Cross Current International Journal of Medical and Biosciences
Abbreviated Key Title: Cross Current Int J Med Biosci
ISSN: 2663-2446 (Print) & Open Access
DOI: 10.36344/ccijmb.2024.v06i02.001

Volume-6 | Issue-2 | Mar-Apr, 2024 |

Original Research Article

The Seroprevalence of Parvovirus B19 at the Laboratory of Virology of IBN Sina Rabat University Hospital

Hind Zahid[1,2*], Amal Zouaki[1,2], Sophia Tazi[1,2], Ghizlane el Amin[1,2], Jalila Zirar[1,2], Nora Touyar[1,2], Leila Laamara[1,2], Myriam Seffar[1,2], Hakima Kabbaj[1,2]

[1]Mohammed V University, Faculty of Medicine and Pharmacy, Rabat, Morocco
[2]Ibn Sina University Hospital, Central Laboratory of Virology, Hospital of Specialties, Rabat, Morocco

***Corresponding author:** Hind Zahid

| **Received:** 13.01.2024 | **Accepted:** 20.02.2024 | **Published:** 04.03.2024 |

Abstract: Parvovirus B19 (PVB19) is a DNA virus whose main tropism is erythroid precursors, it is responsible for infections that can be life-threatening in fetuses and immunocompromised individuals. The aim of this study was to determine the seroprevalence of Parvovirus B19 in a Moroccan population. We conducted a retrospective study between March 2019 and July 2022 at the Central Laboratory of Virology of Ibn Sina University Hospital of Rabat. All included samples were qualitatively tested for parvovirus B19 anti-VP2 IgG by ELISA on the Chorus analyzer (Diesse diagnostic). Of the 343 patients included, 181 (53%) were women. 165 (48%) were adults with an average age of 45 years [17 - 89], while 178 (52%) were children with an average age of 6 years [0.7 - 16]. Anti-PVB19 IgG were positive in 166 patients, giving an overall seroprevalence of 48.4%. The latter was significantly higher in adults (63.1% vs. 34.8%; p= <0.001) and increased significantly with age, from 32.5% in children aged [7 months to 5 years], to 65.1% in patients over 35 years (p= <0.001). Gender had no impact on seroprevalence. Our study showed an overall seroprevalence of parvovirus B19 of 48.4%. Seroprevalence increased significantly with age, which aligns with the findings in the literature. No previous data in Morocco.

Keywords: Age, ELISA, Morocco, Parvovirus B19, seroprevalence, immunoglobulin.

INTRODUCTION

Human Parvovirus B19 (PVB19) is a small DNA virus responsible for a benign maculopapular exanthem of childhood, megalerythema epidemic also known as fifth disease. Cossart *et al*., in a blood donation bag bearing the references B19 first identified this virus in 1975. However, it was not until 1981 that a pathogenic role was attributed to it in erythroblastopenia attacks in sickle-cell patients [1, 2]. In the *Parvoviridae* family, which includes numerous animal viruses, parvovirus B19, belonging to the Erythrovirus genus and is the only spices pathogenic to humans.

The unique feature of this virus is its tropism for precursors of the erythrocyte lineage expressing the P group antigen on their surface, which is the virus receptor, which explains the occurrence of transient, moderate anemia during primary infection with the virus. This erythrocyte damage can also lead to chronic anemia in immunocompromised patients [3]. Finally, in the case of maternal primary infection, central impairment of fetal erythropoiesis can lead to profound anemia and hydrops fetalis.

Arthropathies occur very frequently with adult infection, and can persist for up to several months after primary infection. Transmission is mainly respiratory, but may also occur via blood donation from a viremic patient, allogeneic bone marrow transplant or transplacental transfer [3, 4].

PVB19 infection is common worldwide, revealing regional epidemiological differences, with usually a notion of previous exposure in more than half of the adult population. The prevalence of PVB19-specific antibodies in the population varies with age, ranging from 2-20% in children < 5 years, to 15-40% in children aged 5 to 18 years and 40-80% in the adult population, depending on the tests used and the study population [5]. The typical age at which an individual becomes infected with PVB19 is 5 to 15 years, but susceptible adults can also be infected. Infection induces an immune response, with neutralizing IgG produced

Quick Response Code

Journal homepage:
https://www.easpublisher.com/

Citation: Hind Zahid, Amal Zouaki, Sophia Tazi, Ghizlane el Amin, Jalila Zirar, Nora Touyar, Leila Laamara, Myriam Seffar, Hakima Kabbaj (2024). The Seroprevalence of Parvovirus B19 at the Laboratory of Virology of IBN Sina Rabat University Hospital. *Cross Current Int J Med Biosci*, *6*(2), 33-37.

