



Seroprevalence of varicella-zoster virus in the prevaccine era: A population-based study in Izmir, Turkey

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KEYWORDS

IgG-specific test;
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Summary

Purpose: To determine the population-based seroprevalence of varicella zoster virus (VZV) and related risk factors in Izmir.

Materials and methods: A population-based household survey was conducted. A representative sample of the population older than 15 years of age was selected using multistage random sampling. A total of 2136 healthy persons participated in this cross-sectional study. The participants completed a questionnaire designed to collect data related to socio-demographic characteristics and risk factors. Blood samples were collected, and VZV-specific IgG was measured using an ELISA.

Results: In total, 94.3% of individuals were seropositive for VZV. The difference between VZV seroprevalence in urban and rural populations was significant (OR: 2.6 (95% CI, 1.7–3.8)). No statistically significant differences in seropositivity were observed with respect to other sociodemographic characteristics.

Conclusion: A large proportion of the participants were found to be immune to VZV. © 2012 King Saud Bin Abdulaziz University for Health Sciences. Published by Elsevier Ltd. All rights reserved.

Introduction

Varicella virus infection (chicken pox) is an acute, highly contagious viral disease with a worldwide distribution. Varicella-zoster virus (VZV), the causative agent, shows little genetic variation

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and has no animal reservoir [1]. In healthy children, chicken pox is a self-limiting disease with a benign course, but severe disease may be encountered in adult cases with immune deficiencies [2]. Complications due to chicken pox are more common in adults, and the frequency of pneumonia is increased 25-fold in the adult group [3–5]. There is little information from developing countries on the disease burden of varicella-zoster infection. Most developing countries have other vaccine-preventable diseases that cause significantly greater morbidity and mortality, and the varicella vaccine is not a high priority for routine introduction into their national immunization programs [6].

The epidemiology of chicken pox shows variations in tropical and mild climates. In mild climates, chicken pox is generally encountered during childhood, whereas its frequency increases in young adults in tropical regions [7,8].

The chicken pox vaccine generates long-term immunity, and the disease occurrence has been reported to decrease by 90% after vaccination. If infection develops, its progression is mild, and the hospitalization rate and complications have been reported to decrease following chicken pox vaccination [9,10]. Therefore, determining the VZV seroprevalence and taking preventive measures for susceptible individuals are important. This population-based study aimed to describe the seroprevalence of VZV in Izmir.

Materials and methods

Survey design

This cross-sectional population-based study included the city population of Izmir (3,739,353). Izmir is a city with intense migration and is composed of individuals from different socioeconomic backgrounds and cultures. The majority of the population lives in urban areas. The required responding sample size was calculated using the EpiInfo computer program (Centers for Disease Control and Prevention, Atlanta, GA), and a stratified sampling method was used. The number of participants in this study was defined with respect to the population of each district. The previously defined seropositivity of Izmir (71.5%) was accepted as the prevalence in the sample size calculation. The sample size was calculated using a 99% CI as 1847 participants. The list of people to be interviewed was provided by the Izmir Provincial Directorate of Health. If any of the listed people could not be reached or they declined participation

in the study, substitutes were identified in the same manner by randomized sampling. During the study period, a total of 2136 healthy individuals aged 15 years or older from 29 districts of Izmir were contacted between December 2009 and March 2010.

Persons were interviewed face to face and given a questionnaire regarding their sociodemographic characteristics (age, gender, place of residence, education level, family size and socioeconomic level).

The study protocol was approved by the Ethics Committee of the Provincial Directorate of Health of Izmir. Participants were informed about the objective of the study, and the written consent of the voluntary participants was obtained.

Serology

An 8 cm³ blood sample was collected from each participant using a Vacuette[®] Standard tube holder (Becton Dickinson, Heidelberg, Germany). All blood samples were centrifuged, and the serum was stored at –20 °C until it was tested. After all serum samples were collected, the presence of anti-VZV IgG was determined using an ELISA (DiaSorin, Italy).

Statistical analysis

Data were assessed using Statistical Package for Social Sciences (SPSS) version 14.0. The Chi square test and percentages were used for data analysis, and a logistic regression was performed to determine the risk factors for VZV. The level of significance was accepted as $p < 0.05$.

Results

Of the participants, 38.2% were male. The sociodemographic characteristics and seropositivity of the participants are shown in Table 1.

The prevalence of anti-VZV IgG positivity was 94.3%; 95.2% of males and 93.8% of females were seropositive. The age-specific VZV IgG antibody seroprevalence rates are shown in Table 1. The seropositivity rates ranged from 93.3% in participants aged 15–19 years to 94.4% in those 40 years of age and older. A significant percentage of women of childbearing age were immune to VZV (93.1%).

A multiple logistic regression analysis was conducted. There was no statistically significant difference in seropositivity by age group, personal income level, education level, occupation or marital status. The seropositivity rates of the individuals in urban and rural areas were 96.1% and 90.8%,

Table 1 Demographic features and seropositivity distributions.

