

REPORT ON THE HEALTH OF 401 CHINDITS.<sup>1</sup>

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THE "X" British General Hospital received its first convoy of patients from the "Special Force" (the second "Wingate" Expedition) on July 21, 1944, and further overflows from the advanced hospitals on three subsequent occasions. It is uncertain how representative these patients were of "Chindit" casualties. In the first place, cases diagnosed early as malaria were filtered off to Forward Treatment Units and, secondly, it may be presumed that the more seriously sick were also retained forward. [This is merely a special instance of a general problem—the limitations of hospital material for epidemiological study.] The 401 men who were evacuated here by aeroplane, flying boat, train and ambulance, after spending three to five months in the jungles of Burma, made a highly interesting group. The opportunity has been taken to report on them as a cross-section, though incomplete and "biased," of the morbidity of jungle warfare.

The term "group" has been used deliberately. These men came from all parts of Britain, belonged to different formations and presented manifold disorders, but they tended to conform to a clinical pattern and the group spirit was strong among them. What we learnt to call "the Chindit syndrome" soon emerged—the frequent association of long hair and long dirty finger nails; superior intelligence, morale and manners; fatigue and hunger, pallor and loss of weight, skin sepsis, diarrhoea and malaria.

Table I describes the conditions for which they were treated. Of the 401, 19 were Officers and 382 Other Ranks. On account of the small absolute (and relative) number of officers

TABLE I.—BILL OF MORBIDITY IN 401 BRITISH CHINDITS.

		Number of cases	Incidence, per cent of all patients
I. <i>Disturbances of Nutrition</i>			
Loss of weight, 10 lb. and more .. ..		171 (of 191 men)	90 (of the sample)
Glossitis—diarrhoea .. .. .		86	21
Angular stomatitis .. .. .		5	1.2
Edema of the legs .. .. .		7	1.7
II. <i>Alimentary Infections</i>			
Dysentery .. .. .		80	20
E. H. cysts .. .. .		18	4.5
Worms .. .. .		43	10
Flagellates .. .. .		14	3.5
IIA. <i>Simple diarrhoea</i> (without glossitis or evident infection) .. .. .			
		35	8.7
III. <i>Infective hepatitis</i> .. .. .			
		87	22
IV. <i>Malaria</i> .. .. .			
		127	32
V. <i>Anæmia</i> .. .. .			
		108	27
VI. <i>Skin sepsis</i> .. .. .			
		217	54
VII. <i>Polyn neuritis</i> .. .. .			
		14	3.5
VIII. <i>Scrub typhus</i> .. .. .			
		6	1.5
IX. <i>Weil's disease</i> .. .. .			
		3	0.7
X. <i>Psychoneurosis</i> .. .. .			
		3	0.7
XI. <i>Injuries</i> (including enemy action) .. .. .			
		21	5.2
XII. <i>Miscellaneous</i> .. .. .			
		40	10
Total		1,085	—

1,085 disorders were thus discovered among 401 patients and this total omits minor skin sepsis, diarrhoea, short "P.U.O." and trivial conditions, generally, as well as unrecorded loss of weight (*see text*).

<sup>1</sup> Read at the Physicians' Conference, Alfsea, February, 1945.

these were not, except in one instance, analysed separately. This table raises some interesting points, positive and negative, which may be noted at the outset. The striking positive features are the frequency of multiple disorders (I think it may safely be said that each patient had two or three conditions requiring hospital treatment), and the immediate evidence of malnutrition to an unexpected degree. On the negative side the very low incidence of psychoneurosis was unexpected after two and a half years' experience of a British General Hospital in India.

#### CASE HISTORIES.

Following are six representative case notes of patients in the Medical Division, apart from the skin section:—

Pte. P., A.—Admitted with loss of weight (14 lb.), diarrhoea and a pustular dermatitis B.T. malaria was found on examination. Hb. 83 per cent. No cause was found for the loose motions. Regained 7 lb. in five weeks' stay.

Pte. P., J. J.—Lost 23 lb. Admitted with infective hepatitis. Glossitis—diarrhoea also present. Examination of the stools revealed a bacillary exudate. Regained 4 lb. in twenty-seven days. Evacuated for further treatment.

