

THE CONTROL OF TICK BORNE RELAPSING FEVER IN ANKOLE.

It is evident from the Annual Reports of the Medical Department, Uganda, that the district of Ankole has for many years been the main focus of tick borne relapsing fever in Uganda, as many as 892 cases being recorded in 1945. (Annual Report of the Medical Department, Uganda, 1947).

Ornithodoros Moubata, the tick vector of this disease, is notoriously tenacious of life and, although some of the older insecticides are relatively effective in high dosage, the replacement of the only thoroughly effective method of destroying the tick viz. by burning the infested house, became a practicable possibility only after the discovery of the insecticidal qualities of hexachlorocyclohexane (benzine hexachloride) by Imperial Chemical Industries in 1942.

Laboratory and field tests, demonstrating the effectiveness of this insecticide against *Ornithodoros Moubata*, have been carried out by Robinson (1944), Hocking (1946), Jepson (1947); Knowles and Terry (1950) and Teesdale (1952). These investigators have all used B.H.C. in powder form, which, in field conditions, has the disadvantages of smell, uneven distribution and possibly the risk of toxic absorption by the operators. The smoke preparations, though theoretically ideal, are unsuitable because of the practical impossibility of sealing the average African hut. Furthermore, they are relatively expensive. The use of kerosene as a diluent is

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also unsuitable because of the smell, the risk of fire, the expense, and the fact that kerosene is a profitable source of pilferage in primitive communities.

The water miscible preparation, marketed under the name P. 520, was therefore chosen, since it is relatively cheap and odourless, is non-inflammable and, by means of a pressure sprayer, can be spread evenly over walls and floors.

METHODS:

Since Ankole covers an area of 6363 sq. miles and has a population of over 400,000, it was obviously impracticable with the limited resources available, to treat every house in the district. Accordingly a regional chart on which was plotted every proved case of relapsing fever treated at the district hospital in Mbarara and at dispensaries over a period of a year was first made. This showed the main foci to be around Mbarara itself; a dispensary (Lwashamairi) some fifty miles away and a third place (Bwizibwera) some twenty miles away. A regional chart of incidence in a country such as this where communications are poor, is of limited value, since reasonable proximity to a hospital is usually a prime factor in inducing patients to seek admission. Nevertheless, it has some value in a preliminary assessment as the results will show. Initially this campaign was confined to the environs of Mbarara, being subsequently extended to the other two areas.

In the pilot scheme around Mbarara, every house in

each of the small administrative areas (mirukas) was systematically examined for infestation and then, irrespective of the result of such examination, was treated with P. 520.

Each of these houses was resprayed after an interval varying between three and ten months.

Three months after spraying, the great majority of these houses, including all those originally found to be infested, were re-examined. This re-examination preceded the second spraying.

Nine months after spraying, and again preceding retreatment, all the houses found to be infested at the first re-examination i.e. three months after treatment, were again examined, together with a large number in the immediate neighbourhood.

In the preliminary and subsequent examinations for ticks, one foot square of a likely area of floor was dug up to a depth of 3-4 inches, and the number of ticks in this material was counted. As many as 37 have been found in one such small area.

The equipment was very simple and consisted of a Kent sprayer; a spoon and bowl in which to mix the P 520 and water; a 2 pint measure; a tape measure to assess the area to be treated; a chart showing the dosage necessary for given areas; a four gallon container for water and a drum of P 520.

It was found that the optimum pressure was about $12\frac{1}{2}$ lbs./sq.in. as higher pressures caused too rapid a dispersal of the fluid.

The staff of each team, of which there were ultimately three, consisted of an African Assistant Health Inspector, engaged on measuring the degree of infestation; another African Assistant Health Inspector who measured the areas to be sprayed and generally supervised mixing and spraying; and three porters who carried the equipment and moved furniture out of the houses to be sprayed.

After removal of all furniture, the floors and lower three feet of walls were sprayed with P 520, in a dosage of 12 oz. of P 520 per gallon of water, applied at the rate of $\frac{1}{2}$ gallon per 1000 sq. ft. This gave a deposit of 11 mg. of gamma BHC (the most effective isomer) per sq. foot.

With this staff and equipment, it was possible to treat over 100 houses weekly, although the number varied according to the degree of dispersal of the population.

RESULTS:

1181 houses were systematically examined. The results on the tick population are shown in Table I.

Table I.

T A B L E I.

	No. of houses examined	No. in- fested	Max.No. of ticks in defined areas.	Min.No. of ticks in defined areas.	%age in- fested.
Before disinfestation	1181	66	37	1	5.6%
Three months after "	904	13	8	1	1.4%
Nine " " "	359	3	2	1	0.8%

After disinfestation and before re-examination 18 houses were demolished for various reasons.

It should be noted that, after spraying, no fresh infestation was observed in the re-examination. The thirteen infested houses found three months after treatment had all been infested before treatment; and the three found nine months after treatment had been infested when examined three months after treatment.

Since the sixty-six houses, initially found to be infested, were all included in the re-examination, it is probable that the rates of infestation after treatment of the whole sample of 1181 houses were less than those shown in the Table.

It is clear that the infestation rate was markedly reduced and that, even where complete eradication was achieved, the degree of infestation was very considerable less.

EFFECT ON RELAPSING FEVER INCIDENCE:

For a year before this campaign was begun, accurate records were kept of cases of relapsing fever originating in those houses near Mbarara which were subsequently to be treated with P 520. Previous records were quite inadequate for this purpose.

