



Seroprevalence of Varicella Zoster Virus Immunoglobulin G Among Asymptomatic Healthcare workers

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ABSTRACT

Introduction: Varicella zoster virus (VZV) is found worldwide. Health care workers (HCWs) are frequently exposed to this virus and develop lifelong immunity, but they are a constant source of infection on the work place, so it is an occupational hazard for other susceptible HCWs. Although many infected individuals have history of disease in the past but a negative history does not rule out their status as carrier of VZV. Screening of HCWs would prevent the transmission of varicella to the other colleagues and patients. The purpose of this research is determining the seroprevalence of VZV and validity of recall history as a predictor of immunity against VZV among HCWs. **Aims & Objectives:** Determining the seroprevalence of varicella zoster virus (VZV) immunoglobulin G (IgG), among asymptomatic healthcare workers (HCWs). **Place and duration of study:** The study was conducted in Shaikh Zayed Hospital, Lahore, from March 2013 to February 2014. **Material & Methods:** It was a cross-sectional descriptive study. Total 200 HCWs, employed in Shaikh Zayed Hospital in various job categories, were recruited in the study. All the participants completed a questionnaire which elucidated past history or family history of VZV infection. The antibodies against VZV were detected by the enzyme-linked immunosorbent assay (ELISA) IgG. The data was analyzed and necessary statistical tests were used. The p-value was considered of statistical significance if it came less than 0.05. **Results:** Out of 200 HCWs tested for VZV IgG, 174 (87%) were seropositive and 26 (13%) were seronegative, indicating susceptibility to VZV infection. A previous history of chickenpox was reported by 74 HCWs, all of them were seropositive on ELISA. A negative recall was reported by 126 HCWs, out of which 100 were seropositive and 26 were seronegative on ELISA. Sensitivity, specificity, positive and negative predictive values of a self-reported history of varicella infection were 43%, 100%, 100% and 20% respectively. The recall history of doctors to varicella had higher sensitivity (85%) than other medical professionals (nurses, paramedical staff or administrative staff). Susceptibility was most frequent among administrative staff against varicella, while doctors were the most immune to varicella. **Conclusion:** The presence of previous history of varicella was a reliable indicator of immunity among HCWs, whereas absence of previous history of varicella was not a good predictor of immunity. Also VZV screening of HCWs with no history of chickenpox, and vaccination of susceptible HCWs should be mandatory, so as to prevent transmission of VZV from their colleagues or patients.

Key words: Varicella Zoster Virus, Chicken Pox, Shingles, Seroprevalence, Health Care Workers

INTRODUCTION

Varicella-zoster virus (VZV) belongs to the class of ubiquitous human herpes viruses and is a DNA virus. It causes two distinct exanthematous diseases: varicella and zoster. Varicella (or chickenpox) is the primary infection of VZV, whereas zoster (or shingles) occurs when the latent virus reactivates. It is a highly contagious systemic disease that results

in lifelong immunity.¹ The virus spreads by human reservoir and transmission is through airborne droplets, direct contact with lesions and congenital transmission. Communicability is one to two days prior and four to five days after appearance of rash. If an individual is exposed to a patient having zoster, it can result in varicella, but it cannot result in zoster. The incubation period varies from 10-21 days, mostly 14 to 16 days.² The patient remains contagious 1-2 days prior to the appearance of rash

and until the lesions begin crusting which is around 5-6 days after the manifestations of rash. The VZV is a cause of significant disease burden, including hospitalizations and mortalities, in Australia and New Zealand.³ There are several convincing reasons to believe that why all HCWs should be immune to VZV. Firstly if a HCW gets infection, he can transmit it to the hospital coworkers and patients. Secondly, the susceptible HCWs can acquire the VZV infection through the patients. varicella is a renowned nosocomial infection among HCWs.⁴ Screening of HCWs should be done for immunity against VZV when they are being employed in the hospital.

