

AABB	American Association of Blood Banks
B19V	Human Parvovirus B19
CDC	Centers for Disease Control and Prevention
DGHS	Directorate General of Health Services
DNA	Deoxyribonucleic acid
EID	Emerging Infectious Disease
ELISA	Enzyme Linked Immunosorbent Assay
FDA	Food and Drug Administration
HI	Haemagglutination Inhibition
IgM	Immunoglobulin M
IgG	Immunoglobulin G
NAT	Nucleic acid Amplification Test
NS1	Non Structural Protein 1
NTU	Nova Tec Units
OD	Optical Density
PCR	Polymerase Chain Reaction
PARV4	Parvovirus 4
RMH	Receptor Mediated Haemagglutination
RNA	Ribonucleic acid
TMB	Tetra Methyl Benzidine
TTI	Transfusion Transmitted Infections
WHO	World Health Organisation

INTRODUCTION

INTRODUCTION

Blood transfusion is a lifesaving therapy in hospital practices for patients. It is proven to be an invaluable human resource used for diverse kind of medical and surgical conditions.[1]

Blood is a biologically active substance and for an effective blood transfusion services, the blood and blood products provided should be safe as possible and adequate to meet the patient requirements. Blood borne infections are common and can be transmitted by transfusion of infected blood donated by apparently healthy and asymptomatic blood donors.[2] First step for safe blood donation depends on, building a panel of regular, voluntary, non-remunerated blood donors.

According to WHO (World Health Organization), all blood donations should be screened for infections prior to use. The goal of WHO is to obtain all blood supplies from voluntary, non-remunerated donors by 2020.[3]

In India, it is essential to test every unit of blood collected for Hepatitis B (HBsAg), Hepatitis C (Anti-HCV), Human Immunodeficiency Virus (HIV 1&2 antibodies), Syphilis (VDRL/RPR/TPHA) and Malaria (Thick and Thin Blood Smear/ Antigen test).[4] If a donor test positive to any of the five infections, their blood is considered infectious and discarded.[5] Moreover the threat of emerging infectious agents worldwide continues to place demands on the collection of blood to ensure safety.

When a potential pathogen present in the donated blood gets transmitted to a recipient via blood transfusion, it is called as Transfusion Transmitted Infection (TTI). There are many infectious agents like bacteria, viruses, protozoa and prions which can be transmitted through blood transfusion.[6] Majority of the problems are due to the prevalence of asymptomatic carriers as well as blood donations that are carried on during window period of infections. The magnitude of the problem of transfusion transmitted infections varies from country to country depending on the prevalence of that particular disease.[7] Presently it has become essential to establish a risk control system against emerging infectious diseases.[8]

The risk control system usually includes identifying emerging/re-emerging infectious agents, any potential cause that could be transmitted/transferred by blood transfusion, monitoring, assessing the severity, evaluation, intervention (tests, donor history, pathogen reduction) and outcome of the intervention.[9]

Ideally, blood for transfusion should be either tested for all pathogens that are prevalent in a given population that can cause serious disease, or treated to inactivate all such pathogens. In practice, neither is possible.[10]

Viral infections are of great importance in transfusions associated with morbidity and mortality in patients. Viruses are easily transmitted by transfusion because many donors are asymptomatic during the donation of

blood.[11] Most commonly proven viruses transmitted by transfusion include HIV, HBV, HCV, HTLV, WNV, CMV and DENV. In addition to these commonly transmitted viruses, Human parvovirus B19 adds to the list of potentially transfusion transmissible infection as the virus can be demonstrated in asymptomatic individuals.[12]

Human parvovirus B19 is one of the emerging causative agents of blood borne infections worldwide.[8]

There is a large increase in the incidence of parvovirus infection as the primary mode of transmission is mainly by respiratory route. The acute infection is mild and self-limited, but it is clinically significant in those with underlying haemolytic process, immunocompromised, transplant recipients and pregnant women.[12] The levels of viral DNA during acute infection can exceed 10^{12} IU/ml.[13]

Asymptomatic individuals with viremia as blood donors can represent a risk to the safety of the blood supply, especially to high risk group such as pregnant women, congenital or acquired haemolytic anemia, immunodeficiency patients and transplant recipients.[14] Hence there is an increasing concern about the risk of parvovirus B19 transmission via blood products posing a threat to the safety of blood supply.

At present parvovirus B19 is not included in the mandatory donor screening tests for transfusion transmitted diseases. According to FDA, the recommended upper limit of viral load of parvovirus B19 for plasma derivatives should not exceed 10^4 IU/ml.[13] Since parvovirus B19 is emerging as a common viral infection with a serious threat of getting transmitted via blood transfusion, this cross sectional study was conducted to observe and analyse the seroprevalence of Human parvovirus B19 among voluntary blood donors.

Although the risk of Transfusion transmitted human parvovirus B19 virus has been a concern, till date five proven cases have been identified following blood component transfusion in high risk group recipients.[15]

Several studies done on European population between 1995-2014, on the prevalence of parvovirus B19 in blood donor population reveal 6% to 79% for IgG, 0.72% to 7.53% for IgM, 0.01 to 15.3% for IgG+IgM, 0% to 1.3% for parvovirus B19 DNA.[16] In India, among the blood donors, the seroprevalence ranges from 27.96% to 39.9% for IgG, 7.3% for IgM and 2.40 % for IgG+IgM.[14]

An estimate of the seroprevalence of Human parvovirus B19 among voluntary blood donors may be of help to decide whether screening for parvovirus B19 would eliminate transmission of infection to high risk groups. Since, such studies are few in India, the present study was undertaken in an attempt to address this aspect. Such information may be of great value to health planners and policy makers.

AIM AND OBJECTIVES

AIM AND OBJECTIVES

AIM

The aim of the study is to find the seroprevalence of Human parvovirus B19 among voluntary blood donors in Chennai.

OBJECTIVES

1. To estimate the seroprevalence of Human parvovirus B19 among the voluntary blood Donors in Chennai.
2. To detect anti-B19V IgM and IgG antibodies by ELISA.
3. To confirm anti-B19V IgM seropositive samples by PCR.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Human Blood and its components is a lifesaving resource in hospital practices. Safe and sufficient supply of blood and blood products for all patients requiring transfusion is significant for every blood transfusion service.[16] The precious human resource in the form of voluntary blood donation is the back bone of well organised Blood transfusion service.

Blood transfusion service is considered as one of the eight key life-saving interventions in health care.[18] Transfusion of blood and its products is a specialised modality of patient treatment and management, saving millions of lives worldwide each year and also reducing the morbidity.[19]

Voluntary non remunerated blood donors are the corner stone of a safe adequate supply of blood and blood components.[20] WHO (world health organisation) recommends that all blood donations should be screened for infection prior to use. The goal of WHO is to obtain all blood supplies from voluntary unpaid donors by 2020 for all countries.[3]

The national blood policy in India depends mainly on voluntary blood donors, as they are usually considered to be with low levels of transfusion-transmitted infection. In India, it is mandatory to test every unit of blood collected for Hepatitis B (HBsAg), Hepatitis C (Anti-HCV), Human Immunodeficiency virus (HIV1&2antibodies), Syphilis (VDRL/RPR/TPHA) and Malaria (Thick and Thin Blood Smear/antigen test).

If a donor test positive to any of the five infections, their blood is considered infectious and discarded.[5] A spectrum of blood infectious agents is transmitted by transfusion of infected blood donated by apparently healthy and asymptomatic blood donors.[6]

Blood should be tested from each donation to identify donors and donated components that might harbour infectious agents. This screening process is critically important because many blood components (eg, red cells, platelets, plasma, and cryoprecipitate) are administered intravenously to recipients without pasteurization, sterilization, or other treatments to inactivate infectious agents. Thus, infectious agents in a donor's blood at the time of donation that are not detected by the screening process can be transmitted directly to recipients.[10]

For any infectious agent or infection to be transmitted by blood, usually have the following characteristics: [21]

- Duration of incubation period is long, before the appearance of clinical signs.
- Stability in the blood stored at 4^0C or lower.
- Presence in the blood for long periods and in high titres.
- Asymptomatic phase in the blood donors.

The various markers of infection usually appears at different times one after another. For each Transfusion transmitted infection the window period varies, ranging from few days to weeks and months, which in turn depends on the type of the infectious agent, the screening marker and the screening technology used. During the window period, the particular screening marker is not detectable in a recently infected individual, but the individual may still be infectious.[22]

The Nucleic acid (DNA or RNA), as a part of native infectious agent itself, is the first detectable target, followed by antigen, and antibody as the immune response develops. An effective and a well-organized blood screening programme is essential for the provision of good quality and safe blood supply to meet the transfusion needs of patients.[22]

Viral infections are of great importance in transfusions associated with morbidity and mortality in patients. Viruses are easily transmitted by transfusion because many donors are asymptomatic at the time of blood donation. Most commonly transmitted viruses by transfusion include HIV, HBV, HCV, HTLV, CMV, DENV and HUMAN PARVOVIRUS B19.

EMERGING INFECTIOUS DISEASE

In the year 2009, experts from AABB in United States reviewed about the Emerging infectious disease agents. It includes recognition or spread of a new agent, recognition of an infection or disease that has been in population

but previously undetected or that a disease has an infectious origin and re-appearance of a known infection after a decline in incidence.[9] The rate of emergence from 1940 to 2004 includes 5.3 new viruses discovered every year, the expected rate of such emergence will continue beyond the year 2020.[9]

Human exposure can occur by a number of overlapping conditions, many of which humans have clearly precipitated in 'forcing' a new agent by mutation including the appearance of drug resistance strains, failure of existing control measures, population movements and rapid transportation, Human behavioural changes and intensive farming practices to name a few.[23]

The AABB identified around sixty eight EID agents of concern to blood safety; each agent had enough evidence and potential for clinical disease to warrant further consideration.[23] Four categories were created based on priority levels such as: red, orange, yellow and white.[24] The red category was assigned to those agents with low to high risk for blood safety; the agents with risk of progression to a higher category in the future were classified as orange category. And those agents that have absent to low evidence of risk to the blood supply were classified as yellow category. White category includes agents that the deems to pose no risk at this time.

Even though the emerging infectious agent that appears to pose biggest risk to the blood supply are found in red and orange categories, the yellow priority agents that includes Hepatitis A virus, HHV-8, HIV variants, Borrelia

burgdorferi are gaining importance recently.[24] In addition to these agents, Human parvovirus B19 also adds to the list in the view that most cases are asymptomatic and can cause transfusion transmitted infection in humans.[25]

HUMAN PARVOVIRUS B19

Human Parvovirus B19 (Latin word “Parvum” means “small”) is a newly emerging DNA virus, belongs to Erythroparvovirus genus, a member of Parvoviridae family, Parvovirinae subfamily.[26] The virus was discovered in 1975 by an Australian virologist, Yvonne Cossart, while working in London, when screening donor sera for Hepatitis B virus, but found the B19 virus in the sera, numbered 19 in row B, hence named it B19.[16] B19 association with disease was first identified in 1981, when it was linked to an aplastic crisis in a patient with sickle cell disease.[28] The virus was independently described in Japan and France where it was called as Nakatani or aurillac antigen respectively.

Human Parvovirus B19, the only known human pathogenic virus of the Parvoviridae family.[8] Parvovirus are the smallest of the known animal virus having linear and single stranded DNA genomes. They are quite dense and non-enveloped, the capsid proteins are arranged with icosahedral symmetry. It is approximately 20-25 nm in diameter and can survive many inactivation procedures, that are commonly used to protect the blood supply, and they can remain fully viable at ambient temperature for months and even for years.

The parvovirus B19 genome contains approximately 5600 nucleotides and encodes three major proteins, two capsid proteins, VP1 and VP2 and a non-structural protein, NS1.[30] The capsid protein, VP2 is the major protein that makes 95% of capsid structure, it can self-assemble on target cells and can bind to the parvovirus B19 receptor, globoside (the blood group P antigen).The capsid protein VP1 antigen contains the main neutralizing epitopes, and essential for viral entry. The NS1 is a phosphoprotein, has important role in activation of viral gene transcription, viral replication and encapsidation of the viral genome within the virus. It is also cytotoxic and can cause cell cycle arrest and induces apoptosis in infected cells.[27]

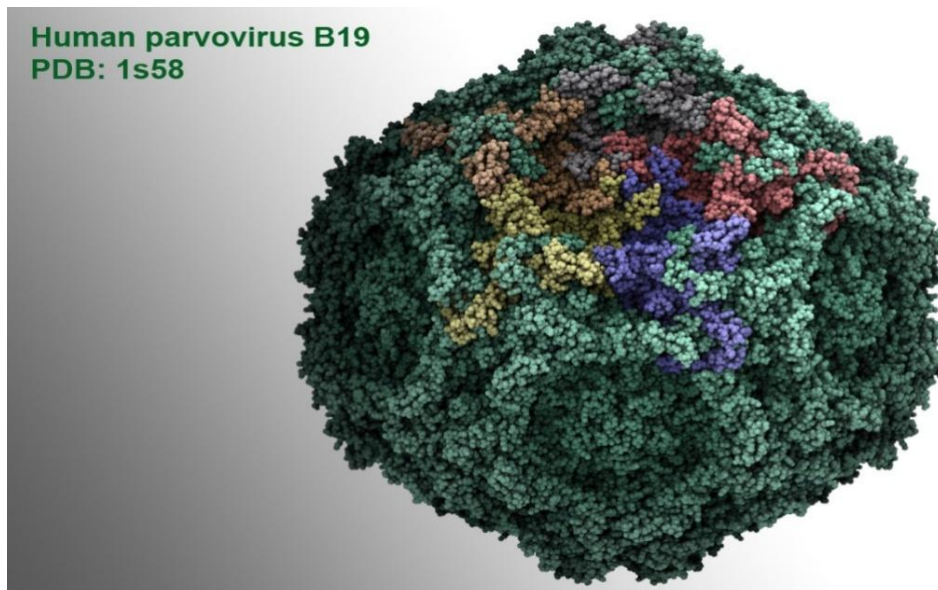

Figure 1: Structure of Human Parvovirus B19[31]

The parvovirus B19 genome is a well conserved genome with 10% sequence variation between the isolates. Folding of the proteins creates alpha-helical loops that appear on the surface of the assembled capsids, where the

host immune system can recognize them as antigenic determinants. The unique region of VP1 is external to the capsid and it has many linear epitopes recognised by neutralising antibodies.

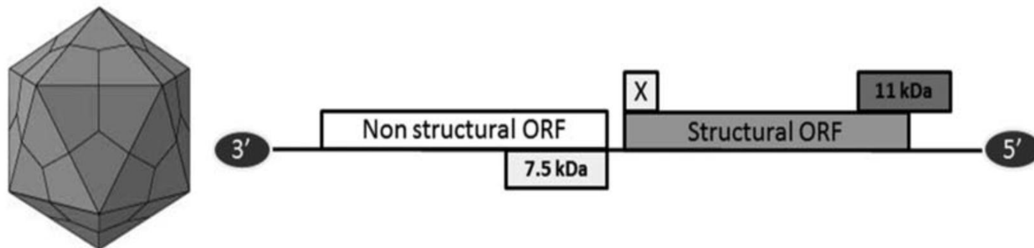

Figure 2: Human parvovirus B19 icosahedral virion and genome structure.[16]

PARVOVIRUS B19 GENOTYPE

There are three distinct genotypes (1, 2 and 3) and all studies in the literature usually relate to type 1 genotype.[30] The current serological assay can detect all three genotypes.[30] Genotype 1 is the most prevalent type and has a worldwide distribution found in different time periods. Genotype 2 is seen in patients from European countries, the United States and Brazil. Genotype 3 is seen in tropical countries such as Brazil and Ghana. A new parvovirus sequence PARV4 was discovered but it differs genetically from the parvovirus B19 genotypes and probably a new genetic type of family Parvoviridae.[32] Parvovirus cannot be cultured in any established cell line and they are predominantly isolated from viremic human sera.[26] Parvoviruses depend on host and propagate in actively dividing cells.

EPIDEMIOLOGY OF PARVOVIRUS B19

Infection with Human parvovirus B19 is common and seen all over world. The infectivity rates are almost similar in the United States, Europe and Asia.[33] It is mostly endemic, potentially emerging at any time during the year in all seasons, although in temperate climates, outbreaks are commonly seen in late winter and early summer. The infection are particularly apparent in children, but it continues at a lower rate throughout adult life, by the time they are elderly, most persons are seropositive. The seroprevalence of this virus increases with age.[34] Once infected, immunity generally persists for life, and it is considered as a reliable marker of previous exposure.

PARVOVIRUS B19 TRANSMISSION

Human Parvovirus B19 virus is primarily transmitted by respiratory droplets, and the virus can be detected in throat swabs during the initial period for a week following infection. Initially replication occurs in nasopharyngeal lymphoid tissue resulting in high titre viremia during which the viral load is at concentrations of up to 10^{12} particles/ml of blood.[32]

Parvovirus B19 is also transmitted by blood and its products, mainly through pooled factor VIII and factor IX concentrates.[33] The small size of the virus, absence of a lipid envelope and their genomic stability makes them resistant to the heat and solvent detergent treatments and even escape removal by filtration, traditionally used in pathogen inactivation technology in blood products preparation.[26]

The risk of vertical transmission varies between 30% to 50% following exposure to infection in pregnant women.[16] Transmission of infection may occur in solid organ or haematopoietic transplantation and can lead to serious complications in such patients.[16]

PATHOPHYSIOLOGY

The only known natural host cell for Parvovirus B19 is the human erythroid progenitor cells. The virus after entering blood initially replicates in human erythroid progenitor cells (late erythroid cell precursors and burst-forming erythroid progenitors of the bone marrow and blood, thereby inhibiting erythropoiesis).[35] Globoside, a neutral glycolipid that acts as a cellular receptor accounts for the trophism in erythroid cells.[33]

Globoside is also known as erythrocyte P antigen.[37] Individuals with rare p phenotype blood group, whose erythrocytes lack P antigen are not susceptible to infection and they have no serologic evidence to infection with Parvovirus B19, their marrow erythroid progenitors proliferate normally in the presence of high concentration of virus. The rare p phenotype frequency is 1 in 2, 00,000 and most commonly seen in Swartzentruber Amish population than in general population.[36] The presence of the P antigen alone is not sufficient for the virus to gain entry into the human erythroid progenitor cells and it has been suggested that some of the β–integrins also acts as co-receptors for cellular entry.[34]

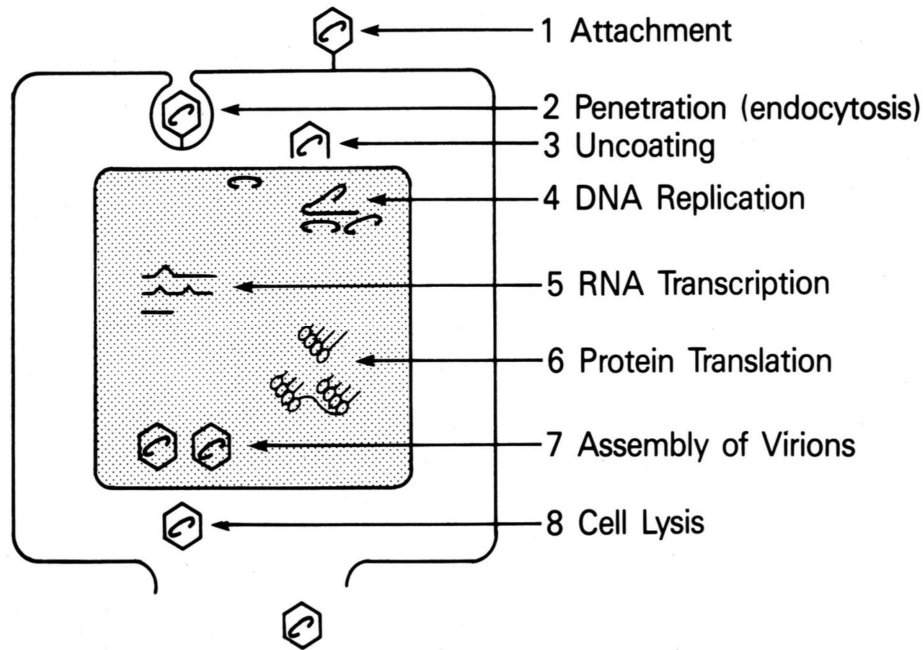

Figure 3: Schematic life cycle of B19.[40]

Once the virus binds the receptor, it is rapidly internalized by receptor mediated endocytosis, mainly via clathrin-coated pits.[26] Inside the host cells, the viral DNA enters the nucleus. The 3' end of the viral DNA strand folds back, forming a hairpin like bend that acts as a self-primer for viral DNA to replicate. The virus is cytotoxic to the host cells. This, along with the tropism for rapidly dividing erythrocyte precursors (particularly pronormoblasts and normoblasts, wherein they replicate in high titers), leads to the suppression of erythropoiesis seen during infection.