At the outset, it was decided to lay down two very severe criteria before a case could be accepted as originating in a specified house. These were :-

1. There had to be a history of tick bite within the limits of the incubation period. In fact, it was found that the proportion of patients remembering any such bite was only about 50%. And
2. During the incubation period, the patient must not have moved outside the environs of his own house or of other houses subsequently treated.

It will be appreciated that these criteria were extremely severe and resulted in the exclusion of many cases which might otherwise have been regarded with reason as having originated within the specified houses. Even by these severe criteria, thirty-five cases originated in these 1181 houses in the year before treatment.

In the year after treatment, and irrespective of whether these criteria were applied or not, not one case occurred.

With the extension of the campaign to the Lwashamairi and Bwizibwera areas, 8431 houses had been treated up to July 31st, 1953. Not a single case of relapsing fever has occurred in any of these houses since treatment. It should here be said that "relapsing fever houses", from which cases originate almost with regularity over the years, are well known by the African natives and many of these houses were included among those treated.

The effects of this campaign on the incidence of relapsing fever in Ankole are summarized in the subjoined histogram which however must be interpreted in the light of certain qualifications.

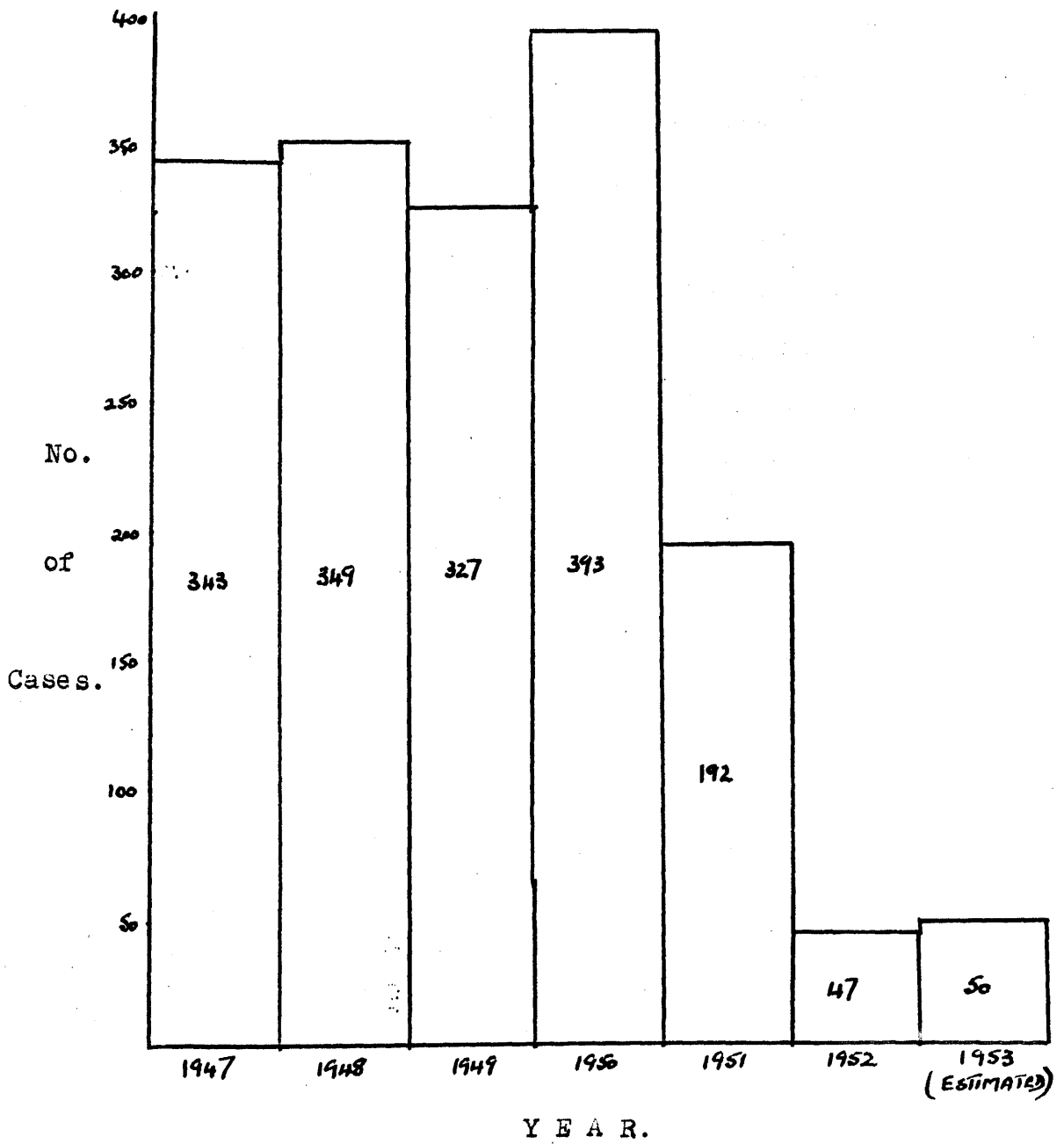
Only since June, 1951, when this campaign was conceived, was microscopical confirmation of the disease made a sine qua non of diagnosis. Because its clinical features and course are so characteristic and because laboratory records shew that in fact the great majority of cases were confirmed microscopically, it is not believed that this precaution resulted in any substantial decrease in "incidence".

