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ORIGINAL ARTICLE

Investigation of Cytomegalovirus Seroprevalence in Adults in Erzurum and Its Surroundings

Erzurum ve Çevresinde Yetişkin Bireylerde Sitomegalovirüs Seroprevalansının Araştırılması

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ABSTRACT

Objective: Cytomegalovirus (CMV), a double-stranded DNA virus in the family Herpesviridae, like other known herpes viruses, remains latent throughout a person's life following the initial infection in CMV and causes recurrent infections. The study aimed to reveal the current status of CMV seroprevalence in adults in Erzurum and to investigate the trends in CMV infection by comparing the obtained seroprevalence data with the previously reported data.
Materials and Methods: In our study, the results of people whose anti-CMV IgG and anti-CMV IgM serology were investigated by family physicians in Erzurum between 2020-2023 were retrospectively analyzed. Blood samples of individuals were studied in Erzurum Public Health Serology Laboratory using the ELISA method and the Architect kit. To make comparisons between individuals, the working group was divided into six different age groups: 18-24, 25-29, 30,34, 35-39, 40-49 and ≥50.
Results: Our study consisted of 9,252 people between 18 and 103 who were investigated for anti-CMV IgG serology and 13,276 people between 18 and 97 for anti-CMV IgG. Anti-CMV IgG seropositivity was 98.5%, and anti-CMV IgM seropositivity was 2.1% in our study group. Anti-CMV IgG and IgM positivity were 98.7% and 2.1%, respectively, in women and 97.7% and 2.2% in men.
Conclusion: In our study, anti-CMV IgG seropositivity was found to be 98.7%, anti-CMV IgM seropositivity was found to be 2.1%, and CMV IgG seropositivity rates were found to be higher in our province compared to similar studies conducted in our country. The CMV IgM seropositivity rate is consistent with the data from Turkey. To reduce CMV infection in our region's community, public awareness of the route of transmission of CMV infection and ways to prevent disease should be increased.

Keywords: Cytomegalovirus, anti-CMV IgG, anti-CMV IgM, prevalence, Erzurum

ÖZ

Giriş: Herpesviridae ailesinde çift sarmallı bir DNA virüsü olan sitomegalovirüs (CMV) bilinen diğer herpes virüsleri gibi CMV'de ilk enfeksiyonu takiben kişinin hayatı boyunca latent kalır ve tekrar eden enfeksiyonlara neden olur. Çalışmanın amacı, Erzurum'da yetişkin bireylerde CMV seroprevalansının güncel durumunu ortaya koymak ve elde edilen seroprevalans verilerin daha önce bildirilen verilerle karşılaştırarak CMV enfeksiyonundaki eğilimleri araştırmaktır.
Materyal method: Çalışmamızda 2020-2023 yılları arasında Erzurum'da aile hekimlerince anti-CMV IgG ve anti-CMV IgM serolojisi araştırılan kişilere ait sonuçlar retrospektif olarak incelendi. Kişilere ait kan örnekleri Erzurum Halk Sağlığı Seroloji Laboratuvarında ELISA yöntemiyle Architect kiti kullanılarak çalışılmıştı. Bireyler arasında kıyaslama yapabilmek için çalışma grubu; 18-24, 25-29, 30,34, 35-39, 40-49 ve ≥50 olmak üzere 6 farklı yaş grubuna bölündü.
Bulgular: Araştırmamızın evreni anti-CMV IgG serolojisi araştırılan 18 ve 103 yaş arasında 9.252 kişiden, anti-CMV IgM ise 18 ve 97 yaşları arasında 13.276 kişiden oluşmakta idi. Çalışma grubumuzda anti-CMV IgG seropozitifliği %98.5, anti-CMV IgM seropozitifliği ise %2.1 oranında bulundu. Anti-CMV IgG ve IgM pozitifliği kadınlarda sırasıyla %98.7, %2.1; erkeklerde ise %97.7, %2.2 oranında bulundu.
Sonuç: Araştırmamızda anti-CMV IgG seropozitifliği %98.7, anti-CMV IgM seropozitifliği %2.1 oranında bulunmuş olup, ülkemizde yapılan benzer çalışmalarla kıyaslandığında CMV IgG seropozitiflik oranları ilimizde daha yüksek bulunmuştur. CMV IgM seropozitiflik oranı ise Türkiye verileriyle uyumludur. Bölgemizdeki toplumda CMV enfeksiyonunu azaltmak için, CMV enfeksiyonunun bulaşma yolu ve enfeksiyondan korunma yolları hakkında halkın farkındalığı artırılmalıdır.