No reticulocytes are formed to replace aging or damaged erythrocytes as they are cleared by the reticuloendothelial system. Although decreases in hemoglobin levels of greater than 1 g/dL are rare in healthy individuals infected with Parvovirus B19, decreases of 2-6 g/dL may be observed in patients with haemolytic anemias. Occasionally, the virus can infect leukocytes

(particularly neutrophils). Parvovirus B19 does not usually infect megakaryocytes; however, in vitro, it is seen that parvovirus B19 proteins have a cytotoxic effect on megakaryocytes. Although parvovirus B19 infection may sometimes manifest with pancytopenia, it is not believed to contribute significantly as an aetiology of true aplastic anemia.

Fetal myocardial cells also express P antigen and can be infected with Parvovirus B19 and can lead to some of the direct myocardial effects seen during fetal infection.

Both in vivo and in vitro studies, has shown that the pluripotent erythrogenic stem cell is resistant to parvovirus B19 infection.[26]

PARVOVIRUS B19 STABILITY

Because of its small DNA genome and non-enveloped structure, B19 is resistant to many inactivating procedures used to inactivate viruses. It is stable in lipid solvents (ether, chloroform) but can be inactivated by formalin, beta-propiolactone and oxidizing agents.[30] The heat stability also varies depending on the environment. B19 viruses can survive heat treatment at 48^0C for 30 minutes. In blood products parvovirus B19 retained infectivity after heating at 56^0C for 60 minutes. It is also virtually resistant to 60^0C heat for more than one hour when suspended in 60% sucrose.[30] Over recent year's parvovirus B19 has been used as a model virus for various viral inactivation procedures in pathogen inactivation technology.[23]

IMMUNE RESPONSE

Specific immunoglobulin IgM and IgG antibodies are produced following infection with Parvovirus B19. In normal individuals who are healthy the initial and predominant immune response is production of antibodies. The parvovirus B19 immunological response is mainly directed against two structural proteins, VP1 and VP2 proteins, which has both linear and conformational epitopes.[41] The VP1 and VP2 capsid proteins, coded from the same reading frame, are identical except VP1 contains 227 additional amino acids at the amino terminus.

Parvovirus B19 infection initially is characterised by a 5-day phase with high viremia (titre about 10^{14} IU/ml parvovirus B19 DNA). This viremia is neutralised with antibodies generated by the humoral immune system directed against two structural proteins VP1 and VP2. IgA antibodies are also detectable for a short period following the onset of clinical symptoms.[42]

The presence of specific IgM is consistent with the patient experiencing an acute B19 infection. The presence of B19- specific IgG in the absence of IgM is consistent with an infection in the remote past, with immunity to further infection. This immunity is considered to be lifelong.[43]

A cellular immune response to B19 has been much harder to detect, although it must be present to illicit the humoral response. Recent studies have suggested that individuals mount a classic Th1 response to the virus, with

capsid proteins presented to CD4 T cells through class II molecules.[40] The cell-mediated immune response occurs before the humoral immune response with the proliferation of specific CD4+ T cells against the VP1 and VP2 antigens. When the cellular immune response is activated, neopterin levels (6-D-erythro-trihydroxipropilpterin) also increase in B19 infection. Neopterin is a direct marker for monocyte activity and an indirect marker for macrophage activity.[42]

The pattern of clinical disease is strongly influenced by the hematologic and immunologic status of the host. In the healthy host, B19 infection may cause a self-limiting subclinical erythroid aplasia, followed by rash or arthralgia mediated by the immune response. In patients suffering from diminished production or increased destruction of erythrocytes, infection can result in a dramatic decrease of haemoglobin, leading to aplastic crisis, whereas immunocompromised individuals might fail to eradicate virus, thereby generating a state of chronic anemia.

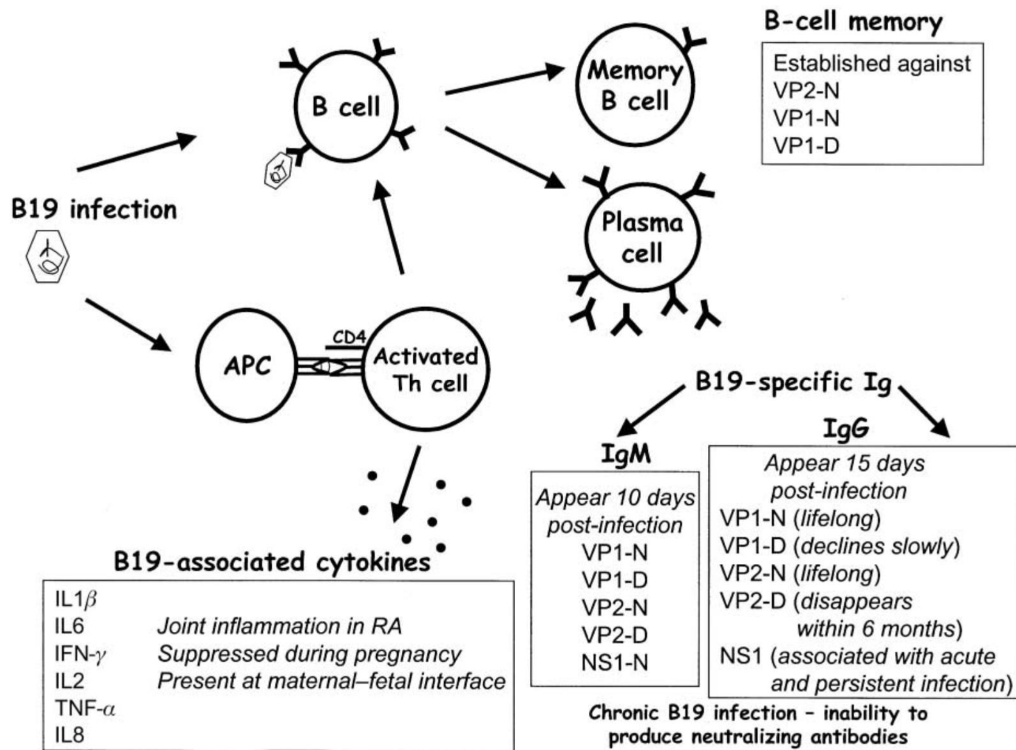

Figure 4: Schematic depiction of T and B-cell response to parvovirus B19infection[34]

CYTOPATHOLOGY

The effect of parvovirus B19 on progenitor cells of erythroid lineage in bone marrow is characterised by the formation of giant pronormoblasts or lantern cells. These are nothing but erythroid cells in early developmental stage of diameter approximately around 24 to 30 µm, they have eosinophilic nuclear inclusions bodies, cytoplasmic vacuolization, and occasionally, “dog ear, projections. These abnormal cells are seen either in bone marrow or peripheral blood. These cells are often absent in immunocompromised patients, patients with Human immunodeficiency virus infection and other chronic infection.

Hence their presence or absence is not helpful to make a diagnosis of B19 infection.[40]

CLINICAL ASPECTS

The spectrum of disease linked to parvovirus B19 infection range from asymptomatic to serious and fatal conditions particularly in susceptible population such as immunosuppression, decreased erythropoietic reserve, or both.[37]

ASYMPTOMATIC INFECTION

The Parvovirus B19 presents mostly as a subclinical infection in adults and children. In patients with haemolytic anemia the recently transfused erythrocytes can mask the symptoms of the infection suggesting asymptomatic seroconversion. It is mainly due to transfused erythrocytes which has longer life span than the erythrocytes of the host.[40] In most of the cases the presentation of symptoms is nonspecific which is similar to common flu and in many individuals the infection passes largely unnoticed.[23]

ERYTHEMA INFECTIOSUM

The most common manifestation of infection in children is fifth disease or erythema infectiosum.[25] It is also referred as "slapped cheek disease". The characteristic presentation is erythema over the face concentrated on the cheeks, along with circumoral pallor which usually begins 2-3 weeks after

infection. Rashes also occur in the trunk and limbs. Prodromal symptoms include fever, malaise, headache and nausea. The formation and deposition of immune complexes in skin leads to these symptoms.[33] This stage indicates seroconversion, either IgM antibodies, or the presence of newly formed IgG antibodies can be seen in serologic testing.

ARTHROPATHY

The most common manifestation of primary infection of parvovirus B19 in adults is non-erosive arthritis or arthralgia. It is commonly seen in females than males.[44] It is immunologically mediated due to circulating antibodies. The joint symptoms often mimic rheumatoid arthritis, presenting as an acute peripheral symmetric polyarthritis involving the metacarpophalangeal joints, knee joint, ankle joints, without articular erosions.[31]

INFECTION IN PATIENTS WITH INCREASED RED CELL TURNOVER

TRANSIENT APLASTIC CRISIS

In Patients with increased red cell destruction and increased demand for the production of red cells, acute parvovirus B19 infection can cause an abrupt cessation of red-cell production for 10 to 15 days and can lead to anemia. Transient aplastic crisis is seen in patients with sickle cell anemia and hereditary spherocytosis infected with Parvovirus B19. Although self -limited,

an aplastic crisis can cause severe, occasionally fatal, anemia that precipitates congestive heart failure, acute splenic sequestration and cerebrovascular accident.[40] The bone marrow during transient aplastic crisis is characterised by an absence of maturing erythroid precursors and the presence of giant pronormoblasts.

Conditions associated with decreased red cell production rendering patients susceptible to B19-induced aplastic crisis includes iron deficiency anemia, congenital dyserythropoietic anemia,[1] alpha and beta thalassemia. Transient aplastic crisis in patients with increased red cell destruction includes hereditary spherocytosis, hereditary elliptocytosis, G6PD deficiency, pyruvate kinase deficiency, sickle cell disease, malaria, chronic auto-immune haemolytic anemia, cold and heat antibody mediated auto-immune haemolytic anemia, paroxysmal nocturnal hemoglobinuria and even blood loss. Severe anemia with B19 can also rarely affect healthy subjects with no underlying hematologic disorder. Patients with transient aplastic crisis usually require transfusion support for a satisfactory haemoglobin concentration.[45]

INFECTION IN IMMUNODEFICIENT HOST

CHRONIC PURE RED CELL APLASIA

In immunocompromised patients who are unable to produce neutralizing antibody response due to a persistent BM insufficiency, B19 infection may cause chronic anemia. Predisposing conditions include Nezelof's syndrome,

acute lymphatic leukemia (ALL), acute myeloid leukemia, chronic myeloid leukemia, myelodysplastic syndrome, Burkitt's lymphoma, lymphoblastic lymphoma, myelodysplastic syndrome, astrocytoma, Wilms'stumor, HIV infection, SCID, BM transplantation, organ transplantation, steroid and cancer chemotherapy treatment. Patients usually have absent or low levels of specific antibodies, with persistent or recurrent viremia. Clinical hallmarks include fatigue and pallor, while immune-mediated symptoms (rash and arthralgia) are generally absent. As patients fail to mount an antibody response, serological diagnosis is not possible and detection of infection is usually achieved by PCR assay.[34]

B19 INFECTION IN PREGNANCY

HYDROPS FETALIS

Parvovirus B19 infection in a pregnant woman, followed by transplacental transmission to the fetus, can lead to either miscarriage or hydrops fetalis.[46] The P blood group globoside , which acts as a receptor for parvovirus B19, is present on cells of villous trophoblast of placental tissues in varying amounts during pregnancy.[32] Parvovirus B19 also infects the fetal liver, the site of erythrocyte production during early development. The swollen appearance in hydrops is due to severe anemia and myocarditis which leads to congestive cardiac failure. Based on varies studies in United States[47] and United Kingdom[48] the estimated risk of transplacental infection among

pregnant women who are infected with parvovirus B19 during pregnancy is 30 percent, with a 5 to 9 percent risk of fetal loss and the infection particularly during the second trimester of pregnancy leads to greatest risk of hydropsfetalis. Parvovirus B19 also accounts for 10 to 20 percent of all cases of non-immune hydropsfetalis.

VIROLOGICAL DIAGNOSIS

VIRUS CULTURE

The virus is grown in culture with difficulty as there is no animal model for culture. B19 virus can be cultured in erythroid progenitor cells from a variety of sources such as human BM, fetal liver, umblical cord and peripheral blood and in all culture system erythropoietin is required to maintain viral replication. B19 virus can also be propagated in a few specialized cell lines: two Megakaryoblastoid cell lines, MB-02 and UT-7/Epo and two human Erythroid leukemic cell lines, JK-1 and KU812Ep6.[40] The yield of virus from all these cultures is poor, and they cannot be used as a source of antigen for diagnostic tests.

DIAGNOSTIC CYTOPATHOLOGY

The characteristic cytopathological abnormality caused by parvovirus B19is the formation of giant pronormoblasts (also referred to as lantern cells) in the bone marrow, these are early erythroid cells with a diameter of 25 to 32

μm in diameter,[40] which is characterized by ground glass appearance of the nucleus, perinuclear halo, immature chromatin and cytoplasmic vacuolization. This cytopathological evaluation is particularly useful in the evaluation of suspected hydrops fetalis[41] but it is not sufficient for diagnostic purposes.[32]

IMMUNOHISTOCHEMISTRY

Immunohistochemistry can be used for the pathological examination of different tissues materials from hydropicfetuses (thymus, liver, heart, placenta, lungs, kidney). It enables visualisation of parvovirus B19VP1/VP2 within the myocardium in hydropsfetalis. Since it is a time consuming method, it is not routinely used as an diagnostic procedure.

RECEPTOR MEDIATED HEMMAGGLUTINATION ASSAY

Receptor mediated hemagglutination (RHA) assay was introduced by Japanese Red Cross blood centres in 1998 and used as a screening test for parvovirus B19 for all donated blood until 2007. It is a parvovirus B19 antigen detection method in which the indicator RBCs agglutinate via parvovirus B19 particle binding to globosides on the RBC membrane at a critical pH. The sensitivity of RHA is approximately 10^{10} IU/mL.[48] This was replaced by chemiluminescence enzyme immunoassay-based screening assay with a sensitivity of approximately 10^{7} IU/mL.

SEROLOGICAL METHODS

The exact diagnosis of recent or past infection with B19 virus can be detected by enzyme linked immunoassay to detect anti-B19 IgM and anti-IgG or radioimmunoassay or immunofluorescence and for B19 DNA by using PCR.[40] The virus capsid proteins that are expressed in eukaryotic expression system (the baculovirus expression system) is used in immunoassay system. The co-expression of VP1 and VP2 in the eukaryotic expression system results in empty capsids that are antigenically analogous to native B19 virions, these co-capsids contain conformational epitopes that are essential for accurate detection of infection. Recombinant VP1 and VP2 proteins, expressed in both prokaryotic and eukaryotic systems, can be used to detect an immune response against conformational or linear epitopes when non-denatured or denatured antigens are used respectively.[34]

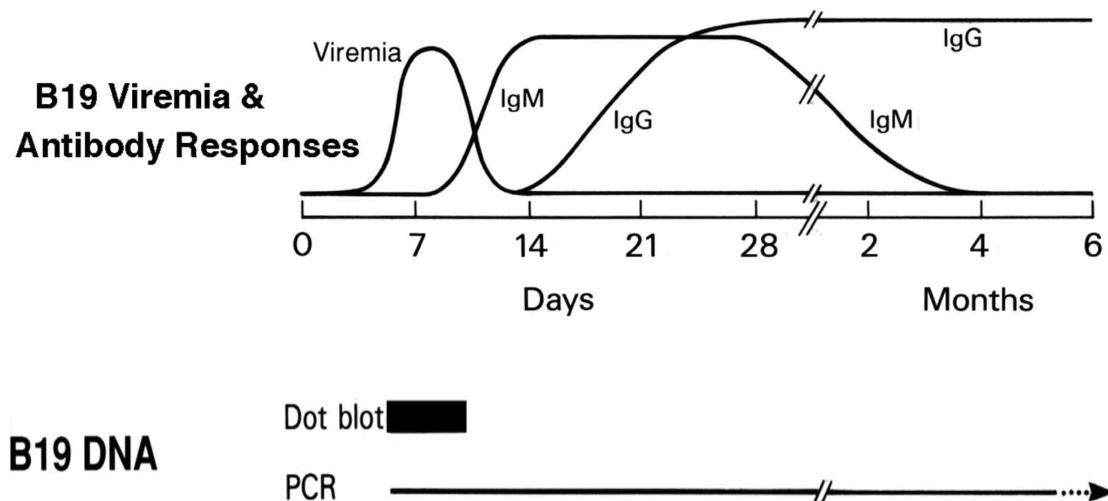

Figure 5: Diagnostic markers of parvovirus B19infection in patient serum[40]

B19 IgM IMMUNODETECTION

The IgM antibodies usually appears 7-10 days post-infection and are directed against linear and conformational epitopes of VP1 and VP2 antigens. It usually persists approximately for 3-5 months.[40] It indicates recently infected, and thus potentially infectious individuals.[23] Currently there is no international standard preparation for B19 IgM.[40]

B19 IgG IMMUNODETECTION

Development of B19 IgG antibodies coincides with a decline in the IgM response. These antibodies are protective, has life-long persistence and identify previously infected rather than infectious individuals.[23] The antibody response wanes against linear epitopes on B19 capsid proteins, it persists against conformational epitopes of both capsid proteins (VP1 and VP2).[40]

PCR DETECTION OF B19 DNA

The B19 PCR improves the sensitivity of detection of B19 infection. The parvovirus B19 can even present rarely in the blood and bone marrow of healthy subjects for long periods thus the qualitative PCR is not considered as a valid diagnostic assay to confirm recent infection. The nucleic acid amplification technology (NAT) assay for parvovirus B19 was standardised by WHO. The 1st WHO international standard for parvovirus B19DNA for NAT assays (code 99/800) was replaced by the 2nd WHO International Standard for

parvovirus B19DNA for NAT assays (code 99/802) with a potency of 10^6 IU mL^{-1} (or 10^5 IU per vial).[49] This standardized PCR quantitative control is applied for screening of plasma in minipools and other blood products, thereby improving the safety of transfusion and the haematological treatment.

At present, there is no Food and Drug Administration (FDA) licensed blood donor screening tests for Human Parvovirus B19.[25] Moreover the inability of transplant patients to produce sufficient anti-B19 Ig could present a diagnostic dilemma resulting delay treatment in such patients who rely on serological examination for the diagnosis Parvovirus B19.[50] In such patients PCR detection of Bl9 DNA is essential.

Various studies done in healthy blood donors in different countries had shown variable seropositivity results for IgG and IgM parvovirus B19 antibodies.

A Seroprevalence study done by Manaresiet al[51] in Bologna, Italy among 446 healthy blood donors in Italy by IgG ELISA against capsid proteins VP1 and VP2 showed 79.1% seropositivity. No significant difference was found between men and women.

A Seroprevalence study of human parvovirus B19in 1633 healthy blood donors done by Satish Kumar et al[52] at Pune in India, showed the net prevalence of IgM antibodies as 7.53% and prevalence of IgG antibodies as 27.96%. Dual positivity (IgG and IgM) was 2.40%.

A Seroprevalence study done in healthy adult population by Rohrer et al[53] in German population among 6583 adults, showed anti-IgG positive in 72.1%, 66.9% in adolescents (18-19 years). Significant differences were observed between females (73.3%) and males (70.9%).

A Seroprevalence study done in blood donors by Iheanachoet al[44] in Lagos, Nigeria among 150 voluntary blood donors showed anti-IgG positive in 66.0% and anti-IgM positive in 1.3%.

A Seroprevalence study by Kishore et al[17] in 1000 North Indian voluntary blood donors in India using in-house anti-B19 IgG ELISA showed anti-IgG positive in 39.9%. Seroprevalence was higher in males than females and it increased with increasing age. Socioeconomically, B19 IgG antibody positivities were 61.8%, 61.1%, and 44.4% in low, medium, and high income groups respectively.

Banwatet al[1] reported the presence of anti-B19 antibodies among 88 blood donors in Kogi state, Nigeria. They showed 33(37.5%) out of 88 blood donors were anti-IgG positive and 13 (14.8%) were anti-IgM positive. Males had higher Seroprevalence compared to females for IgG.

Aldo Gaggeroet al[54] studied the Seroprevalence of Human parvovirus B19among 400 voluntary blood donors from Santiago, Chile. The overall prevalence of IgG antibodies was 54.8%. No significant difference was found between men and women (57.6% and 49.3%, respectively).