Additionally, since June, 1941, as a result of a directive from higher medical authorities, the use of the organic arsenicals in the treatment of this disease at outlying dispensaries in the district was forbidden. However unsatisfactory a method of treatment this may be (vide infra), the African in the bush, when he finds that he cannot obtain an injection (in which he has great faith) at dispensaries

for his relapsing fever, will not report sick at these dispensaries. This effect was, to some extent, minimised by encouraging him to come to the district hospital at Mbarara for treatment with aureomycin or terramycin but, of course, difficulties of transport and prejudice would prevent some, possibly many, from doing this.

Furthermore, from this time onwards, arrangements were made for publicity to be given to the peculiar virtues of B.H.C. and, although at first, this met with little response, it became of increasing importance as more and more householders bought it for their personal use. This effect was, indeed, one of the main objects of the campaign which, directed as it was against known foci of heavy infestation, was expected to shew, in manifest form, the value of B.H.C. in local conditions, thus encouraging its purchase by individual householders.

Yearly Incidence of Relapsing Fever in Ankole .



Up to 31st July, 1953, only twenty-eight cases had occurred in that year. As the peak incidence usually occurs in March - May and October - November, just after the heavy rains break c.f. Appendix 1, the total incidence for 1953 is not likely to be more than fifty cases. This is a very notable reduction compared with the incidence recorded in the Annual Reports of the Medical Department as far back as 1935, the first year in which figures are given (Appendix 2), especially if one considers that diagnostic and treatment facilities have expanded and improved throughout the years.

Discussion:-

It is clear that there has been a dramatic fall in incidence but this fall cannot be wholly ascribed to the campaign.

During 1951, four factors were operating to lower the recorded incidence of relapsing fever in Ankole. These were, in order of importance :

1. A systematic campaign to eradicate the vector.
2. The withdrawal of organic arsenicals for treating patients at outlying dispensaries.
3. The use by individual householders of B.H.C. preparation. (This, in effect, was an essential part of 1).
4. Insistence on microscopic confirmation of the diagnosis.

Clearly, the fall in incidence in 1951 could only partly be due to the campaign, which began only in the latter part of the year.

In 1952, all these factors continued to operate but their degree of importance, relative to each other, changed considerably. The systematic campaign was extended widely and its direct effect can be gauged from the fact that, although it was concentrated on the main foci of tick infestation, not a single case had originated from the thousands of houses treated at the time of writing. (It would have been reasonable to expect up to 200 cases from those houses which were treated). The preliminary use of a chart of regional

incidence was thus fully justified. No doubt, owing to transportation difficulties, prejudice and the like, many cases never reach hospitals or dispensaries and hence the true incidence of this disease has probably never been known. Nevertheless, the results of a campaign such as this, where justice is not only done but manifestly done to the nefarious tick and also equally to the multifarious insect denizens of African huts, has a profound propaganda value, which, like ripples on a pool, spreads further and further without additional effort. Every effort, however, has been made, by lectures at dispensaries and county headquarters, by articles in the vernacular press and by propaganda through the Demonstration Team of the Department of Community Development, to popularise the use of B.H.C. by private householders.* It will be evident, therefore, that the third factor mentioned above, is now, as had originally been hoped and planned, of prime importance in maintaining the present low incidence and preventing reinfestation. The degree of reinfestation - a possibility, indeed a probability in some cases - will be measured in the future by sample surveys.

* When the campaign began, the retail price of the cheapest tin of B.H.C. was three shillings, a major expenditure to the African peasant, but, as the result of an appeal to Imperial Chemical Industries Limited, a small tin is now available at less than a shilling. The demand for this product is now so great in the district that the agents have had difficulty in maintaining supplies.

For reasons already given, insistence on microscopic confirmation of the diagnosis has had little effect in lowering the figures of incidence. With the spread of the systematic campaign and, more important, with the increased appreciation and consequent self use by individual householders of B.H.C. preparations, the effect of withdrawal of arsenicals from dispensaries on the recorded incidence of the disease has become progressively less, its maximum effect being reached shortly after its initiation. News of this sort quickly spreads in a primitive community.

CONCLUSIONS:-

It appears clear from the foregoing that tick borne relapsing fever is a disease very susceptible to control measures. Indeed, in a community whose educational and economic status permitted, it could readily be stamped out. The long term answer to the problem is the provision of adequate housing. The short term answer, and it is an effective one, is the use of B.H.C. and it is suggested that, in the conditions prevailing in Ankole, a water miscible preparation is the most suitable, for reasons which have been given. The cost is low. If the results of this campaign be accepted, the occupants of an average African house can protect themselves from this disease over a period of nine months for the sum of fivepence. Where labour for disinfestation has to be provided, an additional threepence per house (at current local rates) is required.

Finally, the manifest benefits of a campaign such as this provide a favourable psychological background for the introduction of other more prosaic public health measures such as the digging of pit latrines, protection of water supplies etc., and in this way, interest is stimulated, not only in the control of ticks and other insects, but in the fundamental aspects of public health.

SUMMARY:-

1. The severity of infestation by *O. Moubata* and the consequent high incidence of relapsing fever in the Ankole District of Uganda is described.
2. Before beginning a campaign of control, it is important to determine as far as possible the main foci of infestation.
3. Methods for the control of the tick vector, using simple equipment and virtually untrained staff are detailed.
4. A water miscible preparation of B.H.C. is considered the most suitable for an organised campaign.
5. The effects of residual spraying on the tick vector and consequently on the incidence of relapsing fever are marked, indeed dramatic.
6. The prevention of reinfestation must rest with individual householders and the degree to which this occurs may be assessed by sample surveys.
7. An effective campaign of this nature provides a suitable background for more prosaic public health measures.
8. The cost of such a campaign is low, a point of importance in poor, undeveloped countries.

