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Prevalence of Human Parvovirus (B19) and Rubellavirus Infections in Urban and Remote Rural Areas in Northern Brazil

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Sera from inhabitants of Belém, Pará (542 sera), Brazil and of members of 3 Brazilian tribes—Tiriyo/Alto Paru (near Surinam) (212 sera), Xicrin (128 sera), and Mekranoiti (121 sera)—of different age and sex groups were tested for the presence of specific antibody against human parvovirus (B19) (RIA) and rubellavirus (latex agglutination test).

Parvovirus (B19) IgG was found in 42.6% of the population sample from Belém but in only 4.7 to 10.7% of the members of the tribes. Rubellavirus antibody was found in 72.7% of the sera from Belém but approaching a prevalence of 85–90% in age groups above 20 years. In the tribes rubellavirus antibody was detected in 36.9 to 72.6% of all sera. There were remarkable sex differences of antibody prevalence in several age groups of the population from Belém and of the tribal populations.

About a quarter of the skin rashes in Belém that were not attributable to infections with rubella, measles, or arboviruses were caused by recent B19 infections.

KEY WORDS: primary parvovirus B19 infections, erythema infectiosum (Fifth Disease)

INTRODUCTION

Human parvovirus (B19) has been recognized as the causative agent of erythema infectiosum (Fifth Disease), a common infection in childhood that is generally benign and self-limited and occurs without clinical symptoms in approximately 20% of the cases. In patients with blood diseases such as thalassaemia, hereditary spherocytosis, or sickle cell anaemia, infection with B19 parvovirus leads to life-threatening aplastic crises as the virus preferentially replicates in erythroid progenitor cells [Anderson, 1987; Pattison, 1988]. In immunocompromised patients, parvoviruses B19 initiates chronic infections followed by chronic anaemias [Kurtzman et al., 1988, 1989]. Finally, parvovirus B19 can infect the fetus; this is often followed by spontaneous abortion, but no congenital malformations have been recorded [Pattison, 1988; Hall et al., 1990].

By early adulthood, only 50–60% of the population in the UK have parvovirus B19 antibody [Cohen and Buckley, 1988]. Similar seroprevalences have been found in West Germany [Schwarz et al., 1987], the United States [Koch and Adler, 1989], and Japan [Nunoue et al., 1985]. Rash/arthralgia or arthralgia alone in adult life is frequently caused by primary parvovirus B19 infections [Shirley and Desselberger, 1989].

Due to the importance of parvovirus B19 in human disease, it is of interest to determine its seroprevalence in different populations. For Brazil, infections by parvovirus B19 causing Fifth Disease were first diagnosed in Belém [Miranda et al., 1989]; more recently the prevalence of B19 antibody in the population of Rio de Janeiro has been reported and found to be very high [Nascimento et al., 1990]. We have carried out testing for B19 antibody in over 500 sera obtained in 1983/89 in the Belém area and in several hundred sera collected between 1974 and 1980 in remote areas of the Amazon basin. As a second marker of childhood infections, we have determined the prevalence of rubellavirus antibody in these populations.

MATERIALS AND METHODS

Sera

Sera were obtained from four different areas of Brazil:

1. Belém, Pará: 460 sera collected from healthy inhabitants, many of them blood donors; 78 additional sera were from patients with rashes attend-

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ing the Institute Evandro Chagas in whom acute rubella, measles, and arbovirus infections had been serologically excluded. All sera were collected between 1983 and 1989.
2. Tiriyo tribe, Alto Paru (near the Surinam border); 212 sera collected between 1974 and 1980.
3. Xicrin tribe, Catete; 128 sera collected in 1976.
4. Mekranoiti tribe, Alto Iriri; 121 sera collected in 1977/78.

The geographical location of the tribe sites in relation to Belém is indicated in Figure 1.

Serological Tests

All sera were heated at 56°C for 30 minutes. Anti-B19 IgM and IgG were determined by antibody capture radioimmunoassays as described by Cohen et al. [1983]. Rubellavirus IgG was detected using a latex agglutination assay [Morgan-Capner et al., 1989]. Parvovirus B19 antibody tests were carried out first, and in some cases there was no material left for rubella antibody testing.

Statistics

Frequencies were compared by the Chi square test using the Yates correction for small numbers.

RESULTS

Seroprevalence Data

The prevalence of B19 and rubellavirus-specific antibodies in the 460 sera taken from apparently healthy inhabitants of Belém is shown in Table I. Parvovirus B19 and rubellavirus antibodies showed different prevalences with age. For B19, in the under-10 age group the seropositivity rate was significantly higher in males than in females. However, in those over 10 years of age, the prevalence was consistently near or above 50% for females, whereas in males the seropositivity rate dropped with age to become significantly lower. For rubellavirus antibodies a high seropositivity rate of near or above 90% was found above the age of 20, and no sex differences in prevalence were recorded.

