Primary and secondary infection with human parvovirus B19 in pregnant women in South Africa

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Abstract **A study of human parvovirus B19 infection in 1 967 pregnant women of all races in Johannesburg revealed an overall prevalence of 24,9% for IgG antibodies and 3,3% for IgM antibodies. Of the 64 IgM-positive sera indicating active infection, 62 were resistant to urea denaturation. No differences in the prevalence of IgG antibodies between population groups were observed, but active infections, as demonstrated by IgM antibodies, were significantly more prevalent in black than in white, coloured or Asian mothers.**

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Human parvovirus B19 has been causally associated with erythema infectiosum (fifth disease) in children, arthralgia and arthritis in adults, transient aplastic crises in subjects with chronic haemolytic anaemia and severe chronic anaemia in immunodeficient patients.[1] Infection during pregnancy may lead to fetal loss, especially during the second trimester, because of severe anaemia of the fetus with resulting congestive cardiac failure and hydrops fetalis. The transplacental transmission rate has been estimated at 33% and the risk of fetal death at 9%.[2]

The determinants of immunity to human parvovirus B19 have not as yet been established. Secondary infection due to reactivation or reinfection may occur as demonstrated by infection of 1 of 4 IgG-positive volunteers following experimental inoculation with the virus.[3] The avidity test which demonstrates the resistance of specific IgG antibodies to denaturing agents such as 8M urea, has been used to distinguish primary (less avid) from reactivation infections or reinfections (more avid IgG antibodies) with viruses such as rubella,[4] cytomegalovirus[5] and varicella.[6]

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Subjects and methods

A total of 1 967 antenatal clinic attenders at Johannesburg Hospital was tested for IgG and IgM antibodies to parvovirus B19 by means of a commercial kit (Mecconti GmbH, Hamburg). Babies born to IgM-positive mothers were investigated clinically and serologically both at birth and at 6 weeks. IgM-positive maternal sera were further tested for IgG avidity with 8M urea as described previously.[5]

Results

Of the 1 967 specimens, 489 (24,9%) and 64 (3,3%) were positive for IgG and IgM respectively. Of the 64 IgM-positive specimens only 2 (3%) had low-avidity IgG antibodies consistent with a primary infection, the remaining 62 having high-avidity IgG antibodies suggesting reinfection. The primary infections occurred in 1 black and 1 coloured subject.

The distribution of the IgG- and IgM-positive sera among the different population groups is shown in Table I. No significant difference in IgG prevalence was found between the groups ($P = 0,43$), whereas the prevalence of IgM antibodies was significantly higher in the black group than in the white, coloured or Asian groups ($P < 0,0001$, Fisher's exact test). No significant differences were found between the latter three groups ($P = 0,45$; χ^2-test).

TABLE I.
Prevalence of anti-B19 antibodies in different race groups

		IgG-positives			IgM-positives		
	No. tested	No.	%	95% CI	No.	%	95% CI
Black	637	180	28,3	24,8 - 31,8	39	6,1	4,2 - 8,0
White	943	236	25,0	22,2 - 27,8	20	2,1	1,2 - 3,0
Coloured	158	37	23,4	16,8 - 30,0	4	2,5	0,1 - 4,9
Asian	151	38	25,2	18,3 - 32,1	1	0,7	0,6 - 2,0

Because of administrative and logistical difficulties, as well as that of delivery occurring elsewhere, only 20 babies of the 62 IgM-positive, secondarily infected mothers were available for clinical examination and the taking of blood specimens. None of these was positive for IgM antibodies, although 6 were positive for IgG antibodies; the remaining 14 were IgM- and IgG-negative. Unfortunately, blood specimens could not be obtained from the babies of the 2 IgM-positive mothers with primary infection. All the babies were clinically normal at birth, as were those who returned after 6 weeks for examination. One IgM-negative baby had a vasculitic skin rash which resolved spontaneously and for which no cause could be found.

