International Journal of Occupational Medicine and Environmental Health 2010;23(1):27–32
DOI 10.2478/v10001-010-0011-x

VARICELLA ZOSTER ANTIBODIES AMONG HEALTH CARE WORKERS IN A UNIVERSITY HOSPITAL, TEHERAN, IRAN

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Abstract
Objectives: This study was designed to evaluate the immune status of health care workers against varicella zoster in a university hospital in Teheran, Iran, and to compare the history of chickenpox infection with the presence of varicella antibodies in this population. **Methods:** Serologic testing for varicella was performed for 405 health care workers with different job categories and at different age. The enzyme immunoassay was used for determining IgG antibodies against varicella zoster virus **Results:** A total of 405 health care workers, aged 19–50 years (median: 29 years), were examined. Of these, 289 (71.4%) were found to be seropositive. No statistically significant differences were observed between gender, age, or occupation, and seropositivity ($p = 0.09, 0.75, 0.54$. respectively). Statistical analysis revealed that the correlation between chickenpox history and seropositivity showed a 62.3% sensitivity, 72.4% specificity, 84.9% positive predictive value, and 43.5% negative predictive value. **Conclusions:** Serologic screening of health care workers is essential to determine their immunity to varicella, regardless of the age, occupation and history of infection. This population is recommended to be considered a target group for future immunization programs in Iran.

Key words:
Health care workers, Varicella zoster infection, Immunization

INTRODUCTION

The Varicella-Zoster virus (VZV) is transmitted through a person to person contact, inhalation of aerosols, through contaminated fluids from vesicular skin lesions caused by acute chickenpox, or shingles, or infected respiratory tract secretions. Varicella is self-limited in children but may lead to serious complications among adolescents, adults and immunocompromised patients [1].

Varicella is a common childhood disease. Nearly a 100% seropositivity to VZV has been documented in children between 11–13 years of age in the USA. An epidemiological variation is being reported between the temperate and tropical climate countries, with varicella occuring mainly among young adults in the tropical regions [2].

The general adult seroprevalence rates amount to 81.3% in the United Arab Emirates, 100% in Belgium, 96.6% in Israel, 95% in Turkey, 95.5% in Spain, 50% in Sri Lanka, and 87.9% in Iran [3–9].

Moreover, nosocomial transmission of VZV is also reported in health care workers (HCWs) [10]. It seems that

Received: Received: August 31, 2009. Accepted: October 27, 2009.
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age alone is not sufficient to guarantee immunity. The community at risk must have a clear history of previous varicella infections or a serologic testing. As a small proportion of the population with a history of the disease might be susceptible, some experts recommend the serologic testing in all HCWs regardless of the disease history [11].

In a study performed in two neonatal units in Brazil, 150 of 215 (70%) workers had a history of varicella infection and all of them had VZ antibodies, which yielded a 100% sensitivity of the varicella history. Of the remaining 65 workers who did not remember having had varicella in the past, 60 (92%) proved to have serologic evidence of varicella infection, and 5 individuals were considered non-immune to varicella. The Brazilian authors have concluded that the positive history of varicella infection is a reliable evidence of immunity against the disease [12].

In a Japanese study, 97.2% of HCWs in a Tokyo hospital were immune against varicella but the authors suggested that aggressive screening and vaccination of susceptible HCWs were essential because most of the Japanese HCWs seemed to have little knowledge about their history of VZV infection [13].

Varicella history was not a reliable predictor of the presence or absence of varicella antibodies in HCWs in Saudi Arabia. Almuneef and colleagues showed that 84% of HCWs in a hospital were seropositive, and the positive predictive value (PPV) of the history of chickenpox for the seropositivity was 89%. The negative predictive value (NPV) was 22% [14].

As no report on varicella zoster virus immunity in HCWs in Iran is available, this study has been designed to investigate the seropositivity of VZV among HCWs in a 625-bed university hospital. In this study, we aimed at determining the relationship between immunity and the history of varicella infection.

