VER
Vascular & Endovascular Review

Prevalence Of Viral Infections In Hemodialysis Patients In A Tertiary Care Hospital Of Eastern India

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ABSTRACT

Background: Hemodialysis patients are more vulnerable to infections, which are the leading cause of hospitalization and death after cardiovascular events. The primary aim of the study was to screen for the presence of viral infections in patients undergoing hemodialysis.

Materials And Methods: Serum samples were collected from 150 end-stage renal disease patients receiving hemodialysis, as well as a control group of 150 healthy people with no predisposing factors. Enzyme-linked immunosorbent assay (ELISA) was used for screening of viral infections in patients for Cytomegalovirus (CMV), Hepatitis B virus, Hepatitis C virus and Human Immunodeficiency virus. Polymerase chain reaction (PCR) was done for confirmation of CMV which was the predominant viral pathogen isolated. The chi-square test and Statistical Package for the Social Sciences software 2.0 were used in the statistical study, with p-values less than 0.05 considered as statistically significant.

Results: Out of 150 patients included in the study, 22% patients belonged to the age group of 61-70 and 41-50 years. Male (64%) preponderance was observed among the patients. Most common viral infection was by CMV. Seropositivity of CMV-IgM and CMV-IgG by ELISA were 5.3% and 58% respectively. PCR detected viral DNA 6.6%.

Conclusion: CMV infection was common among HD patients in our region; therefore we recommend screening for anti-CMV IgG and IgM antibodies.

KEYWORDS: Hemodialysis, Viral infection, ELISA, PCR, CMV

How to Cite: Dr Roshni Dandapat, Dr Dipti Pattnaik, Dr Nirmala Poddar, Dr Kumudini Panigrahi, Dr Smrutilata Sahoo, Dr Preety Mishra, Dr Soumya Nayak, Dr Ankita Roy, Dr Aswini Prasad Patnaik, Dr Basanti Kumari Pathi, (2025) Prevalence Of Viral Infections In Hemodialysis Patients In A Tertiary Care Hospital Of Eastern India., Vascular and Endovascular Review, Vol.8, No.10s, 17-21.

INTRODUCTION

The hemodialysis (HD) treatment, as well as abnormalities in both innate and adaptive immunity, causing HD patients susceptible to infections[1]. These patients are more likely to become infected, which is thought to be caused by risk factors that weaken the host's defenses, such as aging, a breakdown in the skin and mucosal barriers, co-morbid diseases, and malnutrition[2].

Besides bacterial infections, blood-borne viral infections, notably infections caused by hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) and Cytomegalovirus (CMV) are major concerns in HD units[1]. HBV and HCV infections are significant causes of morbidity and death in HD patients, complicating patient management in renal dialysis units since individuals with chronic kidney disease do not completely overcome these viral infections.HCV infects approximately 200 million individuals globally, with a seroprevalence rate of 3-4% in Asian nations and 10-20% in Central Africa and Egypt. South East Asia, Sub-Saharan Africa, China, Indonesia, and Nigeria have reported an HBV prevalence rate of around 8%. Seroprevalence of HBV infection in India is ~5%. The risk associated with dialysis is around 2%, which varies by country[3]. Data regarding prevalence of these viruses in HD infection is less.

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Cytomegalovirus (CMV) is one of the most common opportunistic viral pathogens in immunocompromised people, particularly those on dialysis. Around 90.7% of these patients have CMV seropositivity[4]. CMV infection can occur at any point in a person's life, even in utero. Seropositivity is more frequently seen as people get older. Seropositivity rates among HD patients range from 60% to 90%, depending on age and socioeconomic status. While the first CMV infection can cause significant sickness in vulnerable people, reactivation of the dormant virus is a more common concern[5]. CMV infection has become a serious public health concern, offering a significant danger to dialysis patients who are already immune impaired. Because of their weakened immune systems, these patients' infections can be severe, increasing the risk of mortality and other serious sequelae. In recent years, a substantial frequency of CMV infection in patients with renal failure in HD units was identified[6].
The primary aim of the study was to screen for the presence of viral infections in patients undergoing hemodialysis and to investigate the seroprevalence of anti-CMV IgG and IgM, HBsAg, HCV antibodies and HIV antibodies in patients on HD.

