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Original Article

Seroprevalence of Parvovirus B19 Antibodies in Young Women, Sanandaj, Iran

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Abstract

Background and Aims: Human parvovirus B19 may transmit to the fetus via the placenta during pregnancy and cause serious complications such as severe fetal anemia, non-immune hydrops fetalis, and even intrauterine fetal death. The aim of this study was to determine the seroprevalence of parvovirus B19 antibodies among young women, Sanandaj, Iran.

Materials and Methods: Ninety young women (15-40 years old) referring to clinical laboratory, Sanandaj, Iran, from January 2013 until June 2014 participated in this cross sectional study. In a questionnaire demographic data including age, job, education, place of residence, and history of illness, medications, pregnancy, history of abortion, and blood transfusion were collected. Women's sera were screened for parvovirus B19 IgM and IgG antibodies using ELISA test. The collected data and ELISA results were entered to SPSS statistical software and analyzed using t-test, one-way ANOVA with Tukey post hoc and Chi-squire.

Results: Prevalence of parvovirus B19 IgG and IgM antibodies were 46.7% and 3.3%, respectively in our study population. There were no association between parvovirus antibodies and the demographic variables using t-test, and one-way ANOVA with Tukey post hoc and Chi-squire.

Conclusion: We found that more than fifty percent of the subjects were susceptible to parvovirus B19. Also, IgM antibody was positive in 3.3% of women, indicates that there is an active transmission of the virus in our population. Therefore, if this infection occurs during pregnancy may be harmful to the fetus. Paying more attention is needed to determine the B19 immunity, especially in young women ready for marriage and pregnancy.

Keywords: Parvovirus B19; Seroprevalence; Antibody; Immunity; Women

Introduction

Human parvovirus B19 (HPV B19) is small, non-enveloped and single stranded DNA containing virus that belongs to the family *Parvoviridae*. The important clinical manifestation of HPV B19 primary infection in human is erythema infectiosum (fifth disease) usually in children and acute polyarthralgia in adults. Since the virus replicates in the nucleus of erythroid precursor cells and is cytolytic, it causes a transient cessation of red blood cell production, so infection leads to transient aplastic crisis in persons with underlying abnormalities in erythropoiesis, and hemoglobin disorders (1-2).

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A common mode of parvovirus B19 transmission is through contact with respiratory secretions or aerosol. Transmission via blood products may also occur (3). The placental transmission during pregnancy may account for thousands of pregnancy complications annually around the world (4). Pregnancy itself induces a transient immune suppression, which seems to increase the vulnerability of pregnant women to viral infections (5).

Parvovirus B19 infections during pregnancy are mostly asymptomatic (1, 2). But in approximately 5-10% of pregnant women with primary HPV B19 infection, may result in complications including severe fetal anemia, non-immune hydrops fetalis, abortion and intrauterine fetal death. The risk of parvovirus B19 congenital infection depends on gestational age, with the greatest risk at first 20 weeks of pregnancy (6). The risk of infection compared with nulliparous women increases about several times in women with three or more children. Serious medical conditions and stressful jobs have been shown to be risk factors (2).

The risk of exposure is common as HPV B19 circulates widely in the population, particularly in day care centers and schools. Most employees of these centers are women of childbearing age.

Congenital viral infections can be influenced by immunity and vaccination programs. Unfortunately, no suitable vaccine is available against HPV B19 (7). After primary HPV B19 infection long life immunity is created. Generally, the presence of IgG antibody to viral antigens (VP1 and VP2 capsid proteins) in the blood is indicative of past exposure to viral infection, whereas IgM antibody indicates recent acute infection (4).

The seroprevalence of HPV B19 seems to be variable worldwide. Several factors are known to influence seroprevalence including age, geography, climate, socio-economic status, occupation, race, parity, and working among children (8). In Iran, primary parvovirus B19 infection occurs during childhood and prevalence is higher in women than men (9). In evaluating the risk of this potentially harmful virus during pregnancy, it is important to determine the seroprevalence in the women population regionally revealing the amount of seronegative women susceptible to a primary infection.