Corresponding seroprevalence data for the Tiriyo, Xicrin, and Mekranoiti tribes are presented in Tables II, III and IV, respectively. The overall prevalences of B19 antibody in the tribe populations were very low, ranging from 4.7% (Xicrin) to 10.7% (Mekranoiti); 8.0% were found for the Tiriyos. The numbers are so small that no further analysis according to different age and sex groups would seem to be meaningful. It is of interest to note that no specific antibody was found in the under-30 members of the Xicrin tribe (Table III). In the Tiriyos, there was a significant drop in prevalence in the 30–39-year-olds followed by a prevalence of 50% in the over 40-year-olds (Table II). Testing for rubellavirus antibody in these sera showed that by the age of 30, only 30% of the Tiriyos had specific antibody (Table II). By contrast, 80% of the Xicrins under the age of 10 years had had rubella (Table III). However, whereas this high level of seroprevalence was maintained in the males, it dropped to low levels in the females (Table III). A very similar phenomenon was recorded for the Mekranoiti tribe (Table IV).

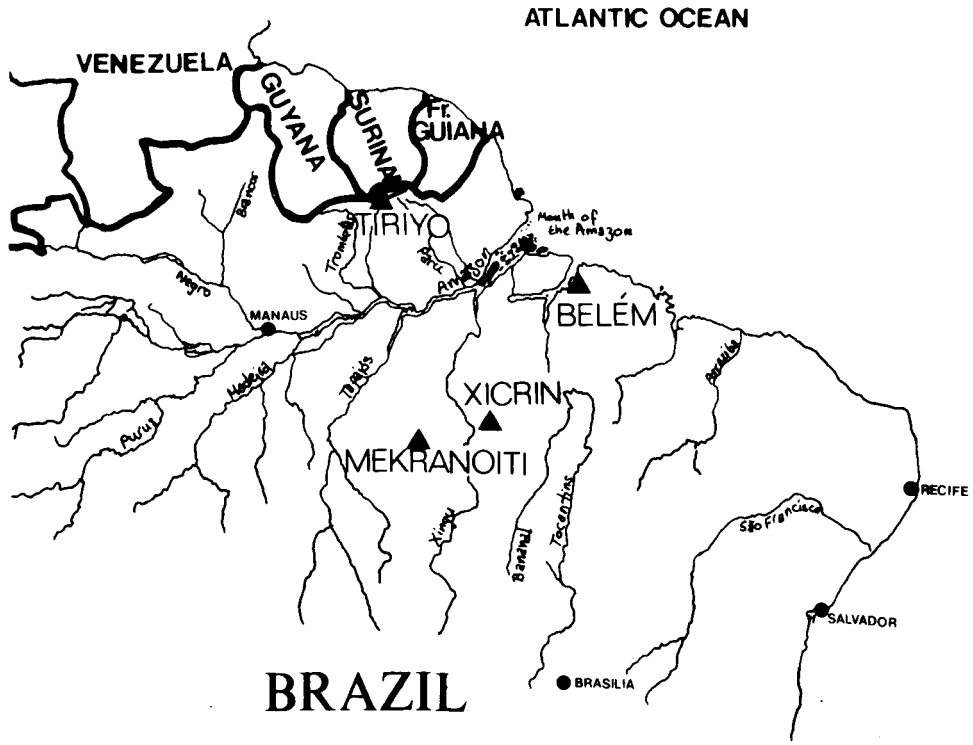

Fig. 1. Map showing the location of the investigated Amazonian communities.

TABLE I. Prevalence of Parvovirus (B19) and Rubellavirus Specific IgG Antibodies in the Population of Belém, 1988-89

Sex/Age (Yr)	Number of Sera Tested for Parvovirus IgG Total	Positive	(%)	Number of Sera Tested for Rubellavirus IgG Total	Positive	(%)
Female						
< 10	59	19	(32.2)	52	9	(17.3)
10-19	20	15	(75.0)	20	14	(70.0)
20-29	25	14	(56.0)	22	18	(81.8)
30-39	24	11	(45.8)	24	21	(87.5)
≥ 40	13	10	(76.9)	13	12	(92.3)
Subtotal of Female (% of Total)	141 (100.0)	69	(48.9)	131 (100.0)	74	(56.5)
Male						
< 10	52	28	(53.8)[a]	50	13	(26.0)
10-19	19	10	(52.6)	15	6	(40.0)
20-29	100	32	(32.0)[a]	78	72	(92.3)
30-39	98	38	(38.8)	97	92	(94.8)
≥ 40	50	19	(38.0)[b]	50	49	(98.0)
Subtotal of male (% of Total)	319 (100.0)	127	(39.8)	290 (100.0)	232	(80.0)
Total Female and Male	460 (100.0)	196	(42.6)	421 (100.0)	306	(72.7)