DeokJa oh et al[55] investigated the prevalence of parvovirus B19 DNA and anti-parvovirus B19 antibodies in 928 randomly selected Korean plasmapheresis donors. The rate of positive identification of anti-parvovirus B19antibody (IgG only or IgG and IgM) among the donors was 60.1% (558 of 928 donors). The prevalence of parvovirus B19 DNA was 0.1%.

A seroprevalence of immunoglobulin G (IgG) to parvovirus B19 in 578 Saudi blood donors in Makkah, Saudi Arabia by Ayman K. johargy[56] showed 76.3% positivity.

A Seroprevalence study by Mahmoodian-ShooshtariM et al[57] in 1640 blood donors in Tehran, Iran showed, 8 (0.5%) subjects had IgM antibody thereby being reported positive and 676 subjects (41.2%,) were positive for anti-B19 IgG. B19 DNA was not found in any of the subjects (0%).

A Seorprevalence study by Al-Danani D.A et al[58] among 100 healthy blood donors in two cities, Aden in Yemen and Alexandria in Egypt showed, 46% and 26% respectively.

TRANSFUSION TRANSMITTED PARVOVIRUS B19

Of five previously reported cases of parvovirus B19 transmission by single-donor blood components, three were by RBC transfusions and two was by Platelet transfusion. The possible reasons for the paucity of the reports are as follows:[48] 1) most of the transfusion recipients are immune to Parvovirus

B19. 2) Parvovirus B19 infection usually does not cause a serious illness even in non-immune adults affecting only patients in the immunocompromised condition. 3) Passive immunization by the transfer of neutralizing anti-parvovirus B19 antibodies mostly occurs with concurrent transfusion. 4) some of the risk factors that increase susceptibility to severe parvovirus B19 disease in recipients, and the signs and symptoms of TT-parvovirus B19 infection, are not well recognized among clinicians.[48]

Cases established as having TT-parvovirus B19 infection[48]

Case	Patient profile	Before Trans-fusion	After Transfusion	Symptoms and laboratory findings	Transfused components
1	41,male Hairycellleukemia Afterchemotherapy		DNA (+) IgM (+) IgG(+)	RBCaplasia(3 months) Reticulocytopenia Viremia 0f 1×10^{12} copies/ml.	RBC (irradiated) DNA(+) 1.8×10^{5} IU/mL IgM(+) IgG(+)
2	57, male AML (M4) After chemotherapy	DNA (–) IgM (–) IgG (–)	DNA (+) IgM (+) IgG (+)	Pure RBC aplasia (approx. 2 months)	PC (irradiated) DNA (+) 9.7×10^{8} IU/mL 2×10^{10} IU/bag IgM (+) IgG (–)
3	35, female Placenta previa	DNA (–) IgM (–) IgG (–)	DNA (+) IgM (+) IgG (+)	Fever Systemic eruption (3 weeks	RBCs (irradiated) DNA(+) 3.0×10^{5} IU/mL 3×10^{6} IU/bag IgM (+) IgG (+)
4	59, male Rectal cancer	DNA (–) IgM (–) IgG (–)	DNA (+) IgM (+) IgG (+)	Sustained high fever (5 days	RBCs (irradiated) DNA(+) 5.1×10^{3} IU/mL 5×10^{4} IU/bag IgM (+) IgG (+)
5	61, male AML After chemotherapy	DNA (–)	DNA (+)	High fever Disseminated erythema Pure RBC aplasia (7 weeks) Reticulocytopenia	PC (irradiated) DNA (+) IgM (+) IgG (+)

Viral concentrations as high as 10^{13} genome equivalents (geq) / mL are often found in the blood of asymptomatic individuals during the early phase of acute infection.[48] There are reports of transfusion transmission by pooled plasma-derived products, including factor 8 and other clotting factors despite solvent/detergent (S/D) treatment, heat treatment, and other viral inactivation methods in pathogen Inactivation. The IgG antibodies present in multiple plasma donors are adequate enough to render the pooled plasma products non-infectious, provided that no donor in the plasma pool has high-level viremia. This provides the valid reason for excluding only those plasma donations for further manufacturing that have viral titers exceeding approximately 10^6 IU/mL.[47]

PREVENTION OF TT-PARVOVIRUS B19

Currently no FDA guidelines or AABB standards exist in regard to donor deferral period for Human Parvovirus B19.[25]

Prudent practice would be to defer any donor with signs and symptoms of parvovirus B19 infection until they resolve. Currently there is no FDA-licensed blood donor screening test for Parvovirus B19.[25]

Since the infectivity of the virus has been associated with a high concentration of parvovirus B19 it is necessary to implement screening for parvovirus B19 DNA by nucleic acid testing (NAT) to exclude high-titre donations from manufacturing pools.

WHO RECOMMENDATION FOR NAT ASSAY

The nucleic acid amplification technology (NAT) assay for parvovirus B19was standardised by WHO. The 1st WHO international standard for parvovirus B19 DNA for NAT assays (code 99/800) was replaced by the 2nd WHO International Standard for parvovirus B19 DNA for NAT assays (code 99/802) with a potency of 10^6 IU mL^{-1} (or 10^5 IU per vial).[49] This standardized PCR quantitative control can be applied for screening of plasma minipools and other blood products, thus improving the safety of transfusion and the haematological therapy. The NAT assays used for screening of plasma donations are recommended to target those viral genome regions that are common to all three genotypes.[49]

STRATAGIES FOLLOWED IN DIFFERENT COUNTRIES

The universal screening of donated blood for parvovirus B19 by NAT is currently carried out in Germany and Austria since 2000.[16]

In Poland the blood donors are tested for parvovirus B19 DNA since 2004.[16]

In United States, the FDA has proposed a limit of less than 10^4 IU/mL for manufacturing pools for all plasma derivatives.[13]

In Netherlands, “B19 –virus safe” cellular blood products are defined as those from a blood donor in which IgG antibodies against parvovirus B19 have

been detected in two separate blood samples, one taken at least six months after the other. The six month delay is to allow viral titre to fall, and for the presence of high titre parvovirus B19 neutralising antibody. These cellular products are used for administration to pregnant women, and B19-seronegative patients with either haemolytic anemia or immunodeficiency.[59]

In Japan, the Japanese red cross blood centres has introduced parvovirus B19 antigen screening by chemiluminescent enzyme immunoassay since 2008 for all donated blood with sensitivity of approximately 10^7 IU/mL.[16]

MATERIALS AND METHODS

MATERIALS AND METHODS

STUDY METHOD

This Cross-sectional study was conducted over one year period from July 2015- June 2016 in the Department of Transfusion Medicine, The Tamil Nadu Dr.MGR Medical University, Guindy, Chennai. A total of 106 voluntary blood donors were selected.

The study was approved by the ethical committee of The Tamil Nadu Dr. MGR Medical University, Chennai. The donors were classified as upper, middle and lower socioeconomic status based on Kuppusamy classification.[60]

SAMPLE COLLECTION

Five ml of blood was collected directly from voluntary blood donors in a sterile plain test tube and allowed to clot; serum was separated and stored at -20°C for ELISA and PCR tests.

INCLUSION CRITERIA

- Those voluntary blood donors who fulfil the criteria as per DGHS guidelines.
- Those blood donors who are willing to participate in the study.

EXCLUSION CRITERIA

- Those voluntary blood donors who do not fulfil the criteria as per the DGHS guidelines.
- Those blood donors who are not willing to participate in the study

ESTIMATED SAMPLE SIZE

- $n = Z\alpha^2 pq/d^2$
- p=Prevalence=28
- q=1-p=72
- d=allowable error (10)

$$n = \frac{(1.96)^2 x28x72}{9^2}$$

- Refusals and drop outs-10% (10)
- Minimum required sample size=106

STUDY PERIOD

The total sample size was split month wise from July 2015 to June 2016.

STATISTICAL ANALYSIS

- Data analysis was done using SPSS software
- Demographic details were given in descriptive statistics
- Quantitative data was given in summary statistics
- $P<0.05$ was considered significant

METHOD OF SCREENING

The samples that were frozen earlier were thawed and used. Sera were tested for Human Parvovirus B19, IgG and IgM by the enzyme-linked immunosorbent assay (ELISA) test. Since there are no FDA (Food and Drug Administration) licensed blood donor screening tests available worldwide,[25] commercial diagnostic recombinant NovaTec Parvovirus B19 kit to detect IgG and commercial diagnostic recombinant NovaTec Parvovirus B19 kit to detect IgM have been used in our study (Figures 6,8). This is based upon the use of micro titer strip wells precoated with parvovirus B19 antigens (conformational epitopes of VP-2 and linear epitopes of specific part of VP-1)[64] to bind corresponding antibodies of the specimen. All steps were done according to the manufacturer's instructions. Reading was taken at 450 nm wavelength using an ELISA microwell plate reader.

ASSAY PROCEDURE FOR IgG

1. All reagents were brought to the room temperature (20-25^{0}C) before starting the test.
2. All reagents were mixed gently prior to use without inducing foaming.
3. A clean, disposable tip should be used for dispensing each control and sample.
4. Dispense 100µl controls and diluted samples into their respective wells. Leave A1 for substrate blank and cover wells with foil.

Figure 6: Human Parvovirus B19 IgG ELISA Kit

5. Incubate for 1 hour at 37^0C.

6. After incubation, wash each well three times with 300µl of washing solution.

7. Dispense 100µl parvovirus B19 anti-IgG conjugate into all wells except for the blank well.

8. Incubate for 30 min at room temperature.

9. After incubation, wash each well three times with 300µl of washing solution.

10. Dispense 100µl TMB Substrate Solution into all wells and incubate for exactly 15 min at room temperature in the dark.

12. Dispense 100µl Stop Solution into all wells in the same order.

13. The optical density (OD) in each well was measured at 450 nm with micro plate reader.

MICROPLATE (IgG)

	1	2	3	4	5	6	7	8	9	10	11	12
A	BL											
B	NC											
C	PC											
D	CC											
E	CC											
F	S1											
G	S2											
H	S3											

BL-Blank, NC-Negative Control, PC-Positive Control, CC-Cut-off Control, S-Sample

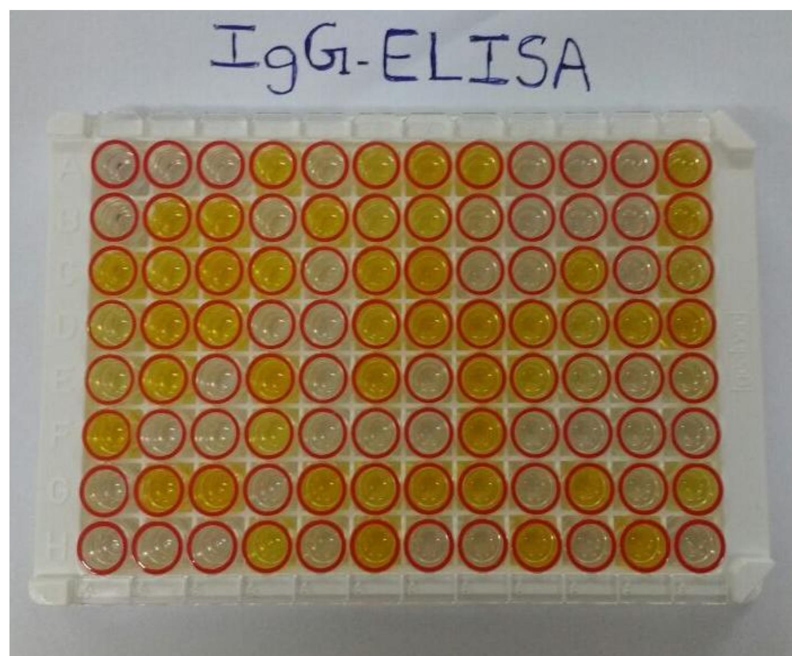

Figure 7: Parvovirus B19 IgG ELISA plate

Interpretation of results

Samples are considered POSITIVE if the absorbance value >10% of cut-off value.

Samples are considered NEGATIVE if the absorbance value <10% of cut-off value.

Samples with an absorbance value of 10% above or below the cut-off value are considered in GREY ZONE.

It is recommended to repeat the test again 2-4 weeks later with a fresh sample. If the second test are again in grey zone the sample is considered NEGATIVE.

Results in Nova Tec Units

Cut-off	10	NTU
Grey zone	9-11	NTU
Negative	< 9	NTU
Positive	> 11	NTU

CALCULATION OF RESULTS

Calculation of Nova Tec Units (NTU)

$$NTU = \frac{\text{Patient (mean) absorbance value} \times 10}{\text{Cut-off}}$$

Cut-off is the mean absorbance value of the Cut-off control determination.

ASSAY PROCEDURE FOR IgM

1. All reagents were brought to the room temperature (20-25^{0}C) before starting the test.

2. All reagents were mixed gently prior to use without inducing foaming.

3. A clean, disposable tip should be used for dispensing each control and sample.

4. Dispense 100µl controls and diluted samples into their respective wells. Leave A1 for substrate blank and cover wells with foil.

Figure 8: Human Parvovirus B19 IgM ELISA kit

5. Incubate for 1 hour at 37^0C.
6. After incubation, wash each well three times with 300µl of washing solution.
7. Dispense 100µl parvovirus B19 anti-IgG Conjugate into all wells except for the blank well.
8. Incubate for 30 min at room temperature.
9. After incubation, wash each well three times with 300µl of washing solution.
10. Dispense 100µl TMB substrate solution into all wells and Incubate for exactly 15 min at room temperature in the dark.
11. Dispense 100µl stop solution into all wells in the same order.
12. The optical density (OD) in each well was measured at 450 nm with micro plate reader.

MICROPLATE (IgM)

	1	2	3	4	5	6	7	8	9	10	11	12
A	BL											
B	NC											
C	PC											
D	CC											
E	CC											
F	S1											
G	S2											
H	S3											

BL-Blank, NC-Negative Control, PC-Positive Control, CC-Cut-off Control, S-Sample

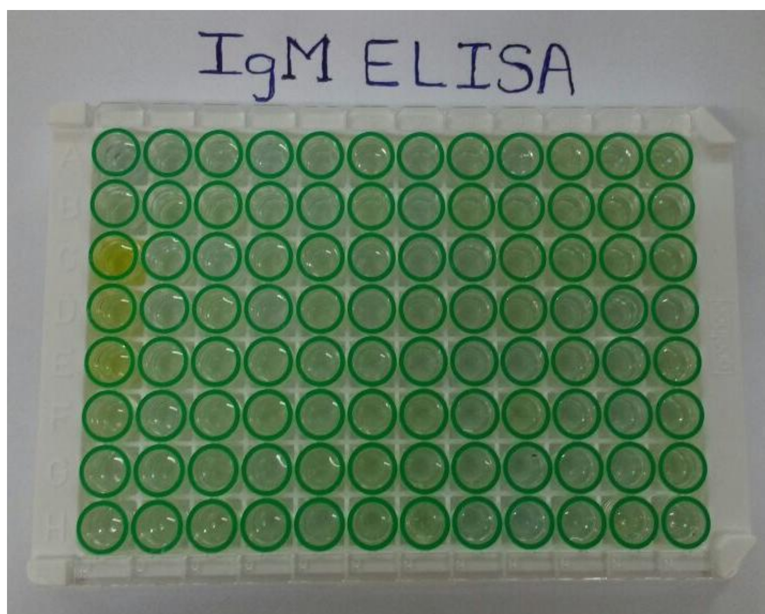

Figure 9: Parvovirus B19 IgM ELISA plate

Interpretation of results

Samples are considered POSITIVE if the absorbance value >10% of cut-off value.

Samples are considered NEGATIVE if the absorbance value <10% of cut-off value.

Samples with an absorbance value of 10% above or below the cut-off value are considered in GREY ZONE.

It is recommended to repeat the test again 2-4 weeks later with a fresh sample. If the second test are again in grey zone, the sample is considered NEGATIVE.

Results in Nova Tec Units

Cut-off	10	NTU
Grey zone	9-11	NTU
Negative	<9	NTU
Positive	>11	NTU

CALCULATION OF RESULTS

Calculation of Nova Tec Units (NTU)

$$NTU = \frac{\text{Patient (mean) absorbance value} \times 10}{\text{Cut-off}}$$

Cut-off is the mean absorbance value of the Cut-off control determination.

Polymerase chain reaction (PCR)

The polymerase chain reaction (PCR) is a technique used in molecular biology to amplify a single copy or a few copies of a piece of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.[63]

PCR amplifies a specific region of a DNA strand (the DNA target). Most PCR methods typically amplify DNA fragments between 0.1 and 10 kilo base pairs, although some techniques allow for amplification of fragments up to 40 kilo base pairs in size. The amount of amplified product is determined by the available substrates in the reaction, which become limiting as the reaction progress.

As PCR progresses, the DNA generated is itself used as a template for replication, setting in motion a chain of reaction in which the DNA template is exponentially amplified. The method relies on heating and cooling (thermal cycling), consisting of cycles of heating and cooling of the reaction for DNA denaturation of the double helix (melting) and enzymatic replication of the DNA.

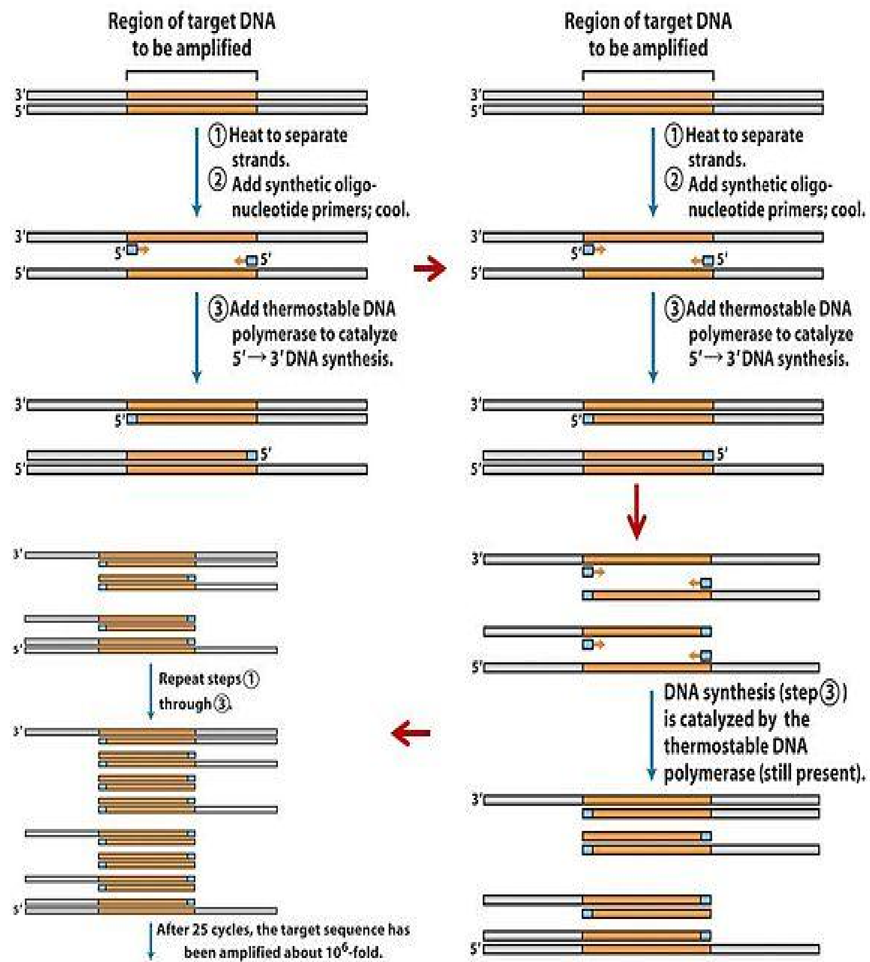

Figure 10: PCR Procedure[62]

1. Select a PCR kit, which should include two primers, Taq DNA Polymerase, deoxynucleotide triphosphates, Buffer solution.

2. Obtain all necessary materials, equipment and instruments (kits should include a detailed list of necessary items).

3. A reaction mix is prepared, which includes dNTPs, primers, template DNA, necessary enzymes and a buffer solution.

4. Add the mix to a PCR tube for each reaction. Then add the template DNA.

5. Place PCR tubes in the thermal cycler to begin cycling.

6. The first step is denaturation which causes DNA melting, yielding single stranded DNA molecules.

7. The second step is annealing which allows annealing of primers to the single stranded DNA.

8. The third step is elongation during which the DNA polymerase synthesize New DNA strand complementary to the DNA template strand.

