ORIGINAL ARTICLE

Seroprevalence of Varicella-Zoster Virus in Females of Childbearing age in Rawalpindi

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ABSTRACT

Objective: To determine the seroprevalence of Varicella-zoster virus (VZV) in females of childbearing age.

Study Design: Cross-sectional study.

Place and Duration of Study: Virology Department, tertiary care hospital, Rawalpindi, from August 2022 to December 2022.

Materials and Methods: A total of 200 females, aged 15-49 years, were included in the study. Data of the participants regarding age, socioeconomic status, marital status, and previous history of VZV infection was collected by a predesigned questionnaire. Blood samples were tested for the detection of VZV IgG by Enzyme Linked Immunosorbent Assay (ELISA) of Ratio Diagnostic, Germany. SPSS version 25 was used to analyze the data.

Results: Out of total 200 samples, 163 (81.5%) were positive for VZV IgG and 37 (18.5%) were negative. The positivity of VZV IgG was highest in age group 2 (20-29 years) with 87 (43.5%) positive cases, followed by 54 (27%) in age group 3 (30-39 years) and 11 (5.5%) in both age group 1 (< 20 years) and age group 4 (40-49 years). Out of 200 participants, 158 (79.0%) were married and 42 (21.0%) were unmarried. Among total, 107 (53.5%) had history of previous VZV infection while 93 (46.5%) had no significant history.

Conclusions: This study showed significant exposure of VZV in females of childbearing age and subsequent development of immunity. However, a substantial proportion of females were susceptible to VZV infection. This susceptibility in females could potentially pose a future risk of infection during pregnancy, resulting in severe complications and congenital abnormalities.

Key Words: *Childbearing Age, Seroprevalence, Varicella Zoster Virus IgG, Varicella-zoster virus Infection*

Introduction

Varicella-zoster virus (VZV) is HHV-3 and belongs to Herpesviridae family. It is a highly contagious pathogen and is distributed worldwide. Primary VZV infection causes vesicular rash of chicken pox (varicella), while reactivation of latent VZV typically results in localized skin lesions known as shingles (zoster).[1] VZV spreads via inhalation of respiratory droplets, however transmission can also occur through direct contact with infectious vesicular fluid.[2] In temperate regions, VZV primarily affects children, whereas in tropical areas, adults are more commonly affected.[3] While the infection is often benign in children, it may have severe consequences when contracted during pregnancy, posing a significant risk to both the mother and fetus.[4]

Globally, over 4.2 million cases of VZV occur each year, resulting in 4200 deaths annually.The incidence of VZV infection during pregnancy is 1 to 5 cases in 10,000 in United States.[6] This low incidence is attributed to high VZV seroprevalence (up to 90%) in developed countries.[7] However seroprevalence rates are lower in developing countries, at about 40%. Fewer than 2 % of women who acquire infection in pregnancy give birth to neonates with congenital varicella syndrome.[8]

VZV infection during pregnancy poses significant risks for the expectant mother, especially an increased likelihood of developing pneumonia. Additionally, there is a risk of transmitting the virus to both the developing fetus and the newborns. The risk of development of congenital varicella syndrome is higher if mother gets infection during first 8 to 20 weeks of pregnancy.[9] Congenital varicella syndrome is characterized by scarring of skin, neurological abnormalities, structural eye damage, hypoplasia of limbs, gastrointestinal abnormalities or low birth weight.[10] If VZV infection develops during five days

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before and two days after delivery, the baby might develop potentially life-threatening infection called neonatal varicella.[11] Early onset of zoster in children is also linked to maternal VZV infection during pregnancy.[12]

Infection with VZV leads to the development of antibody response. VZV IgM appears 2 to 5 days after rash appears and remains detectable for 10 weeks.[13] VZV IgG antibody appears early in infection and levels progressively decrease in a few years.[14] Definitive diagnosis of varicella infection is carried out by PCR testing of skin lesion specimens.[15]

There is an overall change in epidemiology of VZV infection after the introduction of varicella vaccine since 1995.[16] Pakistan, like many developing nations, has experienced advances in healthcare infrastructure and vaccine availability in recent years. These factors, coupled with variations in cultural practices and disease exposure, make this study essential to understand the trends in seroprevalence of VZV. Our study will contribute by providing sufficient base line local data for further studies to be carried out in Pakistan. It will also help to implement infection control measures and take proactive steps towards the well-being of expectant mothers and their offspring. So a research was planned to determine the seroprevalence of Varicella-zoster virus (VZV) in females of childbearing age.