[a,b]Underlined values differ significantly from corresponding values of females at $P < 0.03$ (a) and $P < 0.02$ (b)

TABLE II. Prevalence of Parvovirus and Rubellavirus Specific IgG Antibodies in Members of the Tiriyo Tribe, 1977-78

Sex/Age (Yr)	Number of Sera Tested for Parvovirus IgG Total	Positive	(%)	Number of Sera Tested for Rubellavirus IgG Total	Positive	(%)
Female						
< 10	4	1		4	0	(0)
10-19	43	1		41	8	(19.5)
20-29	29	2		29	10	(34.5)
30-39	27	1		25	17	(68.0)
≥ 40	3	1		3	1	(33.3)
Subtotal of Female (% of Total)	106 (100.0)	6	(5.7)	102 (100.0)	36	(35.3)
Male						
< 10	1	0		1	0	(0)
10-19	43	3		42	6	(14.3)
20-29	30	2		26	7	(26.9)
30-39	21	0		21	17	(80.9)
≥ 40	11	6		11	9	(81.8)
Subtotal of Male (% of Total)	106 (100.0)	11	(10.4)	101	39	(38.6)
Total Female and Male	212 (100.0)	17	(8.0)	203 (100.0)	75	(36.9)

Parvovirus B19 as the Cause of Exanthematous Disease

Seventy-eight sera collected from patients with rubelliform rashes in Belém between August 1988 and June 1989 were investigated for the presence of B19 IgM antibody after other viral causes of such rashes (measlesvirus, rubellavirus, and arboviruses) had been serologically excluded. The results are shown in Table V. In about a quarter of the cases, recent parvovirus B19 infections were diagnosed and can be regarded as the likely cause of the exanthematous disease. The overall seroprevalence rate in this subgroup did not differ significantly from that of the larger subgroup in whom the screening had been performed (Table I).

DISCUSSION

The prevalence studies for human parvovirus B19 antibodies in a sample of over 500 sera of the popula-

TABLE III. Prevalence of Parvovirus and Rubellavirus Specific IgG Antibodies in Members of the Xicrin Tribe, 1977/78

Sex/Age (Yr)	Number of Sera Tested for Parvovirus IgG Total	Positive	(%)	Number of Sera Tested for Rubellavirus IgG Total	Positive	(%)
Female						
< 10	23	0		22	18	(81.8)
10-19	8	0		8	4	(50.0)
20-29	17	0		17	3	(17.6)
30-39	12	3		12	3	(25.0)
≥ 40	5	1		4	3	(75.0)
Subtotal of Female (% of Total)	65 (100.0)	4	(6.2)	63 (100.0)	31	(46.3)
Male						
< 10	15	0		15	12	(80.0)
10-19	15	0		15	14	(93.3)[a]
20-29	17	0		17	16	(94.1)[b]
30-39	15	1		15	15	(100.0)[b]
≥ 40	1	1		1	1	(100.0)
Subtotal of Female (% of Total)	63 (100.0)	2	(3.2)	63 (100.0)	58	(92.1)
Total Female and Male	128 (100.0)	6	(4.7)	126 (100.0)	89	(70.6)

[a,b]Underlined values differ significantly from corresponding values of females at $P < 0.02$ (a) and $P < 0.001$ (b).

TABLE IV. Prevalence of Parovirus and Rubellavirus Specific IgG Antibodies in Members of the Mekranoiti Tribe, 1977/78

Sex/Age (Yr)	Number of Sera Tested for Parvovirus IgG Total	Positive	(%)	Number of Sera Tested for Rubellavirus IgG Total	Positive	(%)
Female						
< 10	16	0		16	14	(87.5)
10-19	13	1		13	10	(76.9)
20-29	18	4		18	8	(44.4)
30-39	12	2		11	4	(36.4)
≥ 40	6	2		6	3	(50.0)
Subtotal of Female (% of Total)	65 (100.0)	9	(13.8)	64 (100.0)	39	(60.9)
Male						
< 10	16	0		16	15	(93.8)
10-19	11	2		8	6	(75.0)
20-29	21	2		21	18	(85.7)[a]
30-39	2	0		2	2	(100.0)
≥ 40	6	0		6	5	(83.3)
Subtotal of Female (% of Total)	56 (100.0)	4	(7.2)	53 (100.0)	46	(86.8)
Total Female and Male	121 (100.0)	13	(10.7)	117 (100.0)	85	(72.6)