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THE TREATMENT OF TICK BORNE RELAPSING FEVER WITH
SPECIAL REFERENCE TO AUREOMYCIN AND TERRAMYCIN.

Although the authors of standard text books of tropical medicine continue to imply that treatment with an organic arsenical is a satisfactory method of curing relapsing fever, this has not been the experience of many doctors accustomed to treating the disease as it appears in East Africa. Thus Tucker (1946) and Muwazi (1946) both recorded a high incidence of relapses after treatment with neoarsphenamine or sulpharsphenamine, although it must be admitted that the dosage employed was low. Significantly, Black, with a wide experience of this disease, stated in his annual report for 1944 that treatment with N.A.B. continued to give unsatisfactory results and that relapses were the rule rather than the exception. Quinn and Perkins (1946) found the same relapse rate in 80 patients treated with N.A.B. .6 G as in 80 untreated controls.

It is clear that, to be classed as effective, any drug used in the treatment of this disease should satisfy two main criteria viz. (1) it should rapidly and consistently terminate the acute attack and (2) it should prevent relapses. To assess the value of any drug is therefore not an easy task since this disease pursues a variable course; each bout of fever terminating after a variable period; patients presenting

themselves for treatment at varying stages; and relapses, if they occur, not always occurring at regular intervals. Furthermore the age of the patient seems to affect the severity of the attack, being more severe in the very young. Natural immunity too plays a large part. Thus, in the presumably non-immune European, in whom the disease is nowadays rare, violent attacks are the rule. To these factors must also be added the difficulty, in this country, of prolonged observation, so necessary to ensure the detection of late relapses.

It will be obvious, therefore, that a large series of cases, carefully controlled and adequately followed up, would be necessary before a reliable assessment of the positive value of any drug could be made. It is much easier to assess the defects of drugs used in the treatment of this disease and Trowell (1951) has recently reviewed the literature in this respect.

The arsenicals have already been mentioned. Penicillin has been used by several observers (Tucker (1946); Muwazi (1946); Charters (1949); Heisch (1950); Lourie and Collier (1934); Schubert and Hemphill (1946); Anderson (1946); Kaul (1949); Neel, Payet and Gonnet (1949)), and it is clear that although it may help to terminate the fever, it has little or no influence on the prevention of relapse. In French West Africa, it appears to be effective in the treatment of neurological complications of the disease (Bergeret and Raoult 1948).

Yeo (1950) treated 100 cases at Johannesburg with either arsenicals, penicillin, sulphonamides, anthiomaline or anti-protozoal drugs, a few having no treatment at all. 70.5% had one or more relapses. It seems reasonably clear that none of these drugs meets the second criterion mentioned above.

Streptomycin has been tried experimentally in mice (Levaditi and Vaisman 1947) and proved more effective than penicillin in sterilizing residual brain infections. In Kashmir, Narain and Kalra (1950) treated 18 cases with .5G twice daily for 2 days and had no relapses over a period of one to two months. The disease, however, appears to be very mild in that part of the world. A controlled trial of streptomycin in the East African variety would be justified.

Yeo (1950) treated 25 cases with aureomycin, the average total dosage being 3 G, and had three relapses, these occurring on the 12th, 15th and 24th days. Trowell (1951) treated sixteen cases without relapse but the longest period of observation was only eighteen days. Five of these cases received only 0.5G. Because of the rapid disappearance of the organisms from blood smears and the apparent freedom from relapse, he suggested that the effective dose of this drug was almost certainly very small. It is apposite to remark, however, that the mere disappearance of parasitaemia, while encouraging, is no criterion of cure. The possibility that in

this disease, small doses of aureomycin might act merely as a suppressant, as small doses of penicillin do in Syphilis, immediately springs to mind. The necessity of prolonged observation then becomes apparent.

To test the value of minimal doses, not only of aureomycin but of terramycin, whose use had not previously been reported in East Africa, supplies of these drugs were made available to the District Medical Officers at Masaka and Mbarara in Uganda. Kapoor (1952) at Masaka treated 12 cases with .5G aureomycin and had no relapses, the average period of observation being 13 days. 12 cases treated with .5G terramycin showed one relapse, the average period of observation being 14 days. With either drug, the fever subsided within 24 hours and the blood slide became negative within 5 hours in the case of aureomycin and eight hours in that of terramycin.

The following is a record of experiments conducted at Mbarara:

METHODS.

All cases were Africans. They were allocated to their appropriate age groups (0 - 5: 6 - 10: 11 - 20: 21 - 40: over 40). Apart from this, there was no selection, patients being placed alternately in one of the three treatment groups, viz.: (1) Aureomycin; (2) terramycin; (3) the Control group treated with veganin q.s.

In the first series, the dosage employed was a single one of .5 G, either aureomycin or terramycin. In the second series, this was increased to .5 G twice daily for two consecutive days. If under 10 years old, the dosage of aureomycin or terramycin was halved.

The duration of fever prior to treatment and the stage of disease, whether a primary attack or relapse, were recorded.

When the diagnosis was made microscopically, the number of spirochaetes per 100 leucocytes was counted. After treatment was given, similar counts were made on blood slides taken every hour until at least three consecutive negatives had been received.

A four hourly temperature chart was kept and the period of pyrexia following treatment was measured. Pyrexia was regarded as having disappeared when the temperature fell to 99° F or below and did not again rise above that level.

