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SPIROCHETAL INFECTION IN ISOLATED INDIAN POPULATIONS

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For several years we have been studying infectious diseases of recently contacted Brazilian Indians, and have enjoyed PAHO's support in this work. A few years ago, we reported on aspects of the measles virus to the Advisory Committee on Medical Research. Since then, we have also published on the epidemiology of a wide variety of diseases in these populations. Today, I would like to focus on one aspect: the nature and incidence of treponemal infections. This subject appeared to be important to us, because it is commonly supposed, on the basis of non-quantitative information from other parts of the world, that syphilis is one of the most important factors in the demise of primitive peoples following contact with cosmopolitan culture. Its effects may be insidious but particularly damaging toward reproductive capacity.

Of the four recognized treponemal diseases only bejel is absent from northern Brazil. Pinta, yaws and venereal syphilis, all have been reported in the Amazon Basin. To my knowledge these three diseases can only be distinguished on clinical grounds; in fact, some people believe that they are all caused by the same agent in different ecological circumstances. In addition to clinical observations, we have used the VDRL and FTA-ABS tests. The first, a flocculation test for reagin, is relatively non-specific and transitory. It usually reverts to negative or low titer after successful treatment and in late stages of the infection. The other, a fluorescent antibody test, is much more specific than the VDRL test. Even so, it does not distinguish between the treponemal diseases, and we could not be sure that it would not give cross-reactions with other human spirochetal infections. Positive reactions with this test do not quickly revert to negative on treatment of the disease.

*Prepared by Drs. Francis L. Black and Richard V. Lee, Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, Connecticut, U.S.A.

I will discuss data from four tribal groups. Incidentally, I hope you will permit me to use the Brazilian term ["]pacification.["] Its literal meaning is inappropriate, but there is no other convenient phrase for the process that occurs when a primitive group overcomes its fears and peaceably seeks desired elements of the cosmopolitan culture. The Parakanan are a Tupi speaking tribe who were pacified in 1971 during the construction of the TransAmazonica Highway. We studied them in 1974. The Ewarhoyana are a remnant group who joined the Tiriyo in 1970. We collected specimens from them only two weeks after they came into the Tiriyo village. The Tiriyo are a Carib tribe whom Frikel first contacted in 1951. They have congregated at the site of a mission and airstrip built in 1961. The Kayapo are a large cultural group with several distinct and mutually hostile villages. We will present data from three sub-tribes. Of these, the Xikrin have been entirely separated from direct contact with the others as long as anyone can remember. The Kuben Kran Kegn and Mekranoti have had occasional social and hostile interaction with each other during the past twenty years. The geographic locations of these villages is shown in the first figure.

I know nothing of the social structure of either the Parakanan or the Ewarhoyana. The Tiriyo is a male dominated society. Girls are usually given in marriage before puberty and polygamy is common. Sexual rights seem to be quite restricted. The husband's nearest male relative has the right to a woman if he is away or dies. Although warfare has subsided in recent years, there are women in the tribe who were taken captive as adults.

The Kayapo society accords greater equality to the sexes. Families are matrilineal, and this gives sisters the advantage of domestic unity. Marriage is only considered effective when the first child is born. Polygamy is not practiced, but widows or other unmarried women may sleep in the front of the

house where they are accessible to nocturnal visitors. Formal exchange of sexual partners for limited periods is recognized, and there is also a good deal of informal philandering. Neither adult men nor women are commonly taken as captives in warfare and marital partners are usually from within the village. The degree of inbreeding is reduced by taking child captives from neighboring tribes.

Results

We have found neither clinical nor serological evidence of treponemal infections in either the Parakanan or the Ewarhoyana (Table 1). These are small groups (there were only 14 Ewarhoyana) and we have not tested all individuals, but it seems probable that they were entirely free of these infections at this time shortly after pacification.

Three of 42 Tiriyo were positive in both tests (Table 2). All three were mature adults; two were women. These results are compatible with venereal disease of low endemicity, possibly introduced since pacification by neo-Brazilians or Surinamese.

