

# Monitoring the Seroprevalence of Herpes Simplex Virus-1 Among Egyptian Hemodialysis Patients

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Hemodialysis patients are at high risk for infections due to their compromised immune systems. Herpes Simplex Virus (HSV) infections can lead to severe complications in this population. Despite its clinical significance, comprehensive data on the seroprevalence of HSV among hemodialysis patients are limited. **Objective:** This study aims to evaluate the seroprevalence of HSV-1 among Egyptian hemodialysis patients. **Methods:** A cross-sectional study was conducted with 218 participants (116 females and 102 males). Among these, 132 (60.6%) were undergoing hemodialysis, while 86 (39.4%) had normal kidney function and were free from HCV, CMV, and HIV infections. Serum samples were analyzed for IgG antibodies against HSV-1. Statistical analyses were performed to determine HSV seroprevalence. **Results:** The study observed a significantly higher prevalence of HSV-1-IgG antibodies in hemodialysis patients (84.1%) compared to the control group (66.3%,  $P < 0.01$ ). Additionally, HSV-1-IgM positivity was also higher in the hemodialysis group (41.6%) compared to the control group (32.6%,  $P < 0.05$ ). These findings highlight the need for vigilant monitoring and preventive strategies for HSV infections in hemodialysis patients.

**Keywords:** Hemodialysis; Herpes Simplex Virus; Seroprevalence; Immunocompromised.

Herpes simplex virus (HSV) infections are widespread globally, affecting a considerable portion of the population. HSV infections are caused by two main types: HSV-1, typically linked to orolabial lesions, and HSV-2, which is primarily responsible for genital herpes<sup>1,8</sup>. While most HSV infections are self-limiting in individuals with normal immune function, they can cause severe complications in immunocompromised populations, including those with end-stage renal disease (ESRD) undergoing hemodialysis<sup>2,6</sup>.

Hemodialysis patients are particularly vulnerable due to impaired immune function, which may be exacerbated by uremia, malnutrition,

and various comorbid conditions. This weakened immune system heightens their susceptibility to infections, including those caused by HSV. In this group, HSV infections can range from mild mucocutaneous lesions to severe, life-threatening disseminated diseases<sup>3,17</sup>.

Despite the risk of serious complications, there is a paucity of data on the prevalence and clinical manifestations of HSV infections in hemodialysis patients<sup>4,5,14</sup>. Preliminary studies indicate that the seroprevalence of HSV may be higher in hemodialysis patients compared to the general population, underscoring the necessity for further research<sup>6</sup>. Gaining a deeper understanding

of the epidemiology and risk factors for HSV infection in this high-risk group is essential for the development of effective prevention and management strategies<sup>5,6,18</sup>.

This study aims to assess the seroprevalence of HSV-1 among Egyptian hemodialysis patients. The outcomes of this research will enhance our understanding of the burden of HSV infection in hemodialysis patients and will support the development of targeted interventions to improve their care and clinical outcomes.

## MATERIALS AND METHODS

### Ethical Approval

The study was approved by the Review Board of Ain Shams University with an approval date of February 2, 2023.

### Study Design and Population

This cross-sectional study aims to determine the seroprevalence of HSV-1 among hemodialysis patients. The study included 218 participants, comprising 116 females and 102 males, aged 29 to 65 years (mean age 39.32±14.45 years). Blood samples were collected from several hospitals: Al-Demerdash, Wadi Alneil, Sayed Galal, Beni Suef University, and Sohag General Hospital. Participants were divided into two groups: 132 patients with renal failure undergoing hemodialysis and 86 control subjects with normal kidney function, negative for HCV, CMV, and HIV antibodies. Informed consent, including information on name, age, gender, and blood transfusion history, was obtained from each subject before sample collection. Serum samples were tested for IgG and IgM antibodies against HSV-1. The data are not publicly available due to the privacy agreements made with the study participants. However, anonymized data may be available from the corresponding author upon reasonable request.

### Sampling Method

Participants were selected using a random sampling method from several hospitals as mentioned above, ensuring the sample is representative of the Egyptian hemodialysis patient population. The sample was stratified into two groups: hemodialysis patients and control subjects with normal kidney function and no infections such as HCV, CMV, or HIV. This stratification helped

in comparing the seroprevalence rates between immunocompromised and immunocompetent individuals.