Finally, every inducement was given to keep the patient in hospital for as long as possible and, on discharge, to report any fever as soon as possible. However, not a few absconded as soon as they felt reasonably well. The longest period of observation was 136 days.

RESULTS.

These are listed in detail in Tables II., III. and IV. and synopsised in Table V.

TABLE II.

RELAPSING FEVER:- A. TREATED WITH AUREOMYCIN .5 G.

No. of Case	Sex	Age	Primary Attack or lapses of relapses	Initial Spir. count per 100 leucocytes.	No. of hours after treatment until B.S. negative.	Duration of illness in hours after treatment.	No. of relapses after treatment.	Period of observation in days.	Remarks.		
1	M	39	P	1	1	48	4	Nil	21	N/A	
2	M	15	P	1	2	72	12	Nil	5	N/A	Ran away.
3	M	18	P	2	1	72	7	Nil	4	N/A	Do.
4	M	8 1/2	P	19	1	72	48	Nil	5	N/A	Do.
5	M	6	P	41	4	72	8	Nil	21	N/A	Taken away. Readmitted 29 days after onset c.f. 5A. Mother also admitted c.f. 6. Possibly reinfection and not relapse, as house heavily infested and not disinfested until after readmission.
5A	M	6	?P	4	4	96	8	Nil	21	N/A	
6	F	32	1st R	3	2	18	76	Nil	16	N/A	
7	M	16	1st R	3	2	240	16	Nil	23	N/A	
8	M	23	P	5	1	48	18	Nil	5	N/A	Ran away.
9	F	1 1/2	P	19	3	?192	87	c.f. remarks	12	N/A	History probably unreliable. Pyrexia with neg. B.S. on 7th day after treatment.
10	F	16	P	24	4	72	32	Nil	9	N/A	Ran away.
11	M	17	4th or 5th R			8	12	Nil	13	N/A	Transferred from Veganin group (Case 9).
12	M	16	P	1	1	72	28	Nil	7	N/A	Ran away.
13	M	22	2nd R	6	2	77	62	Nil	62	Aureomy-cin .5G.	Transferred from Veganin Group (Case 11). Relapsed on 29th and 38th days after treatment.
14	M	18	P	2	1	72	8	Nil	14	do.	Nursing Orderly. ? Relapse, but B.S. negative, on 5th day after treatment.
15	M	17	P	Nil	Nil	96	12	Nil	21	N/A	Only thick film pos. ? Relapse, but B.S. neg. on 18th day.
16	M	35	P	4	1	144	40	Nil	5	N/A	Ran away.
17	M	25	P	23	2	120	28	Menin-gitis	136	Aureomy-cin .5G.	? Relapses, with neg. B.S. on 60th, 64th & 84th days after initial treatment.
18	M	12	1st R	16	2	96	12	Nil	5	N/A	Taken away.
19	M	19	1st R	?	?	96	20	Nil	60	N/A	Nursing Orderly. Only thick film pos.
20	M	5	1st R	2	1	96	12	Nil	5	N/A	Taken away.
21	M	15	1st R	?	?	48	24	Nil	4	N/A	Transferred from Veganin Group (Case 15). Only thick film pos.
22	M	12	1st R	48	3	168	12	Nil	14	N/A	
23	M	30	P	?	?	168	24	Nil	5	N/A	Ran away. Only thick film pos.
24	M	26	P	?	?	48	20	Nil	14	N/A	Only thick film pos.
25	M	1	P	?	?	72	36	Nil	3	N/A	do. Taken away.
26	F	40	P	44	2	96	48	Nil	24	N/A	
27	M	18	P	15	2	48	36	Nil	11	N/A	
28	F	5	P	2	1	96	12	Nil	5	N/A	Taken away.
29	M	15	P	2	2	240	2	Nil	3	N/A	Do.
30	F	3	P	8	3	48	4	Nil	9	N/A	Do.

B. TREATED WITH AUREOMYCIN .5 G b.d. FOR 2 DAYS.

T A B L E III.

RELAPSING FEVER. A. TREATED WITH TERRAMYCIN .5G.