MATERIALS AND METHODS

A prospective cross sectional study was carried out in the Department of Microbiology in association with Department of Nephrology of a tertiary care hospital in eastern region of India from November 2020 to October 2022 which included all End Stage Renal Disease (ESRD) patients undergoing dialysis.Total 150 ESRD patients were included and blood sample was collected for screening of viral pathogens.

ESRD patients, age more than 20 years undergoing hemodialysis for more than three months were included in the study. 150 healthy individuals without any history of kidney problems or any other predisposing and immunosuppressive condition were included as control group in our study.

5ml of blood sample was collected by venepuncture in sterile plain vacutainers under strict aseptic conditions from HD patients and control group patients (50). The plain vial was allowed to stay at room temperature till the blood clot was formed and serum was transferred with the help of pipette in a sterile labeled tube. The serum was preserved at -20ºC till the tests were carried out for ELISA and polymerase chain reaction (PCR)[7-9].

Serological detection of CMV IgG and IgM (ENZY-WELL, Immunoshop India Private Limited, New Delhi), HbsAg (Qualpro diagnostics, Goa), HCV (Qualpro diagnostics, Goa) and HIV (J Mitra, Parwanoo) was done by enzyme linked immunosorbent assay (ELISA).

Detection of viral DNA by PCR (Helini CMV rtPCR kit) was done for confirmation of results.
The chi-square test and Statistical Package for the Social Sciences software 2.0 were used in the statistical study, with p-values less than 0.05 considered as statistically significant.

RESULTS

Out of 150 patients included in the study, maximum number 33 (22%) belonged to the age group of 61-70 and 41-50 years. The common study groups were males 96 (64%) as compared to females 54 (36%). Hypertension and diabetes were the common risk factors found mostly in males.
Seroprevalence of CMV and HBsAg was 58% and 2% respectively. Patients screened for HIV and HCV were found seronegative (Figure 1).

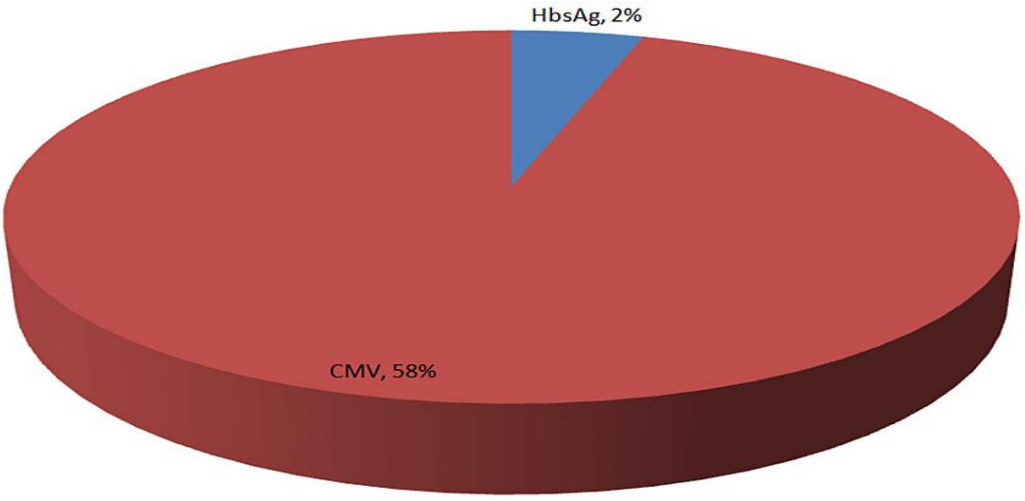

FIGURE 1: Seropositivity of viral pathogens among patients undergoing hemodialysis by ELISA

CMV IgG was present in 87 (58%) patients as compared to the controls 63 (42%). CMV-IgM positivity was 5.3% for hemodialysis patients whereas for controls it was 1.3%. (Figure 2)