around 2 weeks after infection and highly effective in eradicating the virus from the bloodstream. This immunity confers lifelong protection against re-infection. PVB19 is transmitted mainly by the respiratory route, although prodromal symptoms are usually not specific. The mechanism of how PVB19 crosses the barrier of the respiratory epithelium and ultimately reaches the bone marrow to induce infection is currently unknown. Transmission is also parenteral and maternal-fetal. Higher seroprevalences than those assessed in controls have thus been detected in patients receiving blood products and in women who have undergone abortions [5].

The aim of our study is to determine the seroprevalence of Parvovirus B19 and to compare its distribution between adults and children based on the results of serological tests carried out at the Central Virology Laboratory of the Ibn Sina University Hospital in Rabat

MATERIAL AND METHODS

We conducted a retrospective study that ran from March 2019 to July 2022, having included samples from patients in whom we performed anti-Parvovirus B19 IgM and IgG testing. For seroprevalence, we considered only anti-Parvovirus B19 IgG results. Data were collected from each patient's chart, available on the laboratory's "e-LABS LIMS" software.

Sera were collected in dry tubes from the various medical departments and sampling rooms of the different hospitals at Ibn Sina University Hospital in Rabat.

Qualitative detection of parvovirus B19 anti-VP2 IgG in human serum was carried out by unitary ELISA (Enzyme Linked ImmunoSorbent Assay) on the Chorus automated system (Diesse diagnostic), with the result expressed as an index (S/CO).

IgG was considered positive if the result is greater than 1.2, negative if less than 0.8, doubtful and/or equivocal if between these two values [6]. Positive anti-PVB19 IgG was the determinant of parvovirus B19 seroprevalence, independently of IgM.

During the study period, we received 616 requests for parvovirus B19 serology at the Central Virology Laboratory, of which 343 sera were included in this study. We excluded sera from infants aged under 6 months (n= 125), duplicates (n= 58) and sera with indeterminate serological profiles (n= 90) (IgM and/or IgG: doubtful).

Statistical Analysis of Results

Data analyses were performed using SPSS 29.0.1.0 (SPSS Inc. Chicago, IL, USA). Quantitative variables were expressed as mean +/- SD or medians, depending on their distribution. For qualitative variables, data were presented as numbers and percentages, and were compared using the chi-square test or Fisher's exact test. The p-value was considered statistically significant when the value was less than 0.05.

RESULTS

Characteristics of the Study Population

Of the 343 patients included, 181 (53%) were women and 162 (47%) were men, the sex ratio (M/F) was 0.89. The mean age of the population was 25 years [0.7-89]. One hundred and sixty-five patients were adults with an average age of 45 [17 - 89], with referrals mainly from the dermatology department (70 cases), and 178 were children with an average age of 6 [0.7 - 16], with pediatric gastroenterology and infectious diseases as the main departements (148 cases).

PVB19 Seroprevalence by Age

Among the study population, anti-PVB19 IgG was positive in 166 patients, corresponding to an overall seroprevalence of 48.4%. Seroprevalence was significantly higher in adults (62.7% vs. 37.3%; p= <0.001) (Table 1), and increased significantly with age: it was around 32.5% in children aged 7 months to 5 years, 36.6% in patient aged between 6 to 16 years, 58.9% between in patient aged between 17 to 35 years, and 65.1% in patients aged over 35 years (p= <0.001) (Figure 1).

Table 1: A comparison of anti-PVB19 IgG results between adults and children.

	Children n (%)	Adults n (%)	Total n (%)	p-value
anti-PVB19 IgG ♣				< 0,001
Positive	62 (37,3)	104 (62,7)	166 (48,4)	
Negative	116 (65,5)	61 (34,5)	177 (51,6)	

p: corresponds to the difference in anti-PVB19 IgG between adults and children.
♣ : Anti-parvovirus B19 immunoglobulin G.