Materials and Methods

After taking approval from institutional review board (BS AHS/VIR-4/READ-IRB/21/924), a cross-sectional study was conducted at department of Virology, tertiary care hospital, from August 2022 to December 2022. By using WHO Calculator taking population proportion 41%, confidence interval 95% and margin of error 5%, the sample size of 200 was calculated.[16] The females between the age 15-49 years (reproductive age specified by WHO) were included in the study. The women with underlying comorbidities or immunocompromised state were excluded from the study. About 3mL of serum sample was collected from each participant by non-probability consecutive sampling. Informed consent was taken from all participants and a questionnaire was used to collect demographic data. The variables included in the data were age, marital status, socio-economic status, history of VZV vaccination and comorbidities. The indirect ELISA was performed on serum samples for detection of VZV IgG by using Ratio Diagnostic Kit. The tests were performed according to the manufacturer's instructions. The antibody index was calculated for each sample and the values > 1.1 were considered positive. Data was analyzed using Statistical Package of Social Sciences (SPSS) version 25.0. Descriptive statistics like frequencies and percentages were calculated for qualitative variables (marital status, socio-economic status, and history of chickenpox infection, while quantitative variables (age) were expressed as mean and standard deviation.

Results

A total of 200 females were included in this study for the detection of VZV IgG by ELISA method. Out of 200 participants, 163 (81.5%) were positive for VZV IgG and 37(18.5%) were negative. The participants were divided into four age groups. The positivity for VZV IgG was highest in age group 2 (20-29 years) with 87 (43.5%) positive samples, followed by 54 (27%) in age group 3 (30-39 years) and 11(5.5%) in both age group 1 (< 20 years) and group 4 (40-49 years), as shown in figure-I.

Out of 200 participants, 107 (53.5%) had a previous history of VZV infection while 93
(46.5%) did not give significant history. About 97% of the participants with previous history of VZV infection were positive for VZV IgG, however 63% had positive VZV IgG with no history of previous infection, as shown in figure-II. Among total, 158 (79.0%) were married and 42 (21.0%) were unmarried. Seropositivity was high (49.5%) among females living in joint family system and low (32%) in females not living in joint family system.

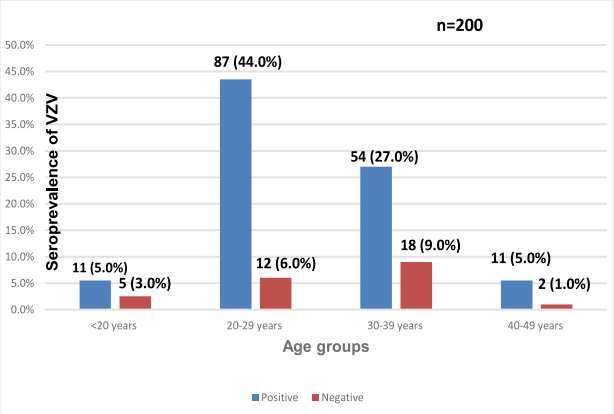

Fig 1: VZV IgG Seroprevalence in Different Age Groups

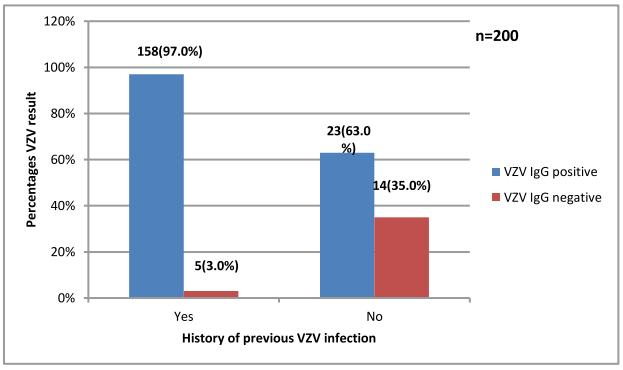

Fig 2: History of Previous VZV Infection

Discussion

Varicella-zoster virus infection poses a considerable worldwide health challenge, carrying significant consequences, especially in terms of reproductive health and its potentially severe impact on fetus. Gaining insights into the prevalence of VZV is of paramount importance for formulating impactful healthcare strategies in a country like Pakistan. The prevalence of VZV has exhibited an upward trend in recent years, a phenomenon attributed to the introduction of the varicella vaccine.

