The relationship of blood-group type to American cutaneous leishmaniasis

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Following the hypothesis that *Leishmania* parasites escape the host defence mechanisms by mimicry of human blood group antigens, conflicting reports have been published. We tested the hypothesis in American cutaneous leishmaniasis, due to *L. braziliensis guyanensis*, by comparing the distribution of blood groups (ABO and Rhesus) among 96 patients in French Guiana with that among 1945 healthy controls. No association between blood groups and disease was found in this study, but further studies are needed with strains of the *L. mexicana* complex.

The association of certain human blood groups with parasites is a controversial subject. In some cases positive correlations have been demonstrated, as in schistosomiasis (Pereira *et al.*, 1979) and giardiasis (Barnes and Kay, 1977), while in other cases, such as filariasis (Higgins *et al.*, 1985), no evidence of correlation appeared to the investigators. In the particular case of leishmaniasis the same discrepancy occurs: Walton and Valverde (1979) noted racial differences in the evolution of muco-cutaneous leishmaniasis (MCL) due to *Leishmania braziliensis braziliensis*, and Decker-Jackson and Honigberg (1978) found that surface glycoproteins of *L. tropica* and *L. donovani* were comparable to certain ABO blood groups, suggesting a possible escape mechanism for these parasites in relation to the blood groups of the patient (Greenblatt *et al.*, 1981). On the contrary, a study of Brazilian patients with American Visceral Leishmaniasis (AVL) due to *L. donovani chagasi* did not show any significant correlation between ABO blood groups and the development of the disease (Evans *et al.*, 1984).

In order to determine whether there is an association between blood group types and American cutaneous leishmaniasis (ACL) due to *L. braziliensis guyanensis*, the distribution of blood groups in patients with this form of leishmaniasis observed in French Guiana was compared with that in a control group of individuals living in the same country, with special attention being paid to ethnic origin and way of life.

MATERIALS AND METHODS

For infected patients, the diagnosis of ACL was parasitologically confirmed by examination of positive smears. In the majority of cases identification of the parasite was made by measurement of the amastigotes in the smears, by behaviour of the parasites in cultures and in hamsters' feet, and by isoenzyme characterization.

The distribution of blood group types in two groups of infected patients was compared with that in three groups of control subjects.

The first group of patients was composed of military personnel of creole origin (French West Indies and French Guiana) undertaking a one-year period of military service between 1984 and 1986. These individuals have relatively frequent contact with the forest, and generally more than one quarter of them develop a cutaneous leishmaniasis. The second group, ACL patients of European origin, was composed of some hunters or scientists coming

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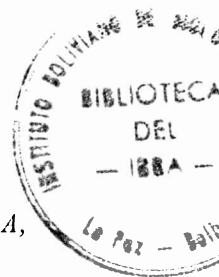
from France, together with a majority of volunteers from the Foreign Legion based in Kourou. Because of their considerable activity in the forest, carrying out civil engineering works, clearing areas, etc., these latter had very frequent contact with infected sandflies, and they made up the majority of the patients examined at the Pasteur Institute of Cayenne.

A first control group (Group 3) was composed of healthy men having the same criteria as the first group of patients: creole origin, life in the same military organization near Cayenne, and training in the forest. In a similar way, we used a second control group (Group 4) with a composition similar to that of the corresponding patients group: healthy soldiers of the Foreign Legion. A third control group (Group 5) was made up of all blood donors in 1986 at the Centre of Transfusion of the Hospital of Cayenne. The composition of this group was the best approximation we could obtain to that of the general population, and was useful for normal population reference.

In the two groups of infected patients (Groups 1 and 2) and in control Group 5, peripheral blood was taken by venepuncture and placed on special paper (Transfu-Labo Service, Milly, France). Commercially available anti-A, anti-B, anti-A+B and anti-O antisera (Centre National de Transfusion Sanguine, Paris, France) were used to determine the blood type. For the subjects in Groups 3 and 4, ABO and rhesus blood groups were obtained from the records of the military health service. For each patient and control the following data were collected: age, sex, ethnic origin, frequentation of the forest, location of habitation and (for patients) of presumed contamination.