Anahtar Kelimeler: Sitomegalovirüs, anti-CMV IgG, anti-CMV IgM, prevalans, Erzurum

Introduction

Cytomegalovirus (CMV), a double-stranded DNA virus in the herpesviridae family, is also known as human herpes virus-5 (HHV-5). Like other known herpes viruses, CMV remains latent throughout the person's life following the first infection and causes recurrent infections (1). CMV can be transmitted by contact with infectious body fluids, including blood, urine, saliva, tears, cervical secretions, seminal fluid, breast milk, and stem cell and organ transplantation (2). Infants and toddlers exposed to CMV infection are an important source of infection because they can spread the virus through urine or saliva months or even years after infection (3, 4).

Primary CMV infection may be asymptomatic in immunocompetent individuals or cause a mild disease, mostly self-limiting with fatigue, fever, myalgia, and headache (5, 6). In immunosuppressed individuals (patients with AIDS and other immune system disorders, organ transplant recipients, patients hospitalized in

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intensive care units, and older adults), the infection may lead to more severe clinical pictures. However, the highest disease burden is caused by congenital CMV infection (7, 8). Congenital CMV infection is the leading cause of neurological damage in children worldwide and has also been reported to be associated with hearing loss, growth retardation, permanent disabilities, and microcephaly (9, 10).

Different regions of the world can be divided into two areas with high seroprevalence (more than 70%) and low seroprevalence (50%-70%) (6, 9). CMV seroprevalence is generally higher in older age groups, women, individuals with low socio-economic standards, and in developing countries. It has been reported that the prevalence of CMV in women in the reproductive period varies between 45% and 100% (11). Currently, treatment options for CMV infections are limited, and no vaccine is currently in use. Therefore, efforts to develop vaccines to prevent CMV infection remain a high public health priority (2).

A limited number of studies have focused on CMV seroprevalence in adults in Turkey. This study aimed to reveal the current status of CMV seroprevalence in individuals over 18 years of age in Erzurum and investigate the trends in CMV infection in our province by comparing the seroprevalence data obtained with previously reported data.

Material and Methods

With this study, the results of people examined by family physicians in Erzurum city center for four years between 01.01.2020 and 31.12.2023 and whose anti-CMV IgG and anti-CMV IgM serology were evaluated retrospectively. Blood samples of individuals were studied in Erzurum Public Health Serology Laboratory using the ELISA method in the Architect I2000 model device (Abbott Laboratories, USA) using the Architect kit. The data were obtained from the laboratory automation system with the Scientific Research Permits dated 03.05.2024 obtained from the Erzurum Health Directorate. In our study, the laboratory analysis results were evaluated as Anti-CMV IgM <0.85 index negative, anti-CMV IgM >0.99 index result positive, 0.85 index <anti-CMV IgM <1.0 index results intermediate; anti-CMV IgG ≤5.99 AU/ml negative, anti-CMV IgG>5.99 AU/ml results positive. To make comparisons between individuals, the working group was divided into six different age groups: 18-24, 25-29, 30,34, 35-39, 40-49, and ≥50.

The necessary ethics committee approval for this research was obtained from the Atatürk University Faculty of Medicine Clinical Research Ethics Committee, whose decision was dated 29.03.2024 and numbered 45.

Statistical Analysis

In the statistical evaluation of the data collected in our research, the SPSS 22.0 program was used. The chi-square test was used in the analysis of categorical data. The statistical significance limit was accepted as $p<0.05$.

Results

Our study population consisted of 9,252 individuals between the ages of 18 and 103 years who were investigated for anti-CMV IgG serology and 13,276 individuals between 18 and 97 years for anti-CMV IgM. The mean age of the group investigated for anti-CMV IgG serology was 32.4±10.09 years. The mean age of the anti-CMV IgM group was 32.6±9.27 years. In our study group, anti-CMV IgG seropositivity was found to be 98.5%, and anti-CMV IgM seropositivity was found to be 2.1%. Anti-CMV IgG and IgM positivity rates were 98.7% and 2.1% in women and 97.7% and 2.2% in men, respectively. Anti-CMV IgG positivity rate was higher in women than men, and the difference was statistically significant ($p<0.05$). Although the rate of anti-CMV IgM seropositivity was higher in males, this was not statistically significant ($p>0.05$). The highest CMV IgG seropositivity rate was found in the 40-49 age group, 99.8%; anti-CMV IgM positivity rate was 2.9% in the 18-24 age group. In our study, anti-CMV IgM results of 113 people were found to be intermediate. The data obtained in the study are presented in detail in Table 1 and Table 2.