In this study, seroprevalence of VZV IgG in women of childbearing age was determined. Of total 200 samples, VZV IgG was positive in 163 (81.5%) samples; however, 37 (18.5%) samples were negative. Notably, the highest prevalence was observed in age group 2 (20-29 years) with 87 (43.5%) cases of VZV IgG positivity, followed by 54 cases (27%) in age group 3 (30-39 years) and 11 cases (5.5%) in both age group 1 (<20 years) and age group 4 (40-49 years). Among total, 107 (53.5%) had previous history of VZV infection while 93 (46.5%) did not give significant history.

A study conducted in Pakistan by Naseem *et al*.[9] in 2022, showed that the seroprevalence of VZV IgG was higher (45.2%) in females as compared to males (39.6%). Moreover, it was observed that seroprevalence increased with age of the individuals; with highest seroprevalence of 53.6% in age group 21-30 years. The results of this study were comparable to our study.

A cross-sectional study was carried out in 2016 in Iran by Majidy *et al.*[17] This study reported the seroprevalence of 71.2% for VZV IgG which showed that majority of women had been exposed to the VZV at some point before the study, either through contracting infection or through varicella vaccination. The outcomes of our study were consistent with this study.

Another study was conducted in 2019 on seroprevalence of VZV IgG among pregnant females in Egypt. They found seropositivity of 88.3% in pregnant females. This study also observed a trend that VZV seroprevalence increased with increasing age of the women. This higher seroprevalence could be due to increased varicella vaccination or previous exposure.[6]

A study conducted by Daulagala and his colleagues in Sri Lanka, found that the seroprevalence of VZV IgG was 77.9% in females. Notably, the highest prevalence (85%) was observed within the age range of 31 to 35 years, consistent with our study. Additionally, a direct relationship was noted between woman's age and the prevalence of VZV IgG. This study also had similar findings as in our study.[18,19]

A review article showed the prevalence of VZV IgG among populations of Gulf countries in 2023. The findings from these studies indicated a wide variation in the VZV seroprevalence, ranging from as low as 15% to as high as 92%. This study reflected a diverse range of immunity levels to VZV within these countries, due to differences in vaccination rates, natural exposure, and other contributing factors.[14]

Another study was carried out in India to assess the prevalence of VZV IgG. Among the entire cohort, 49.9% exhibited seropositivity, and approximately 29% reported a prior history of VZV infection.[5]

The present study demonstrated a rise in the prevalence of VZV IgG within the female population as compared to a previous study conducted in 1999. Since that no similar investigation has been carried out in Pakistan, thereby emphasizing the value of this study in addressing a gap in research. Furthermore, our findings were in alignment with outcomes from other tropical countries, establishing a level of comparability between our results and those of similar studies conducted in those regions.

Limitations of the study

This study included a relatively small sample size and population of northern Pakistan which may limit the generalizability of the findings to other regions. The assessment of previous VZV infection was based on self-reported history, which might be subject to recall bias. Additionally, the unequal distribution of

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participants across age groups may impact the robustness of conclusions.

Conclusion

This study found significant seroprevalence of VZV in our female population of childbearing age. However, a notable percentage of females remained susceptible to VZV. These susceptible females were at risk of VZV infection during pregnancy in future, potentially leading to fetal abnormalities and severe complications in newborns.

