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BACTERIOLOGICAL RESULTS OF TREATMENT OF  
LEPROMATOUS CASES WITH DIAMINODIPHENYL SULFONE  
BY MOUTH FOR PERIODS UP TO FIVE YEARS

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The experimental trial of diaminodiphenyl sulfone (DDS) for the treatment of patients in the Purulia Leprosy Home and Hospital was started in April 1949 by Dr. E. Muir (2, 3), and continued with an enlarged group of patients by the permanent staff after his return to England. This paper deals only with the 99 lepromatous cases of this experimental group, of which 43 were started in the earlier part of 1949 and 20 more later that year; a further 36 were started during the next year, mostly in the first two months. Muir's last progress report (3) dealt with 58 of these cases. The present report is similar to one I published on the enlarged group two years after the beginning of the work (4). Its purpose is to show the effects of the drug on the bacteriological index during this prolonged period of treatment.

Tablets of DDS were not available at the outset, and for a while the drug was given in the form of a 2.5 per cent suspension (100 mgm. in 4 cc.) of the fine powder in sweetened acacia mucilage, this being squirted into the patient's mouth with a syringe. When tablets were procured, they were given under the direct supervision of the doctors conducting the experiment. Skin smears made by the slit method were also examined by them, quarterly during the first two years, and once a year thereafter.

To arrive at a bacteriological index, as described by Muir (1), five such smears were made from what appeared to be the most severely involved parts of the body, and the index was obtained by averaging the individual gradings of the five. The grades were as follows: 4+ for the highest concentration, 1+ for the lowest concentration, and 2+ and 3+ for intermediate degrees. The averaging commonly results in a fractional number with one or more fifths; these are converted to decimals in the table. A grading of "nearly negative" ( $\pm$  in the table) was given cases in which only a few bacilli could be found in all five smears.

The results of the treatment for the entire group of patients, as regards the bacteriological index, are given in Table 1 through March 1954, sixty months after the work was started. The cases are arranged in groups according to the degree of bacteriological improvement (or lack of it, in a few cases) at the time of the last examination. From the first four columns can be seen the length of treatment in each case and the original and final bacteriological indexes, the later columns show the amounts of the drug that were taken in each of the five years from 1949 through 1953, and the indexes at the latest examinations made in each of these years.

Only 69 of the group could be followed to the end of the period. In 12 cases DDS had to be stopped, the patients being usually transferred

TABLE 1.—*Bacteriological indexes of the 99 cases treated, with the amounts of DDS taken each year through 1953, cases grouped according to the last findings.*