Pte. D., F.—Lost 15 lb. in Burma. Admitted with diarrhoea. E. H. Veg. found. Also had septic prickly heat and a whitlow. Eosinophils 1,440 per c.mm. Ankylostoma discovered on flotation.

Pte J., T.—Lost 27 lb. Admitted with diarrhoea; microscopically nil significant in the stools. Also had jungle sores. Regained 8 lb. in hospital (21.7.44 to 28.8.44).

Pte. M., T.—Admitted with fever and diarrhoea. B.T. malaria (R) found and a bacillary exudate. Tinea cruris and severe impetigo also present. Eosinophils 1,572 per c.mm. Ankylostoma found in stools. Lost 14 lb. on the expedition. Evacuated.

Pte. R., J.—Admitted with jaundice. Tinea of flexures present. Had a simple diarrhoea while in hospital.

#### MALNUTRITION.

The severe wasting of many men was the outstanding clinical feature; some loss of weight was general. It is difficult, however, to translate these clinical impressions into figures because the men had no documentary evidence of their weight prior to entering Burma, and many stated they had not been weighed recently. On close questioning, however, 191 men did appear to have a sufficiently precise recollection of their original weights to make comparison with the hospital findings of some value. All these were patients in the Medical Division, and they may be regarded as a representative sample of the whole group.

Among the 191, 41 men seemed to have lost 2 stones or more, 130 between 10 and 28 lb., 20 less than 10 lb. (2 of these claimed they gained during the expedition). The average loss, Table II, was 19 lb., i.e. very roughly, a loss of 1 lb. per man per week but the "scatter" was wide. Unfortunately I have no data on the weight record of the soldiers fighting in more "normal" conditions. Our own experience of a relatively inactive medical unit operating in an averagely unpleasant part of the Brahmaputra valley suggests that the "Monsoon loss" alone was rather less than 9 lb.

TABLE II.—THE LOSS OF WEIGHT IN 191 MEN.

Number whose Pre-Burma weight was "known"	Average loss of weight (lb.)	Range (lb.)	Mode (lb.)	Standard deviation	Standard error of mean
191	19	0-46	14	11	± 8

The next step was to break up the 191 into clinical types. The patients sorted themselves into the four classes of Table III. The trend of this table is clear; it agrees with the expected operation of diarrhoea as a cause of wasting, and with the obvious clinical allocation of the patients on a nutritional basis.<sup>1</sup>

*Specific Deficiencies.*—To the naked eye there was very little evidence of specific deficiencies: 7 cases of angular stomatitis and 5 of oedema of the legs in very undernourished

<sup>1</sup> The chi square test applied to the data yields a probability of about 1 in 300 times that such a distribution might arise by chance; i.e. the clinical classification is quite strongly supported.

subjects. That malnutrition was partly responsible for the anæmia is possible, and a B factor shortage is the common explanation, if only by analogy, of the "glossitis-diarrhœa" syndrome.

TABLE III.—LOSS OF WEIGHT IN 191 MEN—THE CLINICAL TYPES.

<i>Clinical type.</i>	<i>Number of patients</i>	<i>Average loss of weight (lb.)</i>
1. Glossitis—diarrhœa syndrome .. ..	62	25
2. Alimentary infections .. ..	35	21
3. Miscellaneous conditions with incidental and simple diarrhœa .. ..	20	17
4. Miscellaneous conditions without diarrhœa .. ..	74	15
Totals	191	19

## ANÆMIA.

Understaffing made it impossible to estimate the Hb. per cent of all 401. 186 men had one or more examinations. These included all patients clinically suspected of anæmia and some leavening with routine determinations. Of the 186, 108 read less than 13.3 grammes per cent Hb. on our Sahli apparatus, recently standardized, and may be considered anæmic. The average was 11.9 grammes or 85 per cent. To help in evaluating these figures they were compared (Table IV) with 100 consecutive estimations made earlier the same summer, almost all in sick casualties from the more "normal" operations of the battle of Kohima. The "controls" show a superiority of 10 per cent hæmoglobin, a considerable difference among British troops.<sup>1</sup>

The level of hæmoglobin is, of course, a very crude indicator to pathology. In the present instance the anæmia may have been the end-result of malaria, hookworm, multiple infections, leech bites, underfeeding or of all of these or any combination of them. How to determine, at this stage, the influence of these several factors I do not know.