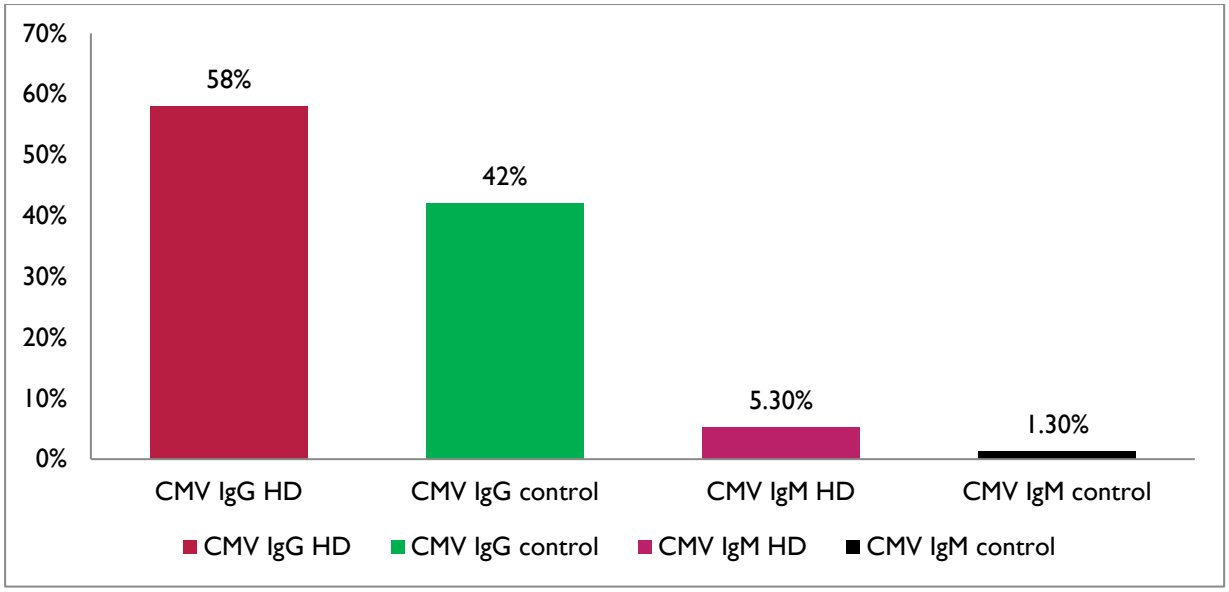

Figure 2. Frequency of CMV-IgG and IgM antibodies in hemodialysis patients and control group

Most of the patients under study were males with CMV-IgG and IgM positivity as 52% and 5% respectively. CMV-IgG positivity for females was 69% and IgM 5.5%. Overall positivity for IgG (58%) was also more as compared to IgM (5.3%) by ELISA and p value was statistically significant. (Table No 1)

Gender	**No of patients**	**CMV-IgG**		**CMV-IgM**		**Overall seropositivity**
		Positive	Negative	Positive	Negative	
Male	95	49 (52%)	46 (48%)	5 (5%)	90 (95%)	54 (36%)
Female	55	38 (69%)	17 (31%)	3 (5.5%)	52 (94.5%)	41 (27.3%)
Total	150	87 (58%)	63 (42%)	8 (5.3%)	142 (94.7%)	
X^2		4.385 with 1 degrees of freedom		0.003 with 1 degree of freedom		
P		0.0363 (significant)		0.9599 (not significant)		

Table No 1. Distribution Of CMV-Igg And Igm Antibodies By ELISA According To Gender

CMV positivity for IgG was 47% in the age group of 40-69 years followed by 7% in the age group ≥70 years. IgM positivity for CMV was 3.3% in 40-69 years of age and 2% in ≥70 years of age. (Table No 2)

Age	**≤39 years**	**40-69 years**	**≥70 years**	**Total (N=150)**
CMV negative	3 (2%)	40 (27%)	20 (13%)	63 (42%)
Previous infection (CMV-IgG)	6 (4%)	70 (47%)	11 (7%)	87 (58%)
Secondary or active infection (CMV- IgM)	0	5 (3.3%)	3 (2%)	8 (5.3%)

Table No 2. Cytomegalovirus infections among the different age groups of hemodialysis patients (N=150)

CMV viral load could be detected in 6.6% cases by PCR in patients undergoing hemodialysis. CMV-IgM (active infection) and IgG (previous infection) could be detected in 5.3% cases and 61.3% cases by ELISA. (Table No 3)

