REVIEW ARTICLE

Seroepidemiology of Parvovirus B19 (PVB19] and Human Papillomavirus [HPV] 16 and 18 in Women with Abnormal Pregnancy Outcomes: A Review

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Abstract
Background: The role of Parvovirus B 19 (PVB19) and human papillomavirus (HPV) was not fully understood as there is a limited study that reported the seroepidemiology of these agents.
Aim: To evaluate the role of PVB19 and HPV 16 and 18 as risk factor on pregnancy outcomes
Materials and methods: Published articles on the role of PVB19, HPV 16 and 18 in women with bad obstetrics history retrieved from Google and reviewed. For PVB19 thirty-five global studies and 9 studies in Arab countries were reviewed.
Results: PVB19 median for IgG seroprevalence was 53.3%, while for IgM the median seroprevalence was 10.3%. Additionally, the mean IgG seroprevalence was 53.04±23.6%, while IgM mean seroprevalence was 20.01±27.71%. HPV seroprevalence of HPV-16 was with a range of 0.72% to 97.71%, while, HPV-18 seroprevalence was with a range of 0.5% to 27.6%.
Conclusions: HPV and PVB 19 were with a wide range of seroprevalence, however, may play a role in the development of bad obstetric outcome.
Key words: Global, Arab countries, Bad obstetrics history, Bad obstetrics outcome, Human parvovirus B19, Human papilloma virus.

1. Parvovirus B 19

1.1. Virus characteristics

Parvovirus is non enveloped viruses and has a linear and single-stranded DNA (ssDNA) genome of 5 to 6 kb, which is flanked by two terminal hairpin structures [1, 2]. B19V was discovered in 1975 by Cossart and colleagues during screening for hepatitis B virus [3]. Three viral genotypes were identified [4-19], however, all three genotypes appear to have similar biological, pathogenic, and antigenic properties and make up a

single serotype [14, 20-22]. Genotype 1 was the most common worldwide genotype [8], while genotype 2 predominant in Finnish, [23] and genotype 3 is endemic in Ghana, but it has sporadically been encountered in Europe, Brazil, India, and South Africa [8,9, 14, 24-29].

1.2. Transmission

Human papilloma virus B 19 (PV B19) may be transmitted by respiratory droplets, transfusion of blood and blood products or to the fetus by transplacental passage [30-36].

1.3. Epidemiology

HPVB19 infection is with worldwide distribution [28; 29]; however, age and location influenced the seroprevalence rate [37-54]. Previous studies reported seroprevalence rate of about 15% in pre-school children, 50% in adults and 85% in the elderly [55-59]. Additionally, the HPVB19 infection prevalence was lower in isolated communities, while it was higher developing countries [60-63]. The infection is followed by lifelong immunity in immunocompetent subjects and with seasonal variation and higher prevalence in hot climates [37, 38, 55]. Disease epidemicity follows 3 to 6 year cycles [37, 55, 64-67], during which groups at risk are children and their domestic contacts, school or nursery workers [34, 35, 56, 68-70]. During epidemics 50% of susceptible children and 25% of susceptible population are prone to secondary attack [41, 69-72].

1.4. Human Parvovirus B19 Reported Studies in Women with BOH.

Thirty-five studies [73-107] outlining the prevalence of maternal parvovirus is shown in Table 1. These studies detected the presence of antibodies to parvovirus as a marker of maternal infection in women with history of BOH. The highest seroprevalence of IgG was 97.9% which was reported for USA [83], while the lowest prevalence rate was 13.2% which reported for Nigeria [85]. Concerning IgM, the highest prevalence in women with BOH was reported in Ireland (97.9%) [88], while the lowest rate was reported in Korea (0.5%) [99]. The mean of IgG parvovirus B19 OF the global studies was 52.80±25.21%, while it was 17.69±26.67% for IgM. However, the median was 53% and 10.3% for IgG and IgM respectively.

In Arab countries, ten studies [50,108-116] outlining the prevalence of maternal parvovirus is shown in Table 2. In women with BOH, the higher IgG seroprevalence was 74.7%, which was reported in Diyala, Iraq [112], while the lowest parvovirus IgG seroprevalence was reported in Diyala, Iraq (19.9%) [114]. Concerning IgM, the highest prevalence was 84%, which reported for Egypt [111] in women with BOH. While the lowest IgM parvovirus seroprevalence was reposted for Sudan (0.2%) [116]. The mean of IgG parvovirus seroprevalence was 53.88±18.78%, while it was 26.11±31.30% for IgM. The median for IgG seroprevalence was 61%, while it was 5% for IgM. When all the 44 studies pooled, the median for IgG seroprevalence was 53.3%, while for IgM the median seroprevalence was 10.3%. Additionally, the mean IgG seroprevalence was 53.04±23.6%, while IgM mean seroprevalence was 20.01±27.71% .