*The Production of Anæmia.*—To two interesting questions, however, it may be possible to return an answer, even if only a very incomplete one. In so far as anæmia was due to malnutrition a relationship might be expected between their anæmia and the weight lost by patients (wasting being an equally crude though probably more reliable measure of malnutrition). Evidence was therefore sought of any linkage between these two clinical indices. In the first place 107 men were separated in whom both the presumptive weight loss and the Hb. per cent were known. The average loss of weight in this group was 21 lb. Taking Hb. 85 per cent (11.9 grammes per cent) as the dividing line, it was found that the loss was 19 lb. in 69 of these men whose blood reached that level, but 26 lb. in the remaining 38 whose blood did *not*, and who were, therefore, suffering from material anæmia, i.e. those whose blood was most affected had also lost most weight. Next, the coefficient of correlation was calculated between the loss of weight in pounds and the fall of Hb. in units per cent after allowing for the difference in the average reduction of these 2 units—19 lb. and 15 per cent ( $r = +.287$ ).

This is small but significant and might have arisen by chance less than once in a hundred times. A positive correlation coefficient may or may not indicate a causal relationship; in the present case a likely event is that a third factor (malnutrition) was among the causes of both. Finally, in an attempt to say how much malnutrition might be involved in the production of the anæmia, the regression coefficient for anæmia in terms of wasting, i.e. the average reduction in Hb. with the loss of each pound of weight, was computed:—Coefficient of regression = .22. In other words, these two indices coincide in just over a fifth of their fields; as to almost 4/5 of its ætiology the anæmia appears to be unrelated to the factors

<sup>1</sup> The Standard Error (S.E.) of the difference between the two averages is 1.5. In routine statistical work the conventional level of "significance" is twice the S.E. which indicates the likelihood of the result arising merely by chance to be less than 1 in 20. The observed difference in the present instance, 10, is nearly seven times its S.E. and is thus highly significant with only a remote possibility of its occurring purely by chance.

producing the wasting; from which it may be inferred that malnutrition—in the present context probably a combination of underfeeding and diarrhoea—was not, anyhow, the main cause of the anæmia.

The next step obviously would be to correlate the anæmia with the volume and duration of malarial infection. Unfortunately this is even less the sort of investigation that can be carried out retrospectively, and, at the time, we were thinking of other things. Looking back, the patients in whom we found parasites must have been clinically the most anæmic, for we did Hb. estimations in about three-quarters of them compared with under a third of the rest. If the discovery of parasites here in patients irregularly on suppressive mepacrine and usually after blanketing is any sort of indication of heavier infection, it is interesting that the average Hb. per cent among these was 83 as against an average of 91 per cent in the rest. (Patients with hookworm were excluded.) This, for what it is worth, seems the only approach that can now be made to the important question of the cause of the anæmia.

#### GLOSSITIS—DIARRHŒA (“G-D”).

There were 86 cases of “glossitis,” part apparently of the syndrome of glossitis—diarrhoea-wasting-anæmia which is usually (and unhelpfully) called “para sprue,” [2] was quite uncommon in the hospital’s South Indian experience and developed acutely in the few weeks prior to admission. These formed the most interesting group of all and will be described in some detail.

*The Tongue.*—Clinically there appeared to be stages of:

(a) *Activity*, with atrophy of epithelium, ulceration, fissuring, hypertrophy and œdema. The atrophy was of every extent from a few millimetres to the whole of the anterior tongue and revealed a red shiny base. Islets of superficially affected papillæ with prominent scarlet heads often stood out on the flat surface. The ulcers were marginal; one or many were present without any very clear relation to the severity of the atrophy. They were commonly shallow with red and angry edges. Cracks were noticed mostly on the mid-line with branches extending on both sides though not to the margins. Areas of heaped up tissues occurred in particular between the fissures. Swelling was associated with pallor rather than redness and teeth indentations were frequent near the tongue edge. Apart from atrophy, apparently the essential lesion, the other constituents of the picture varied from case to case and one or all were commonly absent.