Table No 3. Comparative Evaluation Of Active Infection Of CMV By ELISA And PCR

	ELISA		**PCR positivity (Viral DNA detection) (Active infection)**
	CMV-IgG (previous infection)	**CMV-IgM (active infection)**	
HD patients	87 (58%)	8 (5.3%)	6.6%
Control	63 (42%)	2 (1.3%)	3.3%

DISCUSSION

Patients enrolled in the study were mostly males 96 (64%) as compared to females 54 (36%) and were in the age group of 61-70 and 41-50 years. Probably the disease incidence is higher in the advanced age group requiring hemodialysis as treatment option. Diabetes and hypertension were also seen as common risk factors among males enrolled in the study which may be the common cause of disease severity. Rteil A et al. 2020 and Serefhanoglu K et al. 2011 also had similar observations[10,11].

Seroprevalence of CMV and HBsAg was 58% and 2% respectively in our study. Jalil MB et al. 2022 found 75% overall seropositivity for CMV and Ali N et al.2019 found 7.5% for HbsAg[6, 12].

CMV-IgG seropositivity in our study was 58% for hemodialysis patients as compared to controls (42%).T Vilibic-Cavlek et al.2015 in their study found 90.7% IgG seropositivity in patients and 81.9% in controls which is much higher than our findings[4]. Sephehrvand N et al 2010 found 77.4% IgG positivity in patients only[13].

The present study shows CMV-IgM seropositivity as 5.3% for patients and 1.3% in controls. Our findings are higher than Jalil MB et al. 2022 (2.1%) for IgM antibody in hemodialysis patients[6]. T Vilibic-Cavlek et al.2015 detected IgM antibody in 1.9% patients and 2.5% controls[4].

Our findings show CMV-IgG and IgM positivity for males as 52% and 5% respectively which can be compared with that of Sephehrvand N et al 2010 IgG (36.9) and IgM (4.76%)[13]. Saadoon IH et al.2015 found 85.5% IgG seropositivity and 10.1% IgM for males which is much higher than the present study[14].

CMV IgG and IgM positivity for females in our study was 69% and 5.5 % respectively. However Saadoon IH et al.2015 found 91.5% IgG positivity and 6.4% IgM positivity[14]. Observations of Sephehrvand N et al 2010 for seropositivity of females was 40.4% for IgG and 2.38% for IgM respectively which is much lower than our findings[13].

CMV IgG seropositivity for both males and females was statistically significant but IgM seropositivity was not significant statistically.

Overall seropositivity for both IgG and IgM were more in males (36%) than females (27.3%) in our study. Jalil MB et al. 2022 also found seroprevalence of CMV more in males (54.2%) as compared to females (45.8%)[6].

IgG seropositivity for CMV was maximum in the age group of 40-69 years (47%) followed by age group of ≥70 years (7%). Similar observations were also seen in the study carried out by Sephehrvand N et al 2010 where maximum seropositivity was also seen in the age group of 40-69 years (77.9%) [13]. Probably past infection or reinfection was more common in the age group of 40-69 years among the patients enrolled in the study.

Seropositivity for IgM was also maximum in the age group 40-69 years (3.3%) followed by ≥70 years (2%) as compared to the observations of Sephehrvand N et al 2010 (6.1%) and (10%) in the concerned age groups[13]. Being the most common age group involved in several activities, recent infection was also commonly seen in the same age group as IgG. Viral DNA could be detected in 6.6% cases and 3.3% control group by PCR. Very few studies are available regarding detection of CMV by using PCR.

CONCLUSION

Most common viral infection in patients undergoing hemodialysis in the present study was CMV. Seropositivity of CMV-IgM and CMV-IgG by ELISA were 5.3% and 58% respectively. CMV-IgG and IgM antibodies were seen maximum in the age group of 40-69 years. Confirmation by PCR was comparatively more for cases (6.6%) as compared to controls (3.3%).

The results of the present study confirm a high prevalence of CMV infection among HD patients.
The increased seroprevalence might be attributed to a variety of reasons, including viral endemicity, public health, patient immunity, environmental factors, and geographic location. CMV-IgG antibodies had a greater seroprevalence rate than CMV-IgM antibodies, indicating a past infection or reactivation of the CMV virus among haemodialysis patients, putting them at increased risk of CMV infection.

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