Conflict of interest: None

REFERENCES

1. Cohrs RJ, Badani H, Baird NL, White TM, Sanford B, Gilden D et al. Induction of varicella zoster virus DNA replication in dissociated human trigeminal ganglia. J Neurovirol. 2017 Feb;23(1):152-7 doi: 10.1007/s13365-016-0480-1.
2. Zeng WB, Zhang F, Cheng S, Sun JY, Shen H, Luo MH et al. Concerns on Vaccine against Varicella Caused by Varicella-Zoster Virus Infection. Virol Sin. 2021 Feb;36(1):159-62. doi: 10.1007/s12250-020-00231-4.
3. Balbi O, Baldi S, Rizza S, Pietroiusti A, Perrone S, Coppeta L et al. Seroprevalence survey for Varicella among healthcare workers and medical students in Italy. Hum Vaccin Immunother. 2021 Feb 1;17(2):372-6. doi: 10.1080/21645515.2020.1771989.
4. Amjadi O, Rafiei A, Haghshenas M, Navaei RA, Valadan R, Hosseini-Khah Z et al. A systematic review and meta-analysis of seroprevalence of varicella zoster virus: A nationwide population-based study. J Clin Virol. 2017 Feb;87:49-59. doi: 10.1016/j.jcv.2016.12.001.
5. Suryam V, Khera A, Patrikar S. Susceptibility of cadets and recruits to chickenpox: A seroprevalence study. Med J Armed Forces India. 2021 Oct;77(4):474-8. doi: 10.1016/j.mjafi.2021.05.026.
6. Ibrahim EG, Abdel Wahed WY, Eid HM, Deeb WS. Seroprevalence of varicella-zoster virus among pregnant women in Fayoum Governorate, Egypt. J Egypt Public Health Assoc. 2019; De;94(1-6). doi: 10.1186/s42506-018-0002-5.
7. Chong CH, Liu CE, Leong YY, Liao SY, Lai HW, Lee YL et al.. Seroprevalence of varicella-zoster virus antibody and immunogenicity of live attenuated varicella vaccine in healthcare workers in Taiwan. J Microbiol Immunol Infect. 2023 Apr;56(2):274-81. doi: 10.1016/j.jmii.2022.09.005.
8. Yang J, Liu J, Xing F, Ye H, Dai G, Liu M et al., Nosocomial transmission of chickenpox and varicella zoster virus seroprevalence rate amongst healthcare workers in a teaching hospital in China. BMC Infect Dis. 2019 Jul 5;19(1):582. doi: 10.1186/s12879-019-4222-x.
9. Naseem Z, Ayub M, Shah SA, Ali SA, Abidi SH. Viral infections in Pakistan: prevalence, factors affecting spread, and recommendations for control. J Infect Dev Ctries. 2022 Jun 30;16(6):913-26. doi: 10.3855/jidc. 15078.
10. Zanella B, Bechini A, Bonito B, Del Riccio M, Ninci A, Tiscione E et al. A Study of Varicella Seroprevalence in a Pediatric and Adolescent Population in Florence (Italy). Natural Infection and Vaccination-Acquired Immunization. Vaccines (Basel). 2021 Feb 14;9(2):152. doi: 10.3390/vaccines9020152.
11. Gilbert GL. Chickenpox during pregnancy. BMJ. 1993 Apr 24;06(6885):1079-80. doi: 10.1136/bmj.306.6885.1079.
12. Lenis-Ballesteros V, Ochoa J, Hincapié-Palacio D, León-Álvarez A, Vargas-Restrepo F, Ospina MC et al. Seroprevalence of Varicella in Pregnant Women and Newborns in a Region of Colombia. Vaccines (Basel). 2021 Dec 31;10(1):52. doi: 10.3390/vaccines10010052.
13. Tsou MT, Shao HH. Varicella Seroprevalence in Healthcare Workers at a Medical Center Following Changes in National and Local Hospital Vaccination Policies. Int J Environ Res Public Health. 2019 Sep 22;16(19):3544. doi: 10.3390/ijerph16193544.
14. Badur S, Ozudogru O, Khalaf M, Ozturk S, Albreiki S, Al Awaidy S et al. Epidemiology of Varicella Zoster Virus and Herpes Zoster Virus in Gulf Cooperation Council Countries: A Review of the Literature. Infect Dis Ther. 2023 Jan;12(1):81-93. doi: 10.1007/s40121-022-00715-8.
15. Raj SS, Sarmishta M, Dhanalakshmi MG. Maternal and Fetal Outcome of Fever in Pregnancy. J Evolution Med Dent Sc. 2021;10(13):925-30.
16. Akram DS, Qureshi H, Mahmud A, Khan AA, Kundi Z, Shafi S, et al. Seroepidemiology of varicella-zoster in Pakistan. Southeast Asian J Trop Med Public Health. 2000;31(4):646-9.
17. Majidy P, Khodabandehloo M, Azadi NA. Seroprevalence of Varicella zoster virus antibody among young women before marriage in Sanandaj, Iran. Iran J Microbiol. 2016;8(2):147-52.
18. Daulagala SWPL, Noordeen F, Fara MMF, Rathnayake C, Gunawardana K. Exposure rate of VZV among women attending antenatal care clinic in Sri Lanka - a cross sectional study. BMC Infect Dis. 2017 Sep 16;17(1):625. doi: 10.1186/s12879-017-2725-x.
19. Ghani E, Rehman MU, Rathore MA. Outbreak of chickenpox in a military center in Northern Pakistan. Pakistan Armed Forces Medical Journal. 2016; 66(1): 147-50.

CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.

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