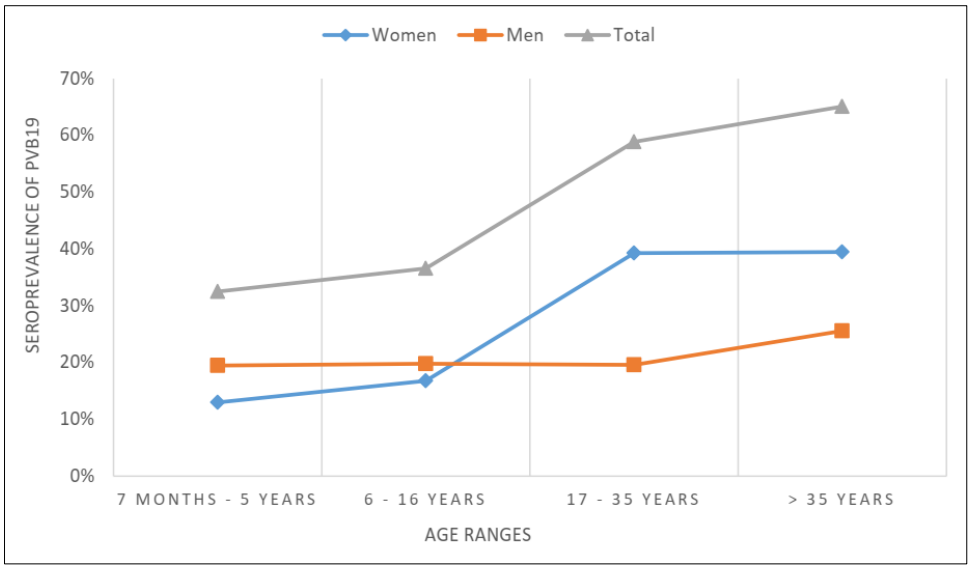

Figure 1: Distribution of PVB19 seroprevalence by age ranges and by gender.

PVB19 Seroprevalence by Gender

Among all patients, seroprevalence was slightly higher in women, at 55.4% (N=92), than in men, at 44.6% (N=74) (p=0.341). In adults, 65 women (39.4%) were IgG-positive versus 39 men (23.6%; p= 0.207); in contrast, in children, seroprevalence was higher in boys than in girls, at 19.7% and 15.2% (N=35 and 27) respectively (p= 0.538). These results do not show significant gender-related variability in seroprevalence within the adult and pediatric populations (Figure 1).

DISCUSSION

Parvovirus B19 is a ubiquitous virus whose exclusive host is humans [7]. In temperate zones, it is responsible for endemics and epidemics in late winter and early spring approximately every four years [8].

The various clinical manifestations associated with Parvovirus B19 infection, and the problem of differential diagnosis with several systemic diseases, underline the importance of biological tests in diagnostic orientation, based essentially on serology, distinguishing two types of antibody: IgM, which appears early, at the end of the viremia phase accompanied by aspecific signs, and persists for around two or three months [9], and is heoretically the marker of recent or active infection; and IgG, which appears simultaneously with the appearance of IgM or after around a week [10], and persists for life in the immunocompetent subject. Serological diagnosis uses a variety of detection techniques, with the antigens VP1 and/or VP2 capsid proteins in different forms, which are the targets of neutralizing antibodies [9]. Interpretation is based on the patient's clinical context, and often involves additional diagnostic tests, including direct molecular testing for the viral genomes [4].

To our knowledge, only one study has been carried out in Morocco on the seroprevalence of parvovirus B19, which was limited to pregnant women of any gestational age attending the Zerktouni Hospital in Marrakech, whose seroprevalence was estimated at 51% [11]. Unlike the latter, our work is a cross-sectional study based on the exploitation of our laboratory's local database. The data collected in our experiment are relevant to patients from different medical departments. The aim was to assess seroprevalence in a Moroccan population and to compare this distribution between adults and children.

Anti-PVB19 Immunoglobulin IgG persists throughout life in the immunocompetent subject and it represent the parameter for assessing parvovirus B19 seroprevalence.

In our study, whatever the anti-PVB19 IgM result, overall seroprevalence was 48.4%. This is higher than those reported in the study by Ooi *et al*., carried out on an urban population in Malaysia, with an overall IgG seroprevalence rate of 37.6% [12], Other studies have reported higher rates, such as those carried out in developed countries like Belgium, with a rate of 74%, and Italy, with a rate of 79% [13].

On the other hand, seroprevalence in the pediatric population was 37.3%, lower than the rate reported by Jegede *et al*., study conducted in patients at the Children's Hospital and University Teaching Hospital in Kano, Nigeria, which was 41.5% [14], and the Alao *et al*., study of children aged 1-18 years with sickle cell disease, which was 39.5% [15].