It was when we looked at the Kayapo specimens, that we obtained unexpected results (Table 3). The three Kayapo groups, in spite of their separation from one another, exhibited very similar patterns and are grouped in the next slide. I think we should dismiss as non-specific the reactions in which VDRL alone is positive. Most of these reactions occurred in the Xikrin who were subject to intense malarial endemicity. Sera with positive reactions only by this test were distributed in a pattern similar to the pattern of specimens positive by both tests. These may represent instances in which the infection has been suppressed by penicillin or natural immunity. This slide also shows, for comparison, data from a 1951 Tahitian serum collection made by Dr. Dorothy Horstmann in the course of a poliomyelitis study.

These particular specimens are from the southern part of the island where a major epidemic with symptoms of yaws and venereal syphilis had occurred two years previously. There are several things we can conclude from the data. First, the prevalence of antibody in the Kayapo is very high, even higher than in Tahiti. Second, conversion to positivity only begins at about the age of puberty. There are a few positives earlier, but not enough to preclude the hypothesis of sexual transmission. The pattern in this respect is quite different from that in Tahiti, where yaws was prevalent. This pattern also excludes the possibility that intrauterine or perinatal transmission is a major factor. Thirdly, the proportion positive increases steadily with age. This suggests either a persistent endemic situation with low infection rates throughout life, or transmission in early adulthood but with reduced frequency in recent decades. Either hypothesis requires that the disease must have been endemic during the pre-pacification period.

We have also examined a number of other potential associations. The two sexes are affected equally; 47% of the males and 43% of the women were FTA positive. There was no association of FTA positivity with particular marital partners (Table 4). The positive reactions were concentrated more in some families than in others, but the positive families were older. This concentration was not due to foci of infection but to the fact that the proportion positives increased in both parents and children as they became older.

We returned to the Xikrin and Mekranoti 2 1/2 years after the initial studies to look at antibody stability and conversion rates. (Table 5) In the Xikrin there was only one conversion to positivity and all persons who had been positive only by VDRL reverted to negative. However, most of those who were initially FTA positive, remained so. In the Mekranoti 9 of 23

negative persons converted to FTA positive and some who had been positive only by the FTA-ABS test gained a VDRL reaction. Those who were positive by both tests generally remained so. We believe, therefore, that the infection, if infection it is, is still active in the Mekranoti and possibly also in the Xikrin.

If a treponemal infection had been brought to the Kayapo by civilizados one would expect gonorrhea to have been brought in also. Using his gonococcal pili test, Dr. Buchanan examined 100 Kayapo sera for evidence of this infection. Only two fell into the positive range. Both were male Mekranoti, one 16 and the other 39 years old. This can not be considered positive evidence of the infection in these tribes.

We have considered the possibility that the serological reactions might be caused by some non-treponemal spirochete and Dr. Felsenfeld has carried out tests for *Borrelia* and *Leptospira*. Three *Borrelia* species were used in four different tests on 50 sera from five tribes and all were negative. The *Leptospira biflexa* agglutination test was positive in 20% of the specimens and in specimens from all five tribes. The positive reactions, however, showed no correlation with the VDRL or FTA-ABS tests (Table 6).

Clinically, there is very little evidence of disease that could be attributed to treponemal infection. Bellizzi made a survey of several Kayapo tribes and reported in 1961 that pinta occurred in the Kuben Kran Kegn. Unfortunately, our time with the KKK was brief and we were then unaware of this problem. We did not look specifically for this disease, but if typical cases were common, they would probably have caught our attention when we were collecting specimens. All the Xikrin and Mekranoti have been carefully examined and

the only sign which might be caused by this infection was a small cluster of slightly raised warts on the forearm of a 15 year old boy (Slide). Yaws was suspected as the cause of ulcers on the head of a boy in Xikrin and on a Tiriyo boy's leg. However, the Xikrin boy was serologically negative and the lesions might equally well have been leishmanial. Again, we were unaware of the problem at the time and made no isolation attempt. We suspected syphilis was the cause of cardiac murmurs in a Xikrin brother and sister of 25 and 17 years age respectively. Both were serologically reactive. The girl seemed retarded and had failed to become pregnant in her first marriage. She later did bear a child who was reported to have been normal but who died at one year of age. We have found, then, no regular pattern of morbidity attributable to treponemal infection.

