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Original Article

Microbiology Section

Varicella Seroprevalence among Healthcare Workers: A Pilot Study from a Tertiary Care Centre in Northern India

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ABSTRACT

Introduction: Susceptible Healthcare Workers (HCWs) lacking immunity to Varicella Zoster Virus (VZV) can get infected and spread the infection to their patients. Effective screening can help in early vaccination to limit nosocomial transmission of VZV.

Aim: To assess the seroprevalence of VZV among HCWs.

Materials and Methods: This was a hospital-based pilot study where serum samples were collected from 201 HCWs working in different departments of the Government Medical College, Srinagar, Jammu and Kashmir, India and its eight associated hospitals over a period from January 2021 to February 2021, after obtaining their consent to participate in the study. Samples were tested for VZV Immunoglobulin G (IgG) antibodies using the Enzyme Linked Immuno Sorbent Assay (ELISA) method (NovaLisaVZVIgG, ELISA Kit). Variables including age, sex, professional category, history of varicella infection, and VZV vaccination were collected in a proforma. Statistical analysis was done using Open Epi version 3.01.

Results: The overall prevalence of antibodies to varicella was 150/196 (76.53%). HCWs had equivocal results in 4 (2.04%) cases. An age-related increase in seroprevalence was observed. Only 6/196 (3.06%) participants were vaccinated against VZV, and 38/196 (19.39%) participants had a history of VZV infection in the past.

Conclusion: The present study found a significant proportion of HCWs susceptible to VZV, making them potentially at risk of acquiring and transmitting the infection. This reinforces the need for screening HCWs against VZV and vaccinating them whenever necessary to protect the patients.

Keywords: Antibodies, Chickenpox, Epidemiology, Vaccination, Viral analysis

INTRODUCTION

VZV, a DNA virus belonging to the family *Herpesviridae*, causes two distinct clinical forms of disease that are vaccine-preventable. The primary infection causes varicella (chickenpox), which is essentially a febrile exanthem during which the virus becomes latent in the dorsal root ganglionic neurons. Varicella infection begins 14-16 days after exposure to VZV. Reactivation of latent VZV leads to a secondary infection known as herpes zoster (shingles), which is largely a painful dermatomal rash. Patients may experience pain for weeks, months, and even years in severe cases, compromising their quality of life. Both varicella and herpes zoster cause self-limiting disease. However, in a subset of the population like the immunocompromised patients, complications can be severe enough to warrant aggressive treatment [1-3].

Wide variations in the epidemiology of varicella occur, especially in temperate and tropical regions. A strong seasonal pattern is seen in temperate regions, with peak incidence during spring and winter [1,4]. In Kashmir, outbreaks of varicella have been reported mainly in the summer season across various districts. Seven, six, and seven chickenpox outbreaks occurred in 2013, 2014, and 2015, respectively, corresponding to a total of 80, 97, and 129 cases of varicella reported in the Kashmir region [5].

The disease caused by VZV is highly contagious, with transmission occurring readily through direct contact with skin lesions. Infection can also occur by inhalation of aerosolised droplets either from the respiratory tract or rarely from lesions of patients with varicella. While community transmission is the norm, nosocomial transmission of VZV has been documented in several studies. Susceptible HCWs can get infected and transmit the infection to other susceptible co-workers and patients. This can have serious implications if the HCW is involved in the care of pregnant females and immunocompromised patients [6-9].

Although VZV vaccination has been recommended for all HCWs, coverage rates are low. It is important to gather information on the immune status of HCWs and administer vaccination to those who are not immune. To the best of our knowledge, very few studies have evaluated the prevalence of IgG against VZV. The rationale for the study was to ascertain the level of protection and the need for vaccination in this cohort. With this backdrop, present study was conducted with the intent to assess the seroprevalence of VZV among HCWs.

MATERIALS AND METHODS

This hospital-based pilot study was conducted in the Department of Microbiology, Government Medical College, Srinagar, Jammu and Kashmir, India over a period of two months from January 2021 to February 2021. HCWs working in different departments of the Government Medical College and its eight associated hospitals participated in the study. The study was approved by the institutional review board (IRB GMC/MIC-10). Informed verbal consent was obtained from all HCWs before their inclusion in the study.

Inclusion criteria: All HCWs who gave their consent to participate were included in the study.

Exclusion criteria: HCWs who refused to participate in the study were excluded for the study. This included doctors, laboratory technicians, nurses, multitaskers, and other professionals.

