SUMMARY

The haemoglobin levels of 732 students at Eastern Command Physical Training School were analysed and a surprisingly high proportion of men were found to have mild anaemia.

Some comparison with published figures is made.

I should like to thank Lieut.-Colonel P. D. Stewart, R.A.M.C., for encouragement, and Mr. S. Rosenbaum, M.A. (A.M.D. Statistics), for statistical information.

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EPIDEMIOLOGICAL FEATURES OF MALAYAN LEPTOSPIROSIS

BY

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The recent occurrence of leptospirosis in troops engaged against the Chinese Communists in the Malayan jungle has stimulated interest in the disease, and reports have appeared dealing with diagnosis and treatment (Fairburn & Semple, 1956; Trimble, 1957; Mackay-Dick & Robinson, 1957). The importance of preventive measures must not be overlooked, however, since no one therapeutic agent is universally regarded as effective.

Epidemiological data collected from 64 consecutive cases of leptospirosis in a Malayan military hospital are presented below. The infection was mild, and only eight cases were jaundiced. All cases were proved by blood culture or serological means.

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### Table 1. Epidemiological details in 64 cases covering the period of 3 weeks before admission

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number admitted from primary jungle</strong></td>
<td>42</td>
</tr>
<tr>
<td>History of drinking untreated water</td>
<td>4</td>
</tr>
<tr>
<td>Noticed proximity of rats</td>
<td>2</td>
</tr>
<tr>
<td>Jungle sores on admission</td>
<td>24</td>
</tr>
<tr>
<td>No special features</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total number admitted from jungle edge, swamps, etc.</strong></td>
<td>16</td>
</tr>
<tr>
<td>History of drinking untreated water</td>
<td>2</td>
</tr>
<tr>
<td>History of swimming in rivers near jungle</td>
<td>9</td>
</tr>
<tr>
<td>No special features</td>
<td>5</td>
</tr>
<tr>
<td><strong>No jungle operations or contact with water</strong></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>64</td>
</tr>
</tbody>
</table>

## RESULTS

The patients in the present series were all adult males with ages varying from 18 to 36, the average being 21.5 years.

Forty-nine cases were British, 11 Gurkha, and 4 Malayan. Approximately equal numbers of British and Gurkha troops were engaged in jungle operations in the area served by the hospital. The number of Malay troops was variable, and some of them were admitted to civilian rather than to military hospitals.

Table 1 shows the epidemiological data collected from patients on admission. Only in six patients could no relation be traced to the jungle, to water or to swimming.

The majority of patients came from operations in primary jungle, where they were exposed continuously to conditions of heat and extreme humidity for periods of 1-2 weeks. Rivers and small streams were frequently crossed during patrol work, and long periods were sometimes spent with the legs immersed in stagnant swamp water.

Scrub, secondary jungle and paddy-fields are even wetter than primary jungle, and 16 patients contracted the disease under these conditions. Nine cases had been swimming in pools or rivers near the jungle. The importance of damp conditions is further emphasised in Fig. 1, which shows the numbers of admissions of confirmed cases of leptospirosis to Taiping hospital over the period April, 1955, to June, 1956. The greatest incidence is seen to occur in October, 1955, at the time of the heavy rains.

The finding of jungle sores in 24 out of the 42 cases admitted from the primary jungle (57 per cent) may be important in indicating the route by which infection occurred, although unfortunately no figures were collected on the incidence of jungle sores in healthy troops.

Softening and infection of the skin were frequently produced by the wearing of the standard canvas rubber-soled jungle boots, by infrequent changing of socks, and by the lack of opportunity for washing and drying the feet.

Four patients from the jungle confessed to drinking untreated water, and infection by the alimentary tract in these cases cannot be excluded. This remark
applies also to those who were infected while swimming, although the cutaneous route seems much more likely.

![Graph showing cases of leptospirosis and rainfall](image)

**Fig. 1.** The number of cases of leptospirosis admitted to Taiping Military Hospital over the period April, 1955, to June, 1956, compared with the rainfall in the same area.

**DISCUSSION**

Leptospirosis throughout the world is predominantly a disease of young adult males since they are the group most frequently exposed to pathogenic leptospiræ (Walch-Sorgdrager, 1939; Gsell, 1952).

Infection is believed to occur most commonly via the skin, especially if the surface is broken (van Thiel, 1948), but is also possible via the alimentary tract and conjunctivæ (Jorge, 1932; van Thiel, 1948). The finding of leg ulcers in 37.5 per cent of the present cases and the comparatively small number of men
Epidemiological Features of Malayan Leptospirosis

who drank untreated water is presumptive evidence in favour of the cutaneous route.

The association of leptospirosis with water is well known and is reflected both in the occupational and seasonal variation. Occupations with a high incidence of the disease in the West are soldiers (Stokes & Ryle, 1916), port workers (Manson-Bahr, 1922), miners (Gulland & Buchanan, 1924), fish-cleaners (Davidson & Smith, 1936), abattoir workers (Johnson, 1950), and agricultural workers (Broom, 1951). In the East a similar increase has been found in sugar-cane workers (Doherty, 1955) and ricefield workers (Gsell, 1952). A seasonal variation occurs in Egypt (Vassapoulo, 1908), Europe (Schüffner, 1934) and Australia (Derrick et al., 1954) at the times of maximum rainfall.

These correlations are emphasised in the present report both in the high percentage of cases in contact with water (91 per cent) and in association with heavy rainfall.