[a]Underlined value differs significantly from corresponding value of females at $P < 0.01$.

tion of Belém showed that at the age of 20 approximately half of the population had experienced infection with this virus. This prevalence figure is comparable with those reported for populations in Europe, the United States, and Japan [Nunoue et al., 1985; Schwarz et al., 1987; Cohen and Buckley, 1988; Koch and Adler, 1989]. Nascimento et al. [1990] observed a seroprevalence of nearly 80% in Rio de Janeiro at the age of 15, which is higher than found in most studies, possibly due to the fact that the sera were collected in a very crowded urban environment. The decrease in B19 antibody prevalence in the 20–40-year-old age groups (especially the female subgroups) in Belém was similar to that found by Nascimento et al. [1990] in Rio and by Cohen and Buckley [1988] in the UK. There was a significant difference in seroprevalence in the sexes

TABLE V. Evidence of Recent Parvovirus Infection in Patients With Rashes,* Belem, 1988/89

Sex/Age (Yr)	Total Number of Sera Tested	Number of Sera Positive for Parvovirus IgM + IgG	IgG Only
Female			
< 10	28	8	2
10-19	5	3	1
20-29	13	4	1
30-39	3	0	1
Subtotal of Female (% of Total)	49 (100.0)	15 (30.6)	5 (10.2)
Male			
< 10	25	6	2
10-19	1	0	0
20-29	1	0	0
30-39	2	1	1
Subtotal of Male (% of Total)	29 (100.0)	7 (24.1)	3 (10.3)
Total Female and Male (% of Total)	78 (100.0)	22 (28.2)	8 (11.5)

*Infections with measlesvirus, rubellavirus, and arboviruses have been previously excluded in these sera (unpublished results).

showing a higher overall prevalence in the females in Belém (Table I). Such a sex difference has also been recorded in Germany [Schwarz et al., 1987] and in the United States [Koch and Adler, 1989]. Although our numbers are small, it could be assumed that contact between infected children and women is more intense than between children and men.

The prevalence of rubellavirus antibody in the population sample of Belém reaches 80–90% in the 20–29-year-old age group and remains high, indicating a high rate of infection at early age with this virus. These results are similar to those obtained by Black et al. [1986], who found prevalence rates of 78–84% in the same age groups in four different urban areas of Brazil, including Belém.

The test results of over 400 sera obtained from 3 tribes living in remote areas in the north (Tiriyo) and the south (Xicrin, Mekranoiti) of the Amazon Basin (Fig. 1) are strikingly different from those obtained in Belém. The prevalence rate for B19 antibodies is generally very low. The virus seems to infect a few people but not to spread widely. This is surprising given the generally high susceptibility of the tribes in remote places to B19 infection. Living conditions are more basic but obviously not as crowded as in urban areas. There may, however, have been waves of infection. The 30–40-year-old Tiriyos show infections in only 1 out of 48 (2.1%; Table II), whereas in the over-40-year-olds, 7 out of 14 (50%; differences significant at $P < 0.001$) were infected. Whereas the under-30-year-old Xicrins do not have a single seropositive tested individual (0/95; Table III), the over-30-year-olds show a seroprevalence of 18.2% (6/33; Table III). The Mekranoiti people show a constant seropositivity of approximately 15% in the age groups above 10 years old (Table IV).

The rubellavirus antibody data of the tribes indicate for the Tiriyo a high seropositivity rate of 70–80% above the age of 30 years; this level of prevalence has been arrived at 10–15 years later than in the population of Belém (Tables I and II). By contrast, members of the Xicrin and Mekranoiti tribes seemed to have experienced rubellavirus infections significantly earlier (Tables I–IV). It is of great interest to observe that in females of both the Xicrin and Mekranoiti tribes, the prevalence of measurable rubellavirus antibody drops with age, whereas it stays high in the men (Tables III and IV). This may indicate that rubellavirus infects the tribal areas in waves and that possibly the men have more contact with urban environments.

The analysis of the sera of patients with rashes in whom measlesvirus, rubellavirus, and arboviruses had been excluded as a cause of infection showed that a quarter of those tested were positive for B19 IgM antibody. This suggests that parvovirus B19 is a frequent cause of illness with rash; also in adolescence and early adulthood. Enterovirus infections as possible causes of the rashes in the remaining sera are being investigated at present.

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