In summary, we believe that some, but not all, Brazilian tribes have a high incidence of treponemal infection. We believe this probably pre-dates regular contact with the cosmopolitan civilization. Its epidemiology is different from that of pinta or yaws, because it is not commonly acquired in childhood. It is not transmitted congenitally.

The presumed infection causes very little morbidity. We do not know whether this reflects attenuation of the organism or increased resistance of the host. Either way, these characteristics suggest a high level of symbiotic adaptation between man and treponema. This circumstance is especially intriguing in relation to the theories of a New World origin of syphilis.

TABLE 1 NEWLY CONTACTED TRIBES. ALL NEGATIVE BY BOTH TESTS.

	PARAKANAN	EWARHOYANA
AGE	NO. TESTED	NO. TESTED
0-9	0	1
10-14	9	0
15-19	6	3
20-29	6	4
30-39	7	1
40+	6	0

TABLE 2 TIRIYO TESTED AFTER 19 YEARS PEACEFUL CONTACT

AGE	NO. NEG.	TESTS
		BOTH POS.
5-9	5	0
10-14	3	0
15-19	5	0
20-24	14	0
25-29	5	1
30-39	7	2
40+	3	0

TABLE 3 HIGH PREVALENCE POPULATIONS

AGE	<u>KAYAPO</u>					<u>TAHITI*</u>		
	NEGATIVE	VDRL ONLY	FTA ONLY	BOTH	%FTA	NEGATIVE	FTA POS.	%
0-4	12	2	0	0	0	8	0	0
5-9	19	2	1	1	9	13	4	23
10-14	10	0	0	2	17	7	5	42
15-19	21	4	4	13	40	8	2	20
20-24	12	2	2	11	48	5	1	} 25
25-29	18	1	2	13	44	3	1	
30-39	14	2	2	20	58	3	2	
40+	5	1	4	23	81	4	1	
TOTAL	113	14	15	83	43	51	16	24

* Sera collected from Taravao Isthmus in 1951. Condition not suitable for VDRL testing.

TABLE 4 CORRESPONDENCE OF SEROLOGY IN MARITAL PARTNERS

	Husbands		All
	Pos.	Neg.	
Wives	Pos.	12 7	19
	Neg.	15 19	34
All	27	26	53

TABLE 5 CHANGES IN TREPONEMAL TESTS IN KAYAPO

<u>STATUS IN</u>	<u>NO.</u>	<u>STATUS 30 MONTHS LATER</u>			
<u>INITIAL TEST</u>		<u>NEGATIVE</u>	<u>VDRL ONLY</u>	<u>FTA ONLY</u>	<u>BOTH POS.</u>
<u>XIKRIN</u>					
Negative	53	52	0	0	1
VDRL Only	6	6	0	0	0
Both Pos.	8	2	0	0	6
<u>MKNT</u>					
Negative	23	13	1	5	4
FTA Only	5	0	0	3	2
Both Pos.	26	1		4	21

TABLE 6 SPECIMENS POSITIVE AT 1:100 FOR
LEPTOSPIRA BIFLEXA AGGLUTININ
(10 specimens from each tribe were tested)

	NO.	AGE	SEX	VDRL	FTA-ABS
Tiriyo	42	29	F	NT	NT
	113	13	M	NT	NT
Parakanan	15	50	M	-	-
	55	13	M	-	-
Xikrin	58	68	M	-	NT
	99	33	F	+	+
Kuben Kran Kegn	55	20	F	-	-
	69	30	F	+	+
	83	32	M	+	+
Mekranoti	144	45	F	+	+