Sample size: A total of 201 HCWs who consented to take part in the study were included. Out of these, five were excluded from the study (three haemolysed samples and two had insufficient data). The total number of eligible candidates in the study was 196. As this was a pilot study, the sample size was calculated as a common rule of thumb with 10-20% of the total survey population. This was approximated to around 179.

Procedure

Blood samples from HCWs were taken in red or yellow-topped tubes with a clot activator and were sent immediately to the laboratory. Serum was obtained by allowing the sample to remain undisturbed for some time and then centrifuging it at 1500 rpm for 10 minutes. In case of a delay in testing, serum was stored at -20°C.

The IgG antibodies specific to VZV were detected using a commercially available ELISA kit (NovaLisaTM, Novatech Immunodiagnostica). As per the manufacturer, the kit has a sensitivity of 92.9% and a specificity of >95%. The cut-off value was calculated according to the manufacturer's instructions in terms of Novotech Units (NTU). Results were interpreted as positive (cut-off value of >11 NTU), negative (<9 NTU), or equivocal (9-11 NTU) [10].

Variables, including demographic data and information regarding the history of varicella and vaccination against VZV, etc., were recorded in a proforma. The seropositivity results were analysed with respect to vaccination history and past infection.

STATISTICAL ANALYSIS

The data were entered into a Microsoft Excel sheet. Statistical analysis was performed using the open Epi software version 3.01, which is freely available online. Continuous variables, such as age and gender, were presented as mean or median, while categorical variables, such as the prevalence rates of VZV, were interpreted as numbers and percentages. Categorical variables were assessed using the Chi-square test. A p-value of ≤0.05 was considered statistically significant.

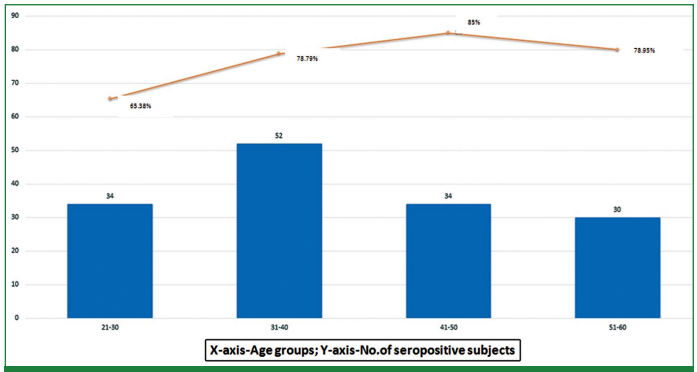
RESULTS

The demographic characteristics of HCWs are shown in [Table/Fig-1]. Male HCWs slightly outnumbered their female co-workers. The age range of participants in the study was 21-60 years (mean 38.9 years). Most of the participants in the study were laboratory technicians 70 (35.71%), followed by doctors 60 (30.61%).

Parameters		n (%)	Positive (%)	*p-value
Gender	Male	104 (53.06)	80 (76.92)	0.89
	Female	92 (46.94)	70 (76.09)	
Age (years)	21-30	52 (26.53)	34 (65.38)	0.0839
	31-40	66 (33.67)	52 (78.79)	
	41-50	40 (20.41)	34 (85)	
	51-60	38 (19.39)	30 (78.95)	
Professional category	Laboratory technicians	70 (35.71)	58 (82.86)	0.14
	Doctors	60 (30.61)	48 (80)	
	Multitask workers	32 (16.33)	18 (56.25)	
	Nurses	28 (14.3)	20 (71.43)	
	Pharmacists	6 (3.05)	6 (100)	
History of infection with varicella	Positive	38 (19.39)	35 (92.10)	0.006
	Negative	108 (55.10)	81 (75)	
	Unknown	50 (25.51)	34 (68)	

[Table/Fig-1]: Demographic characteristics of healthcare workers.
*Chi-square test; p<0.05 significant

The results showed that 150 out of 196 (76.53%) of the HCWs were seropositive for VZV in the study, while 42 out of 196 (21.43%) gave seronegative results. Equivocal results were seen in 4 patients (2.04%). As it was not possible to collect a repeated blood sample in HCWs with equivocal results, they were considered negative. There was no statistically significant difference in the prevalence of seropositivity with respect to gender or age. However, the rate of seropositivity increased with increasing age [Table/Fig-2].



[Table/Fig-2]: Seropositivity of HCWs according to age.

A history of infection with VZV was reported by 38 (19.39%), while a definite negative history of varicella infection was given by 108 (55.10%) HCWs. However, 50 (25.51%) were unable to recall their status. Seropositivity was seen in 35 out of 38 (92.10%) of the HCWs who had a history of varicella infection, and this association was found to be statistically significant. Susceptibility to varicella and selective screening of HCWs based on recall history of varicella infection in the past have been advocated in several studies.