The aim of this study was to determine the seroprevalence of parvovirus B19 IgG and IgM antibodies in young and pregnant women in the city of Sanandaj, Iran.

Methods

Subjects

In this cross-sectional study, 90 young women referring to Hossini-nasab clinical laboratory, Sanandaj, Iran, announced their consent to participate in research. Sampling was done from January 2013 until June 2014. In a questionnaire the name, age, job, education, place of residence, history of any illness, medications, pregnancy, history of abortion, and blood transfusion was collected. 5 to 10 ml whole blood was taken. Clotted blood was centrifuged at 3000 rpm for 15 minutes; serum was separated and stored at -20°C freezer up to detection of antibodies. Parvovirus IgG and IgM antibodies were measured using ELISA kits (Euroimmun, Germany). The antigen sources of kits were recombinant viral structural proteins expressed in eukaryotic cells.

Statistical analysis

The results of ELISA test and demographic data were entered into SPSS statistical software, version 20, and analyzed. Associations of antibodies with demographic variables were evaluated using T-test, and one-way ANOVA with Tukey post hoc and Chi-squire.

Results

In our study population, prevalence of parvovirus B19 IgG antibody was 46.67%. The prevalence of IgM antibody was 3.3%. The seroprevalence of IgG and IgM antibodies against parvovirus B19 according to age groups have shown in Tables 1 and 2. Women in age group 31-35 years old had the highest levels of IgG antibodies (Figure 2).

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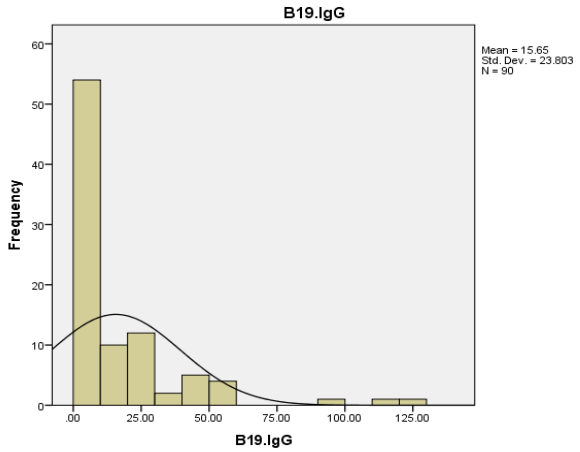

Fig. 1. Frequency of parvovirus B19 IgG antibodies levels according to international units per milliliter (IU/mL) in women detected by ELISA test.

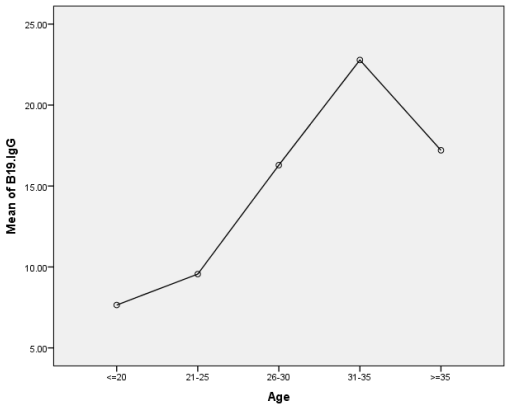

Fig. 2. Distribution of parvovirus B19 IgG antibody means (IU/mL) showed in vertical axis according to age groups of women showed in horizontal axis.