Discussion

Human parvovirus B19 infection has been demonstrated in a number of developed countries throughout the world with adult prevalence rates varying from 30% to 60%.[1] However, few prevalence investigations have been carried out in developing countries. In a study of urban and remote rural populations in northern Brazil[7] the B19 parvovirus seroprevalence in the urban population of Belem was found to be similar to that of the developed countries (42,6%), while it was considerably lower among the remote rural tribes (4,7 - 10,7%). In an African study prevalences of 58,4% and 55,0% were found in Malawi and Mauritius respectively, compared with a very low prevalence of 2,2% on remote Rodriguez Island.[8] The 24,9% prevalence of parvovirus B19 antibodies in our sample was lower than the 50 - 60% reported for Malawi and Mauritius and also somewhat lower than figures from developed countries. However, there were no significant differences between population groups in this regard; this is not the case with other airborne viral pathogens, such as measles, where infection is significantly greater in the more overcrowded conditions associated with the poorer socioeconomic status of the black population in South Africa. Nevertheless, the prevalence of IgM antibodies indicative of secondary infection was significantly greater in the black sample when compared with the other population groups.

The vertical transplacental transmission rate has been estimated at 33%.[2] The rate of transmission in our study could not be established as B19 IgM in infant blood is a poor method of diagnosing intra-uterine infection[2] and the babies were not followed up beyond 1 year of age to detect loss of maternal antibodies. However, none of the 20 infants examined at birth showed any signs of anaemia or any other evidence of intra-uterine infection. This is consistent with other reports of a low risk (9%) for fetal loss or damage from parvovirus infection in pregnancy.[1,2] Thus therapeutic termination of pregnancy and routine antenatal screening have not been indicated for parvovirus infection. From our study it is clear that the majority of active infections in pregnancy are not primary but secondary infections, given the presence of avid antibodies resistant to denaturation with 8M urea. It has been well established that reactivation infection with cytomegalovirus, or reinfection with rubella, carries a substantially lesser risk of fetal infection and fetal damage than primary infection.[9,10] Further prospective investigations of parvovirus infection in pregnancy with the avidity test to distinguish primary from secondary infection, should be carried out to ascertain whether the relatively uncommon primary infection carries a greater risk of fetal infection and damage.

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REFERENCES

1. Centers for Disease Control. Risks associated with human parvovirus B19 infection. *MMWR* 1989; **39:** 81-97.
2. Public Health Laboratory Service Working Party on Fifth Disease. Prospective study of human parvovirus (B19) infection in pregnancy. *BMJ* 1990; **300:** 1166-1170.
3. Anderson MJ, Higgins PG, Davis LR, *et al* Experimental parvoviral infection in humans. *J Infect Dis* 1985; **152:** 257-265.
4. Thomas HIJ, Morgan-Capner P. The use of antibody avidity measurements for the diagnosis of rubella. *Rev Med Virol* 1991; **1:** 41-50.
5. Blackburn NK, Besselaar TG, Schoub BD, O'Connell KF. Differentiation of primary cytomegalovirus infection from reactivation using the urea denaturation test for measuring antibody avidity. *J Med Virol* 1991; **33:** 6-9.
6. Kangro HO, Manzoor S, Harper DR. Antibody avidity following varicella-zoster virus infections. *J Med Virol* 1991; **33:** 100-105.
7. De Freitas RB, Wong D, Boswell F, *et al* Prevalence of human parvovirus (B19) and rubellavirus infections in urban and remote rural areas in northem Brazil. *J Med Virol* 1990; **32:** 203-208.
8. Schwarz TF, Gurtler LG, Zoulek G, Deinhardt F, Roggendorf M. Seroprevalence of human parvovirus B19 infection in Sao Tome and Principe, Malawi and Mascarene Islands. *Int J Med Microbiol* 1989; **271:** 231-236.
9. Alford CA, Stagno S, Pass RE, Britt WJ. Congenital and perinatal cytomegalovirus infections. *Rev Infect Dis* 1990; **12:** suppl 7, S745-S753.
10. Best JM, Banatvala JE, Morgan-Capner P, Miller E. Fetal infection after material reinfection with rubella: criteria for defining reinfection. *BMJ* 1989; **299:** 773-775.