METHODS

This cross-sectional, prevalence study was designed to investigate the seropositivity of VZV among HCWs in a 625-bed university hospital between February and March 2009. Serologic testing for varicella was performed in 405 HCWs with different job categories (physicians, nurses, nurse's aides, medical and nursing students, and administrative workers) who worked at Rasoul-e-Akram hospital, Teheran, Iran.

A checklist was completed including demographic data and the history of varicella. Individuals with acute varicella infection, those under immunosuppressive therapy, or those having blood transfusion during the year 2008, were excluded from the study. The local ethics committee approved the study protocol, and a signed informed consent was obtained from each participant.

Blood samples were collected from each individual and the separated serum was stored at –20°C prior to testing. EIA for varicella-specific IgG was performed using commercial virus-specific IgG EIA kits (varicella IgG EIA well, RADIM, Italy; sensitivity 100%, specificity 88%). Optical density values were indexed according to the manufacturer's instructions. Sera were classified as negative if the OD was less than 0.20 and as positive if it was higher than 0.70; sera with OD between 0.20 and 0.70 were considered equivocal. Equivocal values were considered negative.

Statistical analysis was performed using the SPSS 13 software. After conducting descriptive statistical analyses, we used the chi square test to study the differences in the proportions of the categorical variables between the study groups. The P value of less than 0.05 was considered statistically significant. We compared the history of varicella infection in HCWs with the results of testing for antibody against varicella zoster antigen to assess the reliability of the history of varicella in this population. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated. In this study, sensitivity refers to the percentage of persons with a history of varicella among seropositive HCWs, specificity to the percentage of persons without a history of varicella among seronegative HCWs, PPV to the percentage of seropositives among HCWs with a positive history, and NPV to the percentage of seronegatives among HCWs with a negative history of varicella.

RESULTS

According to the demographic data and serologic test results of the HCWs (Table 1), 405 HCWs were tested for anti varicella IgG. Their age ranged from 19 to 50 years (median 29 years). Of these workers, 289 (71.4%) were positive but we did not find any significant correlation of the gender, age, or occupation and seropositivity (p = 0.09, 0.75, 0.54, respectively). There was no significant difference between the presence of VZV and age (p = 0.75).

Table 2 presents the results regarding the sensitivity, specificity, positive predictive value and negative predictive value of the history of varicella for the seropositivity.

DISCUSSION

Nowadays, the nosocomial transmission of varicella is well recognized. Although all susceptible hospitalized adults are at risk, certain patients, such as immunocompromised persons and pregnant women are at increased risk for a severe complicated infection [9].

Iran is a country in the tropical area. Here, the seropositivity rate against varicella zoster antigen was reported to be about 35% to 60% in children below 10 years to nearly 90% in individuals at the age of 30 years [9,15]. In our study, 405 HCWs were tested to determine the immunity against VZV, and 71.4% of them were found

Table 1. Demographic data and serologic results for 405 health care workers studied

Charateristics	Total n (%)	Serologic results		p
		positive n (%)	negative n (%)	
Gender				0.09
female	235 (58.0)	160 (68.1)	75 (31.9)	
male	170 (42.0)	129 (75.9)	41 (24.1)	
Age (year)				0.75
≤ 25	136 (33.5)	95 (69.8)	41 (30.2)	
26–30	103 (25.4)	74 (71.8)	29 (28.2)	
31–35	58 (14.3)	40 (68.9)	18 (31.1)	
≥ 36	108 (26.8)	80 (74.0)	28 (26.0)	
Occupation				0.54
nurse	78 (19.2)	55 (70.5)	23 (29.5)	
nurse's aide	106 (26.1)	78 (73.6)	28 (26.4)	
physician	42 (10.3)	35 (83.3)	7 (16.7)	
medical student	83 (20.4)	59 (71.0)	24 (28.9)	
nursing student	33 (8.1)	22 (66.7)	11 (33.3)	
administrative worker	63 (15.5)	41 (65.1)	22 (34.9)	

Table 2. Varicella antibodies in two groups with and without a history of varicella, and sensitivity analysis

Hx.[1] of varicella	Ab titer						
	total (n)	positive n (%)	negative n (%)	PPV	NPV	sensitivity	specificity
Positive Hx.	212	180 (84.9)	32 (15.1)	84.9	43.5	62.3	72.4
Negative Hx.[2]	193	109 (56.5)	84 (43.5)				

[1] History.
[2] Including uncertain Hx.

to be seropositive. In fact, a significant proportion of HCWs are susceptible to varicella. This is important in view of their close contact with pregnant women and high risk patients whereby the virus can be easily transmitted.