(b) *Repair* with what appeared, to the hand lens, the formation of new papillæ, filiform and fungiform, covering the denuded areas and healing the ulcers. The shiny redness faded into more normal coloration with often a bluish tinge.

Pain and loss of hypercuity of taste were inconstant and bore no obvious relation to the activity of the degeneration. Red patches on the soft palate occurred, but infrequently.

*Diarrhoea.*—The stools were examined in almost all cases, with these results:—

(1) Evidence of alimentary infection .. .. .	35 cases = 41 per cent
(2) Steatorrhœa .. .. .	3 cases
(3) Simple diarrhoea .. .. .	40 cases

Thus, alimentary infections were in fact rather more common in this group than in the remainder of the 401 who did not have G-D, and they were of a similar nature. Whether the intestinal upset of past or present infection is a factor in the production of the syndrome cannot be argued now. It would have been instructive to treat these patients routinely with sulphaguanidine but unfortunately this was not done. In 2 of the 3 cases the microscopic excess of fats was confirmed chemically (58 per cent and 31 per cent of the stool; normally split). In other respects these two cases did not apparently differ from the rest. The simple diarrhoea was often slight and usually watery, with pale rather bulky motions containing evident undigested material.

*Wasting.*—The average loss of weight in these cases, as already indicated, was 25 lb.; on further calculation it was found to be 23 lb. in those with alimentary infections and

26 in those without, thus emphasizing the responsibility of the syndrome itself as a cause of wasting. (The difference (Table III) between the average loss of 25 lb. in the G-D group and 19 in the whole group of 191 men, 6 lb., is unlikely to have arisen by chance as its standard error is 1.3; a further confirmation of previous findings.) In keeping with the experience of these cases as the most undernourished, 4 of the 5 examples of *angular stomatitis* and 6 of the 7 with *peripheral oedema* occurred in them.

*Anæmia.*—Anæmia is usually considered an essential feature of the syndrome. Hb. per cent was estimated in 69 of the 86 cases. Table V also shows the findings in the majority of the 186 (Table IV) whose blood was examined, but who did *not* have G-D. The results are illuminating. In this small series the anæmia was not particularly striking (average Hb. 83 per cent) and it was not significantly different from that found in a strictly comparable group of patients who did *not* have glossitis with diarrhœa. Which serves, if nothing else, to emphasize the difficulty of disentangling any clinical entity from the multiple pathology of this part of the world.<sup>1</sup>

In view of the small though definite relationship demonstrated above between loss of weight and fall in Hb. the slightly lower Hb. level of this group might, very well, be merely a function of their greater wasting.

Sufficient R.B.C. counts were not done to justify any conclusion on the type of the anæmia.

TABLE IV.—ANÆMIA: THE HÆMOGLOBIN LEVEL IN 186 MEN.

Group	Number	Average Hb. per cent	Standard deviation	Standard error of mean
Chindits	186	85	10.5	± .76
"Controls"	100	95	13	± 1.3

100 per cent = 14 grammes Hb. per cent, standardized.  
(100 per cent Haldane = 14.8 grammes Hb. per cent.)

TABLE V.—ANÆMIA IN PATIENTS WITH AND WITHOUT THE GLOSSITIS—DIARRHŒA SYNDROME

	Number of cases	Average Hb. per cent	Standard deviation	Standard error of mean of variation	Co-efficient
Glossitis—diarrhœa syndrome	69	83	11.5	± 1.4	14
The rest—miscellaneous conditions	117	86	10.2	± .95	12
Total	186				

*Other Features.*—Distension and flatulence were common. Temporary anorexia often occurred. Ordinary examination of the nervous system revealed nothing particular. Asthenia was marked but hardly specific. There were no complaints of photophobia. No characteristic skin lesions were noticed. Test meals were done in 17; 3 had hyperchlorhydria, 8 had normal curves, 2 hypochlorhydria and 4 achlorhydria (alcohol fast).

*Comment.*—The 86 men with glossitis, flatulence and diarrhœa were the worst nourished of all. 41 per cent had obvious alimentary infections, i.e. a somewhat higher incidence than in the whole group of 401. The tongue changes agree well enough with those described in various B<sub>2</sub> deficiency syndromes, in particular in anisocytosis. Anæmia was not a feature of this series. (The prominent macrocytic anæmia of "para sprue," as it is usually described in Indian patients, may possibly be due to simultaneous deficiency, or inadequate reserves, of the "extrinsic," or other B<sub>2</sub> factors.) A follow-up of these cases to discover whether any develop sprue would be instructive.

