areas, and increased oscillometric and surface temperature readings.

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INCIDENCE OF SYPHILIS AMONG SCHOOL CHILDREN OF KINGSTON, JAMAICA*

BY

DAHLIA WHITBOURNE, M.B., B.S.Lond.

AND

GEORGE M. SAUNDERS, B.A., M.D.Harvard

The impression is given in a report (Neville-Rolfe, 1936) recently submitted to the Government of Jamaica that syphilis is particularly prevalent in the general population among both adults and children. The report, however, was based upon observations made largely in hospitals and almshouses among the sick and more unfortunate classes, in which a high incidence of syphilis does not necessarily indicate a similar condition for the entire population. Other studies based upon observations of unselected samples of the population have not been recorded. It was felt, therefore, that a serological survey would be highly desirable as a means of estimating the true incidence of syphilis.

Source of Material and Technical Methods

Pending investigations among adults a serological survey of school children was undertaken. Children were selected at random from those in attendance on an ordinary school day at seventeen schools which serve the majority of the lower-middle and lower classes of Kingston, practically all of whom are black or coloured. The method of selection was to have the teachers choose indiscriminately volunteers to submit to a blood test, the nature of which was unknown to the children. It is felt that this system gave a random sample which possibly erred on the side of selecting the less healthy individuals. Each child was examined by one of us and blood specimens were taken. Nearly every child whose blood gave positive serological tests was brought to a hospital clinic, where more careful examinations were conducted than was possible at the time of the first visit. Also repeated tests were made on fresh samples of all blood sera which gave positive or questionable results.

Note was taken of any signs of congenital syphilis or yaws, and particular inquiry was made for a history of yaws or injection treatments. It is well known that yaws, which gives positive results with routine serological tests as consistently as syphilis, is prevalent among the children of rural Jamaica, many of whom come into Kingston and enter school. For this reason great care was taken to secure accurate information about a previous yaws infection, and any history of this disease was carefully checked

* The studies upon which this report is based were conducted with the support and under the auspices of the International Health Division of the Rockefeller Foundation and the Government of Jamaica.

with parents or guardians. No case was classed as yaws unless there was a definite clear-cut story of infection for which injection treatments had been given, and if a child had not lived at some time in an area where yaws was known to be endemic a positive history was discredited unless characteristic scarring or active lesions were present. It has been shown (Turner and Saunders, 1935) that a history of yaws infection as given by children or parents is highly accurate, but that a negative history is more subject to error.

There were 1,103 children examined, of whom 504 were males and 599 were females. The ages varied from 5 to 16 years, but the great majority were between 10 and 14 years old (Table I). Racially they were practically all black or coloured, there being very few Chinese, East Indians, and whites (Table II).

TABLE I.—Age and Sex of Children Examined

Age in Years	Males	Females	Total
5—9	138	103	241
10—14	364	485	849
15—16	2	11	13
	504	599	1,103

TABLE II.—Race and Sex of Children Examined

Race	Males	Females	Total
Black	275	272	547
Coloured	214	304	518
East Indians	5	2	7
Chinese	6	16	22
White	4	5	9
	504	599	1,103

All sera were examined in the laboratory of the Jamaica Yaws Commission, where the Wassermann and Eagle tests were performed on each. The Wassermann complement-fixation reaction was a standard modification in which the antigen consisted of a cholesterolized alcoholic extract of beef heart, and the preliminary incubation was carried out in the refrigerator (5° C.) followed by half an hour of incubation in the water-bath at 37° C. The standard Eagle flocculation test was used, except that the serum-antigen mixture was allowed to stand at room temperature (26° to 28° C.) for twenty-four hours before adding saline and reading the results. Five years of experience with the methods used had proved them to be highly sensitive and specific. In addition, 600 bloods were subjected to the Kahn test at the Government laboratory through the kindness of the pathologist, Dr. K. Leigh Evans. The results of the Kahn test were practically identical with those of the Eagle test.

Results of Study

Serological Tests.—In forty-three children, or 3.9 per cent., the serological tests were positive. Both Wassermann and Eagle tests were positive in forty; Wassermann partly positive, Eagle positive in two; and in only one instance was the Wassermann negative and Eagle positive to repeated tests. But there were thirteen children among the positive group who gave a clear-cut history of yaws and whose positive tests were almost surely the result of the yaws infection. The remaining thirty children, or 2.7 per cent. of the series, had positive tests, presumably because of congenital syphilis, the percentage being slightly higher among females than among males (Table III).