86. Human Papilloma Virus 16 and 18

Human papillomavirus (HPV) is one of the most prevalent sexually transmitted viral infections in women worldwide [117]. The virus is with more than 180 genotypes with varied virulence [118]. HPV is an oncogenic virus and divided into high risk and low risk HPV. HPV 16 and HPV 18 were classified as high risk HPV [119]. High risk HPV infection is associated with cervical cancer, oropharyngeal, head, and colorectal carcinomas [120,121]. Additionally, HPV infections were associated with bad obstetric outcomes [122-137]. A systematic literature review and meta-analysis [138] indicated that there was no significant association between HPV infection and spontaneous abortion. However, pooled OR indicated that HPV infection increased the ratio of

spontaneous abortion. HPV infection is common in the general population with a wide range infection rate (0.6% in Iran to 83.3% in Jamaica [139].

2.2. Human papillomavirus studies in women with bad obstetric history.

Seventeen studies [140-156] outlining the prevalence of maternal HPV is shown in Table 3. The seroprevalence of HPV-16 was with a range of 0.72% in Saudi Arabia [154] to 97.71% in China [144]. While, HPV-18 seroprevalence was with a range of 0.5% in China [143] to 27.6% in Brazil [146].

In women with normal cervical cytology, HPV 16 was with global variable ranges. In Africa, detection range was 0.5% in Algeria to 12.8% in Tanzania. However, within the same country, there HPV 16 infection is varies in different studies. The rate range of infection was 0.5-6.8%, 3.5-7.5%, 1.3- 4.1%, 1.5-3%, and 1.6-5.2% for Algeria, Kenya, Morocco, Nigeria, and Tunisia respectively [139].

In America, the range of HPV 16 infection rate was 0.5% in Brazil to 36.6% in Colombia. Additionally, the infection rate was 0.5-9.6% for Brazil, 3.3-36.6% for Colombia, 1.2-11.3% for Mexico, 1.9-8.7% for Canada, 3.2-15.1% for Argentine and 0.5-26.7% for USA [139].

In Asia, the HPV16 infection rate was 0.2% in Kuwait to 22.9% in Korea. However, the rate varies between the studies performed in the same country. The infection rate was 0.7-22.9% for Korea, 0.3-4.5% for Japan, 1.8-4% for Iran, 0.5-10.1% for India, 0.9-10.9 for China, 0.2-3.1% for Taiwan 1.4-7.1% for Turkey and 0.7-12.9% for Thailand [139].

In Europe, the HPV 16 infection rate was 0% in Greece to 24.1% in Russia. HPV 16 infection rate range was 0-4% for Greece, 0.1-4.4% for UK, 0.4-3.1% for Spain, 0.9-2.7% for Netherland, 0.9-8.8% for Italy, 1-5.8% for Sweden, 1.1-6.6% for Germany, 1.4-5.6% for Belgium, 1.8-10.6 for France, 2.7-24.1% for Russia, and 4-8.4% for Denmark. In Australia, one study reported infection rate of 5.8% of HPV 16 in women with normal cervical cytology [139].

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Table 1. Characteristics and results of global studies reporting the prevalence of maternal human parvovirus B19 infections

Article	Location, study setting	Type and study duration	Population	Results
Marcinek et al [73]	Poland, Hospital	Cross- sectional	633 BOH pregnant women	IgG 35%; IgM 19.5%
Turkdaq et al [74]	Turkey, Hospital	Cross-sectional	631 BOH pregnant women	IgG 34.7%
Wanq et et al [75]	China, Hospital	Cross- sectional	105 Embryo tissue	24.5% PB19 DNA positive
Amish et al [76]	Italy, Hospital	Prospective	494 BOH pregnant women	IgM 2.4%
Cohen et al [77]	England, Hospital	Case control, 2 year	300 BOH pregnant women	IgG 53%
Sohrabi et al [78]	Iran, Hospital	Cross- sectional, 1 year	79 BOH pregnant women	IgG 55.7%
Fatemeh et al [79]	Iran, Hospital	Cross- sectional, 1 year	156 BOH pregnant women	IgG 21.8%; IgM 10.3%
Janak et al [80]	India, Hospital	Prospective, 1 year	89 BOH pregnant women	IgM 13.6%
Salimi et al [81]	India, Hospital	Cross- sectional	1303 BOH pregnant women	IgG 86.9%
Reza et al [82]	Iran, Hospital	Case control	31 placenta tissue	7.7% PCR positive PVB19
Ella et al [83]	USA, Hospital	Review, 2 year	198 BOH pregnant women	IgG 97.9%; IgM 92.3%

