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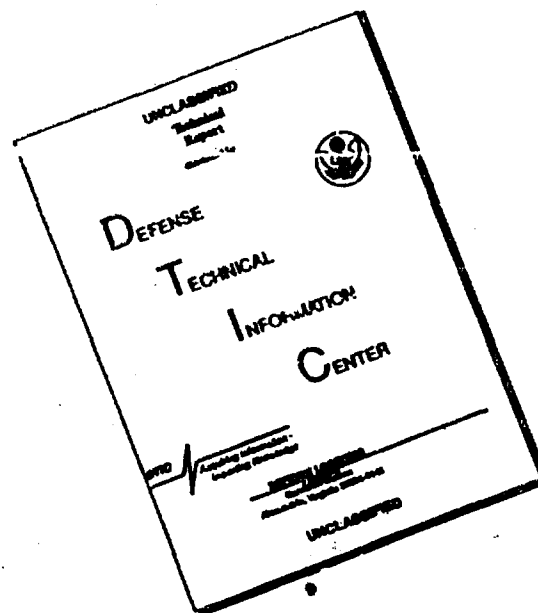
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Asexual Erythrocytic Forms of *Plasmodium Falciparum* in Asymptomatic American and Korean Soldiers Serving in Vietnam*

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THE presence of asexual forms of *Plasmodium falciparum* in the blood without accompanying clinical symptoms is a common phenomenon in indigenous populations residing in malarious areas of the world.¹ Bourke *et al.*² observed that only 15.3 per cent of 111 Thai school children infected with asexual erythrocytic forms of *P. falciparum* had oral temperatures of 100°F. or above. It is the purpose of this paper to report the occurrence of asexual erythrocytic forms of *P. falciparum* in clinically-well American and Korean soldiers serving in the Republic of Vietnam, both of whom had been on weekly anti-malarial prophylaxis.

Materials and Methods

During the latter part of November, 1965, 396 clinically-well American soldiers were questioned and examined for blood parasites. Two groups of 216 and 180 were surveyed three and eight days respectively after their return from a known malarious region of Vietnam. Inquiries indicated that the standard-issue prophylactic tablet, containing 300 milligrams (mgm) of chloroquine base and 45 mgm of primaquine base, had been, and was still being, administered under supervision to each soldier on a weekly basis. Hospital and battalion health reports for the four week period after the initial survey were used to de-

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The opinions and conclusions expressed are those of the authors as individuals, and are not the official position of the Surgeon General, United States Army, or the United States Army Medical Service.

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termine the incidence of clinical malaria in the American group.

In June, 1966, 284 clinically-well Korean soldiers were similarly questioned and examined for blood parasites. Two groups of 150 and 134 were surveyed one and two days respectively after their return from a known malarious region in Vietnam. Inquiries indicated that a prophylactic tablet, containing 300 mgm of chloroquine base, had been, and was still being, administered under supervision to each soldier. Data on the occurrence of malaria in the study group, subsequent to the survey, are not available.

Between January and February, three groups of clinically-well troops on regular anti-malarial chemoprophylaxis were similarly surveyed. They comprised 192 American combatants, 120 Australian combatants and 76 Australian administrative and support soldiers, all of whom were serving in Vietnam. Of these only the two groups of combatants had paid prolonged visits to malarious regions. Since the findings were negative, no attempt was made to determine the incidence of malaria in any of the three groups subsequent to their respective surveys.

Results

Thick and thin blood smears were prepared from finger punctures. Although smears col-

lected during the first survey were stained with aqueous Romanowsky's stains by the method of Field and Sandosham,³ the remainder were subjected to Giemsa's stain. One hundred oil-immersion fields per thick smear were examined for parasites. These thick smear preparations averaged 20 white blood corpuscles per oil-immersion field.

Figure 1 summarizes the findings of the initial survey in American soldiers. Of 396 examined, 356 (89.9 per cent) had no parasitemia. The remaining 40 (10.1 per cent) had parasite densities ranging from one to five asexual forms of *P. falciparum* per 100 oil-immersion fields; no gametocytes were observed. Of the 40 with parasitemia, only seven (1.8 per cent of the total, and 17.5 per cent of those with parasitemia) developed frank clinical malaria during the four-week follow-up period. Thirty-three of the 40 remained symptomless. Sixteen of the 356, who were parasite free on initial screening, developed clinical malaria during the four-week follow-up. Figure 2 illustrates the time distribution, by date of diagnosis, of the 23 cases of clinical malaria that occurred in the 396 soldiers during the follow-up period.