Table 1. Distribution of anti-CMV IgG serology results by gender and age groups

		Anti-CMV IgG		
Variables		**Positive N (%)**	**Negative N (%)**	**Total N (%)**
Gender	Male	1918 (97.7)	46 (2.3)	1964 (100)
	Woman	2601 (98.7)	94 (1.3)	7288 (100)
	Total	4519 (98.5)	140 (1.5)	9252 (100)
P value	<0,05			
Age groups	18-24	1526 (97.6)	38 (2.4)	1564 (100)
	25-29	2601 (98,7)	34 (1.3)	2635 (100)
	30-34	2292 (98.2)	41 (1.8)	2333 (100)
	35-39	1220 (98.3)	21 (1.7)	1241 (100)
	40-49	879 (99.8)	2 (0.2)	881 (100)
	≥50	594 (99.3)	4 (0.7)	598 (100)
	Total	9112 (98.5)	140(1.5)	9252 (100)
P value		<0,05		

N: Number of patients, %: Percent

Table 2. Distribution of anti-CMV IgM serology results by gender and age groups

		Anti-CMV IgM			
Variables		Positive N (%)	Intermediate value N (%)	Negative N (%)	Total N (%)
Gender	Men	52 (2.2)	21 (0.9)	2291 (96.9)	2364 (100)
	Wo-man	228 (2.1)	92 (0.8)	10592 (97.1)	10912 (100)
	Total	280 (2.1)	113 (0.9)	12883 (97.0)	13276 (100)
P value	>0,05				
Age groups	18-24	51 (2.9)	20 (1.1)	1694 (96.0)	1765 (100)
	25-29	80 (2.2)	28 (0.8)	3589 (97.1)	3697 (100)
	30-34	75 (2.0)	30 (0.8)	3591 (97.2)	3696 (100)
	35-39	36 (1.8)	17 (0.8)	1995 (97.4)	2048 (100)
	40-49	28 (2.1)	12 (0.9)	1311 (97.0)	1351 (100)
	≥50	10 (1.4)	6 (0.8)	703 (97.8)	719 (100)
	Total	280 (2.1)	113 (0.9)	12883 (97.0)	13276 (100)
P value	>0,05				

N: Number of patients, %: Percent

Figure 1 shows a histogram graph of the change in anti-CMV IgG and anti-CMV IgM seropositivity rates in age groups and the total population.

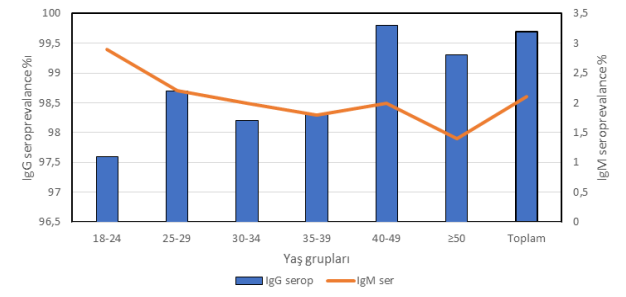

Figure 1. Variation of anti-CMV IgG and IgM seroprevalence by age groups

Discussion

The prevalence of CMV infection in different geographies varies depending on living conditions, social habits, and age. In a study conducted in the USA, the prevalence of CMV was reported to be 59% in the general population and 96.4% in Brazil (12, 13). In the European region, seropositivity was reported at a rate of 83% in Sweden, 77% in Portugal, 77% in the population in Croatia, and 56.5% in Germany (6, 14–16). CMV IgG seropositivity was reported to be 94.1% among Koreans on the Asian continent, 95.7% in Iraq, 91.8% in Iran, and 97.4% among blood donors in India. CMV IgG seropositivity was also reported to be 95.7% among blood donors in Saudi Arabia (17-21).

World Health Organisation (WHO) has estimated CMV seroprevalence for different population groups regionally and globally. According to this estimate, the global average prevalence was 83% (95% UI: 78-88). The region with the highest estimated average prevalence was the Eastern Mediterranean at 90% (95% UI 85-94), while the lowest estimate was made for the European region with 66% (95% UI 56-74). In the European region, the lowest seroprevalence estimate was estimated at 39% (95% UI 18-62) for Ireland, while the highest seroprevalence estimate was reported as 96% (95% UI 93-98) for Turkey (22).