Case No.	Treatment (mos.)	Range of BI		Drug consumption <sup>a</sup> and subsequent BI's <sup>b</sup>									
		Original	Final	1949		1950		1951		1952		1953 <sup>c</sup>	
				DDS	BI	DDS	BI	DDS	BI	DDS	BI	DDS	BI
<i>Bacteriologically negative</i>													
6 <sup>a</sup>	30	0.2	0	27	0	25	0	—	—	—	—	—	—
14	47	3.4	0	26	4.0	33	0.8	33	0	15	0.2	4	0
16	34	0.4	0	27	0.4	14	0	22	0	—	—	—	—
29	60	1.4	0	43	0.8	45	0.4	42	0.6	40	0.8	28	0.4
42	54	1.2	0	8	0.8	20	0.2	42	0.4	30	0.2	4	0
54	46	1.8	0	20	1.8	48	1.0	39	0.6	43	1.0	10	0
61	54	2.0	0	6	2.0	35	1.4	41	1.0	27	0.6	23	0.4
82	51	3.2	0	—	—	27	3.2	35	0.2	27	0.2	28	0.6
86	14	0.5	0	—	—	62	0.4	6	0	—	—	—	—
<i>Nearly bacteriologically negative<sup>d</sup></i>													
5	60	1.0	±	39	3.0	38	1.0	41	2.2	31	1.2	24	0.8
7	51	3.6	±	8	4.0	32	4.0	54	1.6	61	1.0	55	1.0
9	19	0.4	±	34	0	50	2.0	—	—	—	—	—	—
17	60	0.6	±	41	0.8	45	0.4	43	0.4	42	0.4	43	0.4
53 <sup>a</sup>	51	2.8	±	—	—	41	2.8	50	1.6	41	0.8	41	0.6
68	54	3.4	±	9	—	46	3.8	34	1.8	26	1.0	28	0.2
70	17	3.2	±	2	2.4	67	1.0	1	0.2	—	—	—	—
77	51	2.0	±	—	—	13	1.8	29	1.0	28	1.0	28	0.8
79	51	1.2	±	—	—	21	1.2	28	1.0	28	1.0	26	0.2
80	16	4.0	±	—	—	11	2.6	11	0.6	—	0.2	—	—
<i>Bacilli 75% diminished</i>													
3	51	4.0	0.2	—	—	24	3.0	34	1.0	19	1.0	20	0.6
4	59	4.0	0.6	25	4.0	24	3.8	23	1.2	28	1.2	27	0.8
6	60	4.0	1.0	25	4.0	12	3.6	21	3.0	17	3.2	21	3.0
18	33	3.2	0.8	19	3.0	12	2.5	16	0.8	—	—	—	—
19	59	2.4	0.4	16	2.0	28	1.6	39	1.2	42	1.0	43	0.4
20	60	3.6	0.4	7	3.6	9	3.0	13	1.0	15	2.2	14	0.6
26	60	3.4	0.6	35	2.0	19	3.4	24	1.8	15	1.8	24	1.0
28	60	3.6	0.2	35	2.6	40	3.6	57	1.8	29	1.6	27	0.6
30	50	4.0	1.0	—	—	36	3.8	41	2.0	23	1.6	20	1.0
34	45	2.6	0.2	34	0.6	27	0.2	—	—	—	—	—	—
37	51	3.8	0.6	—	—	15	4.0	27	3.2	19	2.0	22	1.0
44	55	3.8	0.6	14	3.8	28	1.2	44	1.0	28	1.0	23	0.6
57	56	4.0	1.0	19	3.8	36	4.0	50	3.2	23	1.0	24	0.6
58	56	3.6	0.8	13	3.2	24	2.6	32	1.8	31	1.0	34	0.8
59	55	3.8	0.6	7	3.8	24	4.0	34	3.2	28	2.0	19	1.4
62	54	3.2	0.4	9	—	36	3.6	61	2.4	45	1.0	40	0.8
67	49	3.8	0.4	—	—	29	3.2	30	2.6	39	1.2	42	1.8
69	54	4.0	0.4	8	—	39	3.6	49	2.6	29	0.4	27	0.4
71	54	2.6	0.2	8	—	46	2.8	57	0.4	38	1.0	28	0.0
74	53	1.4	0.2	4	—	56	1.2	52	1.2	42	1.2	22	0.6
83	51	3.2	0.4	—	—	14	3.8	31	2.6	29	1.2	28	0.4
84	51	3.4	0.4	—	—	30	2.6	65	2.8	42	1.8	43	0.6
85	33	4.0	0.8	—	—	34	3.6	64	2.0	52	0.8	—	—
88	50	3.2	0.8	—	—	18	2.8	18	0.4	14	1.0	15	0.4
95	47	1.0	0.2	—	—	30	0.6	41	0.2	35	0.4	28	0.2