#### RATIONS—AND THE CONSUMER.

Long range penetration into the jungle behind enemy lines does not permit of the transport of bulky rations, and opportunities are limited for supplementing, "off the land," the food which is carried. The basis of the Chindit diet during their stay in Burma was the "K"

<sup>1</sup> The S.E. of the difference between the two averages is 1.8. The observed difference of 3, therefore, is less than twice its S.E. The + test shows that the probability (P) of such a difference arising merely by chance is as much as once in ten times.

ration reinforced as far as possible by multi-vitamin tablets, and air drops of fresh supplies. These last, of necessity, were irregular. The "K" ration is a compact and closely calculated dietary and the problem arises why, in general, the men lost weight and, in particular, developed glossitis, on the face of it a B<sub>2</sub> deficiency syndrome. Table VI sets out the relevant nutrients of the "K" ration and compares them with the optimal standards suggested by the National Research Council, U.S.A. [3]. The only indication of any *primary* inadequacy

TABLE VI.—DIETARY STANDARDS.

- (1) Recommended by National Research Council, U.S.A., for a very active man weighing 70 kg.  
 (2) Supplied by full "K" ration.

Standard	Calories	Thiamine mgm.	Riboflavin mgm.	Nicotinic acid mgm.
(1) N.R.C.	4,500	2.3	3.3	23
(2) "K." Ration	app. 3,400	1.5	2.1	app. 16.3

that might lead to malnutrition is the total number of calories which fall several hundred short of the optimum. The strenuous nature of the operations, the fatigue and broken sleep, suggest figures of 3,500–4,000 C as the possible heat output. If the usual intake was 3,000–3,400 C, burning of body tissue equivalent to the average loss of weight of 1 lb. per man per week might well result. Speculation on possible *secondary*, or "conditioning," factors is unlikely to be very profitable but several interesting points arise. Dietary monotony in itself is not unknown to cause B vitamin deficiencies as the history of pellagra in the Southern United States and beri beri in the Far East illustrates. The Chindits soon tired of these concentrated and synthetic foods; "they all tasted the same," "they all tasted of chewing gum," "there was nothing to bite on" were the commonest complaints. Much in fact was left uneaten and what, on paper, may appear sufficient if not optimal might in practice turn out very differently.<sup>1</sup> Poor thiamine intake, in turn, might aggravate this anorexia. Further, there is a suggestion from what I was told that the fraction of the ration which actually was eaten contained a disproportionate amount of its carbohydrate, long recognized as a factor in the precipitation of B<sub>1</sub> and, more recently, possibly of B<sub>2</sub> deficiencies. Interference with absorption by diarrhoea is clinically the clearest association of wasting (Table III). Whether the peculiar malabsorption of sprue also occurs in the G–D syndrome has not, as far as I know, been investigated. Interference with spontaneous synthesis of B vitamins by sulphaguanidine therapy and their excessive excretion in the sweat are even more conjectural.

*Treatment of Malnutrition.*—We aimed at providing a first-class diet which, analysed by food tables, contained, on the average, approximately: 4,000 calories; 120 grammes animal protein; 100 grammes fat; 15 mgm. iron; 10,000 I.U. vit. A; 4 mgm. riboflavin; 28 mgm. nicotinic acid; 85 mgm. ascorbic acid. (Supplements of cod-liver oil, ascorbic acid and beef extract were included as a routine.)