We also note the variation in seroprevalence from the study conducted by Salimi *et al*., in Iran, among people aged 5 to 25 years (86.6%) [16], and the study conducted by Gilbert *et al*., among day-care workers in Montreal, Canada (70%) [17].

This difference in rates could be explained by the number of cases included in each study, the profile of the population studied, geographical origin, and the

sensitivity and specificity of the kits used for diagnosis [14].

In addition, several factors have been identified as risk factors for parvovirus B19 infection, such as age, gender, socio-economic status and environmental conditions. Age is still the major factor predicting anti-parvovirus B19 IgG seropositivity [12, 15]. This was also demonstrated in our study, where seroprevalence was significantly higher in adults than in children (62.7% vs. 37.3%), in line with the study conducted by Jegede *et al*., (51% vs. 25%) [14], which further shows that around 40% of patient aged 20 had been infected with PVB19.

Furthermore, as anti-PVB19 IgG seropositivity is synonymous with immunity, the increase in seroprevalence with age means that the proportion of individuals susceptible to parvovirus B19 decreases with age [17]. In our study, IgG seropositivity increased significantly with age, rising progressively from 32.5% in children aged 7 months to 5 years to 65.1% in adults over 35 years. This increasing rate of seropositivity according to age is line with the results of Mossong *et al*.,'s study conducted in a general population in five European countries (Belgium, England, Finland, Italy and Poland) [18], and those reported by other authors in several countries [12-17], including Salimi *et al*., who reported seropositivity rates in Iran [16], that increased significantly with age, ranging from 79.3% in patient aged between 5 to 9 years to 93.5% in patient aged between 20 to 25 years (P = 0.000). However, this results contrast with the study conducted by Ujo and colleagues, who reported that seropositivity did not increase with age [19]. This discrepancy may be due to the fact that their study was carried out in sickle-cell children, whereas our study and that conducted by Mossong were carried out in patients aged between 0.5 and 89 years all reasons combined.

In the overall population, our study did not demonstrate an association between gender and anti-PVB19 IgG seropositivity, as although parvovirus B19 seroprevalence was slightly higher in women (55.4%) than in men (44.6%), this difference was statistically insignificant (p = 0.341). This is in line with the results reported by Salimi *et al*., in Iran, with a seroprevalence in men and women of 85.3% and 88% respectively (p = 0.129) [16], and Jegede *et al*., in Nigeria, who has reported a rate of 42.6% and 40.4% in women and men respectively (p > 0.05) [14]. In our study, we also noted non-significant gender-related variability within the adult and child population, with a higher seroprevalence in boys than in girls in the population aged 7 months to 16 years (19.6% vs. 15.1%) (p = 0.538), and reversed in the adult population aged over 16 years, with a higher rate in women than in men (39.4% vs. 23.6%) (p = 0.207).

Some authors have mentioned other socio-demographic factors affecting PVB19 seroprevalence, include socio-economic level, mother's literacy, and promiscuity [15]. The role of occupational exposure through contact with infants is controversial in the literature. According to a study carried out in the French department of Isère showed no significant correlation in women working in creches [20]. However, other studies showed a higher seroprevalence, estimated at 85.7% among professionals in contact with children under 6 years of age [13], and an increased risk among educators working with children under 18 months of age, which may be due to their potential exposure to saliva and respiratory secretions [17]. Furthermore, according to C. Rohrer *et al*., there is a highly significant difference in the prevalence of PVB19 between people living in small towns (74.8%) and those living in large cities (69.0%) [13].

CONCLUSIONS

Our study, which was carried out to assess PVB19 seroprevalence in an overall Moroccan population of 48.4%, corroborates data in the literature concerning the increase in seroprevalence with age. Indeed, the latter was higher in the adult population (63.1%) than in the paediatric population (34.8%). Our work has not demonstrated an association between gender and anti-PVB19 IgG seropositivity, not only in the overall population, but also in the adult and paediatric populations.

Moreover, other authors have highlighted other risk factors that affect PVB19 seroprevalence, and which it would be more interesting to study in other series.

Conflict of Interest: Authors have no conflict of interest to declare.