The results of a recent study regarding seropositivity differ from the findings of other studies. In Turkey, 98% of 363 HCWs had antibodies against varicella [16]. The immunity rates for varicella among medical students in Germany and Switzerland were 96.9% and 97%, respectively, [17,18], while in our study, only 71% of medical students were immune. In Israel, the seroprevalence of VZ among the HCWs in three studies was 94.8%, 94.4% and 98.5% [19–21]. In Japan and Brazil, the seropositivity for VZ among HCWs ranged from 97.2% to 99.1% [13,22,23]. The seropositivity rate in the population of 1106 HCWs was 91% in North Italy [24] and 93.1% in Canada [25]. In Saudi Arabia, the seropositivity amounted to 83%, which was less than in the other countries studied [26]. Altogether, these data indicate that there is a difference in the immunity against VZV among HCWs in the countries of the temperate and tropical climatic zones.

In our study, we found a susceptibility rate of 31.9% among 235 women of childbearing age (20–40 years). This rate is higher than in Finland (seronegativity 3.8%) [27], Ireland (seronegativity 11.3%) [28], Italy (seronegativity 20%) [29], and lower than in Sri Lanka (seronegativity 56.2%) [30]. Therefore, the chance of acquiring and transmitting varicella to, or from, the patients among our female HCWs is much higher than in other countries. Thus, the findings of the present study indicate the importance of the screening test and vaccination for susceptible HCWs in order to reduce the rate of varicella in this high risk group.

On the other hand, we compared the history of varicella in HCWs with the results of testing for VZ antibodies to assess the reliability of the history of varicella in this group. These data are fundamental to analyze the cost effectiveness of different vaccination strategies in Iran. Like in other studies, our data showed that the history of varicella was not a reliable predictor of the varicella antibody status in HCWs. Indeed, a positive history of chickenpox better correlated with the presence of antibody than did a negative serologic test result for varicella [14,23,25]. In the populations of Brazil and Turkey, and the child population of Switzerland, the positive predictive value of the clinical history of varicella ranged from 95% to 100% [16,31–33]. In the applicants for nurse training in Scotland, the positive predictive value of the history of varicella for seropositivity was 98%. The negative predictive value was 14%. A positive history of chickenpox showed a sensitivity of 84% and specificity of 60%. The authors concluded that the absence of the chickenpox infection in the patient's past medical history is an unreliable predictor of susceptibility to infection in HCWs [34].

The low PPV in our study might be due to the lack of data regarding the past history of viral infections like varicella, and the subclinical diseases. The higher NPV in our study (43.5%), which is not consistent with other reports, may reflect a lower general seroprevalence in the Iranian HCWs [14,34].

In conclusion, we suggest that, before any decision is made to start mass vaccination against VZV in Iran, it is necessary to conduct further large-scale studies on seroepidemiology of varicella in different populations (including immunocompromised patients, women of childbearing age, HCWs, children from different age groups, etc.). The findings of our study, showing a weak correlation between the clinical history and seropositivity, indicate that the serologic screening of all HCWs should be recommended. The limitations of our study include a small population size and the failure to determine which HCWs come from which province of Iran.

ACKNOWLEDGEMENTS

The authors thank Dr. Leila Zahedi-Shoolami, Dr. Tahereh Mousavi, and Ms. Yeganeh Shoaee for their assistance. This study was supported by the Deputy Research, Iran University of Medical Sciences, Teheran, Iran (Grant No. 499).

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