In practice this was not at all easy owing to the peculiar circumstances in which we were situated. However, by sundry manipulations we managed to produce four nutritious and moderately attractive meals a day which approached, if they did not sometimes achieve, the standard we set ourselves; and with some of these men "elevenses" and, soon, the nightly visit to the canteen, often made a fifth and sixth. Some patients had an initial nausea, and even sickness until they were accustomed to the relatively gargantuan bulk of the hospital dietary. In a few anorexia was troublesome, in some, appetites seemed to be insatiable. The length of stay in hospital depended too often on factors irrelevant to the purely medical condition of the patients to permit any confident statement on the response to treatment. It may be said that often, despite the elimination of obvious infections, it was a matter of weeks before a few pounds were regained. In the patients with G–D, improvement of the tongue epithelium and of the diarrhoea was strikingly earlier than improvement in general nutrition. In contrast were half a dozen men who developed an acute "glossitis" while

<sup>1</sup> In consequence the need for more attractive light rations designed for consumption over prolonged periods—the "K" Ration was intended for short term use only—has now been met.

in hospital and on a good diet. In one a complete superficial atrophy was produced in two to three days, in the others it was patchy, in all the tongue quickly epithelialized again. There did not seem to be any deficiency of computable B<sub>2</sub> factors, either absolute or relative to the calorie intake, or to each other, which might account for this phenomenon.

Liver and dried yeast were scarce, yeast extract plentiful and this was freely used. Supplies of nicotinic acid were erratic, of riboflavin nil, and the contents of these vitamins in the basic diet high. No opinion can therefore be expressed on their value in the treatment of patients with malnutrition in general or with glossitis in particular.

#### ALIMENTARY INFECTIONS.

The dysenteries were made up thus :—

Protozoal ... ..	45 cases
E.H. Veg. . . . .	21
Clinical . . . . .	24*
Bacillary type . . . . .	32 cases
Amoebic hepatitis . . . . .	3 cases might also be included.

\* A clinical diagnosis of amoebic dysentery was made on the combination of clinical findings, history, exudate  $\pm$  E. H. cysts, and the response to specific therapy.

18 men in all had amoebic cysts ; hitherto, in S. India, we very rarely found them.

Flagellates as follows :—

Giardia . . . . .	9 cases
Trichomonas H. . . . .	5 cases

Infestations of these genera :—

Ascaris . . . . .	24 cases
Ankylostoma . . . . .	17 cases
Trichuris T. . . . .	2 cases

These last figures were disappointingly small as a large number of examinations were done for anæmia, loss of weight, gastro-intestinal disturbances and eosinophilia. On the other hand, of 40 individuals with worm infestations 25 had W.B.C., 13 showing eosinophilia and 12 normal counts. Ankylostoma was oftener associated with high eosinophil counts than Ascaris.

Several men had two or more types of alimentary infection.

The 35 examples of " simple diarrhoea " without glossitis or evident infection were all of some severity and all occurred in this hospital. They were not, perhaps, investigated as exhaustively as they might have been. Sporadic sulphaguanidine may have masked bacillary infections. If a history of diarrhoea had also been accepted the total who suffered at one time or another would have approached 100 per cent.

#### SKIN SEPSIS.

Trivial infections complicating prickly heat were omnipresent. Considered worthy of note were 106 examples of " I.A.T." (indolent ulcers usually of the legs) and 111 severe attacks of impetigo, tinea, otitis externa, etc. There were some appalling infections involving large areas of the body surface. In general the skin cases did remarkably well despite the twenty-four hours' daily drip of sweat of the Indian summer. As regards the jungle sores comment may be limited to remarking that, for the first time, I was impressed by the possibility of a material nutritional element in these cases. Despite any particular " line " on treatment, as the general state of the patient improved the ulcers often cleared up much quicker than our South Indian disappointments led us to expect. Examination for L.D. bodies in a fair number of patients was unsuccessful : from four ulcers we recovered K.L.B.

## EOSINOPHILIA.

A word may be said here on eosinophilia. 51 men, i.e. 13 per cent of all, had more than 500 eosinophils per c.mm. The highest number was 10,494 per c.mm. All these with very high counts had skiagrams which excluded "eosinophil lung." 13 of the 51 had worms. Of the remaining 38, 33 had their stools examined—104 direct examinations, and 19 of the 33 had, between them, 34 stool flotations, all with negative results. Review of these 38 men showed that 21 had skin sepsis or jungle sores of average, or more than average, severity and duration; in the other 17 there was nil of note. In this group of 51, i.e. a potentially responsible or contributory factor was found in 34 (13 with worms, 21 with skin complaints) and no clue to the cause of the eosinophilia discovered in 17.