### Sample size determination

The sample size for this study was calculated based on an estimated 50% seroprevalence of HSV-1 in immunocompromised populations, particularly hemodialysis patients. Using a 95% confidence level, a 5% margin of error, and the formula for sample size calculation  $N = [Z^2 * P(1 - P)] / E^2$ . In this equation, N= required sample size - Z = Z-value (1.96 for 95% confidence) - P = estimated prevalence (50%) - E = margin of error (5%), the required sample size was approximately 218 participants

### Laboratory Testing

Serum samples were analyzed for the presence of IgG antibodies specific to HSV-1 by enzyme-linked immunosorbent assays (ELISA) technique using commercially available HSV-1-IgG and IgM kits Enzygnost® ELISA Kit (Behring, Marburg, Germany). Tests were done according to the manufacturer instructions and results of HSV-1-IgG and IgM were expressed as optical density (O.D) units.

### Data Analysis

Data analysis was performed using SPSS software version 23.0 (Armonk, NY: IBM Corp). The statistical analysis will begin with descriptive statistics to summarize patient demographics (age, gender, dialysis duration, vaccination history) and calculate HSV-1 seroprevalence (IgG, IgM). Bivariate analysis will compare seroprevalence rates across demographic factors using chi-square tests for categorical variables and t-tests or ANOVA for continuous ones. Multivariate analysis with logistic regression will identify independent factors associated with HSV-1 seropositivity. Correlation analysis will examine relationships between HSV-1 seropositivity and renal function. P-values (<0.05) and 95% confidence intervals will be reported for significance and effect estimates.

## RESULTS

### Total HSV-1-IgG antibodies responses

Among the 132 patient cases, 111 (84.1%) were positive for HSV-1-IgG antibodies, while 15.9% were negative. In the control group of 86 individuals, 57 (66.3%) tested positive for HSV-

1-IgG antibodies, with 33.7% testing negative. (table.1)

**Total HCMV-IgG antibodies responses**

In the hemodialysis group, 55 of 132 patients (41.6%) were positive for HSV-1-IgM antibodies, whereas 58.4% were negative. For the control group, 28 out of 86 individuals (32.6%) showed detectable HSV-1-IgM antibodies, while 67.4% were negative. (Table 2)

**HSV-1 antibodies responses in different ages for the study Populations**

The data presented in Table 3 clearly demonstrated a decrease in HCV-IgG response by decreasing the age range, where IgG response increased in elderly patients. There is opposite trend toward HSV-IgM rates, where IgM response in young cases of control group was the same as that in older cases. Also, the results displayed in

Table 3 showed HSV-IgG antibody in control cases, whose age ranged 55:65 years, had the highest response.

**DISCUSSION**

Herpes Simplex Virus 1 (HSV-1) is a ubiquitous virus that primarily causes oral herpes (cold sores). While it is generally benign in most individuals, it can pose significant health risks for immunocompromised patients, including those on hemodialysis<sup>7,9,10</sup>.

This study examines the seroprevalence of HSV-1 among Egyptian patients with renal failure who are undergoing hemodialysis. The findings showed that the rates of seropositivity for HSV-1-IgG and IgM were significantly greater (P<0.05) among hemodialysis patients compared

**Table 1.** HSV-1- IgG rates in Hemodialysis and Control cases

	Total No. of Cases	HSV-1-IgG				P-value
		Positive No.	%	Negative N	%	
Hemodialysis cases	132	111	84.1%	21	15.9%	<0.001
Control cases	86	57	66.3%	29	33.7%	<0.05

**Table 2.** HSV-1-IgM antibodies rates in Hemodialysis and Control cases

	Total No. of Cases	HSV-1-IgM				P-value
		Positive No.	%	Negative N	%	
Hemodialysis cases	132	55	41.6%	77	58.4%	<0.05
Control cases	86	28	32.6%	58	67.4%	<0.05

**Table 3.** HSV-1- antibodies rates in Hemodialysis and Control cases according to Gender and Age

Age range	Gender	Hemodialysis Cases (n=132)		Control Cases (n=86)	
		HSV-1-IgG	HSV-1-IgM	HSV-1-IgG	HSV-1-IgM
29-39(n=55)	Male	9 (8.1%)	4 (7.3%)	9 (15.8%)	7 (25%)
	Female	15 (13.5%)	6 (11%)	7 (12.3%)	6 (21.4%)
40-54(n=73)	Male	18 (16.2%)	8 (14.5%)	8 (14%)	2 (7.1%)
	Female	20 (18%)	10 (18.2%)	9 (15.8%)	2 (7.1%)
55-65(n=90)	Male	19 (17.1%)	12 (21.8%)	13 (22.8)	6 (21.4%)
	Female	30 (27%)	15 (27.3%)	11 (19.3%)	5 (17.6%)
Total	total	111 (84.1%)	55 (41.6%)	57 (66.3%)	28 (32.6%)

to the control group, which included individuals with normal kidney function and no HCV, CMV, or HIV infections.