9. The process of denaturation, annealing, and elongation consists of one cycle.

10. Agarose gel electrophoresis is employed for separation of PCR products.

INFORMED CONSENT

All the study details will be explained to the donors in vernacular language and consent will be obtained.

ETHICAL COMMITTEE CLEARANCE

Ethical clearance was obtained from the Institutional ethical committee of The Tamil Nadu Dr. M.G.R Medical University, Chennai. (Copy enclosed).

RESULTS

RESULTS

TABLE 1

Gender Distribution of the Study Group

Sex	Number of donors	Percentage %
Male	96	90.6
Female	10	9.4
Total	106	100.0

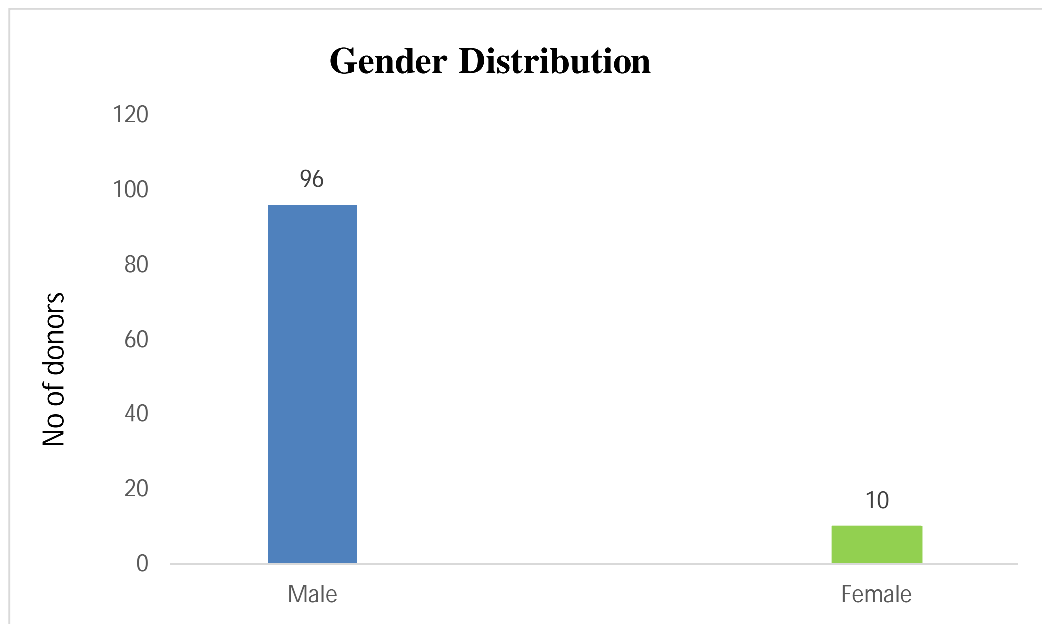

Figure 11: Gender distribution

Demographic analysis showed, of the 106 donors, 96 (90.6%) were males and 10 (9.4%) were females. (Table 1; Figure 11).

TABLE 2

Age Distribution of the Study Group

Age group In years	Number of Donors	Percentage %
18-20	28	26.4
21-30	49	46.2
31-40	21	19.8
41-50	7	6.6
>50	1	1.0
Total	106	100.0

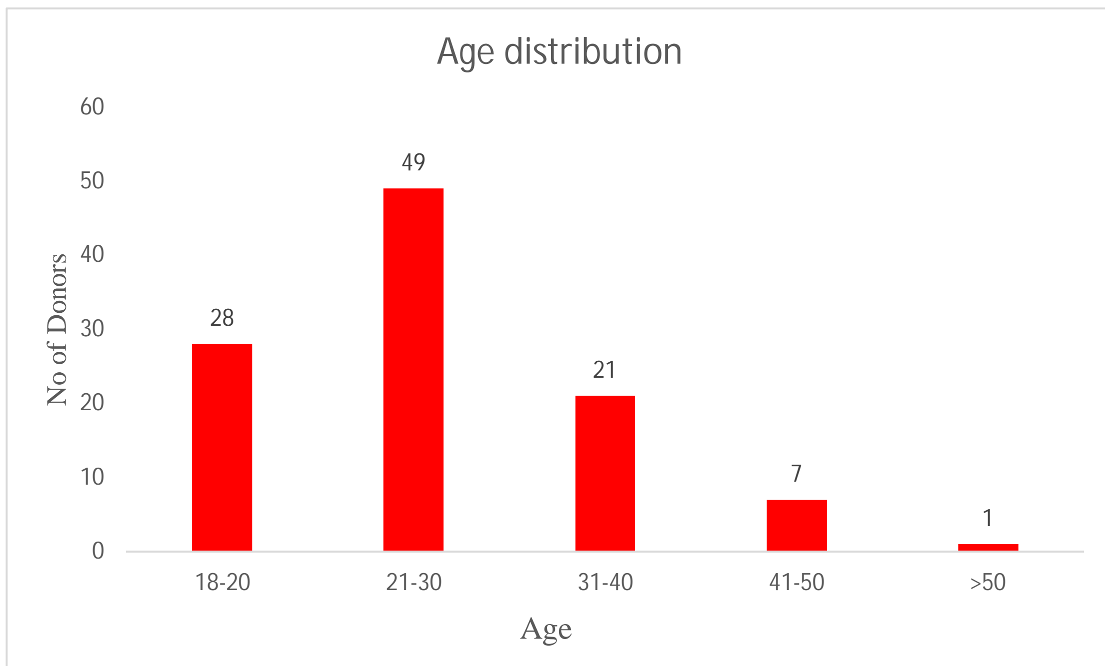

Figure 12: Age Distribution

Age distribution among the blood donors were 26.4% in 18-20 years, 46.2% in 21-30 years, 19.8% in 31-40 years, 6.6% in 41-50 years, 1.0% in >50 Years. (Table 2; Figure 12).

TABLE 3

Distribution on the basis of occupation

Occupation	Number of donors	Percentage %
Professionals	16	15.1
Students	51	48.1
Clerical jobs	34	32.1
Coolie	5	4.7
Total	106	100

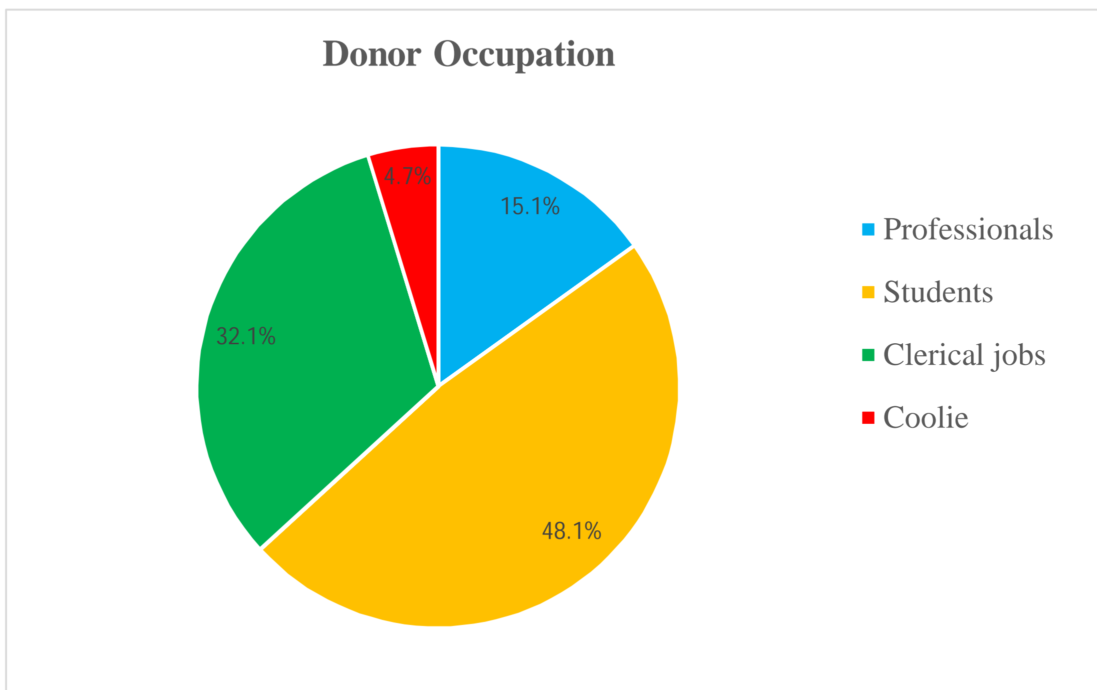

Figure 13: Donor Occupation

Percentage distribution of blood donors on the basis of Occupation were 15.1 % of Professionals, 48.1% of students, 32.1% of Clericals, 4.7% of Coolie. (Table 3; Figure 13).

TABLE 4

Distribution on the basis of socioeconomic status

Socioeconomic status	Number of donors	Percentage %
Upper	17	16.0%
Middle	59	55.7%
Lower	30	28.3%
TOTAL	106	100.0%

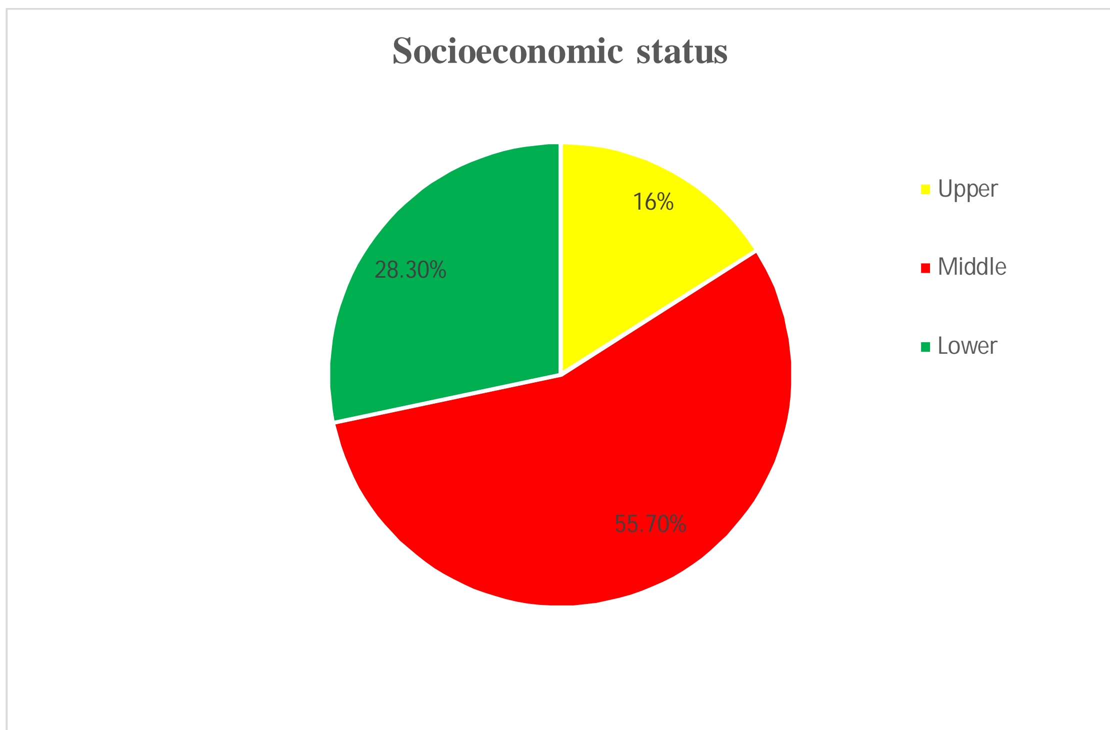

Figure 14: Socioeconomic status

Most of our donors belong to middle socioeconomic status (55.7%) followed by low (28.3%) and high (16%). (Table 4; Figure 14).

Zonal Distribution of Voluntary Blood Donors

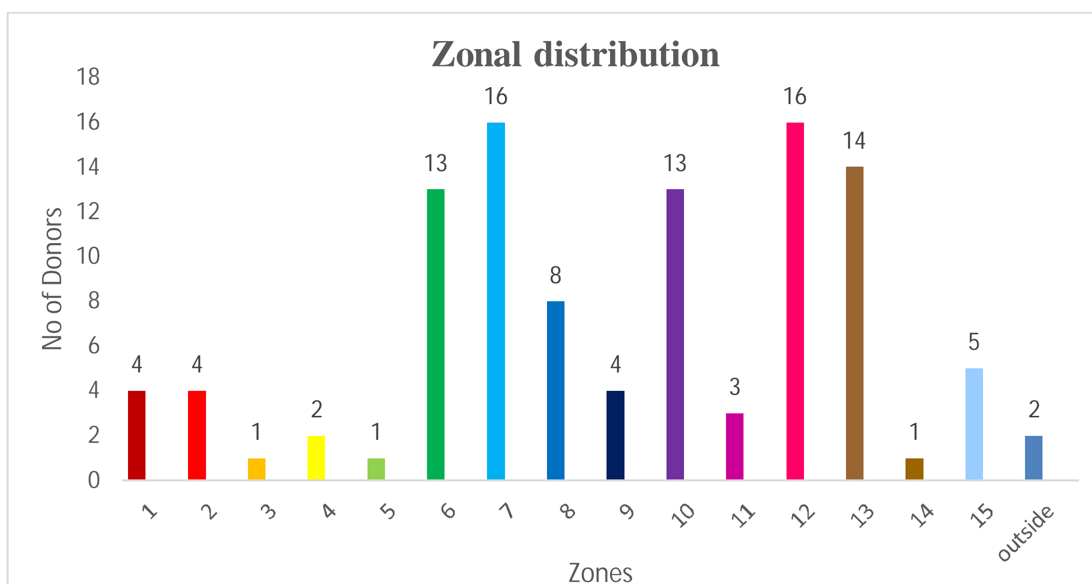

Figure 15: Zonal distribution

Zonal distribution of donors were on the basis of their residence in and around Chennai. Those within the city were divided further in to 15 zones. 104 donors were from 15 zones within Chennai city and 2 were from outside the city limits.

According to zones in the city there were 3.8% in zone 1, 3.8% in zone 2, 0.9% in zone 3, 1.9% in zone 4, 0.9% in zone 5, 12.3% in zone 6, 15.1% in zone 7, 7.5% in zone 8, 3.8% in zone 9, 12.3% in zone 10, 2.8% in zone 11, 15.1% in zone 12, 13.2% in zone 13, 4.7% in zone 15. The remaining 1.9% were from outside the limits of Chennai city. (Figure 15).

TABLE 5

Distribution of Blood Group

Blood Group	Number of Donors	Percentage %
A	24	22.6
B	37	34.9
O	36	34.0
AB	9	8.5
Total	106	100.0

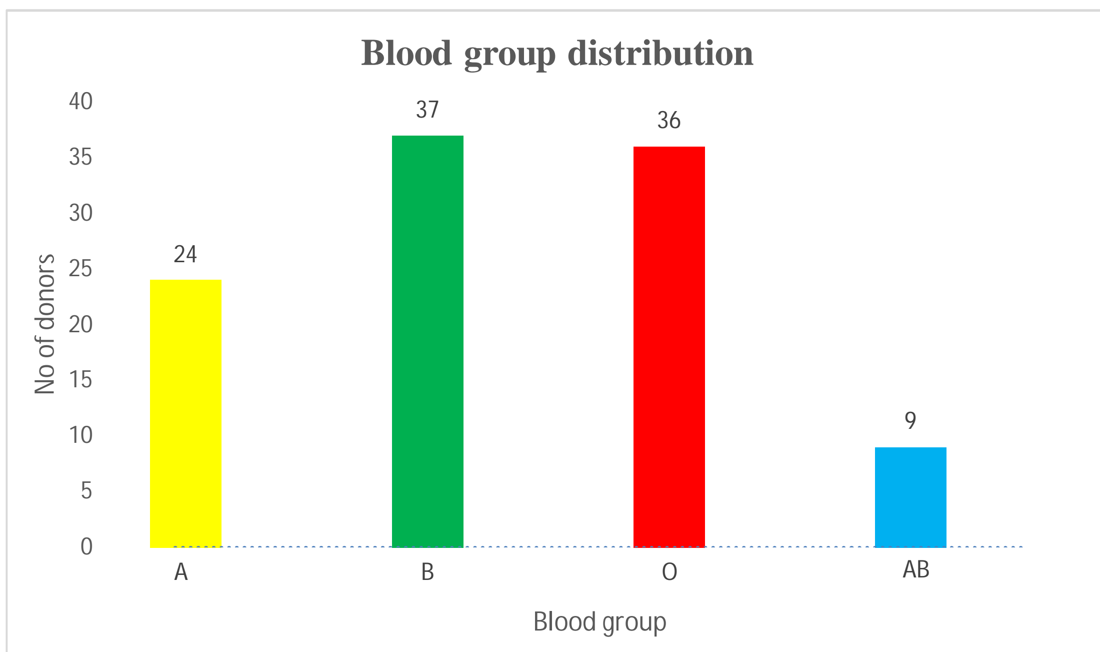

Figure 16: Blood group distribution

Blood group distributions among the blood donors were 22.6% of ‘A’ group, 34.9% of ‘B’ group, 34.0% of ‘O’ group, 8.5% of ‘AB’ group. (Table 5; Figure 16).

TABLE 6

Distribution of Rh Type

Rh Type	Number of Donors	Percentage %
Positive	101	95.3
Negative	5	4.7
Total	106	100.0

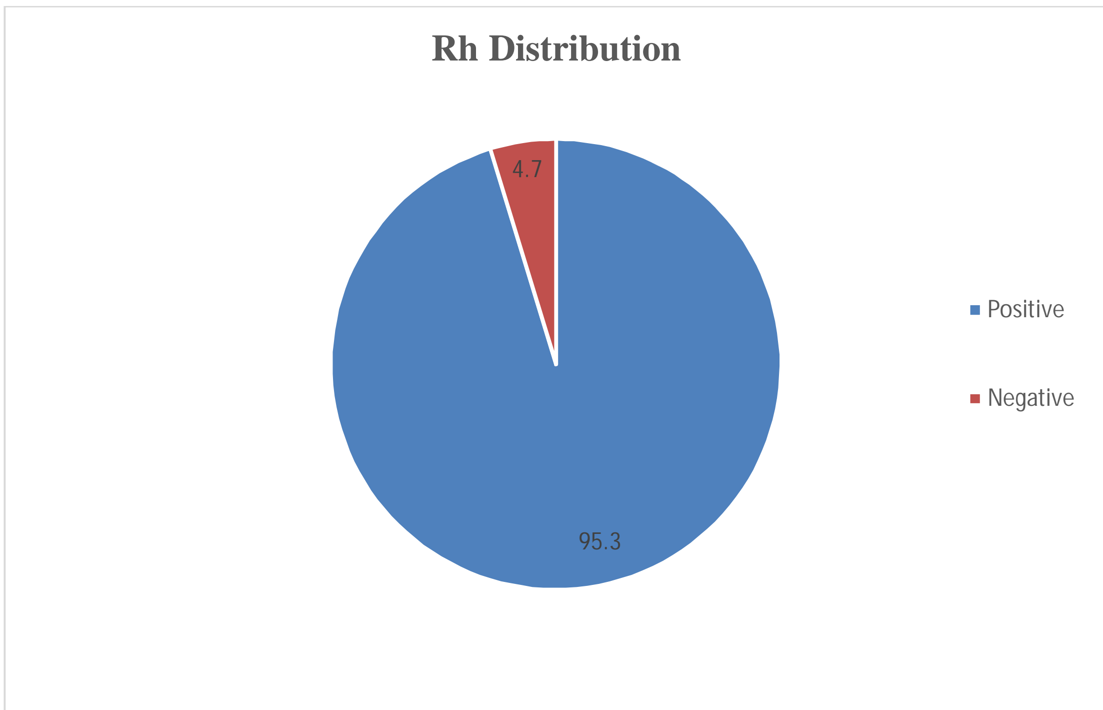

Figure 17: Rh Distribution

Rh distribution among donors were 95.3% of Rh D positive group, 4.7% of Rh negative group. (Table 6; Figure 17).