Table 1: Parvovirus B19 IgG antibodies in women according to age groups

Age groups [years]	**Negative*** (antibody level < 0.4 IU/mL)	**Equivocal** (4 < antibody level < 5.5 IU/mL)	**Positive** (antibody level > 5.5 IU/mL)	**Total**
[≤20]	6 (6.66%)**	0 (0%)	4 (4.44%)	10 (11.1%)
[21-25]	10 (11.11%)	0 (0%)	5 (5.55%)	15 (16.66%)
[26-30]	16 (17.8%)	1 (1.11%)	16 (17.78%)	33 (36.68%)
[31-35]	8 (8.9%)	1 (1.11%)	9 (10%)	18 (20.0%)
[≥35]	6 (6.66%)	0 (0%)	8 (8.9%)	14 (15.56%)
Total	**46 (51.11%)**	**2 (2.22%)**	**42 (46.67%)**	**90 (100%)**

*antibody level: international units per milliliter (IU/mL), women's ELISA test results categorized as Negative, Equivocal and Positive according to ELISA manual
**Frequency (percent)

Table 2: Parvovirus B19 IgM antibodies in women according to age groups

Age groups [years]	**Negative*** (antibody level < 0.8 IU/mL)	**Equivocal** (0.8 < antibody level < 1.1 IU/mL)	**Positive** (antibody level > 1.1 IU/mL)	**Total**
[≤20]	7 (7.77%)**	3 (3.33%)	0 (0%)	10 (11.1%)
[21-25]	14 (15.55%)	0 (0%)	1 (1.11%)	15 (16.66%)
[26-30]	29 (32.22%)	2 (2.22%)	2 (2.22%)	33 (36.68%)
[31-35]	17 (18.9%)	1 (1.11%)	0 (0%)	18 (20.0%)
[≥35]	13 (14.44%)	1 (1.11%)	0 (0%)	14 (15.56%)
Total	**80 (88.89%)**	**7 (7.77%)**	**3 (3.33%)**	**90 (100%)**

*antibody level: international units per milliliter (IU/mL), women's ELISA test results categorized as Negative, Equivocal and Positive according to ELISA manual
**Frequency (percent)

The levels of IgG and IgM antibodies were 15.65±23.80 IU/mL and 0.49±0.7 IU/mL, respectively (95% confidence intervals for mean). Minimum and maximum levels of IgG antibodies were 0.30 and 126.80 IU/mL, respectively. Minimum and maximum levels of IgM antibodies were 0.12 and 6.40 IU/mL, respectively.

There were no association between prevalence of parvovirus B19 IgG and IgM antibodies and

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demographic variables including age, job, education, place of residence, history of illness, medications, pregnancy, history of abortion, and blood transfusion.

Discussion

Maternal primary infection with cytomegalovirus (CMV), human parvovirus B19 (HPV B19), and rubella virus may result in fetus and pregnancy complications (6). Because the congenital rubella infection is controlled by the vaccine, CMV and HPV B19 are the most important causes of clinically significant intrauterine viral infections (8).

In our study population, the prevalence of IgG antibody against HPV B19 was 46.7%. Thus more than half (53.3%) of women especially under 21-25 years old age groups were IgG negative (Figures 1 and 2), so they are susceptible to the HPV B19 infection. In addition, the prevalence of IgM antibody against HPV B19 was 3.3% in women. It can be a sign of acute infection, and indicates that B19 is present in the population. Therefore, if the primary infection occurs during pregnancy, the virus may transmit and can cause adverse effects on the fetus.

Recently, HPV B19-specific IgG antibody was detected in 65 out of 86 (75.6%) of pregnant women in west Azerbaijan, Iran. Also, the frequency of abortion in the seropositive group was 4.03 times greater than in seronegative group (1). In other study, HPV B19 IgG was found in 70.09% of women and 60.04% of men among 5-25 years old individuals in Shiraz, Iran (9). Also, seroprevalence of HPV B19 was detected in three different groups in Shiraz. The first group included 91 to-be-married girls. The second group included 184 pregnant women and the third group consisted of 184 neonates, who were born to the women in the second group. The prevalence of HPV B19 IgG was 56 (61.5%), 127 (69%), and 127 (69%) for the first, second and third groups, respectively. Overall 66.5% of women with childbearing age had IgG. The prevalence of HPV B19 IgM was 2.2% among pregnant women (10). Our result of IgG is somewhat lower than the results of those studies; this difference may be due to ELISA techniques and populations variations.