The prevalence of HSV-1 infections is notably high among hemodialysis patients. As seen in our results, 84.1% of hemodialysis patients tested positive for HSV-1-IgG antibodies, indicating past exposure, while 41.6% had detectable HSV-1-IgM antibodies, suggesting recent or ongoing infection. This is higher compared to the control group, where 66.3% were positive for HSV-1-IgG and 32.6% had HSV-1-IgM antibodies.

Other studies have shown that in immunocompromised individuals, such as those undergoing hemodialysis, the prevalence of HSV infections might be higher due to the altered immune responses [1, 8]. HSV infections in patients undergoing hemodialysis can present with more frequent or severe episodes, contributing to a higher prevalence of IgM antibodies<sup>7,13,14</sup>.

There are several factors that contribute to the increased prevalence of HSV-1 infections in hemodialysis patients. Hemodialysis patients often have compromised immune systems due to uremia, malnutrition, and other coexisting conditions, which increases their susceptibility to infections, including HSV-1<sup>11,12,23</sup>.

Regular visits to healthcare facilities for dialysis and potential exposure to infectious agents in these settings also increase the risk of HSV-1 infection<sup>7,13,16</sup>. Dialysis patients often have skin changes and immune dysfunction that can facilitate HSV-1 entry and replication<sup>14,21</sup>. The presence of HSV-1-IgM antibodies in hemodialysis patients suggests recent infection, which may present as oral lesions or, less commonly, as more severe manifestations like encephalitis or disseminated disease<sup>12,15</sup>. HSV-1 can cause serious complications, including encephalitis, particularly in immunocompromised individuals<sup>2,13,16</sup>.

Across all age groups, both HSV-1 IgG and HSV-1 IgM positivity are consistently higher in the hemodialysis group compared to the control group. The seroprevalence of HSV-1 IgG increases with age, reflecting more lifetime exposure to HSV-1. For instance, IgG positivity in the 55-65 age range is 44.1% in the hemodialysis group compared to 42.1% in the control group. Additionally, the highest proportion of IgM-positive cases is seen in the 55-65 age group among hemodialysis

patients (49.1%), suggesting increased viral reactivation or new infections in older patients, which is consistent with other studies showing older age as a risk factor for viral reactivation. These findings align with previous research highlighting that as age increases, the likelihood of viral coinfections, including HSV-1, also rises due to cumulative exposure and a weakened immune system<sup>25,26</sup>. Older patients, particularly those with compromised health, such as those undergoing hemodialysis, are more susceptible to reactivation of latent viral infections because of declining immune function<sup>18,22,24</sup>.

Females in the hemodialysis group exhibit higher IgG and IgM positivity rates compared to males. For example, in the 55-65 age group, IgG positivity is 27% for females compared to 17.1% for males. A similar pattern is observed for IgM. These gender differences in HSV-1 seroprevalence are consistent with research showing that women may have higher rates of infection, possibly due to differences in immune response. These findings align with previous research highlighting that hormonal and immunological differences between males and females may influence the susceptibility and response to viral infections, including HSV-1<sup>17,20</sup>.

The control group shows consistently lower seroprevalence rates for both IgG and IgM across all age and gender groups compared to the hemodialysis group. This difference highlights the increased susceptibility of hemodialysis patients to both past and recent infections, reinforcing the need for regular monitoring and preventive strategies in this population.

The immunosuppressed state of hemodialysis patients can lead to recurrent HSV infections, which are often more severe and harder to manage compared to those in immunocompetent individuals<sup>19,21</sup>.

## CONCLUSION

The findings of this study reveal a significant prevalence of HSV infection among Egyptian hemodialysis patients. The seroprevalence of HSV-1 was found to be higher compared to the general population, emphasizing the vulnerability of this group to HSV infection

The higher prevalence of HSV-1-IgG

antibodies among hemodialysis patients indicates a greater historical exposure to HSV-1. The elevated levels of HSV-1-IgM antibodies in the same group suggest ongoing or recent infections, potentially exacerbated by their immunocompromised state.

These findings highlight the significant burden of HSV infection among hemodialysis patients. The findings underscore the importance of considering HSV infection in the differential diagnosis of clinical presentations in this population and emphasize the need for proactive measures to prevent and manage HSV infections effectively. By addressing the unique challenges faced by hemodialysis patients, we can strive towards improving their overall health outcomes and quality of life.

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#### Conflict of Interest

The author does not have any conflict of interest.

#### Data Availability Statement

This statement does not apply to this article.

#### Ethics statement

The study protocol was approved by the Ethics Review Committee of Ain Shams University, Cairo, Egypt.

#### Informed Consent Statement

All participants were enrolled following written informed consent.

#### Authors' Contribution

The sole author was responsible for the conceptualization, methodology, data collection, analysis, writing, and final approval of the manuscript

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