The sensitivity, specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) of the history of varicella infection with seropositivity were 23.33% (95% Confidence Interval (CI): 17.28, 30.72), 93.48% (95% CI: 82.5, 97.76), 92.11% (95% CI: 79.2, 97.28), and 27.22% (95% CI: 20.88, 34.63), respectively.

In the present study, only 6 out of 196 (3.06%) of the participants were vaccinated against VZV. All the vaccinated participants were doctors. Seropositivity in vaccinated participants was 5 out of 6 (83.3%).

DISCUSSION

Susceptible HCWs, if infected with VZV, pose a considerable risk of transmitting the infection to their patients. Henceforth, it is important to assess the susceptibility of HCWs to tackle nosocomial transmission and outbreaks of varicella. An immunity level of more than 94% at the community level has been suggested to interrupt the chain of transmission in viral infections [11,12]. To the best of our knowledge, very few studies from India have documented the seroprevalence of VZV in HCWs. Moreover, HCWs are not screened for VZV antibodies at the time of recruitment. This study aimed to determine the positivity rate of IgG antibodies against VZV in HCWs as a measure of protection.

The prevalence of VZV seropositivity in the present study was 76.53%. Seroprevalence studies on HCWs conducted in various countries have shown a wide degree of variability, with susceptibility rates ranging from as low as 5% to as high as 50% [4,13]. In India, studies by Suryam V et al., and Lokeshwar MR et al., found a significant proportion of adolescents and adults susceptible to varicella, with overall seropositivity of 49.9% and 68.22%, respectively. A similar study conducted by Arunkumar G et al., showed that 25.8% of health science students were susceptible to VZV [14-16].

A study by Kadri S et al., found a rising trend of varicella-zoster infection in school children in Kashmir. The authors observed that the average age of infection acquisition has progressively increased from 10 years in 2013 to 15 years in 2015 [5]. In the present study, the seroprevalence was higher in older age groups. The highest rate of seropositivity was found in the age group of 41-50 years. However, a paradoxical dip was seen in the seropositivity of participants in the age group of 51-60 years. A study by Vandersmissen G et al., reasoned that older populations tend to lose detectable antibodies over time. Consequently, serological assays may have limited sensitivity to detect low antibody levels. Although detectable levels of specific antibodies tend to decline over time, studies have revealed that cell-mediated immunity provides lifelong protection [17].

Several studies have recommended selective screening based on previous varicella infection [8,18]. A positive history of varicella infection has been found to have excellent PPV for long-lasting protection and a positive VZV antibody titer. The sensitivity and specificity of the recall history, as reported by Wu MF et al., were 82.3% and 48.6%, respectively [8]. Similarly, Almuneef MA et al., reported 57% sensitivity and 63% specificity in their study [18]. In the present study, a statistically significant association between VZV seropositivity and a positive recall history was observed. However, low sensitivity and specificity in predicting VZV immunity based on past infection was observed. This was likely because most of the participants (158, 80.61%) in this study provided an unreliable or negative history of chickenpox (108 subjects presented with a negative history and 50 were not aware of their history). As chickenpox is largely a disease of childhood, the participants were unable to accurately recall their history and differentiate VZV from other exanthematous diseases. Kang JH et al., found poor agreement between self-reported infection with VZV and immunity. They also observed that the high PPV in their study was due to high seroprevalence and not due to self-reported infection with varicella [19].

In present study, only 3.06% of participants had a history of immunisation against varicella. Although VZV vaccination is recommended for HCWs, it has not been made mandatory in the universal immunisation program. The low immunisation coverage against VZV can be attributed to several reasons, including vaccine availability, the perception among HCWs that VZV is a childhood disease, and vaccine hesitancy. Policies should be formulated to make VZV screening and vaccination mandatory for HCWs to protect patients, especially immunocompromised patients.

Limitation(s)

Firstly, the equivocal results in the study were interpreted as negative. Secondly, since this was a single-centre study, caution should be exercised when generalising the results to HCWs working in other centres.

CONCLUSION(S)

In the present study, it was observed that a significant proportion of HCWs working in various sections of the hospital did not have antibodies against VZV, making them susceptible to infection. As the sensitivity of a history of past infection is low, it is an unreliable predictor of immunity. Therefore, it is recommended to screen HCWs for VZV antibodies and consider vaccination to reduce the chances of nosocomial transmission of VZV.

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