The racial factor is of particular interest in Malaya where men of widely separate origins are exposed to the disease under similar epidemiological conditions. The relative immunity of dark-skinned troops has been previously noted (Fairburn & Semple, 1956; Levis, 1957), and is confirmed by the present report. The reason for this may be that constant exposure to leptospirä of low virulence produces a high incidence of sub-clinical infections. Immunity produced in this way has been shown to occur (van Thiel, 1948; Johnson, 1950) and serological evidence of past infection has been demonstrated in about a quarter of the Malayan civil population (Wisseman et al., 1955).

Alternatively the immunity of the dark-skinned races may simply be due to the thickness of their skins. This would explain why the Gurkha, although equally a stranger to leptospirosis, is less frequently affected than the Englishman. The incidence of skin disease of all sorts is higher in white than in coloured troops and the presence of leg ulcers or macerated fungal infections is likely to decrease the effectiveness of the skin as a barrier to infection.

It is now agreed (Gsell, 1952) that the source of pathogenic leptospirä is the urine recently voided by infected animals and that leptospirä are non-pathogenic in the free-living state. The rats and other muridae are the most important hosts of leptospirä and have been firmly incriminated in Europe as the source of classical Weil's disease (Davidson et al., 1934; Fairley, 1934). Other leptospirä are pathogens in a variety of wild and domestic animals. Thus in Europe the principal host of Leptospira canicola is the dog, of L. grippotyphosa the field vole, of L. pomona the pig, of L. sejro the gleaner mouse and of L. saxecoburg the harvest mouse. In the rodents the infection is mild and hardly recognisable although the carrier state may be prolonged. The geographical distribution of the various types of leptospirosis is governed by that of the animal hosts since one animal species generally harbours predominantly one serotype or a few related serotypes.

It has been postulated (Gsell, 1952) that many of the specific antigens which characterise the various types of leptospirä have been acquired during the existence of the organism in the body of the host. If this is correct the multiplicity
of leptospiral groups and types in Malaya (Trimble, 1957) would indicate a similarly large and varied number of animal hosts. These are probably various species of wild rodent, of which one-sixth has been found to have serological evidence of past infection (Wisseman et al., 1955). It is perhaps surprising that rats were not noticed by more of the men in the present report, but the animals may be more timid than those in the towns. Jungle camps are used intermittently and in the unoccupied intervals are likely to become rat-infested. Stagnant water in the vicinity would then tend to become contaminated with leptospiræ.

The problem of preventing jungle leptospirosis is a formidable one since eradication of the carrier animals and drainage of stagnant water are practicable only in permanent jungle camps. Active immunisation is unlikely to be successful because of the large number of infecting strains and the absence of cross-immunity; second attacks of leptospirosis due to organisms of a different strain have been recorded on a number of occasions (Broom, 1958). Efforts must be concentrated on more efficient protection of the skin of jungle troops and development of footwear which will not produce softening and predispose to ulceration. Furthermore, men with leg ulcers should be withdrawn from jungle duty.

SUMMARY

The epidemiological features of 64 cases of leptospirosis in Service men in Malaya over a period of 15 months are presented.

The agency of water was evident in 58 out of 64 cases. Over one-third of patients had ulceration of the leg. Only 2 patients noticed the proximity of rats.

The various factors controlling infection with leptospiræ are reviewed and discussed. Suggestions are made for the more effective protection of the legs of jungle troops.

REFERENCES

A SURGICAL CAREER IN THE R.A.M.C.

Comments by a Recent Entrant from Civilian Life

At this time it may be pertinent to consider the relative merits of an Army surgical career and a civilian one, and it will perhaps be of interest to learn something of the impressions gained by one who, prior to becoming a regular officer two years ago, was a senior registrar in general surgery. Possibly the words "general surgery" require some clarification. Nowadays civilian general surgeons seem to work largely on the abdomen and neck, excluding head, chest, and orthopaedic conditions, though probably they will have some special interest either within the average field or, more rarely, outside it. My training as a senior registrar was average in this respect except that about one-third of my time was spent in working for a whole-time genito-urinary specialist.

Very shortly after joining the Service I was posted, as a surgical specialist, to a military hospital overseas and have remained there continuously since. The hospital is quite a busy one and I find that I have to work just as hard as, if not harder than, I did in civilian life. I do two or three "cold" operating-lists a week as compared with four or five as a civilian. The number of out-patients sessions is about the same. The amount of time spent on the initial management of emergencies has been, however, much greater since I was only rarely required to carry out this type of work in my civilian hospital.

It is in the quality, as opposed to quantity, that great differences from civilian surgery are seen, and at first sight it may seem that Army surgery comes off badly in comparison. Thus one did relatively far more major "cold" cases of a general nature prior to entering the Service. An average list, for example, would have at least one case such as a gastrectomy or thyroidectomy. Army "cold" lists are largely composed of so-called minor cases such as hernias, varicose veins and haemorrhoids, with the addition of orthopaedic cases of similar status such as meniscectomy. Also there is a difference in the age of patients treated. In the average military hospital one rarely sees the elderly, and it is from this group that the civilian surgeon draws many of his major cases. However, if one examines the position more closely, I believe that the matter is shown in an entirely different light. The general surgeon's "bread and butter" major cases do come one's way in the Army with sufficient frequency to keep one in practice. I am not, of course,
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