## INFECTIVE HEPATITIS.

There were 87 cases of infective hepatitis making an incidence of 22 per cent in the whole group of 401. This was unexpectedly high compared, e.g. with the 8.5 per cent in Leishman and Kelsalls survey of 11,645 medical cases [4] and when it is remembered that all contracted the infection during the summer. Two of the men with jaundice were on anti-syphilitic treatment; none had yellow fever inoculation. This, it should be noted, was a body of seasoned troops. Analysis of random samples of 30 men with jaundice and 100 without showed that the length of service in India averaged twenty-four months in the former and twenty-two and a half months in the latter; which does not suggest lack of previous opportunity to acquire immunity was a material predisposing factor.

On the possible routes of invasion, it can be said that living and fighting in the jungle did not particularly favour contact or droplet infection. Insects were omnipresent. Alimentary infections were common.

*In Officers and Other Ranks.*—The rates among officers and O.R.s were analysed in the hope of shedding some light on the vexed question of the class incidence of this disease. In the Middle East, as is well known, infective hepatitis occurs much more frequently in officers than in other ranks [5]. In the present campaign officers and men were exposed to the same trying conditions and there was neither tent life nor opportunity for mess infection by communal cutlery and the like. (I did not inquire closely into the consumption of alcohol but fancy there was too little anyhow.) Table VII gives the results and reveals a considerably greater infection rate among the officers.

TABLE VII.—THE INCIDENCE OF INFECTIVE HEPATITIS IN BRITISH OFFICERS AND B.O.R. PATIENTS.

	Cases	Total No. of patients	Case incidence per cent
Officers ..	8	19	42
B.O.R.s ..	79	382	21

By the chi square test (fourfold table)  $X_2 = 4.95$ , which (with 1 degree of freedom) means that the probability of such a distribution arising by chance is 1 in 30 times, i.e. the difference in the case incidence among the two classes is statistically significant. When, as a refinement, Yates' correction for continuity is calculated to allow further for the small number in the sample,  $X_2 = 3.7$ —the stricter test shows the chance probability to be 1 in 19, i.e. just below the level of significance.

This differential incidence, if confirmed, would be an important lead to the operation of some predisposition among British officers which, in the circumstances of jungle warfare, must have been effective *before* and not *during* the campaign. But it was not confirmed. Examination of the records of the whole expedition kindly made available by D.D.M.S., Special Force, reveals an opposite trend—the disease was in fact rather more common in B.O.R.s than in officers; and this agrees with the experience of 14th Army as a whole. We are therefore, in this theatre, left with the interesting position found elsewhere in certain Dominion and Allied Forces: where the living conditions of officers and men are roughly the same the incidence of infective hepatitis is not greater among the officers. (The pre-

ponderance among the men in this instance is probably of no special significance in view of the greater load of all important infectious diseases among them.) The above, incidentally, well illustrates the dangers and difficulties, already referred to, of drawing epidemiological conclusions from hospital records.

#### MALARIA.

This was the distribution :—

B.T.	..	..	..	..	..	..	..	108 cases
M.T.	..	..	..	..	..	..	..	11 cases
(Mixed	..	..	..	..	..	..	..	1 case)
" Clinical "	..	..	..	..	..	..	..	8 cases

Adrenalin stimulation was frequently and successfully used, sternal puncture occasionally. Such figures probably bear little relation to the volume of infection among the Chindits. Many were diagnosed early and diverted to the Special Forward Treatment Units, many, doubtless were "blanketed" before they presented an obvious clinical attack. A good number were yellow with mepacrine.

#### POLYNEURITIS.

There were 14 cases, all but 2 clinically post diphtheritic, developing as far as could be judged rather late, with skin ulceration or healed scars and usually evidence of disturbance of accommodation. In only 1 did we recover K.L.B. One of these patients died shortly after evacuation from here with respiratory paralysis.

#### SCRUB TYPHUS.

The only death that occurred in this hospital was an example of overwhelming typhus toxæmia. The series is too small to bear analysis. Our six examples were all contracted during the monsoon.

