International Journal of Medical and Health Sciences

Journal Home Page: http://www.ijmhs.net ISSN:2277-4505

Original article

Seroprevalence of Human Cytomegalovirus Among Voluntary Blood Donors In Chennai

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ABSTRACT

Background: Human Cytomegalovirus (CMV) is one of the most significant pathogens infecting immunosuppressed individuals. CMV is known to be a significant cause of morbidity and mortality following blood transfusion in immunocompromised individuals. The immunosuppressed population for whom CMV free blood products are requested is increasing due to advances in medical care. The most effective way to minimize the risk of CMV transmission in high risk recipients would be to administer CMV free blood products. The study was performed to find out the seroprevalence of Human CMV among voluntary blood donors in Chennai. **Materials and methods:** A total of 580 voluntary blood donors were tested for IgM and IgG anti-CMV antibodies by ELISA technique and seronegative samples were confirmed by Polymerase Chain Reaction (PCR). Demographic details and laboratory results were analyzed.

Results: Among the 580 donors, 441 (76.03%) were males and 139 (23.97%) were females. It was found that 550 donors were positive for IgG anti-CMV antibody giving an IgG seroprevalence rate of 94.82%. IgM anti-CMV antibody was negative in all the donors. None of the IgG seronegative blood samples were found to contain CMV DNA by PCR. **Conclusion:** Human CMV is highly prevalent and is a threat to the safety of blood transfusion. Considering the fact that IgM antibody positive donors seldom found, screening for IgM anti-CMV antibody may be practiced only for high risk recipients. Other preventive strategies like leukoreduction or pathogen inactivation can be made available to prevent CMV transmission.

KEYWORDS: Blood donors, Cytomegalovirus, ELISA, Seroprevalence

INTRODUCTION

Cytomegalovirus (CMV), a member of the human herpes family of viruses, transmissible through blood transfusions, is an important cause of concern worldwide [1]. CMV is a ubiquitous organism found universally in all geographic locations. However, CMV is more common in developing countries and in people belonging to lower socio-economic status. Like most other herpes viruses, they remain latent in the host after primary infection and persist for lifelong in the organism. Nevertheless, these viruses can be reactivated in immunosuppressed individuals and can be an important cause of morbidity and mortality [2].

CMV can be transmitted by blood transfusion, transplacental route or by transplantation of hematopoietic stem cells and solid organs from infected donors. Most studies suggest that 13-38% of immunocompromised patients will contract CMV from transfusion of unscreened and unfiltered cellular blood components [3, 4]. Therefore, the most effective way to minimize the risk of CMV transmission in high risk recipients would be to administer CMV free blood products. The immunosuppressed population for whom CMV free blood products are requested is increasing due to advances in medical care. [5]. In view of the increasing demand for CMV free blood products, this study was performed to determine the seroprevalence of CMV antibodies among voluntary blood donors.

MATERIALS AND METHODS

This prospective study was conducted over one year period from 2009-2010 from the donors donated in the Department of Transfusion Medicine, The Tamilnadu Dr.MGR Medical University, Chennai. A total of 580 voluntary blood donors were selected. The study was approved by the ethical committee of the institution. Five ml of blood from each donor was collected from the collection bag into a sterile capped tube. It was then centrifuged and plasma was separated and stored as two aliquots at -80°C till further use. Donors who are eligible for blood donation as per the NACO guidelines were included in the study. Socio economic status of the donors were classified based on Kuppuswamy socioeconomic scale [6]. Sera were tested for IgG and IgM CMV separately by the enzyme-linked immunosorbent assay (ELISA) test. The CMV-specific antibodies were studied by the commercial Diagnostika Nord CMV IgG ELISA Kit and CALBIOTECH CMV IgM ELISA Kit. This is based upon the use of micro titration wells coated with purified antigen. All steps were done according to the manufacturer's instructions. The detection of CMV DNA in the CMV seronegative samples was done by real time Polymerase Chain reaction (PCR). Statistical analysis was done with SPSS software. When relating variables to each other, multivariate analysis was done. Chi square test was employed to detect any significant correlation between different variables.

RESULTS

Demographic analysis showed, of the 580 donors, 441 (76.03%) were males and 139 (23.97%) were females. Age distribution among the blood donors were 33.27% in 18-20 years, 33.96% in 21-25 years, 19.65% in 26-30 years, 7.75% in 31-35 years, 4.31% in 36-40 years, 1.03% in >40 years. Blood group distributions among the donors were 21.66% of 'A' positive, 30.55% of 'B' Positive, 35.6% of 'O' Positive, 6.1% of 'AB' positive. Rh D negative donors constitute about 6.1%. Most of our donors belong to middle socioeconomic status (78.27%) followed by high (12.75%) and low (8.96%). Among 580 voluntary blood donors, three were found to be reactive for Hepatitis B Surface Antigen (HBsAg). CMV IgG antibody screening by ELISA was positive in 550 donors giving an overall CMV IgG antibody prevalence rate of 94.82%. None of the 580 blood donors were reactive for CMV IgM antibodies by ELISA test (Table 1). CMV IgG antibody status in different age groups was shown in Table 2. There was no significant statistical difference (p=0.072) in IgG seroprevalence among different age groups by chi square test. IgG seroprevalence among male donors was 93.19% and in female was 100%. There was a significant statistical difference (p=0.036) in IgG seroprevalence between sexes by chi square test (Table 3). IgG seropositivity is significantly higher (p=0.041) among lower socioeconomic group people (100%) as shown in Table 4. Among the 30 IgG seronegative blood samples, none were found to contain CMV DNA by real time PCR.

