Poliomyelitis Survey in Rio de Janeiro

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CLINICALLY recognizable poliomyelitis was accepted in Brazil as an endemic disease of sporadic occurrence until 1953. Rio de Janeiro with a population of 2,626,875 had 25 reported cases per year from 1949 to 1952, an attack rate of 0.9 per 100,000 and a case-fatality rate of 20 percent (*1*). The disease occurred evenly throughout the year with perhaps a slight increase in incidence during the summer months of November, December, and January.

In 1953, the impact of a severe epidemic alerted physicians and health authorities. A total of 746 cases were reported from Rio de Janeiro. Of these patients, 561 were classified as residents and 185 as nonresidents. The nonresidents were patients from neighboring states who came to Rio de Janeiro for medical treatment. The result for this single year was a resident attack rate of 21.5 per 100,000 and a case-fatality rate of 4.6 percent.

In 1954, the disease again assumed epidemic proportions with a recorded total of 356 patients (245 residents and 111 nonresidents). The resident attack rate was 9.3 per 100,000 and the case-fatality rate, 4.2 percent. The epidemic curves for the 2 years are shown in the figure. The analysis of the 1954 data showed that 91.8 percent of the cases occurred in children under 5 years old (83.6 percent under 3 years) and no cases were seen in persons over 40 years of age. It further showed that a larger percentage of cases (60 to 70 percent) came from higher than average socioeconomic groups as determined by the type of residency, sanitary installations, and race (67.7 percent white, 32.3 percent nonwhite).

Prior to 1953, the only other recent epidemic of poliomyelitis in Rio de Janeiro was in 1939. Then 287 cases were recorded.

In other tropical and subtropical countries and in areas of the world where standards of hygiene are generally poor, exposure to the poliomyelitis viruses and the consequent development of antibodies occur almost universally and at an earlier age than in communities in which hygienic standards are higher (*2–9*). Crowded conditions and frequent pollution of the environment facilitate the spread of any disease in which the etiological agent is present in the oropharynx and stools (*8*).

Serologic evidence of the extent of poliomyelitis infection in the general population of Brazil is limited to a single study reported in 1937 by Hudson and Lennette (*10*). These workers examined serum samples from 10

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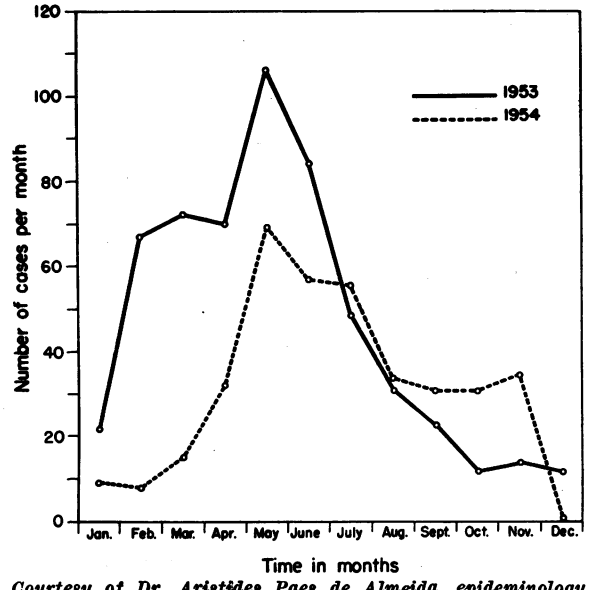
Dr. Waldir Cordeiro de Morais and Dr. Helio Lopes da Costa, members of the staff of the third pediatric service, Sao Zacharias Hospital, obtained the samples, and Companhia Harkson Industria Comercio Kibon and Pan American World Airways provided air transportation of these samples.

Poliomyelitis incidence by month in Rio de Janeiro, Brazil, 1953–54



Courtesy of Dr. Aristides Paes de Almeida, epideminology service, Department of Hygiene, Rio de Janeiro, D. F., Brazil.