In a case-control study, 168 women with term pregnancy and 156 women with pregnancy loss, both IgG and IgM HPV B19 antibodies were assayed in Zahedan, southeast of Iran. HPV B19 IgG was positive in 20.8% of term pregnancy and in 21.8% in pregnancy loss. IgM antibodies were detected in 10.3% of cases and 6.5% in control, no significant difference were seen between two groups (11). In other study maternal parvovirus B19 infection was not associated with fetal death in a case-control study within pregnant women in Norway (12). Although, we did not conduct a case-control study; however no association was observed between antibodies and history of abortion.

In other countries, prevalence of parvovirus B19 antibodies was reported in 59.9% of European and 67.7% of non-European women, without significant differences in demographic parameters (13). In 558 women in Finland, IgG and IgM antibodies against parvovirus B19 were measured from maternal serum in the first trimester and at delivery and from cord serum. Seroprevalence of HPV B19 was 58.6% (8). Also, B19 IgG antibodies detected in 46.6% and IgM antibodies in 2.25% of different age groups of childbearing women in Makah (14). B19 IgG seroprevalence was 61.4%, with one subject positive for IgM in Sudan (15). In another study, of the 231 women in Nigeria, 45 (20%) were positive for parvovirus B19 IgG, 10 (4%) were positive for parvovirus B19 IgM (2). Also, seroprevalence of HPV B19 in 404 Tunisian pregnant women was 76.2% (16). The prevalence of anti-parvovirus IgG was 66% in the serum samples in 819 pregnant women from Cordoba, Argentina (17). IgG prevalence was 61% among the women of child-bearing age in Tripoli, Libya. The seroprevalence of IgM was 5% (18). Differences in the results of our study and those studies may be due to ELISA techniques and populations variables.

Pregnant women in Nigeria, those aged 36-40 years had the highest prevalence of IgG. Significant determinants were the blood transfusion, occupation and the presence of a

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large number of children in the house (4). A previous study reported that, three factors significantly increased the risk of acute B19 infection such as: having children at home; suffering from serious diseases; and having a stressful job (19). Outbreaks of B19 occur commonly in day care centers and schools. Thus, working in day care centers and schools was independently associated with HPV B19 infection (6). Most of employees of day care centers and schools are women of childbearing age, are repeatedly exposed, therefore, are at risk to HPV B19 (4). But, in our study B19 seroprevalence was not correlated with job, education, place of residence, history of illness, medications, pregnancy, history of abortion, and blood transfusion.

In one study parvovirus B19 IgG seroprevalence was correlated with multigravidity (15). In other study the only variable associated with acquisition of IgG antibodies to parvovirus B19 was number of pregnancies more than one (20). But, we did not analyze the association of seroprevalence with gravidity.

IgM was positive in 3.3% of our study population; it indicates that acute HPV B19 infection is prevalent in our population. It is compatible with a previous study that showed an active transmission of the virus in the community (2). A similar study showed that a significant percentage of child-bearing women were at risk of primary infection which could adversely affect their pregnancy (18). Prenatal screening for parvovirus B19 and passive immunization were recommended (21). Systematic screening of HPV B19 is not done in young women of Iran. We recommend serologic testing to determine immunity status of women for making immunization policy when a vaccine becomes available in the future.

Conclusion

It is evident that 46.7% of women of our study population are immune against parvovirus B19; yet, 53.3% of women are susceptible. Also, IgM antibodies were positive in 3.3% of women, indicates that there is an active transmission of the virus in our population. Therefore, parvovirus B19 as a cause of pregnancy and fetus abnormalities is needed paying more attention, such as determination of immunity, especially in young women ready for marriage and pregnancy.

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