TABLE 1—Continued

Case No.	Treatment (mos.)	Range of BI		Drug consumption <sup>a</sup> and subsequent BI's <sup>b</sup>									
		Original	Final	1949		1950		1951		1952		1953 <sup>c</sup>	
				DDS	BI	DDS	BI	DDS	BI	DDS	BI	DDS	BI
<i>Bacilli 50% diminished</i>													
1	60	3.4	1.0	41	2.6	24	2.8	42	1.0	28	0.8	28	0.8
10	60	2.2	0.6	32	2.0	36	1.2	28	2.6	14	1.0	17	0.6
11	41	3.6	0.8	34	1.4	39	1.6	40	0.8	10	—	—	—
12	43	2.4	1.2	22	1.4	17	2.2	31	1.2	12	—	—	—
13	60	2.8	1.0	20	2.8	17	3.4	37	1.0	42	1.0	29	0.6
22	34	2.6	1.0	12	3.1	28	3.0	33	1.0	17	1.0	—	—
25	60	1.8	0.6	—	—	5	—	39	1.2	40	1.0	28	0.4
27	60	3.6	1.4	11	3.6	47	4.0	60	3.6	16	2.4	19	2.2
31	60	3.6	1.0	38	4.0	47	4.0	52	4.0	45	2.6	42	2.0
33	45	4.0	1.4	—	—	9	4.0	33	4.0	24	2.4	19	2.2
36	49	2.8	1.0	—	—	21	3.0	22	3.0	18	3.0	13	2.2
47	43	4.0	1.2	16	4.0	42	4.0	51	2.8	8	1.0	—	1.2
49	28	3.6	1.0	19	3.6	20	2.4	10	1.2	—	1.0	—	—
50	19	3.2	1.8	8	3.2	17	1.8	—	—	—	—	—	—
51	36	3.0	0.8	12	2.0	15	2.4	21	0.6	4	0.8	—	—
52	33	2.2	0.8	8	2.0	28	2.4	41	0.6	9	0.8	—	—
53	27	2.8	0.8	3	1.6	9	2.4	20	0.8	—	0.8	—	—
56	58	4.0	2.0	11	4.0	22	3.4	24	3.0	17	1.6	23	1.8
60	36	1.2	0.4	10	1.2	30	0.4	42	0.4	7	—	—	—
63	54	4.0	1.2	6	2.0	35	1.4	41	1.0	27	0.6	23	0.4
64	54	4.0	1.8	8	—	29	4.0	41	3.6	28	3.0	27	1.8
65	46	2.0	0.6	6	—	27	0.8	23	0.6	15	0.6	8	—
66	54	1.6	0.8	8	—	23	0.6	41	0.6	43	1.0	33	0.4
72	31	1.4	0.6	—	—	44	0.8	57	0.6	—	—	—	—
78	51	1.4	0.6	—	—	27	1.0	29	1.0	28	1.0	28	0.8
87	14	1.2	0.4	—	—	22	0.4	9	—	—	—	—	—
89	50	3.8	1.0	—	—	50	3.6	65	2.2	53	1.6	53	1.4
90	50	4.0	2.0	—	—	22	4.0	21	3.6	11	3.4	20	3.2
92	21	4.0	2.0	—	—	7	4.0	14	3.4	—	2.0	—	—
93	49	4.0	1.8	—	—	12	4.0	17	4.0	11	3.0	17	2.6
94	45	3.4	1.0	—	—	17	3.4	28	3.2	28	1.6	20	1.0
99	43	4.0	2.0	—	—	15	—	18	4.0	49	3.2	22	1.6
<i>Slightly improved cases</i>													
2	48	2.0	1.6	41	3.0	32	3.2	38	2.8	33	1.6	4	—
8	60	3.0	2.6	33	3.0	34	2.8	71	2.2	66	1.6	56	0.2
15	22	4.0	3.0	8	4.0	19	4.0	16	4.0	—	3.0	—	—
21	39	4.0	2.6	6	4.0	11	1.8	11	3.0	4	2.6	—	—
23	33	1.4	1.2	39	1.2	24	3.4	22	1.2	5	—	—	—
25 <sup>a</sup>	60	4.0	3.2	34	4.0	26	4.0	27	3.8	24	4.0	33	3.4
32	39	2.8	2.0	—	—	—	—	41	4.0	41	1.8	42	2.6
35	35	3.6	2.0	34	3.2	44	3.6	58	2.0	—	—	—	—
38	52	2.4	1.8	1	—	26	3.0	21	3.0	15	1.6	21	1.2
40	48	4.0	2.8	—	—	35	4.0	32	4.0	24	2.4	24	1.0
43	58	3.4	1.2	24	3.8	40	3.8	48	1.4	22	1.4	—	—
46	54	4.0	2.6	12	4.0	27	3.8	64	3.0	31	2.6	31	2.0
48	53	4.0	2.8	5	2.6	13	4.0	23	3.6	15	2.6	2	2.8
50 <sup>a</sup>	40	3.2	2.0	—	—	1	3.2	37	0.8	32	1.4	28	1.8
55	23	1.6	1.2	24	1.6	50	1.4	14	1.2	—	—	—	—
73	14	4.0	2.8	—	—	44	3.6	62	2.8	—	—	—	—
81	51	4.0	2.2	—	—	22	4.0	24	3.4	31	1.2	32	1.4
97	43	3.4	3.0	—	—	4	3.6	28	3.4	4	—	14	2.0
98	31	4.0	2.2	—	—	9	4.0	39	4.0	25	4.0	3	2.2

TABLE 1. — Concluded

Case No.	Treat-ment (mos.)	Range of BI		Drug consumption <sup>a</sup> and subsequent BI's <sup>b</sup>									
		Original	Final	1949		1950		1951		1952		1953 <sup>c</sup>	
				DDS	BI	DDS	BI	DDS	BI	DDS	BI	DDS	BI
<i>Stationary cases</i>													
24	19	0.2	0.2	42	0	44	0.2	—	—	—	—	—	—
34 <sup>d</sup>	43	4.0	4.0	—	—	5	—	37	3.4	28	3.0	17	3.6
39	22	4.0	4.0	4	—	24	4.0	11	4.0	—	—	—	—
76	18	4.0	4.0	—	—	23	4.0	16	4.0	—	—	—	—

*a* The annual totals in grams are rounded to the nearest whole figures.