Table 1 continued

Article	Location, study setting	Type and study duration	Population	Results
Porter et al [84]	**USA, Hospital**	**Prospective**	**96 women with spontaneous abortion**	**8% positive for PVB19 DNA**
Akyala et al [85]	**Nigeria, Hospital**	**Case control, 8 months**	**273 BOH pregnant women**	**IgG 13.2%; IgM 27.5%**
Kishore et al [86]	**India, Hospital**	**Cross- sectional, 1 year**	**399 BOH pregnant women**	**IgG 39.9%; IgM 6.8%**
Ziyaeyanet et al [87]	**Iran, Hospital**	**Cross- sectional, 1 year**	**184 BOH pregnant women**	**IgG 69%**
Butchko et al [88]	**Ireland, Hospital**	**Cross-sectional, 6 months**	**194 BOH pregnant women**	**IgG 97.4%; IgM 97.9%**
Jegede et al [89]	**Nigeria, Hospital**	**Case control, 5 months**	**230 BOH pregnant women**	**IgG 48.2%**
Xu et al [90]	**Switzerland, Hospital**	**Case control, 3 months**	**116 women with spontaneous abortion**	**27.4% positive for PVB19 DNA**
Skjolclebrand et al [91]	**Sweden, Hospital**	**Prospective, 2 years**	**457 BOH pregnant women**	**IgG 81%**
Schoub et al [92]	**South Africa, Hospital**	**Prospective, 8 months**	**1967 BOH pregnant women**	**IgM 3.2%**
Okojokwu et al [93]	**Nigeria, Hospital**	**Cross-sectional**	**326 pregnant women attending antenatal clinic**	**IgG 52.5%; IgM 9.5%**
Cartter et al [94]	**Ireland, Hospital**	**Prospective, 4 months**	**796 BOH pregnant women**	**IgG 53%; IgM 6.1%**
Kaiser et al [95]	**USA, Hospital**	**Retrospective, 7 years**	**15 Autopsies**	**IgG 26.6%**
Gratacos et al [96]	**India, Hospital**	**Prospective, 9 months**	**161 BOH pregnant women**	**IgG 35%; IgM 3.7%**

Table 1 continued

Article	Location, study setting	Type and study duration	Population	Results
Emiasegen et al [97]	**Nigeria, Hospital**	**Prospective, 1 year**	**273 BOH pregnant women**	**IgG 27.5%; IgM 13.2%**
Abiodun et al [98]	**Nigeria, Hospital**	**Case control, 6 months**	**231 BOH pregnant women**	**IgG 20%; IgM 4%**
Yoo et al [99]	**Korea, Hospital**	**Prospective, 2 years**	**221 BOH pregnant women**	**IgG 53.3%; IgM 0.5%**
Oszukowshi et al [100]	**Poland, Hospital**	**Cross- sectional, 10 months**	**78 BOH pregnant women**	**IgM 12.8%**
Wermelinger et al [101]	**Brazil, Hospital**	**Case control, 11 months**	**214 BOH pregnant women**	**IgM 14.8%**
Odland et al [102]	**Russia, Hospital**	**Cross sectional**	**182 BOH pregnant women**	**IgG 75.3%**
Jensen et al [103]	**Denmark, Hospital**	**Prospective, 2 years**	**3596 BOH pregnant women**	**IgG 66%; IgM 12.9%**
Mirambo etal [104]	**Tanzania, Hospital**	**Cross-sectional, 7 months**	**258 Antenatal clinic**	**IgG 55%; IgM 32.8%**
Lassen et al [105]	**Denmark, Hospital**	**Cross-sectional, 3 years**	**2918 BOH pregnant women**	**IgM 0.8%**
Shukri et al [106]	**Scotland, UK, Hospital**	**Cross-sectional, 4 years**	**2447 pregnant women**	**IgM 1.63%**
Rahbar etal [107]	**Iran, Hospital**	**Cross-sectional, 1 year**	**94 BOH pregnant women**	**IgM 18.1%**