#### WEIL'S DISEASE.

After many "misses" in South India we diagnosed our first three cases of leptospirosis<sup>1</sup>:

Pte. A. J.—A clinical picture of fever with painful muscles and, later, petechiæ and jaundice which was mild and transient. Urine: 7th day—pus and R.B.C.; present for three days. Agglutination at School of Tropical Medicine, Calcutta, 1:1,000, L.Ict. Hb. 66 per cent. W.B.C. 23,600; P. 20,532, L. 2,832, eosinophils 236 per c.mm.

Gnr. B. S. This man was very ill on admission. B.T. malaria was treated. Jaundice was deep and for several days he was drowsy. Pneumonia developed. In the second week OXK agglutinated 1:125 but later dropped to zero. Urine N.A.D. throughout. W.B.C. 17,000, P. 14,280, L. 2,550, E. 170 per c.mm. Hb. 70 per cent. Agglutination with L. Ict. 1:1,000.

Pte. C. L. This patient was admitted for diarrhoea; glossitis and angular stomatitis were also present. Hb. 85 per cent. While in hospital he ran a twelve-day fever which was unexplained by any of the routine investigations. On the tenth day, however, examination of urine now showed albumin and pus cells which persisted for a couple of days. No icterus present. W.B.C. 12,400, P. 4,464, L. 7,688, E. 248 per c.mm. on third day; later normal. Agglutination with L. Ict. at Calcutta, positive, 1:1,000.

D.G. examinations of urine were negative in all three. Summing up, the first case was classical, the second presented as an unexplained jaundice, the third as "P.U.O." with a passing urinary infection. Opportunities for infection were ubiquitous, and the men seem to have exposed themselves to every known method of acquiring leptospirosis except the curing of fish. They all made satisfactory recoveries. In none of the cases was the diagnosis confirmed in time to try penicillin or serum.

<sup>1</sup> In the last nine years, an average of only 10 cases a year of leptospirosis have been diagnosed in all India, to the knowledge of the School of Tropical Medicine, Calcutta [1].

## MISCELLANEOUS INFECTIONS.

This assortment of infections included 6 of conjunctivitis, 7 of thrush, 7 of pharyngitis, 6 of otitis media, 7 of bronchitis, 1 of mitral stenosis (without obvious cardiac enlargement who carried through the whole expedition and reported sick with amœbic hepatitis), 1 of pulmonary tuberculosis and 1 of acute kala-azar.

## PSYCHONEUROSIS.

In the month of June, among 250 admissions to the medical ward, mostly from the battle of the Kohima-Imphal Road, there were 14 cases of neurosis and 10 downgradings on this account. In S. India about 8 per cent of the officers admitted to the Division and 6 per cent of the B.O.R.s were so diagnosed. The 3 cases among the 401 Chindits were mild; only 2, as far as I could see, were related to the campaign, and these cleared up quickly. The point is not worth labouring, however, as the difference between the expected and actual incidence of neurosis is so gross as to be, most likely, the result of special arrangements made for evacuation of such cases. The infrequency of neurosis, nevertheless, is in keeping with the high morale of these men as observed even in hospital.

## SUMMARY.

401 medical casualties of jungle warfare are reported. The patients were all British troops; each on the average had 2 or 3 conditions requiring hospital treatment. The loss of weight during the expedition seemed to be in the region of 1 lb. per man per week. The average level of hæmoglobin in a large sample was 11.9 grammes per cent. 86 men were suffering from glossitis with flatulence and diarrhoea, a syndrome hitherto very uncommon in two and a half years Indian experience. These were the most undernourished of all; there was no evidence, however, to suggest that they were particularly anæmic. In general, two factors seem to have been responsible for the malnutrition: underconsumption and diarrhoea. Over a third of the patients had obvious alimentary infections. Eighty-seven were suffering from infective hepatitis. Skin sepsis was omnipresent and more than half the men required active treatment for infections and indolent ulcers of some severity. The special medical arrangements of this theatre probably account for the relatively few cases of malaria. There were 14 cases of polyneuritis, clinically post-diphtheritic, 6 of scrub typhus, 3 of leptospirosis and sundry other infections.

These notes give some idea of the condition of a group of the Chindits at the end of the expedition. Their final state cannot be described as the more seriously ill were evacuated to India for further treatment and the rest were transferred to convalescent depots for rehabilitation. The report, however, may afford some guidance in the planning of future jungle operations.

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