TABLE 7

Transfusion Transmitted Infection Status

TTI status	Number of donors	Percentage %
Reactive	3	2.8
Non-Reactive	103	97.2
Total	106	100

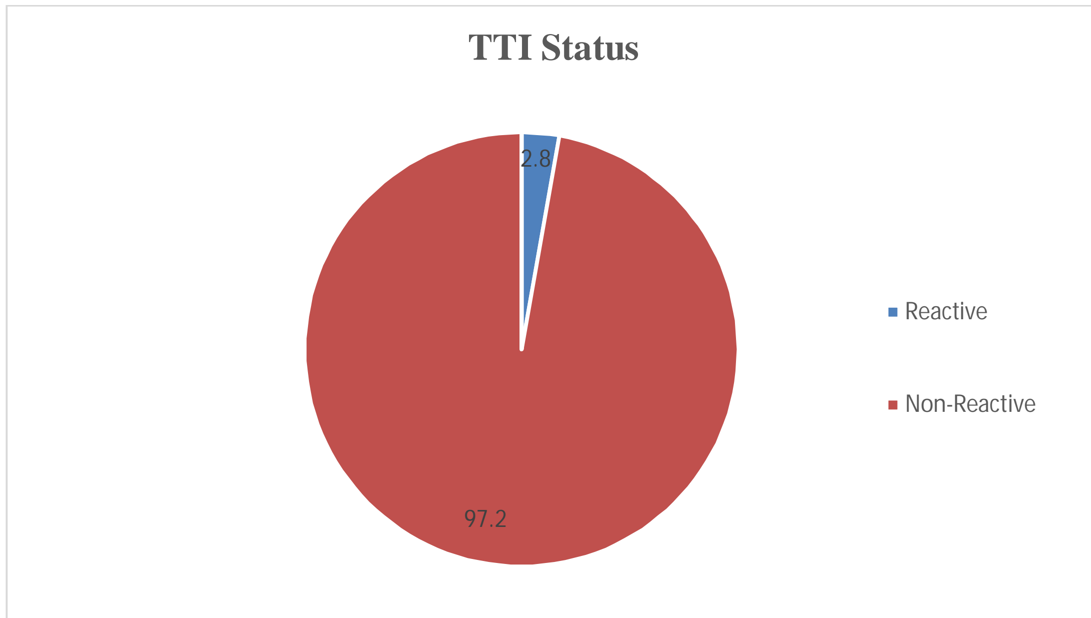

Figure 18: TTI Status

Among 106 voluntary blood donors, three were found to be reactive, of which one was found to be reactive for Hepatitis B Surface Antigen (HBsAg) and two were found to be reactive for Hepatitis C Virus. (Table 7; Figure 18).

TABLE 8

Month wise Sample Distribution

Month	No. of Samples
July 2015	6
August	5
September	7
October	4
November	5
December	5
January 2016	11
February	13
March	12
April	14
May	13
June	11

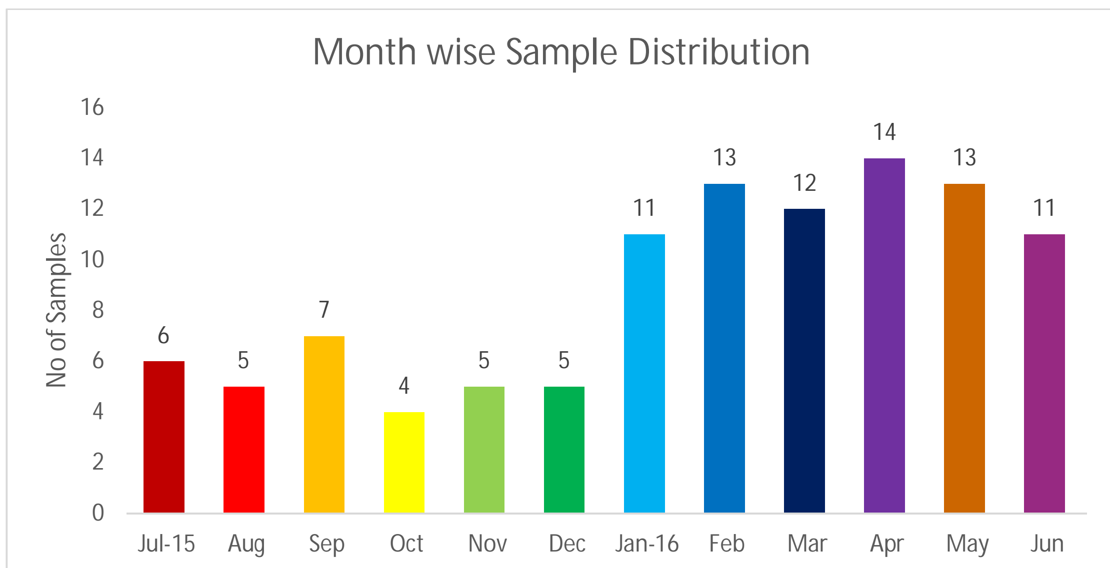

Figure 19: Month wise Sample Distribution

TABLE 9

Parvovirus B19 screening by Elisa

PARVOVIRUS B19	Positive	Negative
IgM	0	106
IgG	47	59

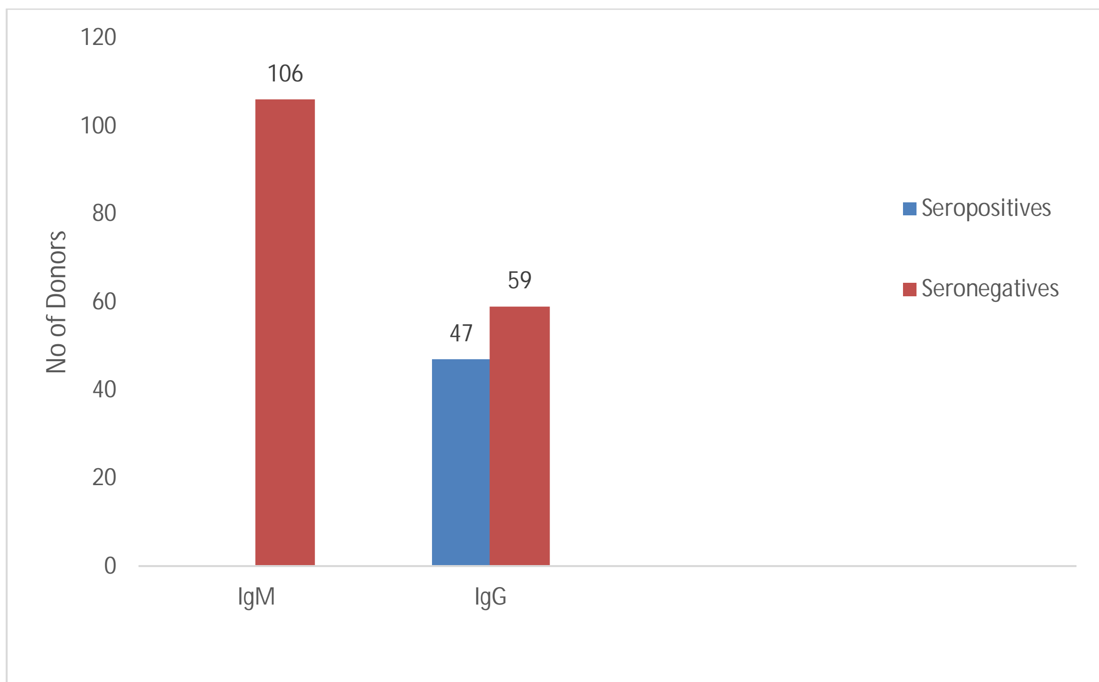

Figure 20: Human parvovirus B19 screening by ELISA

Human parvovirus B19 IgG antibody screening by ELISA showed that 59 were negative and 47 were positive, giving an overall parvovirus B19 prevalence rate of 44.3%. None of the 106 blood donors were reactive for parvovirus B19 IgM antibodies by ELISA test. (Table 9; Figure 20).

TABLE 10

Age Distribution of IgG seropositive

Age group In years	IgG seropositive donors (Total donors)	Percentage %
18-20	5 (28)	17.8%
21-30	25(49)	51.0%
31-40	12(21)	57.1%
41-50	4(7)	57.1%
>50	1(1)	100%
TOTAL	47(106)	44.3%

P=0.018

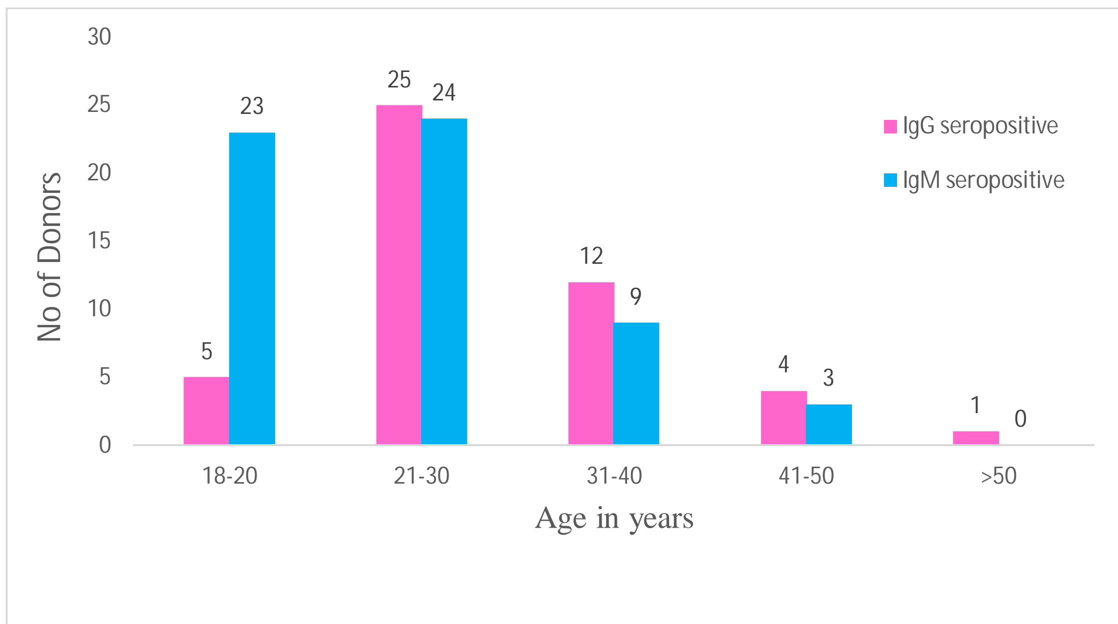

Figure 21: Age Distribution of IgG seropositives

TABLE 11

Gender Distribution of IgG Seroprevalence

Sex	IgG seropositive donors (Total donors)	Percentage %
Male	45(96)	46.9%
Female	2(10)	20.0%
TOTAL	47(106)	44.3%

P>0.05

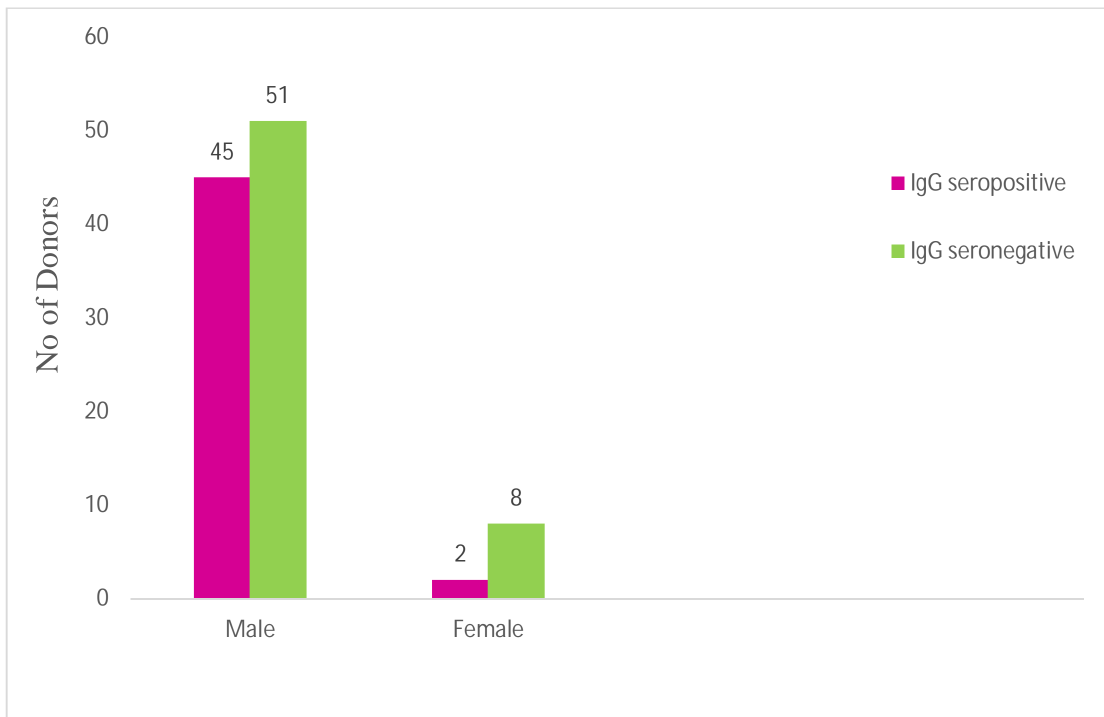

Figure 22: Gender Distribution of IgG seropositives

TABLE 12

IgG seropositive on the basis of socioeconomic status

Socioeconomic status	IgG seropositive donors (Total donors)	Percentage %
High	5(17)	29.4%
Middle	20(59)	33.9%
Lower	22(30)	73.3%
TOTAL	47(106)	44.3%

P=0.001

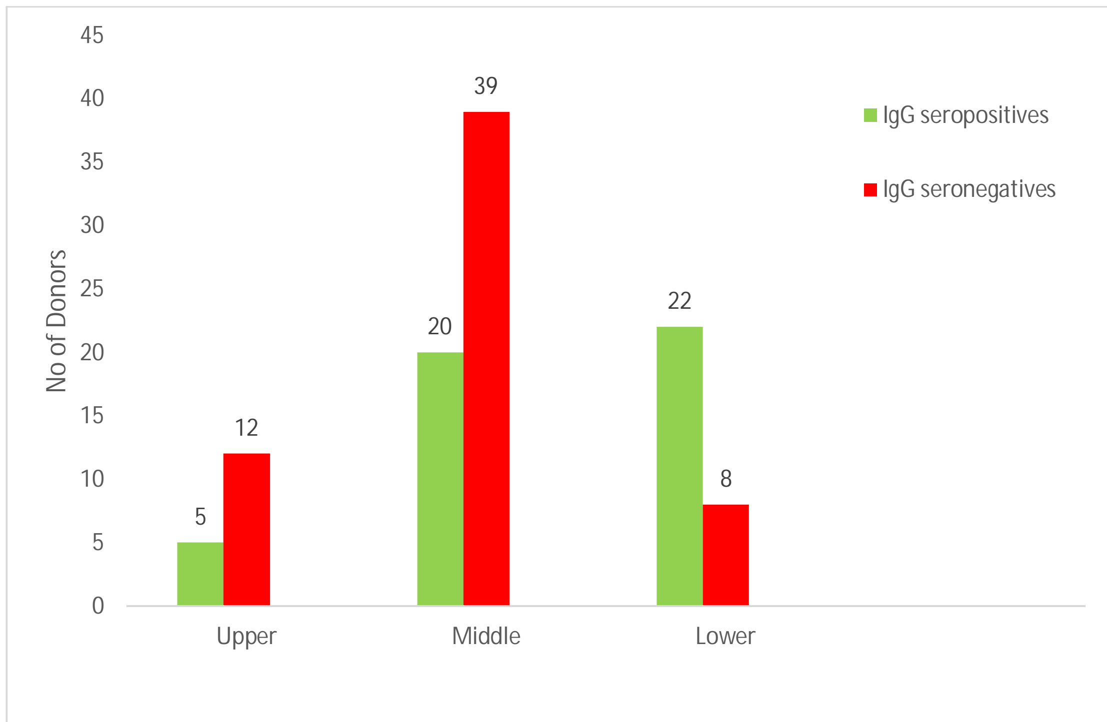

Figure 23: IgG seropositives on the basis of socioeconomic status

TABLE 13

Blood Group Distribution of IgG seropositives

Blood Group	IgG seropositive donors (Total donors)	Percentage %
A	8(24)	33.3%
B	18(37)	48.6%
O	19(36)	52.8%
AB	2(9)	22.2%
TOTAL	47(106)	44.3%

P>0.05

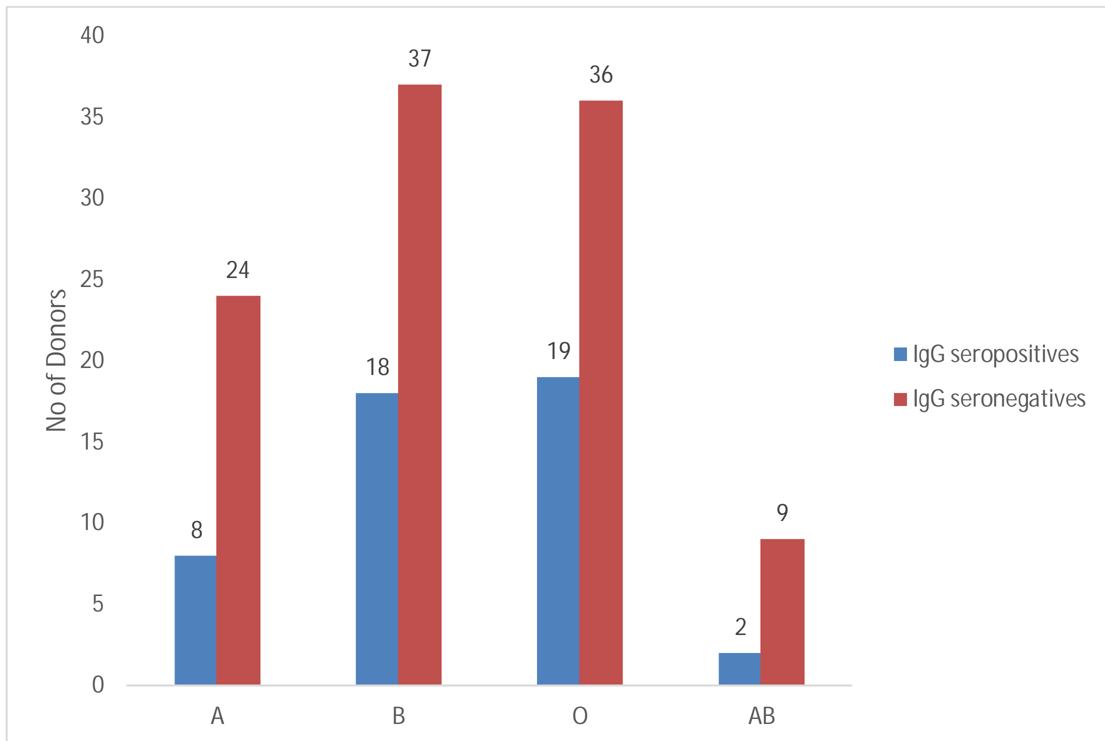

Figure 24: Blood Group Distribution of IgG seropositives

TABLE 14

Rh Type Distribution of IgG seropositives

Rh Type	IgG seropositive donors (Total donors)	Percentage %
Positive	45(101)	44.6%
Negative	2(5)	40.0%
Total	47(106)	44.3%