Table 1: Seroprevalence of Human Cytomegalovirus (IgG and IgM)

Anti-CMV antibody	Positive	Negative
IgG	550	30
IgM	0	580

*p= 0.000

Table 2: Age Distribution of CMV IgG seropositive donors

Age group In years	IgG seropositive donors	Total donors	Percentage of IgG seropositive donors
18-20	184	193	95.33%
21-25	188	197	95.43%
26-30	104	114	91.22%
31-35	43	45	95.55%
36-40	25	25	100%
> 40	6	6	100%
TOTAL	550	580	94.82%

*p= 0.072

Table 3: Gender Distribution of CMV IgG Seropositive donors

Sex	IgG seropositive donors	Total donors	Percentage of IgG seropositive donors
Male	411	441	93.19%
Female	139	139	100%
Total	550	580	94.82%

*p= 0.036

Table 4: CMV IgG seropositive donors on the basis of socioeconomic status

Socioeconomic Status	IgG seropositive donors	Total donors	Percentage of IgG seropositive donors
High	427	454	94.05%
Middle	71	74	95.94%
Low	52	52	100%
Total	550	580	94.82%

*p= 0.041

DISCUSSION

The present study was undertaken to define the seroprevalence of CMV infection among voluntary blood donor population, since voluntary donors are expected to provide the major source of most blood transfusion requirements. The present study comprised only of voluntary blood donors. Kaur et al reported that voluntary donations need to be encouraged as voluntary donors are safer than replacement donors [7].

As is evident from the results shown in our study, about 550 out of 580 (94.82%) donors were positive for IgG anti-CMV antibody, suggestive of past exposure to infection. (p=0.000; 95% CI 1.0340-1.1104). Our study results are in concordance with the results of developing countries [5, 8]. In contrast, the IgG seroprevalence is comparatively lower in developed countries [9, 10].

On the other hand, none of the donors were positive for IgM anti-CMV antibody, indicating the absence of primary infection. Our IgM anti CMV seropositivity was similar to the study done by Kothari et al [11] in New Delhi, Adjei et al [12] in Ghana. In contrast, Amarapal et al [13] reported 9.52% of Thai blood donors to be positive for IgM anti-CMV antibody while Moniri et al [14] reported 2.3% IgM seropositivity in Iran. These reflect donors with recent infection or reactivation.

There was no statistically significant difference in the CMV IgG status in different age groups (Table 2). No correlation was observed between IgG seropositivity of CMV and either educational level, marital status or the blood groups.

The IgG seropositivity among male donors in our study was 93.19% while it is 100% in females. There was a significant statistical difference (p=0.036) in seroprevalence between sexes (Table 3). This is similar to the study done by Pultoo et al who reported that the seropositivity was 93.1% in males and 100% in females [5].

About 94.05% of the donors in higher socio economic group are found to be seropositive for CMV while 95.94% in middle and 100% in lower socio economic group are found to be seropositive (Table 4). There was a statistically significant difference (p=0.041) in IgG status in different socioeconomic status which is similar to the study done by Sheevani et al in Punjab who reported that the seropositivity increases in the lower socio economic group when compared to higher socioeconomic group [15].

Since all the donors included in our study were voluntary blood donors, the prevalence of infections (HIV, HBV, HCV, Syphilis and Malaria) that are screened as mandatory tests in the study group were low. Only three among 580 blood donors were found to be positive for HBsAg. These donors were also positive for IgG anti-CMV antibody.

To address the issue of window period, the 30 seronegative samples were subjected to real time PCR for detecting CMV DNA. But none was found to contain CMV DNA. This is similar to the study done by Bitsch et al on 116 CMV seronegative donors, which showed absence of amplifiable DNA in all [16]. Greenlee et al showed that CMV DNA was undetectable by real time PCR in both seronegative (n=93) and seropositive donors (n=110) [17].

However, our results differ from those of Larsson et al who found amplifiable CMV DNA in 19 out of 140 seronegative donors [18]. The discrepancies might be explained by the use of different methods of extraction and DNA amplification. Roback JD et al had done the first multicentre trial to compare the sensitivity of PCR techniques and showed that some of the positive results in seronegative donors were due to spurious amplification of background genomic DNA in the samples. They also reported that at low viral concentrations in seropositive donors, not all aliquots of a given sample would contain sufficient target to be detectable by PCR, which may explain indiscriminate results in various studies [19]. It should be noted that the minimal viral load required for CMV transmission has not been determined, and it must be assumed that any seropositive unit is potentially infectious.

The council of Europe has endorsed that alternatives like leukoreduced blood products can be used when seronegative blood is not available. However, CMV seronegative components should

continue to be used in preference to leukoreduced components for the transfusion needs of patients who are at increased risk of CMV disease [20].

CONCLUSION

The CMV IgG seroprevalence among voluntary blood donors was found to be 94.82%. So it would not be essential to screen blood donors for CMV as very few seronegative units would be available for transfusion. Due to high seropositivity in our study, discarding blood positive for IgG anti-CMV antibody is not possible. Screening for CMV antibodies can be done only for those patients who are at high risk. We have to look for other cost effective techniques to prevent transfusion transmitted infection especially in country like India due to high seroprevalence.

Acknowledgments: We are indebted to the donors participated in the study.

Conflicts of interest: The authors had no conflicts of interest to declare in relation to this article.

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