	Total		Seropositive	
	N	%	N	%
Gender				
Male	806	38.2	767	95.2
Female	1304	61.8	1223	93.8
Age groups				
15–19 years	135	6.5	126	93.3
20–29 years	340	16.3	321	94.4
30–39 years	427	20.5	401	93.9
40+ years	1180	56.7	1114	94.4
Education				
Illiterate	236	11.3	223	94.5
Primary school	921	43.9	867	94.1
Secondary school	220	10.5	211	95.9
High school	425	20.3	397	93.4
University	294	14.0	278	94.6
Occupation				
Housewife	865	41.7	810	93.6
Retired	353	17.1	340	96.3
Student	121	5.8	112	92.6
Public employee	105	5.1	98	93.3
Worker	190	9.2	180	94.7
Other	438	21.1	413	94.3
Monthly income TL				
<1000	1280	64.1	1211	94.6
1000–2000	517	25.9	482	93.2
>2000	201	10.0	193	96.0
Marital status				
Married	1610	77.1	1519	94.3
Single	385	18.4	358	93.0
Separated/divorced	94	4.5	92	97.9
Living area				
Rural	706	33.4	641	90.8
Urban	1406	66.6	1351	96.1
Household size				
1–4 individuals	632	78.4	1537	94.2
5–9 individuals	430	20.7	406	94.4
10+ individuals	19	0.9	19	100.0

respectively. This difference was statistically significant (OR: 2.6 (95% CI, 1.7–3.8)).

Discussion

The total VZV seroprevalence in this study was 94.3%. Kanra et al. reported a chicken pox prevalence of 77.8% in their study, which was conducted on subjects younger than 30 years of age in a total of 9 cities in 2001 [11]. Another study identified 71.5% seropositivity in 590 persons in Izmir in 2008 [12]. In a study performed in Northern Cyprus, 84.1% of subjects younger than 30 years of age were seropositive [13]. In Erzurum, the VZV seroprevalence was 78% in subjects younger than 30 years of age [14].

In this study, 93.3% of the 15- to 19-year-old age group was seropositive. In a previous study, VZV positivity was detected in 61.6% of 7- to 15-year-old children who attended schools in the center of Manisa [15]. Dilli et al. reported a VZV seropositivity in adolescents in Ankara of 55.7% [16], while the seroprevalence of VZV was reported to be 78% in primary school students in the city of Adana [17]. However, a higher rate of seropositivity was detected in our study compared to the other studies. These differences could be attributable to the different climates and cultural practices in the studied regions.

In Western countries, the seroprevalence has been reported to increase with age [18]. Different results have been reported in different

geographical regions. The seroprevalence was 39% in children younger than 14 years in Athens [19], while the seroprevalence of VZV was reported to be 80.6% in the United Arab Emirates [20]. Likewise, the seroprevalence was 94.6% among young adults in Israel [21], 80% in Bolivia [22], and 68.2% in India [23].

Kanra et al. reported no statistically significant difference in the VZV seroprevalence between subjects living in urban and suburban areas [11]. Similar results have been emphasized in previous studies performed in Izmir [12]. However, there was a statistically significant difference between rural and urban regions in this study. Lolekha reported that the seroprevalence was significantly higher in the urban population than in the rural population, and they hypothesized that this was due to population density [24].

There were some limitations to our study. The data collected via questionnaire were dependent on the study subjects' answers. This population-based study was performed using a random sampling method, and the results therefore represent the entire Izmir population. We did not record past history of chickenpox. Other rash-causing diseases are often confused with chicken pox, and a negative history of varicella is not a reliable predictor of varicella seropositivity [11,25].

Determining VZV seroprevalence is important for identifying susceptible individuals and taking preventive precautions. Cohen stated that knowledge of pre-vaccination seroepidemiology is important for evaluating the effect of vaccination programs on the epidemiology of the disease [21]. In developed countries, it has been emphasized that the cost-effectiveness of the vaccine should be evaluated prior to including the chicken pox vaccine into the routine vaccination schedule [26]. However, there are obstacles (e.g., accessibility, cost of the vaccine) to vaccination in many countries [27].

Chicken pox was not a notifiable disease in Turkey until 2011. The Turkish Ministry of Health and the National Immunization Advisory Committee introduced varicella vaccination into the national routine immunization program, and it will be included starting in 2014. According to the decision of the Ministry of Health, the chicken pox vaccine will be administered in the 12th month of life in a single dose.

The routine use of the varicella vaccine is controversial. Some authors, particularly pediatricians, have stated that the VZV vaccine should be introduced into the routine childhood vaccination program in Turkey [11,12,14]. Additionally, Dinleyici et al. indicated that hospitalization as a result of varicella infection is not uncommon in

children, and universal vaccination is the only realistic option for preventing severe complications and death [28]. However, some public health specialists raise different concerns, believing that it is not appropriate to routinely include the varicella vaccine in the childhood vaccination program in Turkey. For example, Ergin and Durusoy reported that this vaccine did not generate life-long immunity, requiring a booster dose and a zoster vaccination at later ages. The current cost-effectiveness studies do not consider these additional doses, and new cost-effectiveness analyses are required [29].

This study contributes valuable information regarding the current status of VZV seroprevalence prior to introducing the varicella vaccine into the routine vaccination program. Further studies will be required after introducing the varicella vaccine into the routine vaccination program to evaluate vaccination coverage and its effectiveness.

In conclusion, all age groups had a high seropositivity rate in Izmir. Although Izmir does not have a cold climate for much of the year, a large proportion of the population was naturally immunized against VZV.

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