P>0.05

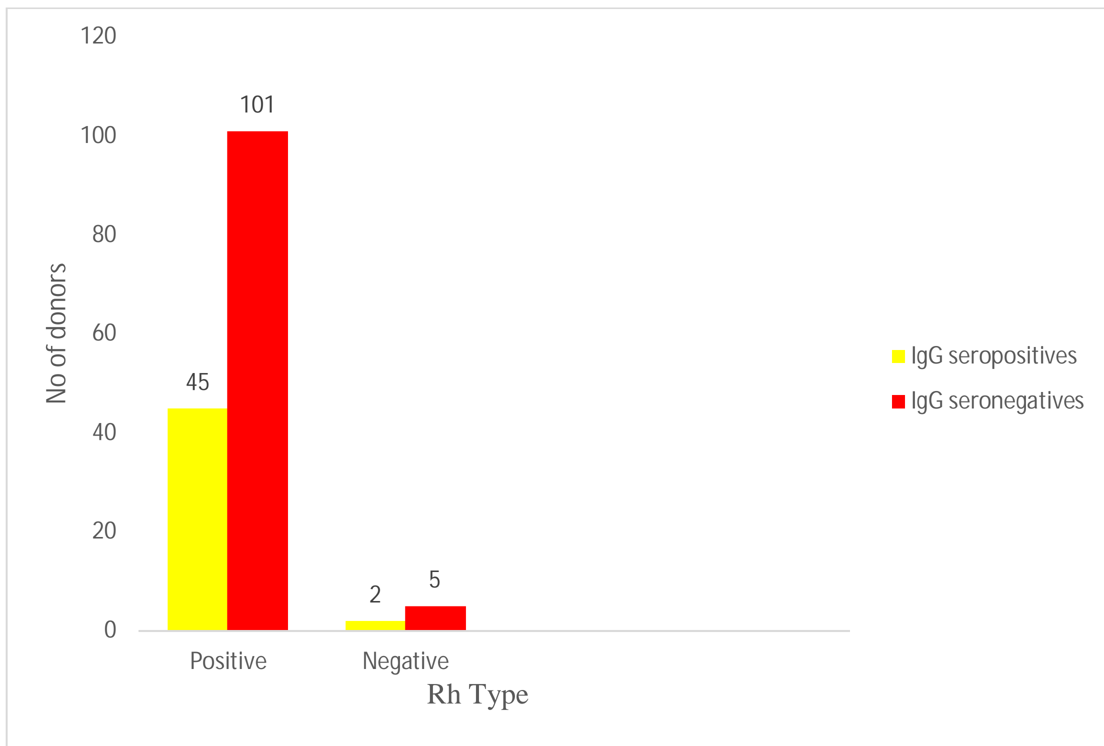

Figure 25: Rh Type Distribution of IgG seropositives

TABLE 15

Zonal Distribution of IgG seropositives

Chennai Zones	IgG seropositive donors (Total donors)	Percentage %
1	2(4)	50.0%
2	2(4)	50.0%
3	1(1)	100.0%
4	1(2)	50.0%
5	0(1)	0%
6	6(13)	46.2%
7	10(16)	62.5%
8	4(8)	50.0%
9	3(4)	75.0%
10	6(13)	46.2%
11	1(3)	33.3%
12	2(16)	12.5%
13	6(13)	42.9%
14	0(1)	0%
15	2(5)	40.0%
Outside	1(2)	50.0%

P>0.05

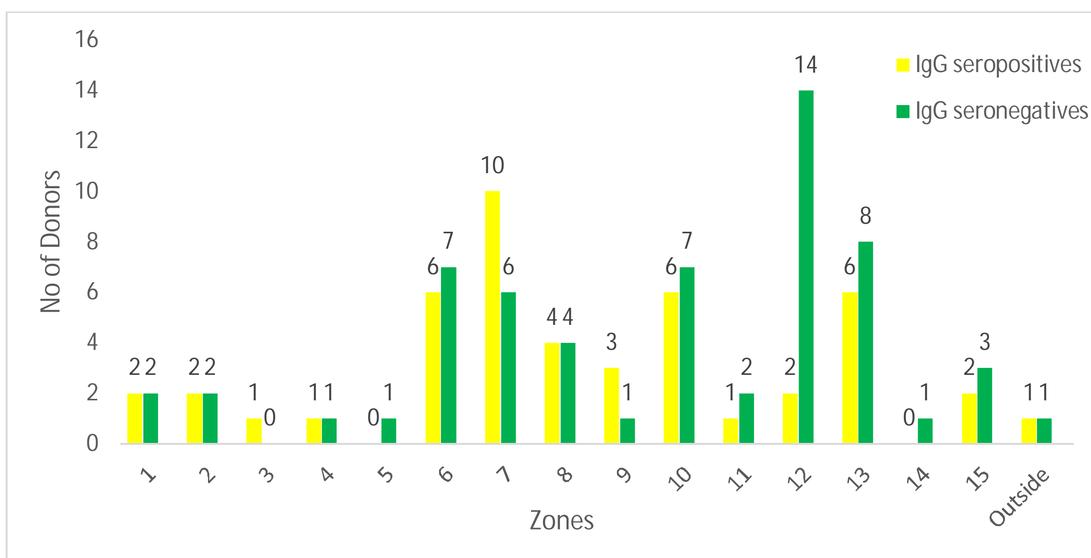

Figure 26: Zonal Distribution of IgG seropositives

TABLE 16

Month wise Distribution of IgG Seropositive

Month	IgGseropositives Donors (Total Donors)	Percentage %
July 2015	2(6)	33.3%
August	4(5)	80.0%
September	3(7)	42.9%
October	3(4)	75.0%
November	1(5)	20.0%
December	2(5)	40.0%
January 2016	8(11)	72.7%
February	9(13)	69.2%
March	6(12)	50.0%
April	5(14)	35.7%
May	4(13)	30.8%
June	0(11)	0%

P=0.019

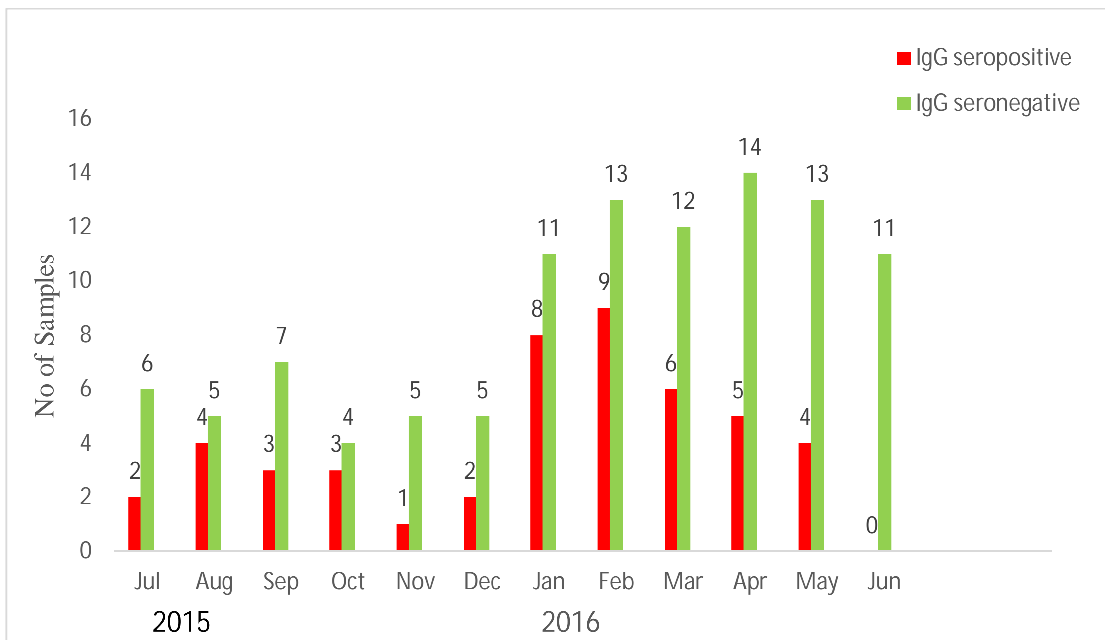

Figure 27: Month wise Distribution of IgG seropositives

DISCUSSION

Comparison of IgG, IgM seroprevalence of Human Parvovirus B19 in various studies

Parameters		Present study	Satish Kumar et al[52]	Kishore et al[17]	Manaresi et al[51]	Rohrer et al[45]	Iheanacho et al[44]	Banwat et al[1]	Aldo Gaggero et al[54]	Ayman K. johargy[56]	DeokJaoh et al[55]	Mahmoodian-Shooshtari M et al[57]	Al-Danani D.A,[58]	Hadia Ahmed Abou-Donia et al[58]	Gini GC. Van Rijickevorsel et al[66]
Place of study		Chennai	Mumbai, India	Lucknow, India	Bologna, Italy	Germany	Lagos, Nigeria	Kogistate, Nigeria	Santiago, Chile	Makkah, Saudi Arabia	Korea	Tehran, Iran	Aden, Yemen	Alexandria, Egypt	Amsterdam ,Netherlands
Elisa Kit used		Novalisa(IgG &IgM)	Serion classic IgG Novalisa IgM	In-house Elisa	Medac IgG	recomWell Elisa	IBL Elisa	Demeditec Diagnostic, Germany	Focus Diagnostics USA	Novalisa	recomWell Elisa	IBL Elisa	IBL Elisa	IBL Elisa	Novalisa
Viral antigens coated		Recombinant antigens VP1&VP2	Recombinant VP2/ Recombinant antigens VP1&VP2	Purified VP1/VP2 capsid proteins	VP1+VP2/ VP2 alone	VP1+VP2	Parvovirus B19 antigens	Parvovirus B19 antigens	VP1	Recombinant antigens VP1&VP2	VP1+VP2	Parvovirus B19 antigens	Parvovirus B19 antigens	Parvovirus B19 antigens	Recombinant antigens VP1&VP2
No of donors		106	1633	1000	446	6583	150	88	400	578	928	1640	100	100	1323
IgM seropositivity		0 %	7.53%	-	-	-	1.3%	14.8%	-	-	-	0.5%	26%	26%	-
IgG seropositivity		44.3%	27.96%	39.9%	79.1%	72.1%	66.0%	37.5%	54.8%	76.3%	60.1%	41.2%	46%	26%	62.3%
Sex	Male	46.9%	28.4%	40.6%	78.2%	70.9%	65.3%	38.6%	57.6%	76.3%	-	-	46%	26%	60.7%
	Female	20.0%	9.0%	27.3%	80.0%	73.3%	83.3%	20.0%	49.3%	-	-	-	-	-	63.7%

Age	18-20 21-30 31-40 41-50 >50	26.4% 46.2% 19.8% 6.6% 0.9%	-	40.3% 37.1% 44.5% 50%	77.0% 88.5%	66.9% 70.0% 70.0% 72.6% 79.1%	-	0% 46.7% 38.7% 0% 0%	-	68.0% 78.7% 69.8% 82.4% 82.6%	50.0% 56.9% 64.9% 64.4% 77.1%	-	31% 13% 2%	17% 4% 5%	64.8% 64.0% 61.4% 61.8%
Occupation	Professional Student Clerical Coolie	31.3 27.5 70.6 80.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Socio-economic status	Upp Mid Low	29.4 33.9 73.3	-	44.4 61.1 61.8	-	71.3 71.8 74.3	-	-	-	-	-	-	-	-	-
Blood Group	A B AB O	33.3 48.6 22.2 52.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Rh Type	Pos Neg	44.6 40.0	-	-	-	-	-	-	-	-	-	-	-	-	-

DISCUSSION

IgG Seroprevalence of B19V

In the present study, by testing serum of the 106 voluntary blood donors against VP1 linear and VP2 conformational recombinant B19V antigens (NovaLisa In-vitro Diagnostic Kit) revealed the seroprevalence rate 44.3%. Since there is no FDA licensed blood donor screening test for B19V exists,[25] the study was performed by using NovaLisa in-vitro Diagnostic kit.

Kishore et al,[17] Lucknow, India screened 1000 voluntary blood donor samples with in-house ELISA for IgG (purified VP1 and VP2 capsid proteins) revealed 39.9% of seroprevalence for B19V. This is slightly lower than our study.

Satish Kumar et al,[52] in their study in Mumbai, among 540 donors by using recombinant VP2 antigen (serion classic ELISA) showed 27.96% seroprevalence for B19V. The lower prevalence rate could be because of using only VP2 as the screening antigen in comparison to our study.

Similar studies using same antigens among 578 voluntary blood donors by Ayman K.johargy[56] in Saudi Arabia showed 76.3% seropositivity for B19V infection. The increase in prevalence rate among voluntary blood donors of different age group from 18 to 60 years could be explained by gradual increase in seroprevalence of B19V among general population in accordance with

increase in age in other studies.[55,66] In our study also we observed similar increase in prevalence rate for B19V parallel to increase in age of the donors.

Gini GC. Van Rijickvver sel et al,[66] in their study in Amsterdam, Netherlands among general adult population (n= 1323) using similar antigens as that of our study revealed 62.3% prevalence rate for B19V. The study population included participants from Dutch, Morocco and Turkey who showed prevalence rate of 59%, 61.1% and 67.2% respectively. The higher prevalence rate could be due to the study being carried in general population inclusive of participants from different ethnic origin.

DeokJa oh et al,[60] in their study among 928 plasmapheresis donors in Korea by using VP1 linear and VP2 Conformational antigens (recomWell Elisa) revealed 60.1% of seroprevalence for B19V. This study also reiterates parallel increase in B19Vseroprevalence rate along with increasing age of the donors.

The seroprevalence rate among other studies conducted in Lagos Nigeria,[44] Tehran Iran,[57] Aden Yemen and Alexandria Egypt[58] among voluntary blood donors by using recombinant antigens (IBL Elisa, Germany) revealed 66%, 41.2%, 46% and 26% respectively. Two of these studies revealed almost same prevalence rate among voluntary blood donors in our study.

The study by Aldo Gaggero et al,[54] in Santiago Chile among 400 blood donors by using VP1 inactivated antigen (Focus Diagnostics USA) showed 54.8% of seroprevalence for B19V, which is almost similar to our study.

In our study out of 50 donor samples collected during the months of January, February, March and April showed IgG B19V seropositivity in 28 (56%) samples. The prevalence rate is relatively higher during late winter and spring seasons in our study, which is similar to the study done by Kishore et al[17] among 1000 voluntary blood donors in India and Cohen BJ et al[84] study done among 2000 participants from general population in England and Wales (temperate climate region).

IgM Seroprevalence of B19V

In our study, none of the donors out of 106 at different age groups were positive for anti-B19 IgM antibody, indicating the absence of primary infection. However, the study by Satish Kumar et al[52] reported 7.53% of anti-B19 IgM antibody seropositivity among blood donors (n=1093) in Mumbai, India. Banwat et al[1] reported 14.8% anti-B19 IgM antibody among blood donors (n=88) in Kogistate, Nigeria. These results reflect that the donors were with recent infection. Mahmoodian-Shooshtari et al[57] reported 0.5% anti-B19 IgM antibody seropositivity among blood donors (n=1640) in Tehran, Iran.

Correlation of the results of IgG, IgM and PCR in our study

The 44.3% of the donors in our study were found to be positive for IgG against VP1 linear and VP2 conformational antigens and none of them were IgM positive. This could probably be due to the development of immunity to the earlier infection.

Neal S. Young and Kevin E. Brown[33] in their review article on mechanism of disease in Parvovirus B19 has mentioned that antibody production is correlated with the disappearance of virus from the blood and IgG antibodies appear to confer lasting protection against re-infection. They have also mentioned that antibodies to the unique amino-terminal region of VP1 are important for clearance of the virus.

Saikava et al[86] in their study on neutralizing linear epitopes of parvovirus B19 cluster in the VP1 unique and VP1-VP2 junction regions have also revealed that the antibodies against linear epitopes confer efficient immunity compared to antibodies against VP2 region alone.

Lt Col Satish Kumar et al[52] in their study on seroprevalence of human parvovirus B19 in healthy blood donors by using very sensitive and specific nested PCR revealed absence of parvovirus B19 DNA in all donors found to be tested positive for IgM antibodies alone or IgM and IgG antibodies together or IgG antibodies alone.

For safe transfusion of B19V negative blood to the high risk groups such as pregnant women, patients with underlying haematological problems, immunodeficient patients who are constantly multitransfused and transplant recipients, either the blood units have to be IgM and PCR negative as a first priority or else as a second priority, IgG positive blood units may be preferred based on the above studies.

In our study, none of the samples were IgM positive and since IgG positive samples most often revealed absence of viral DNA,[16,33] PCR study was not carried out to confirm B19V infection.

Since the window period of human parvovirus B19 infection is 10 to 14 days,[16] which is relatively shorter, if absolutely essential, at least for high-risk groups, PCR test to detect B19V DNA may be considered to rule out donors with asymptomatic infections.

Socioeconomic status & B19V seroprevalence

In our study, about 29.4% (5 out of 17) of the donors in higher socioeconomic group were found to be seropositive for Human parvovirus B19 infection while 33.9% (20 out of 59) in middle and 73.3% (22 out of 30) in lower socio economic group were found to be seropositive for B19V infection. This is in concordance with the study done by Kishore et al[17] who reported that the seropositivity increases in lower socio economic status when compared to high socioeconomic group.

Blood group

In our study, about 52.8% (19 out of 36) of the donors in "O" blood group are found to be seropositive for Parvovirus B19, while 48.6% (18 out of 37) of the donors in "B" blood group, 33.3% (8 out of 16) in "A" blood group, 22.2% (2 out of 7) in "AB" blood group, 44.6% (45 out of 101) in Rh positive and 40% (2 out of 5) in Rh negative are found to be seropositive. The seroprevalence of parvovirus B19 is found to be higher in "O" blood group in our study.

B19V infection and TTI

Since all donors included in our study were voluntary blood donors, the prevalence of infections (HIV, HBV, HCV, Syphilis and Malaria) that are screened for mandatory tests in the study group were low. Among 106 blood donors one was found to be positive for HBsAg and two were positive for anti-HCV. These three donors were positive for anti B19V IgG antibody. Nguyen L Toan et al[81] reported that 21.4% of HBV infected patients had parvovirus B19 co-infetion. Opaleye et al[82] in their study reported that 18% of patients with a HBV/HCV co-infection had Parvovirus B19 DNA.

Parvovirus B19 is considered as a major contaminant of blood and blood products. Since the virus is resistant to different inactivation procedures, most blood products that contain Parvovirus B19 DNA are considered to be potentially infectious.[56] Currently the Food and Drug Administration (FDA)

guidelines and the European regulatory requirements recommend testing plasma pools by PCR and discard those with a Parvovirus B19 viral load of $>10^4$ genome equivalent/ml.[25]

It is considered that the blood products containing virus titres below 10^4 IU/mL were not infectious. The significance of the neutralizing effect of anti-B19 IgG has been considered in parvovirus B19 infection. The anti-B19 IgG in the donated blood or recipients can neutralize the virus and prevent parvovirus B19 infection. 11 U/ml of anti-B19 antibody can neutralize 4.3 log of parvovirus B19 DNA.[55] The safety of blood and plasma derivatives with regard to parvovirus B19 has been a major concern to date.

Currently interventions for preventing parvovirus B19 transfusion from blood components have not been implemented in the majority of developed countries, because of the existing view that the blood components, with low levels of B19 DNA will not transmit B19 infection.

Since it would be expensive to test all blood products for this emerging pathogen, risk group approach in which only selected groups of patients are given tested blood products. This ensures maximum safety to patients for whom parvovirus B19 could cause problems.[52] This method is similar to the measures taken in blood transfusion medicine with respect to cytomegalovirus.

SUMMARY

SUMMARY

In our study on seroprevalence of Human parvovirus B19 infection on 106 voluntary blood donors by using VP1 linear and VP2 conformational antigen coated ELISA revealed.

- IgG seropositivity in 44.3% (47 out of 106) of donors.
- None of them were IgM positive.
- Percentage of IgG B19V seropositivity gradually increases along with increase in age of the donors.(p=0.018).
- Since none of the samples were IgM positive, they were not subjected for PCR study.
- Among 47 donors positive for IgG B19V, one was positive for HBsAg and two were positive for anti-HCV.
- 50 out of 106 donors donated blood during late winter and spring season of the year. Out of these 50 donors, 28 showed IgG B19V seropositivity, which is relatively higher.(p=0.019).
- 22 out of 30 (73.3%) of the IgG B19V positive donors were from lower socio-economic status. (p=0.001).

CONCLUSION

CONCLUSION

In our study on seroprevalence of Human parvovirus B19 among voluntary blood donors, 44.3% showed IgG positivity and none of them were IgM positive. Since Human parvovirus B19 infection preferentially affects erythroblasts in bone marrow, it is imperative to screen IgM B19V antibodies before transfusion for at least high-risk groups.

For exclusion of donors with asymptomatic infections, advanced techniques like PCR study to detect viral DNA shall be considered.