In 2010, a study showed that VZV seroprevalence among HCWs in Taiwan was 91.1%.⁵ The seroprevalence rate of VZV in Pakistan is 39.6% among males and 45.2% among females.⁶ Celikbas in a study conducted in 2006 reported that 98% of HCWs working in Turkey had antibodies to VZV.⁷ There are studies examining HCWs which support serological screening of selective HCWs based on self-reported history of varicella in the past.⁸ Those authors assume that its more cost effective to test HCWs only with absent or unclear history of Chickenpox before vaccination. Vandermissen, in Belgium, reported that only selective HCWs with a negative history should be screened for VZV susceptibility.⁹ They assessed the reliability of recalled varicella history as a predictor of immunity. They concluded that presence of history of varicella was excellent in predicting immunity but absent history had no value in determining susceptibility status to VZV in HCWs (PPV=98.9%, NPV=3.4%).

MATERIAL AND METHODS

This study was a cross-sectional descriptive study and was carried out in Shaikh Zayed Hospital Lahore, from March 2013 to February 2014. The protocol of this study was approved by "Institutional Review Board" at Shaikh Zayed Hospital, Lahore. Informed consent was obtained from the participants. A total of 200 HCW's were selected randomly from all the departments. They were classified into following four groups of 50 individuals each: doctors, nurses, paramedical staff and administrative staff. Following individuals were excluded:

1. HCWs with varicella in last 6 months.
2. HCWs with immunodeficiency
3. HCWs with history of immunoglobulin treatment in the previous 6 months.

Demographic data and data on history of chickenpox were collected using a self-administered

questionnaire filled by each HCW. Informed consent was taken from each HCW after telling the purpose of the study. A 3 ml blood sample was collected and serum IgG antibodies against VZV were determined by use of commercially available ELISA kit.

Statistical analysis: All the collected data was entered and data processing and statistical analyses were performed with the SPSS version 20. The sensitivity, specificity, positive predictive values and negative predictive values of recall history against VZV antibodies were represented by percentages with 95% Confidence Interval. Chi-square test was applied to study the bivariate relationship between the rates of prevalence of VZV antibody and history of recall of varicella. A p-value <0.05 was considered to be of statistical significance.

RESULTS

This study comprised of 200 HCWs working in Shaikh Zayed Postgraduate Medical Institute, Lahore. Of these 50 (25%) were doctors, 50 (25%) were nurses, 50 (25%) were paramedical staff and 50 (25%) were in administration. Age range of HCWs was among 18-60 years. The age group of 30-39 years had the highest proportion of HCWs (43.5%) followed by 18-30 years (37.5%). The mean age of HCWs was 30.7 years. There were 125 (63%) men and 75 (37%) women. On self-administered questionnaire, 74 (37%) disclosed a positive history of varicella (chickenpox) infection whereas 126 (63%) reported a negative history. In the study, the 125 participants were male i.e. 62.5 % and 75 participants which is 37.5 %, were females. The ratio of male to female came out 1.6:1.

	Sero Positive (%)	Sero Negative (%)	Total
Positive history of varicella	74 (100)	0 (0)	74
Negative history of varicella	100 (79)	26 (21)	126
Total	174 (87)	26 (13)	200

Table-1: Varicella antibodies (anti-VZV immunoglobulin G) in serum

The prevalence of subjects who were VZV seropositive was 87%. Out of 200 HCWs, a positive history of varicella infection was given by 74 (37%) HCWs, whereas 126 (63%) HCWs gave negative history of infection by varicella.

Sensitivity	74/174×100	43%
Specificity	26/26×100	100%
Positive predictive value	74/74×100	100%
Negative predictive value	26/126×100	20%

Table-2: A comparison between recall history of varicella and serological testing

Table-2 shows that sensitivity of past history of varicella infection as indicator of the immune status was 43%. The specificity of the historical enquiry to predict negative assay was 100 percent. A history of chickenpox for the seropositivity had a PPV of 100% and the NPV of 20%. Susceptibility rate to VZV among HCWS found to be 13%. All the HCWs who gave history of past varicella infection (74), were found to be immune to VZV. Among the 126 HCWs who gave no history of past varicella infection, 100 (79%) were sero-positive and 26 (21%) were sero-negative.