Table 2. Characteristics and results of studies in Arab countries reporting the prevalence of maternal human parvovirus B19 infections

Article	Location, study setting	Type and study duration	Population	Results
Elfatah et al [108]	Libya, Hospital	Case control, 1 year	150 BOH pregnant women	IgG 61%; IgM 5%
Makhsheed et al [109]	Kuwait, Hospital	Cross-sectional, 6 months	150 BOH pregnant women	IgG 53.3%; IgM 2.2%
Sadoon et al [110]	Iraq, Hospital	Case control, 1 year	182 BOH pregnant women	IgM 53.8%
Zaki et al [111]	Egypt, Hospital	Case control, 1 year	50 Recurrent abortion	IgM 84%
Abdul-Razak et al [112]	Diyala, Iraq, Hospital	Case control, 1 year	91 BOH pregnant women	IgG 74.7%; IgM 3.3%
Majeed [113]	Thi Qar, Iraq, Hospital	Cross- sectional, 10 months	100 spontaneous abortion	IgG 50%; IgM 46%
Hussein [114]	Diyala, Iraq, Hospital	Cross-sectional, 8 months	90 spontaneous abortion	IgG 19.9%; IgM 14.41%
Abdulhassan et al [115]	Baghdad, Iraq, Hospital	Cross-sectional, 6 months	200 BOH women	PLASMA 20% PCR PVB19
Adam et al [116]	Sudan, Hospital	Cross-sectional, 5 months	500 pregnant women	IgG 64.4%; IgM 0.2
Marwan & Bhtouri [50]	Syria, Hospital			

Table 3. Characteristics and results of studies reporting the prevalence of maternal human papilloma virus 16/18 infections

Article	Location, study setting	Type and study duration	Population	Results
Moradi et al [140]	Iran, Hospital	Case control, 1 year	378 BOH pregnant women	HPV 16= 5.8% ; HPV 18 = 4%
Mona et al [141]	Egypt, Hospital	Case control, 1 year	45 BOH women	HPV 16 = 20%; HPV 18 = 10%
Bahiaet et al [142]	Morocco, Hospital	Cross-sectional, 1 year	751BOH women	HPV 18 = 42.5%
Paul et al [143]	China, Hospital	Cross-sectional, 1 year	2080 BOH pregnant women	HPV 16 = 1.3%; HPV 18 = 0.5%
Rong et al [144]	China, Hospital	Cross-sectional, 1 year	1997 BOH pregnant women	HPV 16 = 97.71%;HPV 18 = 14.2%
Ghazeet et al [145]	Saudi Arabia, Hospital	Cross- sectional, 1 year	100 BOH pregnant women	HPV 16 = 71%; HPV 18 = 15%
Pereira et al [146]	Brazil, Hospital	Case control, 1 year	201 pregnant women	HPV 16 = 53.3%; HPV 18 = 27.6%
Silva et al [147]	Brazil, Hospital	Cross-sectional, 1 year	70,000 BOH women	HPV 16 = 5.3%; HPV 18 = 1.3%
Piras et al [148]	West Africa, Hospital	Cross-sectional, 9 months	725 BOH women	HPV 16 = 17.6%; HPV 18 = 14.8%
Mortazavi et al [149]	Iran, Hospital	Retrospective, 8 months	691 BOH women	HPV 16 = 73.9%; HPV 18 = 11.6%
Sharbatdaran [150]	Iran, Hospital	Case control, 1 year	17 BOH women	HPV 16 = 10%
Pandy et al [151]	India, Hospital	Case control, 20 month	104 pregnant women	HPV 16= 17.3%; HPV 18 = 19.2
Bansul et al [152]	Qatar, Hospital & PHCC	Cross-sectional, 10 month	3008 women	HPV 16= 22.2%; HPV 18 = 22.2%
Elmi et al [153]	Qatar, Hospital & PHCC	Cross-sectional, 17 month	406 women	HPV 16 = 25%
Alobaid et al [154]	Saudi Arabia, Hospital	Cross-sectional, 21 month	417 women	HPV 16 = 0.72%; HPV 18 = 0.95%
Turki et al [155]	Saudi Arabia, Hospital	Cross-sectional, 1 year	40 non pregnant women	HPV 16 = 30%; HPV 18 = 7.5%
Abdulghani [156]	Iraq, Hospital	Case control, 6 months	88 BOH and normal women	HPV 16 =7.5%; HPV 18 =2.5%