*b* When more than one determination was made in the year, the last one is given.

*c* The bacteriological findings of the last examination, made early in 1954, appear as the "Final BI" in the fourth column.

*d* For this tabulation the  $\pm$  sign has been substituted for notes such as "2 bacilli," "a few granular bacilli," "1 granular clump," etc.

to other treatments, in 8 instances because of repeated reactions, and pains in the long bones; in 1 because of eye trouble; in 1 because of asthma and dislike of the treatment; and in 2 for other reasons. Another 14 were lost because of discharge or voluntary departure from the institution, and 4 patients died. From Table 1 can be seen approximately when these cases were lost from the group.

Referring to the data of the first two sections of Table 1, it will be noted that only two (Nos. 14 and 82) of the cases that became negative were heavily infected at the beginning. It is a fact that there is no agreement, or consistency, between the intensity of infection in these patients and the time that it took for them to become negative. Of the second group, however, those which are classed as "nearly negative," one-half started with heavy or fairly heavy infections.

In Table 2 are summarized the data of Table 1, the division into six groups being as before. Here are given the average treatment period for each group and the average amounts of DDS taken per patient per week and for the whole period.

#### SUMMARY AND CONCLUSIONS

The bacteriological changes that occurred in an experimental group of 99 lepromatous cases treated with DDS by mouth during a total five-year period are reported. This treatment was started in April 1949, 63 of the cases entering the group that year and 36 in the next year; the final examinations were made in March 1954. During the period 30 of the cases were lost from the group for various reasons, so that the number of months treated in individual cases range from 14 to 60. The general average was approximately 44.5 months.

At the end of the period, or at the time cases were lost from the

group, 95 of the total had improved to some extent, clinically and bacteriologically. This includes those cases that had to be changed to another treatment because of intolerance or other reasons.

TABLE 2.—Averages of periods of treatment and amounts of drugs consumed, per bacteriological group.

Bacteriological results		Treatment period (av., mos.)	Total DDS (av. per patient)	
Group	Cases <sup>a</sup>		Per week (mgm.)	Whole period (gm.)
Negative	9	43.3	750	114.7
Nearly negative	10	43.0	775	135.4
Bacilli 25% less	25	50.9	605	133.3
Bacilli 50% less	32	44.2	515	134.9
Slightly improved	19	42.2	665	111.4
Stationary	4	25.5	655	65.3

<sup>a</sup> Since the total is 99 cases, the percentage figures are virtually the same as the case numbers.

Only 9 cases became bacteriologically negative, and another 10 nearly so, the latter with only a very few bacilli found in the five smears examined for the bacteriological indexes (BI's). This total of 19 per cent over so long a period, averaging on the whole nearly four years, is not very encouraging. However, another 25 cases were markedly improved (75% less bacilli than at first), and 32 more moderately so (50% less bacilli).

It is impossible to predict from the degree of bacteriological positivity at the beginning of treatment how long it will take a case to clear up if it is to do so. Some cases with low BI's took more time to become negative than cases with high BI's.

#### RESUMEN Y CONCLUSIONES

Describense las alteraciones bacteriológicas observadas en un grupo experimental de 99 casos lepromatosos tratados con SSD (*p*'*p*'-sulfonildianilina) por vía bucal durante un período total de cinco años. Este tratamiento fué iniciado en el mes de abril, 1949, entrando a formar parte del grupo 43 casos aquel año y 36 el año siguiente, haciéndose los exámenes finales en marzo de 1954. Durante dicho período se perdieron 30 casos del grupo por varias razones, de modo que el número de meses de tratamiento en los distintos casos varía de 14 a 60. El promedio general fué aproximadamente de 44.5 meses.

Al fin del período, o al perderse casos del grupo, 95 habían mejorado hasta cierto punto, clínica y bacteriológicamente. Esto comprende los casos en que hubo que cambiar a otro tratamiento, debido a intolerancia u otras razones.

Sólo 9 casos se volvieron negativos bacteriológicamente y otros 10 casi negativos,

encontrándose poquísimos bacilos en los cinco frotis examinados para determinar los índices bacteriológicos (IB). Este total de 19 por ciento para un período tan largo, promediando en conjunto casi cuatro años, no es muy alentador. Sin embargo, otros 25 casos mejoraron notablemente (75 por ciento menos bacilos que al principio) y 32 más moderadamente (50 por ciento menos bacilos).

Resulta imposible predecir por el grado de positividad bacteriológica cuanto tiempo se echará un caso en despejarse si va a hacerlo. Algunos casos con IB bajos tardaron más tiempo en volverse negativos que los casos de IB altos.

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