Of 284 Korean soldiers that were questioned and examined for blood parasites, only four (1.4 per cent) were infected with asexual erythrocytic forms of *P. falciparum*; the average parasite density was three per 100 oil-immersion fields of a thick blood smear. No gametocytes were detected.

No blood parasites were detected in 192

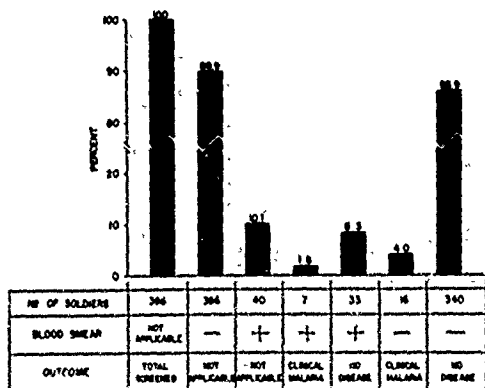


Fig. 1. Distribution of 23 cases of falciparum malaria that occurred in 396 American soldiers serving in Vietnam

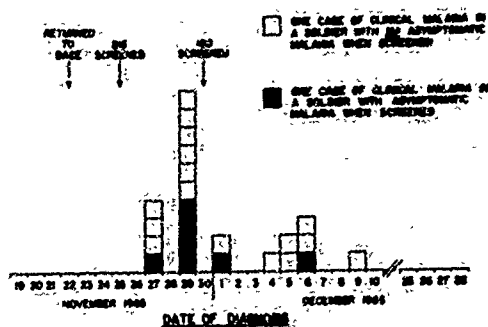


Fig. 2. Distribution of clinical and subclinical infections of *Plasmodium falciparum*.

American combatants, 120 Australian combatants, and 76 Australian administrative and support soldiers.

Discussion

Although seven of the 40 clinically-well American soldiers, that were lightly infected with *P. falciparum*, developed clinical malaria, the fact that 33 remained symptomless indicates that subclinical or asymptomatic malaria can, and does, occur in non-indigenous troops serving in Vietnam, despite weekly chloroquine-primaquine prophylaxis. It therefore seems reasonable to suppose that, in the 33 asymptomatic carriers, the parasite densities were controlled at levels below the fever threshold by the defense mechanisms of the human organism. But, in the case of the seven soldiers that subsequently developed clinical malaria, these mechanisms failed to contain the parasite densities at levels below the fever threshold.

A non-indigenous person may acquire asymptomatic falciparum malaria through the inoculation of a small infecting dose of sporozoites. Since the parasite density in the peripheral circulation would be expected to be low during the early stages of the infection, and would take time to establish reasonable blood levels, it is possible that a non-immune human organism could establish its defenses over the time taken for the invading parasite to establish reasonable density levels. A non-indigenous person may also acquire asymptomatic falciparum malaria through the partial suppression of the parasite with subtherapeutic (prophylactic) doses of chloro-

quine. By lowering a pre-existing parasite density, which has yet to reach the fever threshold level, and by maintaining a low density for a prolonged period, the human organism could conceivably establish its defenses.

Although asexual forms of *P. falciparum* were detected in four out of 284 Korean soldiers, without follow-up data on the incidence of clinical falciparum malaria in the study group they cannot be classified as either asymptomatic carriers or patients in the pre-clinical stage of falciparum malaria.

Summary

Three hundred and ninety-six American and 284 Korean soldiers on active duty in the Republic of Vietnam were examined for circulating malarial parasites. Forty Americans and four Koreans had from one to five asexual forms of *Plasmodium falciparum* per 100 oil-immersion fields of a stained thick blood smear. Only seven Americans with parasitemia developed clinical malaria during the four-week follow-up period; thus 33 were consid-

ered to be asymptomatic cases of falciparum malaria. No follow-up data are available on the Koreans. Malarial parasites were not observed in the following soldiers: 192 American combatants, 120 Australian combatants, and 76 Australian administrative and support soldiers.

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