No. of Case	Sex	Age	Primary Attack or lapses	Initial count per 100 leucocytes.	No. of hours after treatment.	Duration of illness until B.S. negative.	Duration of illness after treatment.	No. of relapses	Period of observation in treatment days	No. of relapses after treatment	Remarks.	
1	M	22	P	12	6	120	8	Nil	3	Nil	N/A	Ran away. Treated at Kampala for Relapsing Fever 6/12 previously.
2	F	28	P	6	2	72	44	Nil	9	Nil	N/A	Ran away.
3	M	32	P	3	1	168	12	Nil	12)	One	.5G Terramycin	Relapse on 11th day after treatment c.f. 3A.
3A	M	32	1st R.	3	1	19	8	Nil	29)	Nil	N/A	
4	F	11	3rd R.	3	2	72	16	Nil	13	Nil	N/A	
5	M	2	3rd R	2	1	48	16	Subtertian malaria on 7th day	28	Nil	N/A	
6	F	12	1st R	39	2	72	12	Nil	11	Nil	N/A	Ran away.
7	M	9	P	41	12	48	72	c.f. remarks	21	?One	N/A	Pyrexia with neg B.S. on 20th day after treatment.
8	M	9/12	P	14	2	168	24	Nil	21	Nil	N/A	Subtertian Malaria on 16th day.
9	M	25	P	2	1	40	16	Nil	8	Nil	N/A	Nursing Orderly, observed for several months.
10	M	18	P	19	5	71	20	Jaundice Pyuria	18)	One	.5G Terramycin	Relapsed on 17th day after treatment c.f. 10A.
10A	M	18	1st R	26	5	36	24	Nil	13)	Nil	N/A	
11	M	16	P	4	1	120	36	Nil	14	Nil	N/A	Ran away.
12	M	16	P	60	-	72	-	Died	-	Nil	-	Died 2 hours after admission. Post-mortem:- hepatitis & encephalitis.
13	F	1	P	5	24	96	36	Nil	10	Nil	N/A	Vomited most of 1st dose. Repeated after 24 hours.
14	F	25	P	?	?	48	12	Nil	6	Nil	N/A	Only thick film pos.
15	M	14	14th R	7	3	72	36	Nil	6	Nil	N/A	
16	M	16	12nd R	?	?	96	12	Nil	10	Nil	N/A	
17	M	27	P	?	7	48	12	Nil	30	Two	.5G Terramycin	Only thick film pos. Relapses on 12th & 22nd days after treatment.
18	F	4	2nd R	7	2	48	24	Bronchitis	21	Nil	N/A	
B. TREATED WITH TERRAMYCIN .5G b.d. for 2 days.												
19	M	17	2nd R	10	6	72	60	Nil	19	One	2G Terramycin	Relapse on 14th day after Treatment.
20	M	30	P	24	4	96	48	Nil	13	Nil	N/A	
21	F	1	P	?	2	72	12	Nil	21	Nil	N/A	Counts not done.
22	M	20	P	?	4	72	96	Nil	24	Nil	N/A	Do.
23	M	15	?P	?	Nil	240	Nil	Jaundice	24	Nil	N/A	Only thick film pos. No pyrexia.
24	M	26	P	3	1	96	4	Nil	24	Nil	N/A	
25	M	25	P	5	2	168	12	Nil	20	Nil	N/A	

T A B L E IV.

RELAPSING FEVER TREATED WITH VEGANIN q.s.

No. of Case	Sex	Age	Primary Attack or no. of relapses	Initial Spir. count per 100 leucocytes.	No. of hours after treatment until B.S. negative	Duration of illness in hours before treatment	Duration of illness in hours after treatment	No. of relapses after treatment.	Period of observation in days.	of re-lapse, if any.	Treatment	Remarks
1	M	12	1st R	?	Nil	72	Nil	Nil	24	Nil	Only thick film pos.	
2	M	22	2nd R	4	24	84	24	One	25	Veganin		
3	M	21	1st R	3	1	140	8	Nil	14	Nil		
4	M	17	2nd R	7	12	48	16	Nil	15	Nil		
5	M	1	1st R	68	48	48	48	One	7	Veganin	Taken away. Relapse on 4th day after treatment.	
6	M	29	P	2	5	72	18	Nil	7	Nil	Taken away.	
7	M	23	1st R	Nil c.f. remarks	Nil	24	48	?Two	23	Veganin	Only thick film pos. ? 2 relapses with neg. B.S.	
8	M	28	P	do.	Nil	96	60	Nil	18	Nil	Only thick film pos.	
9	M	17	3rd or 4th	4	24	48	40	One	22	Aureomycin	Transferred to Aureomycin Group (Case 11).	
10	M	15	?P	28	36	72	72	Nil	10	Nil	Ran away.	
11	M	22	P	6	3	96	72	Two	11	Veganin	Transferred to Aureomycin Group (Case 13).	
12	F	3	P	2	3	96	72	Nil	20	Nil	Given aureomycin on 3rd day because of persistent pyrexia.	
13	F	14	1st R	Nil	Nil	48	24	Two	17	Veganin	Only thick film pos.	
14	M	22	P	? c.f. remarks	?	72	140	Nil	19	Nil	Counts not done.	
15	M	15	P	44	5	48	48	One	21	Aureomycin	Transferred to Aureomycin Group (Case 21).	
16	F	50	?	?	?	?	—	Died c.f. remarks			Died 2 hours after admission. Post Mortem - Hepatitis, encephalitis and petechial haemorrhages in the lungs.	

The control group was discontinued, as the results were similar to the standard description of the disease.

T A B L E V.

Drug and Dosage	No. of Cases	No. with Primary Attack	Av. Spir Count per 100 leucocytes.		AV. No. of hours for B.S. to become negative.		Av. duration of illness before treatment (in hours)		Av. duration of illness after treatment (in hours)		Av. Total duration of illness (in hours)		No. of Cases of relapsing days		Remarks
			Range	100	Range	1 - 4	Range	8 - 240	Range	4 - 87	Range	20 - 256	1	23	
Aureomycin .5G	23	15	1 - 48	10	1 - 4	8 - 240	26½	124½	1	3	prov- ed	4 - 136	1	23	Relapses on 29th & 38th days. ? Relapses on 5th, 7th, 18th, 29th, 60th, 64th & 84th days after initial treatment.
Aureomycin .5G b.d. for 2 days	7	7	2 - 44	10	1 - 3	48 - 240	22½	114½	Nil	3	pos- sible	3 - 24	9½		
Terramycin .5G	18	12	2 - 60	14	1 - 4	40 - 168	24½	109½	3	3	prov- ed	3 - 41	15		Relapses on 11th, 12th, 17th and 22nd days after treatment. ? Relapse on 20th day. One death - moribund on admission.
Terramycin .5G b.d. for 2 days	7	6	3 - 24	8	1 - 6	72 - 240	33	130	1	1		13 - 24	21		Relapse on 14th day after treatment.
Veganin q.s.	16	7	3 - 68	11	1 - 48	24 - 140	46	117	6	1	6	7 - 25	17		All relapses occurred within twelve days.