Clinical Findings.—Signs of congenital syphilis were infrequent, and none of the children with negative serological tests presented any definite findings, although a few of them had slight enlargement of frontal bones or bowing of tibiae. Among the group with positive blood tests probably due to syphilis were ten with characteristic

malformed peg-shaped upper central incisor teeth. On the other hand, the teeth were entirely normal in the children classed as suffering from yaws. Frontal bossing was present in ten of the probable syphilitics and in one of the yaws cases; and tibial thickening, in some cases amounting to moderate anterior bowing, was observed in six of the syphilitic and in three of the yaws groups. Painless hydrarthrosis of the knee-joint was present in one case of congenital syphilis. No case of keratitis or iritis was seen, but one child presented signs of retinitis

TABLE III.—Results of Serological Tests in 1,103 School Children

	Males		Females		Total	
	No.	Per cent.	No.	Per cent.	No.	Per cent.
Number examined..	504	100.0	599	100.0	1,103	100.0
Tests positive ..	18	3.6	25	4.2	43	3.9
Tests positive; history of yaws ..	6	1.2	7	1.2	13	1.2
Tests positive; probably congenital syphilis ..	12	2.4	18	3.0	30	2.7

and two children showed diminished visual acuity with pallor of the optic nerve. These last two cases may have been the result of infection with syphilis or due to nutritional deficiency.

On the whole the signs presented were very meagre, the one of most value being the characteristic change in the teeth. Among the congenital syphilitic group of thirty were eight with entirely normal physical findings, and the remainder showed some changes usually ascribed to the disease. Among the thirteen yaws cases three had skin lesions and four more showed characteristic scarring.

Interpretation of Results

The Yaws Factor.—It has been stated that forty-three, or 3.9 per cent., of the children gave positive results to sensitive serological tests, but that thirteen of the positive cases were almost surely due to yaws, leaving thirty, or 2.7 per cent., with probable congenital syphilis. However, it has been the experience of the Jamaica Yaws Commission that while a history positive for yaws can be relied upon to be highly accurate there are many individuals who deny infection but who present some definite manifestation of the disease. Hence it is very probable that more than thirteen of the children with positive reactions should be classed as yaws, which would decrease the number with congenital syphilis to less than that given. It is to be remembered in this connexion that eight of the possible congenital syphilitics presented no signs of syphilis except the positive serological reactions. Also, where entire population groups were studied in yaws endemic areas congenital syphilis was practically non-existent, only one case being observed among more than 1,000 children who were carefully examined (Turner and Saunders, 1935). Therefore in the present study it may be assumed that the children giving a history of having had yaws in some endemic area showed positive serological reactions because of yaws and not because of congenital syphilis. This assumption is strengthened by the fact that syphilitics are relatively immune to yaws inoculations (Turner, 1936; Van der Schaar, 1934), and hence a diagnosis of yaws in a child virtually eliminates the possibility of congenital syphilis.

Sero-negative Congenital Syphilis.—It is possible that the serological survey did not detect some cases of sero-

negative congenital syphilis, but this source of error is probably very small. Stokes (1928) has estimated that about 88 per cent. of cases of congenital syphilis in the first decade of life, and about 66 per cent. in the second decade, give positive Wassermann reactions. On the other hand Smith (1935) found only five negative Wassermann reactions among nearly 1,000 cases of congenital syphilis, and Chargin and Umansky (1933) state that the Wassermann reaction is one of the most persistent symptoms in the untreated congenitally syphilitic child. Moreover, all sera were subjected to the Eagle and more than half to the Kahn test, both of which are well known to be much more sensitive than the Wassermann test. It is probable that the number of cases of congenital syphilis missed because of negative reactions was very small, not more than 10 per cent., and that this is more than balanced by the inclusion of some yaws cases in the group classed as syphilis.

Syphilis among the General Population.—It can probably be said that approximately 3 per cent. of the children in the schools surveyed have congenital syphilis. Can this figure be used as an index to the prevalence in all children under 15 years of age and in persons of all ages?

It is true that the group studied is a selected one, in that it considers only school children from 5 to 16, the majority being 10 to 14 years of age. There are children in Kingston of school age who do not attend school. These are generally of the lower social order, and doubtless more of them have syphilis than the group examined. Also, congenital syphilis is more prevalent among children under 5 years of age than among those in the older age groups because of the high mortality rate in congenital syphilitics during the first few years of life. Both these factors would tend to make the incidence higher among all children of all ages, but there is another factor which tends to compensate for these sources of error. The survey was conducted only among the lower-middle and poor classes of society, and did not include private and secondary school children, who come from the upper-middle and wealthier classes and among whom syphilis is doubtless much less common. It might be argued that the more severe cases of congenital syphilis would not be found in schools, but this is not entirely true. During the past two years the school medical officer has found among children regularly attending some school three cases of interstitial keratitis, eight of optic neuritis, and one of juvenile tabes, presumably the result of congenital syphilis. Considering all factors, it is probable that among Kingston children less than 15 years of age, black and coloured of all classes, congenital syphilis has a prevalence of 3 per cent. or slightly higher.

Surveys (Maxcy and Brumfield, 1934; Hazen, 1936; Massey, 1936; Jason, 1935) among the black and coloured population groups in the southern United States indicates that syphilis is present in 5 to 10 per cent. of children and in 20 to 40 per cent. of persons of all ages, or four times the rate for children. It is doubtless generally true that the incidence of syphilis among entire populations is much higher than among the children under 15 years of age. It is impossible to state what the true ratio is, but applying that which apparently exists for the southern United States to Kingston we obtain a figure of 12 per cent. incidence of syphilis for black and coloured persons of all ages. However, this point has to be further investigated.

