

An Overview on Parvovirus B19 with Special Reference to B19 Virus Infection in SAUDI ARABIA

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Abstract:

Parvovirus B19 is a small non-enveloped single-stranded DNA virus of the family Parvoviridae and genus Erythrovirus. B19 virus is most known for causing erythema infectiosum (fifth disease) in children as well as numerous other diseases such as arthropathy in adults, Transient aplastic crisis in patients with increased erythropoiesis and persistent anemia in immunocompromised patients. Parvovirus B19, has been the topic of numerous reviews, however, not many have focused on B19 Virus Infection in SAUDI ARABIA. In this review we compile recent data on human parvovirus B19 and its Infection in SAUDI ARABIA.

Keywords: *Parvovirus B19, Saudi Arabia, fifth disease, malignant tumors, Transient aplastic crisis*

INTRODUCTION

Parvovirus B19 (recently renamed as erythrovirus) is most known for causing erythema infectiosum (fifth disease) in children, the virus has also been implicated in many other diseases such as arthropathy in adults, Transient aplastic crisis in patients with increased erythropoiesis, as well as persistent anemia in immunodeficient and immunocompromised patients [1, 2]. Furthermore, Parvovirus B19 was recognized as the cause of hydrops fetalis and congenital anemia in fetus [3].

Parvovirus B19 was discovered for the first time in London in 1975 by Yvonne Cossart, when Cossart observed in an assay for hepatitis B unusual reaction in one of normal blood donor's serum (this serum sample was named B19) [4].

Parvovirus B19 is a small non-enveloped single-stranded DNA virus of the family *Parvoviridae* and genus *Erythrovirus*, this virus is the only member of *Parvoviridae* known to cause disease in human, this large family includes numerous members that cause disease in animals such as canine parvovirus [5], porcine parvovirus [6] and Aleutian mink disease virus [7].

The name of parvoviruses comes from *parvum* the Latin word which means small. Actually, parvoviruses are known to be among the smallest viruses with viral particles of 22 to 24 nm in diameter [8]. Their structure is simple and the viral genome (length 5-6 kb) encodes for three proteins: the first one is a nonstructural protein (NS1) with a molecular weight of 77 kDa, this protein is cytotoxic to host cells and subserves multiple replicative functions, and the others are two structural proteins (capsid proteins), viral protein (VP1) with 11 kDa and viral protein 2 (VP2) with 7.5 kDa [9].

Several studies have been conducted to identify B19V genotypes basing on nucleotide divergence, Three B19V genotypes have been identified, genotype 1 which is circulating worldwide, genotype 2 which is

common in Europe, and genotype 3 in West Africa [10 -12]. Interestingly, Hübschen and co-workers found B19V genotype 3 in samples collected from Asia, Brazil and Europe, this result suggest that B19V genotype 3 is more widely distributed outside Africa than previously described [13].

Recently, Jan-Hendrik Trösemeier and co-workers have reported the genome sequences of two references trains of parvovirus B19, these two references trains belong to genotype 1a1 and 1a2 [14].

Mode of transmission

The virus transmission occur usually by personal contact through respiratory secretions like saliva and nasal mucus, it can be also transmitted through blood and blood products [15, 16]. However, recent studies demonstrate that parvovirus B19 can be transmitted from infected women to her fetus [17].

In fact, Individuals are infected by human B19V when the virus bind to a specific receptor present on the surface of host cells (P-blood group antigen globoside-4 [Gb4]), after that, the virus will be transported inside the host cell via endocytosis, then the virus will be transported to the nucleus and start its replication [18].

In addition, Parvovirus cannot encode its own DNA-polymerase, for this reason, its replication dependent on host cell DNA- polymerase and this explain why individuals who do not have the P-blood group antigen are not susceptible to be infected by B19V [19].

Parvovirus B19 infection symptoms

Actually, numerous patients infected by B19V are asymptomatic or cold-like symptoms. Most patients infected by B19V do not need laboratory tests because the illness is usually resolved in one week [20, 21].

There are three categories of peoples in which parvovirus B19 may cause serious clinical consequences: first categories is peoples with haemolytic diseases such as patients with thalassaemia major or sickle cell disease, in those patients B19V is well known for causing aplastic crisis, the second category contain immunocompromised patients in which B19V was recognized as the cause of chronic anaemia, whereas, the third category contain pregnant women [15]

Parvovirus B19 infection is common in children, especially in children aged between 4 and 11 years, in fact, a study performed in United States showed that 19% of children infected by B19V are less than 10 years old, whereas, 67% of patients infected are more than 49 years old.