The consistent rapidity with which these antibiotics, especially aureomycin, caused disappearance of the parasitaemia was most remarkable. In no case did this persist for more than four hours after aureomycin and twelve hours in the case of terramycin, omitting case 13, where most of the drug was vomited. The duration of parasitaemia after treatment appears to be related to its degree, being longer the heavier the infection.

In this experiment, it is clear from the Tables that neither drug, in the small dosages employed, had any significant effect on the total duration of the pyrexial attack. While most cases did not present themselves until the 3rd or 4th day, when the fever in the natural course of events could be expected to terminate itself, even without treatment, within two or three days, a few cases were seen at an earlier stage. It was significant that, in these early cases, pyrexia persisted longest after treatment, 76 hours in one case treated with aureomycin 18 hours after onset. (Case 6) In these dosages, therefore, neither drug satisfies the first of the assessing criteria.

With regard to the frequency of relapses, the results with aureomycin, and to a less extent, with terramycin, are perhaps promising but it is well to be cautious in this respect as so much depends on the duration of the observation period. Heisch (1952) has shewn that in rats experimentally

infected with Tr. Duttoni and treated with heavy doses of aureomycin, the organism may still be present in the central nervous system 29 days later. Three of the cases, two treated with aureomycin and one with terramycin, occurred in nursing orderlies and were observed over a period of months. They would certainly have reported any relapse had this occurred. However, it is clear that, with these dosages, relapse may occur, though less frequently than in untreated cases.

It would appear also that, when relapses do occur, this may happen at periods much later than would be expected in untreated cases c.f. Table I. Cases 13 and 17 and Table II. Case 10. Although no case treated with aureomycin .5G b.d. for 2 days relapsed, it would be unwise, in view of the relatively short period of observation, to assume that relapse did not occur later. It is therefore unlikely that either drug, in these dosages, fulfils the second of the assessing criteria.

Nevertheless, the extraordinary rapidity of disappearance of the parasitaemia is extremely encouraging and offers hope that, with adequate dosage, specific treatment, especially with aureomycin, may indeed be achieved. Experiments along these lines are now being carried out, the dosage now employed being aureomycin .25G six hourly for 5-7 days, the course being repeated after an interval of 10 days. It is hoped that the second course will eliminate any organisms (possibly lurking in the central nervous system) which have not been destroyed by the initial course of treatment.

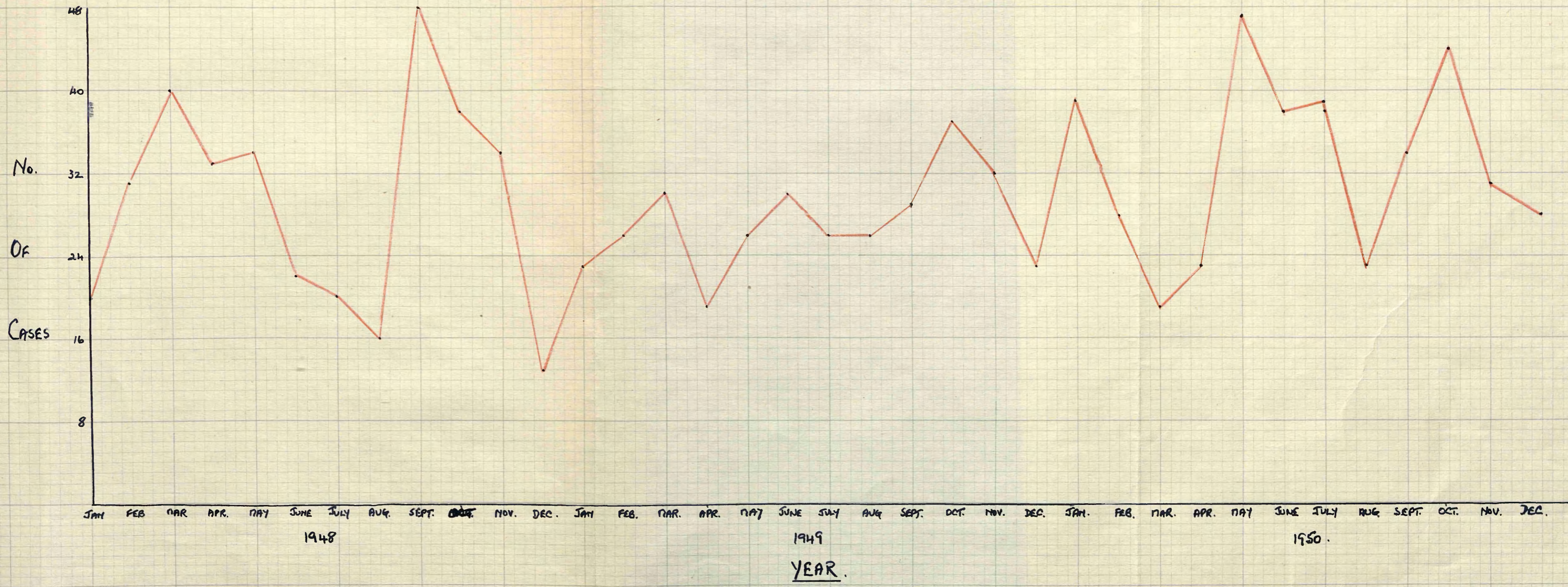
S U M M A R Y.