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ANNEXURES

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

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INSTITUTIONAL ETHICS COMMITTEE

Address of Ethics Committee: The Tamilnadu Dr MGR Medical University Chennai, India	
Presenter: Dr .S. Shogan Raj MBBS	
Seroprevalence of Parvovirus B19 among voluntary blood donors in Chennai - A cross sectional study (ECMGR0309043)	
Documents filed	
Protocol	✓
Informed consent documents	✓
Any other documents	

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INSTITUTIONAL ETHICS COMMITTEE **25.06.15**

NAME OF MEMBER	DESIGNATION	SIGNATURE
Prof. D. SHANTHARAM **M.D., D. Diab** VICE CHANCELLOR, THE T.N. DR.MGR MEDICAL UNIVERSITY	**Chairman**	[signature]
MR. ANAND DAVID UNIVERSITY STANDING COUNSEL THE T.N. DR.MGR MEDICAL UNIVERSITY	**Member**	[signature]
Dr. GEETHALAKSHMI, MD PhD DIRECTOR OF MEDICAL EDUCATION, CHENNAI.	**Member**	—
Dr. PERIANDAVAR MD INSTITUTE OF DIABETOLOGY GOVERNMENT GENERAL HOSPITAL, CHENNAI	**Member**	[signature]
DR.SABARATNAVEL, MD DEPARTMENT OF MEDICINE, MADRAS MEDICAL COLLEGE & GOVERNMENT HOSPITAL.	**Member**	[signature]
DR. SARAVANAN MDS. DEPT. OF ORAL SURGERY GOVERNMENT DENTAL COLLEGE, CHENNAI	**Member**	—
DR. M. LOGAMANIAN, M.D.,Ph.D. NATIONAL INSTITUTE OF SIDDHA, CHENNAI.	**Member**	[signature] 25/6/15
Dr. R. P. ILANGHO, M.D DEPT. OF RESPIRATORY MEDICINE, APOLLO HOSPITAL, CHENNAI.	**Member**	[signature]
Dr. S. MINI JACOB, M.D DEM, THE T.N. Dr. MGR MEDICAL UNIVERSITY	**Member Secretary**	[signature]

(ECMGR0309043)

Representing DME

Dr. [illegible] RAJASEKARAN
DDME

[signature] 25/6/15

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DECISION

Opinion of the institutional Ethics Committee-PLEASE CHECK ONE

___✓___ Approved

_______ Modification required prior to approval (please specify on the space below)

_______ Disapproved

Date of review: 25/6/15

Signed : [signature] (please print name) DR. D. SHANTHARAM M.D., D.Diab.

(please delete as appropriate, Chairperson, Secretary)

Modification needed

The research proponent is hereby informed that the Institutional Ethics Committee will require the following:

1) All adverse drug reaction (ADRs) that are both serious and unexpected to be reported promptly to the IEC within 7 working days.
2) The progress report to be submitted to the IEC at least annually.
3) Upon completion of the study, a final study status report to submitted to the IEC.

(ECMGR0309043)

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தமிழ்நாடு டாக்டர் எம்.ஜி.ஆர் மருத்துவப் பல்கலைக்கழகம்

குருதியேற்றுத் துறை

உரிமம் எண் 191/28C

இரத்ததானப்படிவம்

இரத்தப்பை எண்	தேதி	இரத்தக்கொடையாளர் எண்	இரத்தப் பிரிவு

தனிப்பட்ட விவரங்கள்

இரத்தக் கொடையாளர் பெயர்	வயது : பிறந்த தேதி :	பாலினம் : ஆண் / பெண்

வீட்டு விலாசம் :	அலுவலக விலாசம் :
....	....
....	....
....	....
.... போன் :	.... போன் : ....
இ–மெயில் :	இ–மெயில் : ....

தங்கள் கவனத்திற்கு

அரசு விதிகளின்படி மருத்துவரீதியாக கேட்கப்பட்டுள்ள கீழ்க்கண்ட வினாக்களுக்கு விடையளிக்கவும். ஏதேனும் வினாக்கள் தங்களை மனரீதியாக புண்படுத்தியிருந்தால் தயவுகூர்ந்து பொறுத்துக்கொள்ளவும்.

கடந்த பன்னிரெண்டு மாத காலத்திற்குள்

1. இரத்தம் மற்றும் இரத்தக்கூறுகள் தங்களுக்கு ஏற்றப்பட்டுள்ளதா? ஆம் – இல்லை
2. மஞ்சள் காமாலை நோயினால் பாதிக்கப்பட்டுள்ளீர்களா? இம்மியுனோகுளோபின் தடுப்பூசி போட்டுக் கொண்டுள்ளீர்களா? (அ) மஞ்சள் காமாலை நோயினால் பாதிக்கப்பட்டிருந்த எவரிடமாவது நெருங்கிய தொடர்பு வைத்திருந்தீர்களா? ஆம் – இல்லை
3. உடம்பில் (காது மற்றும் ஏதேனும் உடற்பகுதியில்) பச்சை குத்தி உள்ளீர்களா? ஆம் – இல்லை
4. நாய்க்கடிக்கான தடுப்பூசி போட்டுள்ளீர்களா? (அ) நாய்க்கடிக்காக ஏதேனும் சிகிச்சை எடுத்துள்ளீர்களா? ஆம் – இல்லை
5. பெரிய அறுவை சிகிச்சை ஏதேனும் செய்து கொண்டுள்ளீர்களா? (அ) பெரிய விபத்து ஏதேனும் சந்திக்க நேரிட்டதா? ஆம் – இல்லை

கடந்த ஆறு மாதகாலத்திற்குள்

1. டைப்பாய்டு, காலரா, சிறுநீரக மற்றும் சிறுநீர்ப்பை (கிருமி) நோய்களால் பாதிக்கப்பட்டுள்ளீர்களா? ஆம் – இல்லை
2. சிறிய அறுவை சிகிச்சை ஏதேனும் செய்துகொண்டுள்ளீர்களா? (அ) சிறிய விபத்து ஏதேனும் சந்திக்க நேரிட்டதா? ஆம் – இல்லை

3. மகப்பேறு நடந்துள்ளதா? தாய்மை அடைந்துள்ளீர்களா? கருச்சிதைவு ஏற்பட்டுள்ளதா? தாய்ப்பால் கொடுத்துக் கொண்டிருக்கிறீர்களா? ஆம் - இல்லை

கடந்த மூன்று மாதகாலத்திற்குள்

1. இரத்தம் மற்றும் இரத்தக் கூறுகள் தானம் செய்துள்ளீர்களா? ஆம் - இல்லை
2. மலேரியா நோய்க்கு சிகிச்சை எடுத்துள்ளீர்களா? ஆம் - இல்லை

கடந்த இரண்டு மாத காலத்திற்குள்

1. தட்டம்மை, பொன்னுக்கு வீங்கி, அம்மை போன்ற ஏதாவது நோய்களால் பாதிக்கப்பட்டுள்ளீர்களா? ஆம் - இல்லை

கடந்த ஒரு மாத காலத்திற்குள்

1. முகப்பருக்காக ஐஸோடிரட்டினாயின் போன்றஏதேனும் மருந்தை உபயோகப்படுத்தி உள்ளீர்களா? ஆம் - இல்லை
2. நோய் எதிர்ப்பு சக்தி ஊசி (அ) தடுப்பு ஊசி (டெட்டனஸ், பாம்புக்கடி, டிப்தீரியா, கேஸ்கேங்கரின், ரூபெல்லா) ஏதேனும் போட்டுள்ளீர்களா? ஆம் - இல்லை

கடந்த மூன்று வார காலத்திற்குள்

1. பல் சிகிச்சை ஏதேனும் செய்து கொண்டுள்ளீர்களா? ஆம் - இல்லை

கடந்த இரண்டு வார காலத்திற்குள்

1. அம்மை / அக்கி / தட்டம்மை / பொன்னுக்கி வீங்கி / (எல்லோ) காய்ச்சல் போன்ற நோய்களுக்கு தங்களுக்கு தடுப்பூசி ஏதேனும் போடப்பட்டுள்ளதா? ஆம் - இல்லை

கடந்த ஒரு வார காலத்திற்குள்

1. காய்ச்சலுடன் கூடிய வயிற்றுப்போக்கு ஏற்பட்டுள்ளதா? ஆம் - இல்லை
2. (ஸ்டீராய்டு) கார்ட்டிஸோன் மாத்திரை எடுத்துள்ளீர்களா? ஆம் - இல்லை

கடந்த நான்கு நாட்களுக்குள்

1. நரம்பு வழியாக ஏதேனும் ஆண்ட்டிபயாட்டிக் மருந்து எடுத்துள்ளீர்களா? ஆம் - இல்லை

கடந்த மூன்று நாட்களுக்குள்

1. வாய் வழியாக ஏதேனும் ஆண்ட்டிபாயடிக் மருந்து எடுத்துள்ளீர்களா? ஆம் - இல்லை

கடந்த 24 மணி நேரத்திற்குள்

1. மது அருந்தி உள்ளீர்களா? ஆம் - இல்லை
2. தாங்கள் வான்ஊர்தி (அ) கனரக வாகனங்களின் ஓட்டுநர்களா? ஆம் - இல்லை
3. கட்டுமானப் பணி செய்பவர்களா? ஆம் - இல்லை
4. அடுத்த 12 மணி நேரத்திற்குள் தாங்கள் தங்கள் பணியில் ஈடுபட வேண்டியுள்ளதா? ஆம் - இல்லை
5. காய்ச்சல், சளி, இருமல், தொண்டைப்புண், சைனஸ் போன்றவைகளினால் அவதியுறுகிறீர்களா? ஆம் - இல்லை

பொதுவான சில வினாக்கள்

1. இரத்த தானம் செய்துள்ளீர்களா? அவ்வாறெனில் எப்பொழுது...................... எத்தனை முறை.................... ஆம் - இல்லை

2. தாங்கள் உணவு அருந்திய நேரம் ....

3. அவசரக் காலங்களில் இரத்த தானம் செய்ய விருப்பம் கொண்டுள்ளீர்களா? ஆம் - இல்லை

4. இரத்த தானத்தின் போது மயக்கம் அடைந்துள்ளீர்களா? வலிப்பு ஏற்பட்டுள்ளதா? (அ) உடல் சம்பந்தமான உபாதைகள் ஏதேனும் ஏற்பட்டதா? ஆம் - இல்லை

5. காரணம் இல்லாமல் எடை குறைவு, தொடர் இருமல், காய்ச்சல், பேதி, உற்பகுதியில் ஏதேனும் வீக்கம் (அ) ஊசியினால் காயம் போன்றவைகள் ஏற்பட்டுள்ளதா? ஆம் - இல்லை

நிரந்தரமாக நிராகரித்தல்

1. கட்டுப்படுத்த இயலாத இரத்த அழுத்தம் (அ) பக்கவாதம் போன்றநோய்களில் பாதிக்கப்பட்டுள்ளீர்களா? ஆம் - இல்லை

2. இருதயநோயினால் பாதிக்கப்பட்டுள்ளீர்களா? ஆம் - இல்லை

3. வலிப்பு நோயினால் பாதிக்கப்பட்டுள்ளீர்களா? அவ்வாறெனில் அதற்கான சிகிச்சை எடுத்துக்கொண்டிருக்கிறீர்களா? ஆம் - இல்லை

4. எதிர்ப்புத்திறன் சம்பந்தமான நோய்களால் பாதிக்கப்பட்டுள்ளீர்களா? எதிர்ப்புத்திறன் குறைக்கும் மருந்துகள் ஏதேனும் எடுத்துக்கொண்டிருக்கிறீர்களா? ஆம் - இல்லை

5. இயல்புக்கு மாறான இரத்தக்கசிவு ஏதேனும் ஏற்பட்டுள்ளதா? ஆம் - இல்லை

6. சர்க்கரை நோய்க்காக இன்சுலின் ஊசி (அ) அதற்காக மாத்திரை ஏதேனும் எடுத்துக்கெண்டிருக்கிறீர்களா? ஆம் - இல்லை

7. கல்லீரல் நோய் உள்ளதா? நாளமில்லாச் சுரப்பி குறைப்பாடு ஏதேனும் உள்ளதா? ஆம் - இல்லை

8. பார்க்கின்சன்ஸ் (நடுக்கம்) நோயினால் பாதிக்கப்பட்டுள்ளீர்களா? ஆம் - இல்லை

9. சோரியாஸிஸ் (தோல்) நோயினால் பாதிக்கப்பட்டு சிகிச்சை எடுத்துக்கொண்டிருக்கிறீர்களா? ஆம் - இல்லை

10. மனநலம் பாதிக்கப்பட்டுள்ளதா? ஆம் - இல்லை

11. சிறுநீரகம், இருதயம், கல்லீரல் மற்றும் மூளை போன்றபகுதிகளில் பெரிய அறுவை சிகிச்சை ஏதேனும் செய்து கொண்டுள்ளீர்களா? ஆம் - இல்லை

12. ஒவ்வாமை, ஆஸ்துமா போன்றநோய்களுக்கு ஸ்டீராய்டு சிகிச்சை எடுத்துக்கொண்டிருக்கிறீர்களா? ஆம் - இல்லை

13. நரம்பு வழி போதை மருந்து பழக்கம், தகாத உடலுறவுப் பழக்கம், பால்வினை நோய்கள் போன்றவைகள் ஏதேனும் உள்ளதா? ஆம் - இல்லை

உறுதிமொழி

என்னால் அளிக்கப்பட்டுள்ள அனைத்து தகவல்களும் உண்மை எனவும், எனது விருப்பத்தின் பேரில் இரத்த தானம் வழங்குவதற்கு சம்மதம் எனவும் உறுதி அளிக்கின்றேன். பாதுகாப்பு கருதி எனது இரத்தமானது (எச்.ஐ.வி., எச்.சி.வி., எச்.பி.வி., சிபிலிஸ், மலேரியா) போன்றநோய்களால் பாதிக்கப்பட்டுள்ளதா என்பதைக் கண்டறிய பரிசோதனைகளுக்கு உட்படுத்தப்படும் என்பதை அறிவேன்.

மேற்கூறிய பரிசோதனைகளின் முடிவுகளைத் தெரிந்து கொள்ள விரும்புகிறேன். ஆம் - இல்லை

தேதி

கொடையாளர் கையொப்பம்

PHYSICAL EXAMINATION

Wt. (in Kg)	HB gm %	PR	BP	RR	TEMP.	CVS	RS	CNS	ABD	Skin disease at phlebotomy site

The above donor is FIT / UNFIT to donate blood.

Blood Bag : SINGLE / DOUBLE / TRIPLE / QUADRUPLE

Volume : 350 ml /450 ml

Bag Segment No.	
Sign. of the Phlebotomist	

Remarks :

Signature of the MEDICAL OFFICER.

The Tamil Nadu Dr. M.G.R. Medical University

Department of Transfusion Medicine

Licence No. 191/28C

BLOOD DONOR FORM

Blood Bag No.	Date	Group & Rh

PERSONAL PARTICULARS

Donor's Name	Age : D.O.B. :	Sex : Male / Female

Residential Address	Office Address
....	....
....	....
....	....
........................Mobile/Ph :	........................Mobile/Ph : ....
Email :	Email : ....

KIND ATTENTION

Kindly furnish the following information sought on medical grounds as per Government Notification. If any question is felt embarrassing kindly bear with us

TEMPORARY DEFERRAL, IN THE PAST 12 MONTHS HAVE YOU

☞ Received Tranfusion of Blood or its products	Y/N
☞ Suffered from Hepatitis or had Hepatitis Immunoglobulin or had close contact with an individual suffering from Hepatitis	Y/N
☞ Had exposure to tattoos, acupunture or body piercing?	Y/N
☞ Had antirabies vaccine or was treated for dog bite?	Y/N
☞ Undergone any major surgery or met with any major accident?	Y/N

IN THE PAST 6 MONTHS HAVE YOU EVER

☞ Suffered from Typhoid / Cholera / Acute infection of kidney or Bladder	Y/N
☞ Had delivery / had pregnancy / any abortion / or been breast feeding?	Y/N / N/A*
☞ Had any minor surgery or met with any minor accident?	Y/N

* N/A - Not applicable

IN THE PAST 3 MONTHS

- ☞ Have you donated blood, plasma or platelets? Y/N
- ☞ Have yow been treated for malaria? Y/N

IN THE PAST 2 MONTHS

- ☞ Have you had any history of measles, mumps and chickenpox? Y/N

IN THE PAST 1 MONTH

- ☞ Had treatment for acne with Isotretinoin? Y/N
- ☞ Had Anti tetanus serum, Anti venom serum, Anti diphtheria serum, Anti gas-gangrene serum or Rubella vaccination? Y/N

IN THE PAST 3 WEEKS

- ☞ Have you had tooth extraction or any dental procedure? Y/N

IN THE PAST 2 WEEKS

- ☞ Have you had chicken pox, shingles, measles, mumps or yellow fever vaccination Y/N

IN THE PAST 1 WEEK

- ☞ Have you had cortisone for treatment? Y/N
- ☞ Had history of diarrhea with fever? Y/N

IN THE PAST 4 DAYS

- ☞ Have you had IV antibiotics? Y/N

IN THE PAST 3 DAYS

- ☞ Have you had oral antibiotics? Y/N

IN THE PAST 24 HOURS

- ☞ Have you had alcoholic drinks Y/N
- ☞ Are you an aircrew, a heavy machine vehicle driver, a construction worker? Y/N
- ☞ Are you reporting for duty in the next 12 hours? Y/N
- ☞ Are you suffering from cold, cough, sore throat or acute sinusitis? Y/N

PERMANENT DEFERRAL

H/o. Uncontrolled blood pressure or stroke?	Y/N
H/o. Heart disease or arrhythmias?	Y/N
H/o. Epilepsy or anticonvulsants?	Y/N
H/o. Auto immune disease or immounsuppressive therapy?	Y/N
H/o. Abnormal bleeding tendencies?	Y/N
H/o. Diabetes mellitus on treatment with insulin or hypoglycemic drugs?	Y/N
H/o. Chronic liver disease or endocrine disorders?	Y/N
H/o. Parkinsons diseases?	Y/N
H/o. Psorasis or treatment for the same?	Y/N
H/o. Psychiatric disorders?	Y/N
H/o. Major surgeries for kidney, heart, liver or brain?	Y/N
H/o. Severe allergic disorders or asthmatic on steroid therapy?	Y/N
H/o. IV drug abuse, heterosexual/homosexual promiscuity / STD?	Y/N

GENERAL QUESTIONS

1. Have you donated blood? Y/N
2. When was your last blood donation? ....

   How many times have you donated? ....
3. Are you willing to donate for emergency situations? Y/N
4. Have you had any reactions like giddiness/fainting attacks/ fits after donation? Y/N
5. Any history of unexplained weight loss/ chronic cough / fever / diarrhoea / Lymph nodes enlargement? Y/N

DECLARATION

I hereby declare that the above information is true to the best of my knowledge and this consent of mine to be a blood donor is voluntary. I understood that certain tests (HIV, HCV, HBV, SYPHILIS, MALARIA), will be performed on my blood for the purpose of ensuring the safety.

I would like to know the results, if any positive. Y/N

Date :

Signature of donor

PHYSICAL EXAMINATION

Wt. (in Kg)	HB gm %	PR	BP	RR	TEMP.	CVS	RS	CNS	ABD	Skin disease at phlebotomy site

The above donor is FIT / UNFIT to donate blood.

Blood Bag : SINGLE / DOUBLE / TRIPLE / QUADRUPLE

Volume : 350 ml /450 ml

Bag Segment No.	
Sign. of the Phlebotomist	

Remarks :

Signature of the MEDICAL OFFICER.

DONOR INFORMATION SHEET

SEROPREVALENCE OF HUMAN PARVOVIRUS B19 AMONG VOLUNTARY BLOOD DONORS IN CHENNAI

Human Parvovirus B19 is a common infection. Parvovirus B19 can be transmitted through transfusion of blood and its blood products. It can cause morbidity and mortality in certain high risk patients which could be prevented by screening the blood products.

AIM

To study the seroprevalence of Human Parvovirus B19 among voluntary blood donors.

PROCEDURE

Being a voluntary blood donor, you are recruited for this study. 5 ml of blood will be taken separately from your donated blood and will be used for detecting IgM and IgG antibodies by ELISA for Human Parvovirus B19.

BENEFITS AND RISKS

- All the investigations are done free of cost.
- There is no risk for these investigations.

CONFIDENTIALITY

Your privacy will be protected in so for as permitted by law. Only your researcher and Ethical committee members will have access to the data collected during the study.

PARTICIPATION

Your participation in this study is voluntary and you are free to decide now or later whether to continue or discontinue from the study.

NAME OF THE DONOR:

SIGNATURE :

DATE :

Cµzu öPõøh¯õÎ ¸UPõÚ uPÁÀ £i Á®

Cµzu öPõøh¯õÎ PÎ h® £õº÷Áõ øÁµì ¤19 (PARVOVIRUS B19) öuõØÖ EÒÍ uõ Gß£øu AÔ² ® B ´ Ä.

SÔU÷PõÒ:

Cµzu öPõøh¯õÎ PÎ h® £õº÷Áõ øÁµì ¤19 (PARVOVIRUS B19) öuõØÖ Ps k AÔuÀ.

ö\´ ¬øÓ:

Cµzu öPõøh¯õÎ ¶ß Cµzu ©õv¶° ¼¸¢x 5 ª.¼ AÍ Ä Cµzu ©õv¶ Gk UP¨£mk ÷©ØPs h £¶÷\õuøÚPÒ ELISA ¬øÓ° À IgM, IgG Ab B ßi £õi PÒ AÍ ÄPÒ Ps k ¤i UP¨£k®.