Summary and Conclusions

1. One thousand one hundred and three school children from seventeen schools, representing the lower-middle and

lower classes of society, were examined clinically and serologically to determine the incidence of syphilis.

2. There were forty-three children, or 3.9 per cent., giving positive serological reactions. Among these were thirteen whose positive reactions were almost surely due to yaws, leaving thirty, or 2.7 per cent., with probable congenital syphilis.

3. It is estimated that congenital syphilis is present in about 3 per cent. of all black and coloured children of Kingston.

4. Syphilis doubtless reaches a much higher incidence among the entire population. The exact figure cannot be stated, but on the basis of evidence gathered elsewhere concerning the ratio of the incidence of syphilis in children to that for the entire population it may be said to be approximately 12 per cent.

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EPIDEMIOLOGY OF EPIDEMIC DROPSY*

BY

R. B. LAL, M.B., B.S., D.P.H., D.T.M. & H., D.B.

Officiating Director

AND

S. C. ROY, M.B., D.P.H., Capt. I.T.F.

Assistant Research Worker, All-India Institute of Hygiene and Public Health, Calcutta

Epidemic dropsy belongs to the group of obscure diseases, like tularaemia, which are little known outside their endemic homes. None the less this disease is of much interest to students of tropical medicine, and particularly to those of us who work in this part of the world. It is by no means a minor problem in the provinces of Assam, Bengal, Bihar, and Orissa. One would, perhaps, not be far wrong in saying that a practitioner in Calcutta comes across epidemic dropsy as frequently as malaria, if not more frequently. The city, according to Mazumdar (1933), recorded deaths from epidemic dropsy every year between 1905 and 1931. Widespread epidemics involving thousands of citizens and causing heavy mortality occasionally occur. The epidemics in 1909, 1926, and 1927 were particularly disastrous, when 433, 939, and 636 persons respectively are said to have died. Ten times this number must have been the victims of more or less permanent damage to the heart. The disease is not confined to the towns. Outbreaks occur even in the smallest villages, and at times large tracts of country in the eastern provinces of Assam, Bengal, Orissa, and Bihar become involved. Outside these provinces localized outbreaks have been reported from the eastern districts of United Provinces and parts of Madras Presidency. A few epidemics have occurred in

Burma, Fiji, Mauritius, and certain other parts of the world, but the disease has been practically confined to emigrants from those provinces.

Earlier Studies

The history of the disease carries us as far back as reliable records are available. Chambers (1880) believed that the disease had been prevalent since the famine of 1866. Good descriptions of epidemics occurring in the last quarter of the nineteenth century and since then are given by O'Brien (1879), Caley (1878), Payne (1879), McConnell (1879), Crombie (1879), Deakin (1880), Kastagir (1880), McLeod (1893), Rogers (1902), Munro (1908), Cambell (1908), Greig (1911), and many others. How these epidemics arise, what factors favour their continuance and decline, how and why the disease prevalence is maintained at a low endemic level in certain localities, why certain communities suffer more than others, what determines the sex, age, and occupational distributions, what preventive measures can be taken, are some of the problems which have so far defied solution. In epidemic dropsy, as in many other diseases, bad weather, personal diathesis, water, inadequate or unsuitable food, unknown toxic substances, various types of organisms, and even insects have received their share of blame at the hands of various workers. Yet the lack of exact knowledge cannot be said to be due to want of interest on the part of the profession. Among others epidemic dropsy has engaged the serious attention of eminent workers like Rogers (1902), Lukis (1908), Greig (1912), Megaw (1927), Acton and Chopra (1925), and many important contributions have been made. However, in the absence of exact knowledge every practitioner has perhaps either formulated his own theory or has adopted one advanced by others. We cannot do better than sum up the present position in the words of the editor of the *Indian Medical Gazette* (1935) when he says: "Many theories regarding the cause of the disease have been formulated, have lived their day and become history, and have been revived again." However, from amongst a multitude of theories three have received considerable support. These are: (1) rice theory, (2) contagion theory, and (3) mustard-oil theory. We propose to revive one of these theories and present fresh evidence in support of it, in the hope that it will stand critical examination and will not be cast away again into limbo.

Observations in the Field

These three theories formed our working hypotheses, and it was mainly on these premises that we proceeded to collect exact information in the field. Investigations were made in seven different localities where epidemic dropsy was raging. These included rural, semi-rural, and industrial areas in Bihar, Bengal, Assam, and Orissa, thus representing different living conditions. House-to-house visits were made and important data were collected on printed schedules specially designed for mechanical tabulation. In three localities data were collected for every individual and for each family, whether stricken or not. In other places investigations were confined to the affected families and to such unaffected families as were of special interest. Reasonable precautions were taken to ensure the veracity of the information recorded. Detailed information was obtained from 964 patients and 2,581 healthy persons, comprising 310 affected families and 290 unaffected families. In addition, certain relevant data were collected from 1,727 unaffected families having 9,678 members. The main points that emerged after critical analysis were:

* A more detailed description of these studies will appear in a set of five papers in the July, 1937, issue of the *Indian Journal of Medical Research*.