REFERENCES

1. Cossart, Y. E., Cant, B., Field, A. M., & Widdows, D. (1975). Parvovirus-like particles in human sera. *The Lancet*, *305*(7898), 72-73.
2. Ornoy, A., & Ergaz, Z. (2017). Parvovirus B19 infection during pregnancy and risks to the fetus. *Birth defects research*, *109*(5), 311-323.
3. Mossong, J., Hens, N., Friederichs, V., Davidkin, I., Broman, M., Litwinska, B., ... & Gabutti, G. (2008). Parvovirus B19 infection in five European countries: seroepidemiology, force of infection and maternal risk of infection. *Epidemiology & Infection*, *136*(8), 1059-1068.
4. Servant-Delmas, A., Mercier, M., Laperche, S., & Lefrère, J. J. (2009). Impact de la diversité génétique des erythrovirus humains sur la sécurité infectieuse des médicaments dérivés du sang. *Transfusion clinique et biologique*, *16*(5-6), 482-488.
5. Qiu, J. (2017). Human parvoviruses. *Clin Microbiol Rev, 30*, 43–113.
6. CHORUS Parvovirus B19 IgG. Pour la détermination qualitative des anticorps IgG anti-Parvovirus B19. Fiche Technique, Diesse, Italie, 2016.

7. Jacquot, R. (2022). Infection de l'adulte à Parvovirus. *La Rev Med Interne*, *43*(12), 713-26.
8. Subtil, D., Garabedian, C., & Chauvet, A. (2015). Parvovirus B19 infection and pregnancy. *Presse Medicale (Paris, France: 1983)*, *44*(6 Pt 1), 647-653.
9. Morinet, F. (2015). Erythrovirus B19. Référentiel en Microbiologie médicale, 689-91.
10. Parvovirus B19. In : Précis de Biopathologie – Analyses médicales spécialisées Biomnis; 2013.
11. Bouraddane, M., Warda, K., Elkamouni, Y., Arsalane, L., & Zouhair, S. (2023). Parvovirus B19 in Morocco: Seroprevalence of Immunoglobulin G Antibody in Pregnant Women in Marrakesh. *Clinical and Experimental Obstetrics & Gynecology*, *50*(2), 25.
12. Ooi, S. L., Hooi, P. S., Chua, B. H., Lam, S. K., & Chua, K. B. (2002). Seroprevalence of human parvovirus B19 infection in an urban population in Malaysia. *The Medical journal of Malaysia*, *57*(1), 97-103.
13. Röhrer, C., Gärtner, B., Sauerbrei, A., Böhm, S., Hottenträger, B., Raab, U., ... & Modrow, S. (2008). Seroprevalence of parvovirus B19 in the German population. *Epidemiology & Infection*, *136*(11), 1564-1575.
14. Jegede, A., Aminu, M., & Ella, E. E. (2014). Sero-prevalence of human parvovirus B19 among patients attending some hospitals in Kano metropolis, Nigeria. *African Journal of Clinical and Experimental Microbiology*, *15*(1), 21-26.
15. Alao, O. O., Girei, A. I., Joseph, D., Banwat, E. B., Araoye, M. O., & Orkuma, J. (2009). Effect of socio-demographic variables on anti-parvovirus B19 antibody seropositivity among children with sickle cell anaemia in jos, north central Nigeria. *The Internet Journal of Epidemiology*, *8*(2).
16. Salimi, V., Gouya, M. M., Esteghamati, A. R., Safaie, A., Heshmat, R. A. M. I. N., Saadatmand, Z., & Mokhtari-Azad, T. (2008). Seroepidemiology of human Parvovirus B19 in 5-25 year old age people in Iran. *Iranian Journal of Public Health*, *37*(4), 19-25.
17. Gilbert, N. L., Gyorkos, T. W., Béliveau, C., Rahme, E., Muecke, C., & Soto, J. C. (2005). Seroprevalence of parvovirus B19 infection in daycare educators. *Epidemiology & Infection*, *133*(2), 299-304.
18. Mossong, J., Hens, N., Friederichs, V., Davidkin, I., Broman, M., Litwinska, B., ... & Gabutti, G. (2008). Parvovirus B19 infection in five European countries: seroepidemiology, force of infection and maternal risk of infection. *Epidemiology & Infection*, *136*(8), 1059-1068.
19. Ujo, H., Mamman, A. I., Aliyu, A., & Ogunrinde, G. O. (2012). The Sero-Prevalence of Parvovirus Antibodies among Children with Sickle Cell Anaemia in Zaria. *African Journal of Clinical and Experimental Microbiology*, *13*(2), 74-78.
20. Parra, D., Mekki, Y., Durieu, I., Broussolle, C., & Sève, P. (2014). Manifestations cliniques et biologiques de la primo-infection à parvovirus B19 chez l'adulte immunocompétent: étude rétrospective de 26 observations. *La Revue de Médecine Interne*, *35*(5), 289-296.