DISCUSSION

This is the first study in Pakistan which was conducted to evaluate susceptibility to varicella and reliability of positive history of varicella infection among HCWs. This local survey showed that 87% of HCWs were seropositive for VZV. In Taiwan, VZV seroprevalence was reported to be 91% among HCWs.⁵ Sam et al from Kuala Lumpur found that 82% of the HCWs were seropositive to VZV in Malaysia.¹⁰ Celikbas et al from Turkey investigated 363 HCWs and reported that VZV seroprevalence was 98%.⁷ Almuneef et al studied 4006 new HCW recruits in Saudi Arabia and found that VZV seroprevalence was 86%.¹¹ MacMahon et al in UK reported seroprevalence of VZV was 91.7% among HCWs.¹² Our data showed that 98% of HCWs who gave previous history of varicella, contracted it at the age between 5-10 years. Heininger et al conducted a study in hospital of Switzerland and suggested that seroprevalence of VZV antibodies increases by age and reaches 95%, at the age between 9-18 years.¹³ 59% of chickenpox cases in Singapore were in children who were less than 15 years of age.¹⁴ Among adults the risk of major morbidity or death is 9-25 times higher than in children.¹⁵ In the present study, the HCWs giving positive history of varicella (74 out of 74) had evidence of protective antibodies against VZV. A positive varicella history was very reliable with 100% positive predictive value. Therefore a questionnaire alone can detect a major portion of immune HCWs. On the other hand, more than half HCWs with absent history of varicella (100 of 126)

were also found seropositive for VZV (79%) and only 21% HCWs had no protective antibodies against VZV. It means negative history of varicella is not good at predicting absence of immunity. Accordingly, serological tests should be performed on HCWs having absent history of varicella, rather than presumptive VZV vaccination, because a major proportion of those HCWs would be immune to VZV. In 2007, Apisarnthanarak et al determined the relationship between immune status and history of varicella among HCWs.¹⁶ The study was conducted on 110 HCWs in Thailand. He reported a PPV of 100% and a NPV of 61%. This study shows that self-reported history of varicella was good at predicting immune status. A positive history of varicella correlates well with the seroprevalence of VZV, whereas absence of history of varicella was not reliable in predicting immune status. In 2004, Almuneef et al conducted a study on 1058 newly recruited HCWs, based on a self-administered questionnaire in a tertiary care hospital in Riyadh.¹⁷ The positive predictive value of history of varicella for the seropositivity was 89% and the NPV was 22%. They recommended that serological screening of all employees should be done and the susceptible HCWs should be vaccinated. Absent history of varicella was not a reliable indicator of varicella susceptibility in HCWs whereas positive history was a good at predicting immune status. The reliability of history was not influenced by age, gender or job category. In this study we found that VZV susceptibility rate is 13% among HCWs of Shaikh Zayed hospital, a tertiary care hospital in Lahore. This susceptibility rate is higher than western countries. The VZV susceptibility rate among HCWs in USA was 1-5%, in Ireland was 4% and in Belgium was 1.5%. Hatakeyama et al (2004) reported that VZV susceptibility rate was 2.8% among HCWs of Tokyo hospital.¹⁸ Gallagher in Ireland, reported-- past history of Varicella was not reliable in predicting immunity among HCWs (PPV=95%, NPV=11%). They recommended that serological screening for VZV should be done of all HCWs before joining hospital.¹⁹ A suggestion was given that when levels of immunity are above 94%, then viral transmission got interrupted in the hospital setting.²⁰ In the current study, more than 50 percent of the HCWs (100 out of 126) with absent history of varicella were found seropositive (79%). Only 20% were found seronegative, so susceptible to VZV infection. It means negative history of varicella is not good at predicting absence of immunity. Therefore serological testing of HCWs with absent history of varicella should be performed, prior to VZV vaccination, because a

major proportion of those HCWs would be serologically immune to VZV.

CONCLUSION

We found that VZV seropositivity was 87% and susceptibility rate is 13% among HCWs of Shaikh Zayed hospital, a tertiary care hospital in Lahore. Also presence of recall history of varicella is reliable in indicating susceptibility among HCWs, whereas absence of a positive history is not good at predicting absence of immunity against VZV. The positive recall history of varicella had a high PPV and a low NPV. VZV screening of the HCWs with absence of past history of varicella should be undertaken in the hospital setting and the susceptible HCWs should be vaccinated against VZV. Self reported history of varicella among doctors was more reliable than other professionals. Serological screening of all HCWs is the best approach to determine whether the subject is immune to varicella or not. It decreases the chance of missing any susceptible employees, although it causes a significant cost.

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