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CµP] ¯¨ £õxPõ¨¦:

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÷uv :

CONSENT

I confirm that I read and understood the information about the above research study dated _______________ and I received chance to ask the questions.

My participation in this study is voluntary and I know that I am free to withdraw from the study at any time, without giving any reason and without affecting any of my legal rights.

I agree to this access. I know that my identification will not be revealed in any details that is released to third persons or published.

I agree not to restrict or interfere any data or results that are obtained from this study.

I agree to participate in this research study for the above listed purpose.

Donor's name :

Signature : Date :

Signature of the person
who obtains consent : Date :

Donor ID Number :

ஒப்புதல்

மேற்கண்ட ஆராய்ச்சியினைப் பற்றிய தகவல்களைப் படித்து புரிந்து கொண்டேன் என்பதையும் வினாக்களைக் கேட்பதற்கான வாய்ப்பும் எனக்கு அளிக்கப்பட்டது என்பதை நான் உறுதி செய்கிறேன்.

இந்த ஆராய்ச்சியிலி எனது பங்கு சொந்த விருப்பத்தின் பேரில் மட்டுமே, சட்ட ரீதியான எனது உரிமைகள் பாதிக்கப்பட்டாமலும், எந்த நேரத்திலும் இந்த ஆராய்ச்சியில் இருந்து என்னை விடுவித்துக் கொள்ள முடியும் என்பதை நான் அறிவேன்.

எனது தனிப்பட்ட விஷயங்கள் மூன்றாவது பேருக்கோ அல்லது எந்த பிரசாரத்திற்கும் வெளியிடப்படமாட்டாது என்பதை நான் அறிவேன்.

இந்த ஆராய்ச்சியின் முடிவுகள் மற்றும் புள்ளி விவரங்கள் போன்றவற்றை தடை செய்யவும் குறுக்கிடவும் மாட்டேன் என்பதை ஒத்துக் கொள்கின்றேன்.

மேற்கூறிய நோக்கத்திற்காக இந்த ஆராய்ச்சியில் பங்கெடுத்துக் கொள்ள நான் ஒத்துக் கொள்கிறேன்.

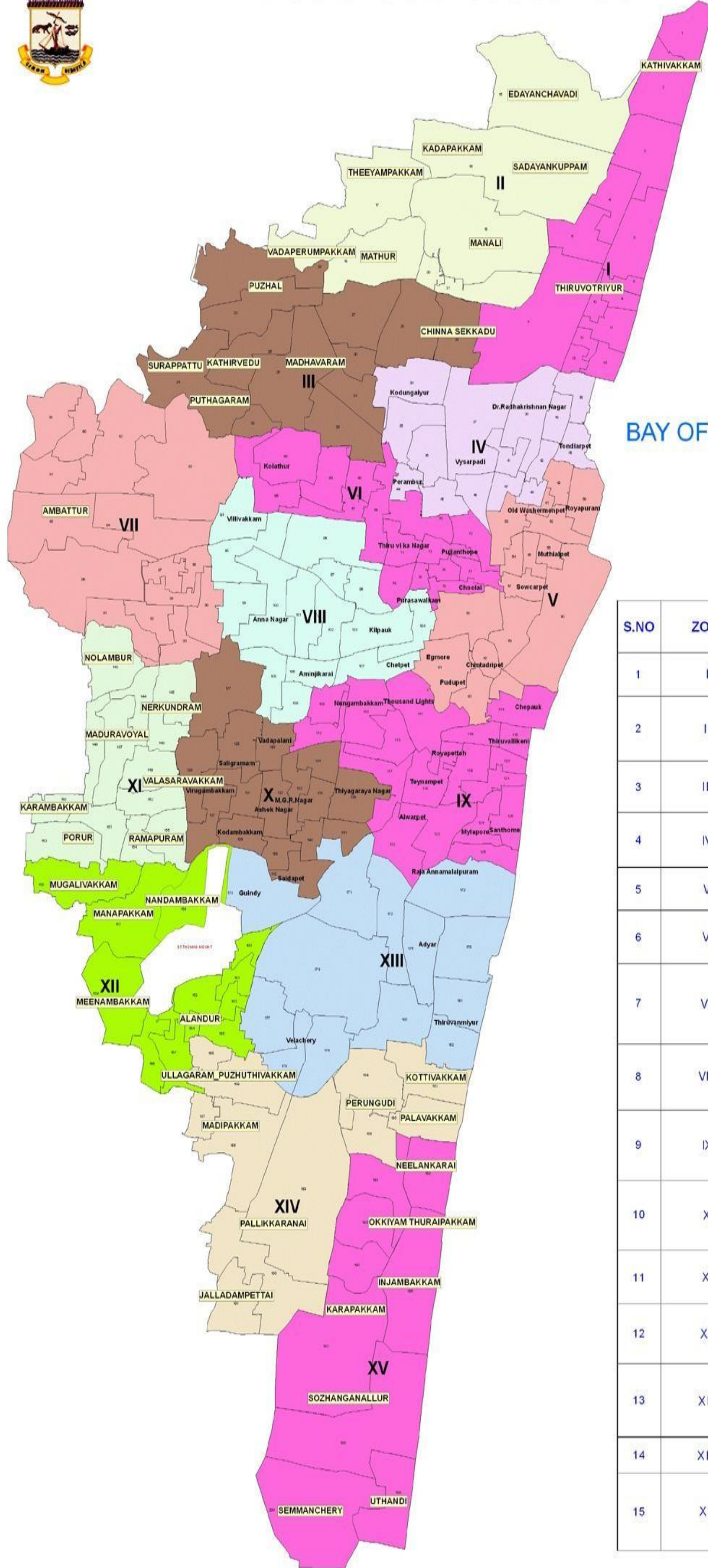
நோயாளியின் பெயர்

கையொப்பம் தேதி

உறுதி மொழி பெறுபவரின்

கையொப்பம்

CORPORATION OF CHENNAI



BAY OF BENGAL

S.NO	ZONE	NAME OF THE ZONE	WARD NUMBER
1	I	THIRUVOTRIYUR	1 TO 14
2	II	MANALI	15 TO 21
3	III	MADHAVARAM	22 TO 33
4	IV	TONDIARPET	34 TO 48
5	V	ROYAPURAM	49 TO 63
6	VI	THIRU-VI-KA NAGAR	64 TO 78
7	VII	AMBATTUR	79 TO 93
8	VIII	ANNA NAGAR	94 TO 108
9	IX	TEYNAMPET	109 TO 126
10	X	KODAMBAKKAM	127 TO 142
11	XI	VALASARAVAKKAM	143 TO 155
12	XII	ALANDUR	156 TO 167
13	XIII	ADYAR	170 TO 182
14	XIV	PERUNGUDI	168,169 183 TO 191
15	XV	SOZHANGANALLUR	192 TO 200

MASTER CHART

DONOR ID	AGE INTERVAL	GENDER	WEIGHT IN KG	AREA	ZONE	OCCUPATION	OECONOMIC CI	TYPE OF DONOR	BLOOD GROUP	Rh TYPE	TTI	MONTH	IgM	IgG
1578	4	1	69	MAGAPPAIR	7	2	3	1	3	1	NEGATIVE	7	2	2
1579	2	1	70	T.NAGAR	10	3	2	1	3	2	NEGATIVE	7	2	1
1580	2	1	90	ANNANAGAR	8	4	3	1	3	1	NEGATIVE	7	2	2
1581	2	1	65	T.NAGAR	10	3	2	1	1	1	NEGATIVE	7	2	2
1583	3	2	84	VALASARVAKKAM	11	1	1	1	1	1	NEGATIVE	7	2	2
1584	4	1	65	ASHOK NAGAR	10	1	2	1	3	1	NEGATIVE	7	2	1
1585	2	1	79	ASHOK NAGAR	10	4	2	1	3	2	NEGATIVE	8	2	1
1586	3	1	112	TIRUVANMAIYUR	13	3	2	1	2	1	NEGATIVE	8	2	1
1587	2	1	78	TIRUVANMAIYUR	13	3	2	1	3	1	NEGATIVE	8	2	1
1589	2	2	70	KOTTURPURAM	13	1	1	1	3	1	NEGATIVE	8	2	2
1592	3	1	95	MANDAVELI	13	3	2	1	2	1	NEGATIVE	8	2	1
1596	2	1	81	GUINDY	12	3	2	1	1	1	NEGATIVE	9	2	2
1632	2	1	74	KODAMBAKKAM	10	3	3	1	1	1	HBsAg(+)	9	2	1
1633	2	1	55	AVADI	7	1	2	1	4	1	NEGATIVE	9	2	2
1634	3	1	73	KORATUR	7	4	3	1	4	1	Anti-HCV (+)	9	2	1
1635	3	1	88	BESANT NAGAR	13	1	1	1	1	1	NEGATIVE	9	2	2
1636	3	1	77	MYLAPORE	10	1	2	1	3	1	NEGATIVE	9	2	1
1637	3	1	61	ANAKAPUTTUR	OUTSIDE	3	2	1	3	1	NEGATIVE	9	2	2
1638	2	1	73	KORUKUPET	4	4	3	1	3	1	NEGATIVE	10	2	1
1639	3	1	78	PADI	8	3	2	1	3	1	NEGATIVE	10	2	1
1640	2	1	66	NUNGAMPAKKAM	10	2	2	1	4	1	NEGATIVE	10	2	2
1641	3	1	69	ANNANAGAR	8	3	2	1	2	1	NEGATIVE	10	2	1
1642	3	1	79	NUNGAMPAKKAM	10	1	1	1	1	1	NEGATIVE	11	2	2
1643	3	1	73	MAMBALAM	10	3	2	1	2	1	NEGATIVE	11	2	2
1644	3	1	80	KORATUR	7	3	2	1	2	1	NEGATIVE	11	2	2
1645	1	1	60	AMBATTUR	7	3	2	1	2	1	NEGATIVE	11	2	2
1647	2	1	57	PONNERI	OUTSIDE	3	2	1	2	1	NEGATIVE	11	2	1
1648	2	1	76	MAMBALAM	10	3	2	1	2	1	Anti-HCV (+)	12	2	1
1649	2	1	60	ERNAVOOR	1	4	3	1	2	1	NEGATIVE	12	2	1
1650	4	1	100	NUNGAMPAKKAM	10	1	1	1	1	1	NEGATIVE	12	2	2
1651	3	1	85	VELACHERY	12	1	1	1	1	1	NEGATIVE	12	2	2
1653	3	1	69	T.NAGAR	10	1	1	1	2	1	NEGATIVE	12	2	2
3	3	1	70	ADAMPAKKAM	12	3	2	1	2	1	NEGATIVE	1	2	1
5	2	1	75	TEYNAMPET	9	3	3	1	1	1	NEGATIVE	1	2	1
6	2	1	70	PERAMBUR	6	2	3	1	1	1	NEGATIVE	1	2	1

7	2	1	85	PERAMBUR	6	2	2	1	3	1	NEGATIVE	1	2	1
8	3	1	74	MANALI	2	2	3	1	2	1	NEGATIVE	1	2	1
9	3	1	86	PERAMBUR	6	2	3	1	3	1	NEGATIVE	1	2	1
10	4	1	75	NAVALUR	7	3	3	1	3	1	NEGATIVE	1	2	1
11	2	1	66	ENNORE	1	2	3	1	3	1	NEGATIVE	1	2	2
12	2	1	58	ENNORE	1	2	2	1	2	1	NEGATIVE	1	2	1
14	2	1	62	AYANAVARAM	6	2	2	1	2	1	NEGATIVE	1	2	2
15	4	1	50	ENNORE	1	3	3	1	2	2	NEGATIVE	1	2	2
18	2	1	60	MOGAPPAIR	7	3	3	1	2	1	NEGATIVE	2	2	1
19	2	1	54	ORAGADAM	7	3	3	1	1	1	NEGATIVE	2	2	1
20	2	1	60	ORAGADAM	7	3	3	1	3	1	NEGATIVE	2	2	1
21	2	1	70	TAMBARAM	12	3	3	1	2	1	NEGATIVE	2	2	2
23	2	1	90	TAMBARAM	12	2	3	1	1	1	NEGATIVE	2	2	2
25	2	1	71	ANNANAGAR	8	3	3	1	1	1	NEGATIVE	2	2	1
26	3	1	79	VIRUKAMPAKKAM	11	3	3	1	2	1	NEGATIVE	2	2	1
27	2	1	63	ORAGADAM	7	3	3	1	2	1	NEGATIVE	2	2	1
28	3	1	70	ORAGADAM	7	3	3	1	3	1	NEGATIVE	2	2	1
31	2	1	57	ORAGADAM	7	3	3	1	3	1	NEGATIVE	2	2	1
38	2	1	76	SAIDAPET	13	2	1	1	3	1	NEGATIVE	2	2	2
37	5	2	50	CHROMPET	13	1	1	1	4	1	NEGATIVE	2	2	1
39	1	1	56	GUINDY	13	2	2	1	3	1	NEGATIVE	2	2	2
40	1	1	52	GUINDY	13	2	2	1	2	1	NEGATIVE	3	2	1
41	1	1	63	PERUNGUDI	14	2	2	1	1	1	NEGATIVE	3	2	2
42	2	1	78	AMBATTUR	7	2	2	1	2	1	NEGATIVE	3	2	1
43	1	1	50	PORUR	12	2	2	1	2	1	NEGATIVE	3	2	1
44	2	1	55	PORUR	12	1	1	1	2	1	NEGATIVE	3	2	2
45	1	1	65	CHROMPET	12	2	2	1	1	1	NEGATIVE	3	2	2
46	1	1	63	CHROMPET	12	2	2	1	3	1	NEGATIVE	3	2	2
47	1	1	75	TYNAMPET	9	2	2	1	3	1	NEGATIVE	3	2	1
48	1	1	65	MADHAVARAM	9	2	2	1	2	1	NEGATIVE	3	2	1
49	1	1	67	MADHAVARAM	3	2	2	1	3	1	NEGATIVE	3	2	1
50	1	1	75	MADHAVARAM	9	2	2	1	2	1	NEGATIVE	3	2	2
51	1	1	55	TONDAIARPET	4	2	2	1	1	1	NEGATIVE	3	2	2
53	1	1	65	ALANDUR	12	2	2	1	2	1	NEGATIVE	4	2	2
90	1	2	60	AYANAVARAM	6	2	2	1	1	1	NEGATIVE	4	2	2
112	2	1	112	GUINDY	13	1	1	1	3	1	NEGATIVE	4	2	1
113	4	1	68	AYANAVARAM	6	1	1	1	1	1	NEGATIVE	4	2	1

116	3	1	81	ADAYAR	13	1	1	1	3	1	NEGATIVE	4	2	2
117	2	1	69	ADAYAR	13	1	1	1	2	1	NEGATIVE	4	2	2
118	3	2	61	SEMBIAM	6	2	3	1	2	1	NEGATIVE	4	2	1
119	2	1	77	PERAMBUR	6	2	2	1	1	1	NEGATIVE	4	2	2
120	2	1	70	VILLIVAKKAM	6	2	2	1	3	1	NEGATIVE	4	2	2
122	2	1	70	VILLIVAKKAM	6	2	1	1	4	1	NEGATIVE	4	2	2
123	4	1	67	AYANAVARAM	6	2	1	1	3	1	NEGATIVE	4	2	1
124	1	1	60	AYANAVARAM	6	2	2	1	2	1	NEGATIVE	4	2	2
139	2	1	55	ROYAPURAM	5	2	2	1	2	1	NEGATIVE	4	2	2
140	2	1	62	MANALI	2	3	3	1	1	1	NEGATIVE	4	2	1
141	2	1	60	AMBATTUR	7	2	1	1	3	1	NEGATIVE	5	2	1
142	1	1	67	ANNANAGAR	8	2	2	1	3	1	NEGATIVE	5	2	2
143	2	1	65	NAVALLUR	15	2	2	1	2	1	NEGATIVE	5	2	2
144	2	1	55	NAVALLUR	15	3	3	1	2	1	NEGATIVE	5	2	1
145	2	1	50	NAVALLUR	15	2	2	1	3	1	NEGATIVE	5	2	2
146	2	1	54	NAVALLUR	15	3	3	1	2	1	NEGATIVE	5	2	2
147	2	1	52	KODAMBAKKAM	10	3	3	1	3	1	NEGATIVE	5	2	2
149	2	1	50	NAVALLUR	15	3	3	1	1	1	NEGATIVE	5	2	1
148	2	1	80	ANNANAGAR	8	3	3	1	3	1	NEGATIVE	5	2	1
180	2	2	55	TVK	6	2	2	1	1	1	NEGATIVE	5	2	2
181	2	2	60	MANALI	2	2	2	1	2	1	NEGATIVE	5	2	2
184	2	1	70	MANALI	2	2	2	1	3	1	NEGATIVE	5	2	2
185	1	1	62	ANNANAGAR	8	2	2	1	3	1	NEGATIVE	5	2	2
186	1	1	56	AMBATTUR	7	2	2	1	3	1	NEGATIVE	6	2	2
187	1	1	70	AMBATTUR	7	2	2	1	4	1	NEGATIVE	6	2	2
188	1	2	55	ANNANAGAR	8	2	2	1	4	1	NEGATIVE	6	2	2
189	1	1	78	PORUR	12	2	2	1	2	1	NEGATIVE	6	2	2
190	1	2	68	PORUR	12	2	2	1	4	1	NEGATIVE	6	2	2
192	1	1	63	VALASARVAKKAM	11	2	2	1	4	1	NEGATIVE	6	2	2
193	1	1	50	ADAMPAKKAM	12	2	2	1	2	1	NEGATIVE	6	2	2
194	1	1	65	ADAMPAKKAM	12	2	2	1	3	2	NEGATIVE	6	2	2
195	1	1	57	ALANDUR	12	2	2	1	1	2	NEGATIVE	6	2	2
196	1	1	57	ADAYAR	13	2	2	1	1	1	NEGATIVE	6	2	2
201	1	2	55	ADAMPAKKAM	12	2	2	1	2	1	NEGATIVE	6	2	2

Age group in Years	Code
18-20	1
21-30	2
31-40	3
41-50	4
>50	5

Month	Code
January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	10
November	11
December	12

Gender	Code
Male	1
Female	2

Occupation	Code
Professional	1
Student	2
Clerical	3
Coolie	4
House wife	5

Type of Donor	Code
Voluntary	1
Replacement	2

Socio economic status	Code
High	1
Middle	2
Low	3

Blood Group	Code
A	1
B	2
O	3
AB	4

Rh Typing	Code
Positive	1
Negative	2

IgM	Code
Positive	1
Negative	2

IgG	Code
Positive	1
Negative	2

Zone	Code
Thiruvotriyur	1
Manali	2
Madhavaram	3
Tondiarpet	4
Royapuram	5
Thiru-vi-ka Nagar	6
Ambattur	7
Anna Nagar	8
Teynampet	9
Kodambakkam	10
Valasaravakkam	11
Alandur	12
Adyar	13
Perungudi	14
Sozhanganallur	15

Shogan raj Selvaraj <dr.shogan159@gmail.com>

Fwd: Clarification about NovaLisa Parvovirus B19 IgM & IgG ELISA

1 message

Arumugam Pothipillai <pothiarumugam@gmail.com> Fri, Sep 23, 2016 at 6:04 PM
To: Shogan raj Selvaraj <dr.shogan159@gmail.com>

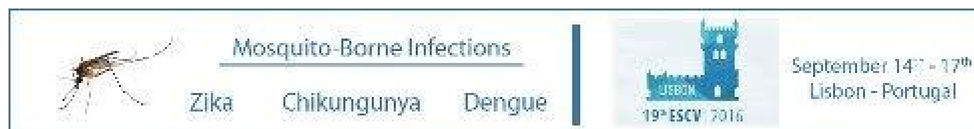
---------- Forwarded message ----------
From: **Dr. Claudia Rezmer** <c.rezmer@novatec-id.com>
Date: Mon, Sep 5, 2016 at 2:57 PM
Subject: AW: Clarification about NovaLisa Parvovirus B19 IgM & IgG ELISA
To: "pothiarumugam@gmail.com" <pothiarumugam@gmail.com>
Cc: Bettina Dörr <B.Doerr@novatec-id.com>

Dear Dr. Arumugam

For Parvovirus IgG and IgM we use recombinant antigens. The plates are coated with conformational epitopes of VP-2 particles and linear epitopes of a specific part of VP-1.

Mit freundlichen Grüßen / Best regards

Dr. Claudia Rezmer
QMR/ QMB
Regulatory Affairs Supervisor



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