In the study conducted in the Antalya region of Turkey, anti-CMV seropositivity in the general population was reported as 97.8% in the 15-49 age group (23). In a study conducted on a massive population of men and women between the ages of 0-84 in Istanbul, seropositivity was reported as 94% (24). In many other studies conducted in different regions of Turkey, it has been reported that the prevalence of CMV in pregnant women varies between 92.6-98.2% (25, 26).

On CMV, seroprevalence has focused chiefly on pregnant women both in the world and in Turkey. This study is one of the few studies in Turkey to investigate CMV seroprevalence in the adult population, including men and women. In our study, total CMV seroprevalence was 98.5% in both sexes. Our result was slightly higher than the seropositivity rates in previous studies conducted on pregnant women. Our result is higher than the average prevalence estimated by WHO for Turkey.

The difference in seroprevalence between countries and regions can be explained by differences in baseline exposures related to CMV transmission. These include the frequency and duration of breastfeeding, childcare arrangements, crowding, and sexual behaviors (10). Some studies have reported a relationship between CMV seroprevalence and education level, household income, social status, race, and ethnicity (2, 27-29).

An analytical model has shown that hygiene education effectively prevents poor outcomes from CMV infection. It also estimated that hygiene promotion was associated with a 50% risk reduction for fetal infections in CMV seronegative people (30).

Many studies have examined whether there is a relationship between CMV seroprevalence and gender. In one study conducted in Germany, the prevalence of CMV was reported to be 59.8% in women and 50.8% in men (6). Many other studies conducted in Germany and the UK have reported a higher incidence of CMV in women (10, 31).

In our study, CMV IgG seropositivity was 98.7% among 7288 women and 97.7% among 1964 men. The difference was statistically significant. As observed in our study, CMV seroprevalence is higher in women than in men. Although it is not fully understood how gender differences affect this outcome, it is believed that the fact that women mainly do childcare contributes to this result. (2, 32, 33). To date, no vaccine has been developed to prevent CMV infection. However, several vaccine studies have been reported to be in clinical development (10, 34). CMV IgG seroprevalence in our study ranged from 97.6% to 99.8% between age groups, and there was a significant difference in seroprevalence between age groups. The highest seroprevalence was 99.8% in the 40-49 age group, followed by 99.3% in the 50 and over age group, and the lowest seropositivity was 97.6% in the 18-24 age group. A generally higher prevalence of CMV IgG was observed in age groups as the mean age increased. This may be because as people age, their interactions with and exposure to CMV risk factors increase. Two studies conducted in Japan in 2016 and Germany in 2012 reported that CMV seropositivity has decreased recently (35, 36). However, as observed in our research, there is no regression in seropositivity rates compared with the data in previous studies in our country. Since no CMV seroprevalence studies in our province included male and female adults, we could not comment on whether there is an increase or decrease in CMV seropositivity rates.

In a study conducted in Brazil, anti-CMV IgM seropositivity was reported to be 2.3% (13). In another study conducted in Kirkuk City, Iraq, the rate of IgM seropositivity in the population was reported to be 6.3% (18). In a study conducted in Iran, CMV IgM seropositivity was reported to be 0.2% (19). In some studies conducted in Turkey, anti-CMV IgM positivity rates were observed to be 0.2-3.2% (24, 37, 38). In our research, anti-CMV IgM positivity was found to be 2.1% (228/10912) in females and 2.2% (52/2364) in males in the general population. In our study group, the highest IgM seropositivity was observed in the 18-24 age group. In contrast to IgG seropositivity, IgM seropositivity was lower as the mean age increased in the age groups. The difference was not statistically significant. The results were similar to the data reported for CMV IgM seropositivity in Turkey.

Staras et al. (12) reported that increasing age was not a risk for CMV IgM seropositivity, whereas they confirmed that age was a risk for CMV IgG seropositivity. In addition, it has been reported that some CMV IgM positive results may be associated with false positive results known to occur due to cross-reactions (39).

Conclusion

Our study constitutes the seroprevalence data of a vast population representing the adult population living in Erzurum. In our research, anti-CMV IgG and anti-CMV IgM seropositivity rates were 98.7% and 2.1%, respectively. Compared with similar studies in Turkey, CMV IgG seropositivity rates were higher in our province. Our results were slightly higher than the CMV seroprevalence rate estimated by WHO for Turkey. The CMV IgM seropositivity rate was compatible with Turkey's data. To reduce CMV infection in our region's community, efforts should be made to increase public awareness about the transmission route of CMV infection and ways to prevent it.

Contribution to Authorship

MU, AY, and GB conceived and designed the study, analyzed the data and drafted the manuscript. They also participated in writing the final version of the manuscript.

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