All the data were put into a microcomputer, and then several statistical comparisons were made to assess the association of blood group types with other parameters. We used a chi-square test, included in a software statistical package (Statist, Laboratoire d'Information médicale, Faculté de Médecine, Nancy, France), and four-fold tables using Yates' correction.

RESULTS AND DISCUSSION

The Results are shown in the Table.

Comparisons between the different groups did not show any significant difference, except between Group 2 and Group 5. This may be due to the fact that the creole population is in the majority in Group 5, and differs from the European population in its ABO blood group proportions. This result strongly suggests that there is no correlation between blood group type (ABO and rhesus) and ACL due to *L. braziliensis guyanensis*.

In accordance with the comments of several authors of population-based studies (Gyorkos *et al.*, 1983; Evans *et al.*, 1984) we gave special attention in this study to statistical problems. First, we were very careful with the selection of the different samples. One solution is to enter patients and controls randomly in the study, as did Gyorkos *et al.* (1983), but we considered that the case/control method could be used with a minimum of precautions, particularly by selecting control groups very similar to the patients' groups, and also a general control group similar to the general population of the country. Second, we used sufficient numbers of controls and checked that the ratio of patients to controls was not too low.

Furthermore, the pooling of data was as homogeneous as possible. The National Centre of Transfusion gives one test for blood-group determination with standardized antisera, so no variations and only a very limited possibility of error are present. The infections with *Leishmania* were evaluated by trained scientists in a laboratory, and not based on clinical features. The patient groups were homogeneously infected with *L. braziliensis guyanensis*, which is the dominant subspecies in French Guiana where 88 of 91 isolates obtained from human lesions were characterized as *L. braziliensis guyanensis* by isoenzyme techniques. Finally, the interpretation of statistical significance with a computer-based analysis, using a widespread microcomputer system and a commercial software package, permits very easy verification

TABLE

Distribution of blood groups in patients with American cutaneous leishmaniasis and in controls from French Guiana

Group *	No. in Group	No. (%) in blood group				Rh	
		A	O	B	AB	+	−
INFECTED GROUPS							
Group 1	36	12 (33·3)	17 (44·4)	6 (16·6)	1 (2·7)	34 (94·4)	2 (5·6)
Group 2	70	36 (51·4)	23 (32·8)	11 (15·7)	0 (0)	55 (78·5)	15 (21·5)
CONTROL GROUPS							
Group 3	42	12 (28·5)	20 (47·6)	8 (19·0)	2 (4·7)	38 (90·5)	4 (9·5)
Group 4	378	164 (43·3)	159 (42·0)	45 (11·9)	16 (4·2)	299† (83·7)	58† (16·2)
Group 5	1525	425 (27·9)	758 (49·7)	294 (19·2)	48 (3·2)	1421 (93·2)	104 (6·8)

*Group 1, patients of creole origin with ACL; Group 2, patients of European origin with ACL; Group 3, control group for group 1; Group 4, control group for group 2; Group 5, control group of donors to blood bank in Cayenne.
†Figures from 357 examinations.

of our conclusions. Further discussion concerning the mathematical basis for biomedical studies, particularly the alternative use of Poisson or binomial regression models, have been detailed elsewhere (Frome, 1986) and can be performed on any microcomputer (Frome and Checkoway, 1985).

The conclusion of our study is similar to that of Evans *et al.* (1984) on AVL, which fails to support the hypothesis of camouflage by using blood group antigens. In their studies on AVL, these authors suggest that the susceptibility of humans to species other than *L. donovani chagasi* may possibly be related to ABO blood type. Apparently this is not true for *L. braziliensis guyanensis*, but further studies are needed with strains of the *L. mexicana* complex.

Rather than a correlation between leishmaniasis in humans and the presence of red-blood-cell antigens other than ABO, we prefer to envisage the alternative hypothesis—also suggested by Evans *et al.*—that susceptibility to leishmaniasis, whether visceral or cutaneous, might be related to surface antigens on human mononuclear phagocytes.

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