Brazilians ranging in age from 10 to 30 years. They resided in the town of Formosa in the State of Bahia, Brazil. The method for assay of neutralizing poliomyelitis antibodies was qualitative by present-day standards; the MV strain of virus (*11*) used in the study presumably was poliomyelitis virus, type 2 (Lansing). This study revealed that 8 out of the 10 persons had neutralizing antibodies for MV virus. In 1937, epidemics of poliomyelitis were not known in Bahia, and only a few deaths were reported from scattered parts of Brazil.

This study was undertaken to learn from serologic evidence the extent of previous poliomyelitis infections in Rio de Janeiro and thereby provide information helpful to an understanding of the recent epidemic outbreaks in Brazil and of the global epidemiology of poliomyelitis.

Materials and Methods

Blood samples from 111 persons of 3 representative socioeconomic groups in Rio de Janeiro and its environs were collected in July and August 1954. An attempt was made to obtain donors, aged 6 or 7 years, for a comparative study of antibody patterns in a similar age group in the United States. In group A two-thirds of the children resided in slum areas located on the hills of the city and one-third were from a semirural grade school of the Federal District. Overcrowding, lack of minimal sanitary facilities (no sewage disposal or running water) characterized the environment of group A. Group B children were city dwellers living in small houses or apartments where sanitary and hygienic standards, as determined by running water, sewage disposal, adequate income, and no overcrowding, were greatly superior to those of the previous group. Group C included children from the upper income brackets, both Brazilian and foreign residents. Their standards of hygiene were as high as those of the Americans in groups D and E (*12*), consisting of children of University of Minnesota faculty members and University of Minnesota medical students, respectively (authors' unpublished experiments).

The sample of blood (about 10 ml.) was withdrawn aseptically without anticoagulant. Serum was separated from the clot within 24 hours and kept sealed in glass vials at refrigerating temperatures (2° to 10° C.). Quantitative assay for neutralizing antibodies in the serums was effected through use of HeLa cell cultures by the procedures employed routinely in this laboratory (*14*). This strain of HeLa cells has been maintained in continuous culture on glass in the laboratory since May 31, 1951.

Table 1. Distribution by immunotype and titer of poliomyelitis antibodies among three different socioeconomic groups in Brazil

Serum titer	Type 1			Type 2			Type 3		
	A	B	C	A	B	C	A	B	C
4,096 or more	1	1	0	3	5	1	0	2	3
1,024	3	10	3	5	12	3	4	8	1
256	7	14	6	9	8	6	6	8	1
64	11	9	4	8	9	4	9	13	1
16	5	9	2	3	9	1	4	8	2
4	1	2	1	0	2	3	1	2	2
0	1	13	8	1	13	6	5	17	14

A=Low socioeconomic group, urban and semirural (29 individuals).
B=Average socioeconomic group, urban (58 individuals).
C=High socioeconomic group, urban (24 individuals).

Table 2. Percentage distribution of poliomyelitis antibody by immunotype among different socioeconomic groups in Brazil and in the United States

Group	Number	Average age	Percentage with antibody to:			
			No type	Single type	2 types	3 types
A	29	8. 6	0	3. 4	17. 2	79. 4
B	58	11. 8	3. 4	20. 6	22. 4	53. 4
C	24	18. 3	4. 2	29. 1	37. 5	29. 1
D	26	6. 5	30. 7	23. 1	30. 7	15. 4
E	43	20–30	20. 9	41. 8	20. 9	16. 2

A=Low socioeconomic group, urban and semirural.
B=Average socioeconomic group, urban.
C=High socioeconomic group, urban.
D=Children of University of Minnesota faculty members (5–10 years).
E=University of Minnesota medical students.