1. An attempt has been made to assess the relative efficacy of minimal doses of aureomycin or terramycin as compared with controls.
2. Both drugs consistently and rapidly caused disappearance of spirochaetaemia.
3. Neither, in the dosages employed, significantly altered the total duration of the pyrexial attack.
4. Although no case treated with aureomycin .5G b.d. for 2 days relapsed in the relatively short periods of observation, it is unlikely that either drug, in the dosages employed, will entirely prevent relapse.
5. Aureomycin appeared to be the more effective.
6. A full course of treatment may offer hope of an effective cure.

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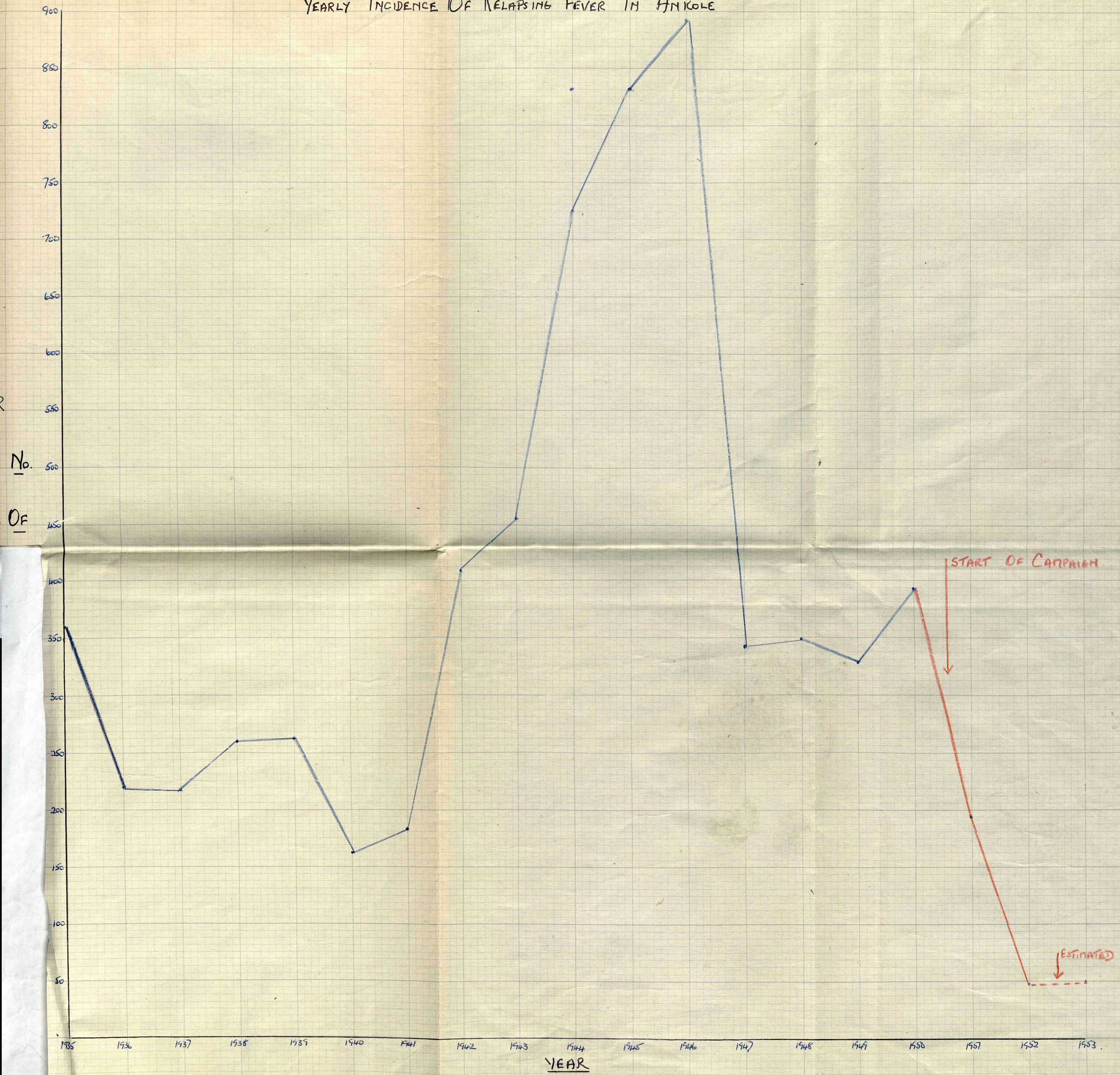
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SEASONAL INCIDENCE OF RELAPSING FEVER.



YEARLY INCIDENCE OF RELAPSING FEVER IN ANKOLE

27





The staff required for each team.
An additional member is shown.
He insisted on being included in the
photograph, as he had taken part in
earlier experiments.

Later teams, once the pilot scheme
had been completed, consisted only
of a headman and three porters.



The simple equipment required
by each team.

RELAPSING FEVER.

Hospital No.

Date of admission.

Adult or Child (if so state age).

Tribe.

Whether Primary Attack or 1st or 2nd (etc.) relapse

BS. Zero hour Spirochaetes / 100 W.B.C.

1

2

3

4

5

6

12

24

(Stop taking BS. after 3 negatives)

Duration of fever in hours.

(Febrile period = Zero hour until temperature fell for first time below 99 and remained down).

Subsequent afebrile period noted for --- days.

Any relapse in hospital: during days.

Complications.

Dose of Aureomycin, (given at Zero hour)

or dose of Terramycin (given at zero hour).

Proforma used for each case.

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