In children infected, B19V cause an erythema infectiosum (Fifth Disease) characterized by a “slapped cheek” rash, this can be accompanied in some cases by fever, headache and diarrhea. In pregnant women, infected mother can transmit B19V to the fetus, which can cause non-immune fetal hydrops (NIHF), spontaneous abortion, congenital anaemia, or intrauterine fetal death [17, 20].

Laboratory diagnosis of Parvovirus B19

Laboratory diagnosis for B19V is usually carried out using different serological and molecular techniques. Serological techniques are based on detection of IgM and IgG anti-B19V antibodies in sera or bloods. IgM class is considered to be specific marker to differentiate the acute phase from convalescent phase of infection, it can be detected during the first few months after B19V infection, whereas, IgG anti-B19V antibodies are considered to be specific marker for remote infection.

Several Serological tests are used for B19V diagnosis, the most commonly used are: immunofluorescence tests, enzyme-linked immunosorbent assay (ELISA) test as well as Immunoblot tests. Numerous diagnostic assays for anti-B19V antibodies are currently commercially available such as, The ELISA

test (EIAgen parvovirus B19 IgM and IgG kit Adaltis, Italy).The virus antigen is a recombinant protein (baculovirus recombinant protein VP1 and VP2 protein). Moreover, other serological techniques based on antigen detection are commercially available. In fact, many researchers focus on developing rapid diagnostic methods like haemagglutination tests for the detection of virus and infected tissues [22].

Recently, molecular techniques based on detection of B19V DNA have been used and developed, such as conventional polymerase chain reaction (PCR) and Quantitative PCR (qPCR). These molecular techniques seem to be more sensitive than serological tests for B19V diagnosis. Furthermore, molecular techniques like qPCR allow the identification of past and recent parvovirus B19 Infection in immunocompetent individuals [23].

Human B19 virus vaccine

The sequencing of human parvovirus B19 genome has encouraged researcher to develop an effective and safe vaccine to protect peoples against B19V infection. Numerous researches have been performed targeting the production of recombinant vaccine (MEDI-491) composed of capsid proteins VP1 and VP2. First clinical trials indicate that MEDI-491 was safe and immunogenic. Moreover, the results obtained seemed promising [24].

B19 Virus Infection in SAUDI ARABIA

In Saudi Arabia, few studies have been performed to determine the seroprevalence of immunoglobulin-G (IgG) to B19V in Saudi blood donors in western areas of Saudi Arabia; Jeddah and Makkah [25, 26].

In 1993, a study have been conducted by Al-Frayh and colleagues to detect parvovirus B19-specific-IgG and IgM antibodies in the serums of patients and general blood donors in Saudi Arabia.in this study, all samples were tested using indirect enzyme-linked immunosorbent assay (ELISA). Results have demonstrated that specific IgM antibodies were detected in 94 % of samples tested, whereas, specific IgG antibodies were detected in 85 % of samples collected. [25]

Recently, another study has been performed by Johargy in Makkah city in Saudi Arabia. In fact, Johargy has tested 578 samples of Saudi blood donors using available ELISA test. Interestingly, the results have demonstrated that among 578 samples tested parvovirus B19-specific-IgG antibodies were detected in 441samples, which means that 76.3% of blood donors have been exposed to this virus. Actually, these results were in good agreement with previous published studies in others countries. [26]

DISCUSSION AND CONCLUSION

Moreover, it was strongly believed that there is a correlation between parvovirus infection and occurrence of malignant tumors. In 2012, LI and co-workers have investigated the effect of parvovirus B19 infection on the occurrence of malignant tumors. In fact, they have demonstrated that the prevalence of B19 DNA in cancer patients was 50.69% whereas in healthy controls the prevalence of B19 DNA was only 4.5%. This result suggested that there is a potential correlation between B19 virus infection and occurrence of cancer [27].

To conclude, until now, our information regarding the seroprevalence of human parvovirus B19 and its role in people in Saudi Arabia is sparse and still unknown. Therefore, further studies are required to determine the seroprevalence rate of immunoglobulin- G and immunoglobulin- M to human parvovirus B19 in the general population of Arabic countries, especially in women of childbearing age in Saudi Arabia.

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