Serums were inactivated for 30 minutes at 56° C. and diluted in BSS (Hanks' balanced salt solution) medium with antibiotics and a fungicide to give fourfold dilutions ranging from 1:4 to 1:4096 (6 tubes/serum/type). One hundred $TCID_{50}$ (tissue culture infectious dose) of poliomyelitis virus, type 1 (Mahoney), type 2 (MEF–1) and type 3 (Saukett), respectively, were added to each serum dilution, kept for 30 to 60 minutes at room temperature, transferred to HeLa cell cultures, and incubated at 36° C. The end point of each titration was determined by microscopic observations on the fourth and seventh days as revealed by the tube with the last serum dilution completely protecting the cells from the cytopathic effect of the virus.

Results

Quantitative assay of 111 Brazilian serum samples for antibodies to poliomyelitis viruses by use of the HeLa cell tissue culture technique (*13*, *14*) revealed for each of three socioeconomic groups comparable composite antibody spectrums as determined by occurrence and titer of antibodies (table 1). These data, by presenting the percentage distribution by socioeconomic groups of the occurrence of antibodies to each of the poliomyelitis viruses, types 1, 2, and 3, are brought out more clearly in table 2. Antibodies to all three types were found for 79 percent in group A, 53 percent in group B, and 29 percent in group C. Antibodies to at least one immunotype were demonstrated for all children in group A (average age 8 years), for 97 percent in group B (average age 11 years), and for 96 percent in group C (average age 18 years). The data provided from comparable studies of children (average age 6.5 years) of faculty members at the University of Minnesota (group D) and of University of Minnesota medical students in an age range of from 20 to 30 years (group E) were 15 percent and 16 percent, respectively. Conversely, data for the last two groups gave no evidence of poliomyelitis antibodies, (*a*) for 30 percent of the children less than 10 years of age, and (*b*) for 20 percent of the medical students from 20 to 30 years of age. These results from studies of subjects in Minnesota contrast with the results from the Brazilian population in which individuals less than 18 years of age, by socioeconomic group, range from 4 percent to none without antibody.

Discussion

The present observations establish the fact that poliomyelitis infection has been widespread in Rio de Janeiro and, presumably, in Brazil. Evidence was obtained of infection of most members of three widely different socioeconomic groups by at least 1 of the 3 antigenically recognized types of poliomyelitis virus. The percentage distribution of antibodies ranged from 96 to 100 percent. Indication of infection by all three types of poliomyelitis virus was found to vary from 29 to 79 percent in the three groups. The incidence and distribution of poliomyelitis antibodies in these three groups are similar to other areas of the world (*9*) with comparable sanitary, climatic, and hygienic conditions. On the other hand, a similar antibody survey for two age groups from Minnesota showed no antibodies in 30 percent of group D (average age 6.5 years) and 21 percent of group E (20 to 30 years of age). Antibodies to the three types of poliomyelitis virus were found to be 15 and 16 percent, respectively.

This serologic study shows that poliomyelitis infections have been widely disseminated in Rio de Janeiro. Presumably, the relative absence of poliomyelitis epidemics in Brazil can be explained in part by exposure to the viruses in

infancy at a time when children are under the protection of maternal antibodies.

Summary

Clinically recognizable poliomyelitis was accepted in Brazil as an endemic disease of sporadic occurrence until 1953. The disease in 1953 and 1954 assumed epidemic proportions. To provide information helpful to an understanding of the recent epidemic outbreaks in Brazil and of the global epidemiology of poliomyelitis, serologic evidence of the extent of previous poliomyelitis infections in Rio de Janeiro was obtained. Quantitative assay of poliomyelitis neutralizing antibodies in a sample of 111 serum specimens from three different socioeconomic groups (A, B, C) in Brazil was effected by using the HeLa cell tissue culture technique. For comparison, a group of University of Minnesota students (group E) and children of faculty members (group D) were studied. The common presence of antibodies to the three types of poliomyelitis viruses in the lowest socioeconomic section of the Brazilian population (group A) by the eighth year led to the conclusion that, presumably, the relative absence of poliomyelitis epidemics in Brazil can be explained in part by exposure to the viruses in infancy at a time when children are under the protection of maternal antibodies.

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