### Malaria Outbreak in Troops Returning from French Guiana

To the Editor: In January 2005, the chief surgeon in a squadron of French policemen reported a cluster of *Plasmodium vivax* malaria attacks in troops returning from a 108-day operation in French Guiana. We conducted a retrospective cohort study to describe the malaria attacks and determine factors related to them.

A self-administered questionnaire was drawn up, with questions concerning operations in French Guiana (dates, locations) and preventive measures implemented against malaria. A malaria case was defined by the association of clinical signs and *Plasmodium* parasites in blood smears or quantitative buffy coat tests (per definition of military epidemiologic surveillance).

The 40-person mission in French Guiana (Operation Anaconda) took place from July 26, 2004, to November 6, 2004 (108 days of exposure). This mission against clandestine gold panning was conducted in a deepforest environment where the troops were temporarily housed in villages of Brazilian gold panners. Occasionally, they washed themselves late in the evening in stagnant water near the river and patrolled outside during maximum biting periods. All troops received a chemoprophylaxis (doxycycline 100 mg daily) during the mission and for 4 weeks afterward.

From July 2004 through January 2005, 10 persons had ≥1 malaria attacks (attack rate 25%) for a total of 18 malaria attacks (incidence 13/100 person-months of exposure). *P. vivax* was isolated for 17 attacks and *P. falciparum* for 1 attack (Figure). Five patients had 1 malaria attack, and 4 patients had up to 3 relapses. Six patients had a malaria attack while receiving doxycycline.

Regarding chemoprophylaxis compliance, 34% reported missing <1 dose per week and 32% were fully compliant. The troops did not have permethrin-impregnated battlefield uniforms as do soldiers in the French Army. They had to impregnate their own uniforms with permethrin. Only 37% said they always wore clothing that fully covered them during the mission, and 86% reported having frequently used a repellent. All reported having slept under mosquito nets. No association was found between malaria attacks and regular chemoprophylaxis intake or use of repellents. Only 1 operation in French Guiana was associated with the risk of experiencing malaria attacks: 39% of troops located in Sikini had at least 1 malaria attack versus 7% of troops in other areas (relative risk: 5.9 [95% confidence interval 0.8-41.7]).

The incidence rate for this study was 10 times higher than the maximum incidence rate observed for French troops deployed in Côte d'Ivoire (1.3/100 troop-months in 2004). During an earlier Operation Anaconda, 37 of 62 persons deployed near the Sikini area had ≥1 malaria attacks (attack rate 61%). Of these, 30 had >1 attacks caused by *P. vivax*;

occasionally an attack was associated with *P. falciparum* (1).

Our results suggest that the Sikini area was the high-risk area for malaria transmission (although the large confidence interval reflects a lack of power in our analysis). The operation dates (15–28 September) are compatible with the duration of the first cases of malaria occurrence.

French Guiana is the only French territory, except for Mayotte, where malaria is endemic, with nearly 5,000 cases per year, occurring mainly along the rivers bordering Suriname and Brazil (2). The highest frequencies of malaria appear during the dry season (September to December) in French Guiana (3), but no seasonality was described near the Brazilian border (4).

The Sikini area is located near the Oyapock River (Brazilian border). The mean annual incidence in Amerindians there is 48.6%, mainly due to *P. falciparum* (incidence 24.8%) and *P. vivax* (incidence 25.9%) (2).

*P. vivax* malaria incidence has increased in the Oyapock region, from 30% in 1987 to 50% in 2000–2004 (2,4–7). French troops were deployed in an area where parasite circulation was high. Troops had

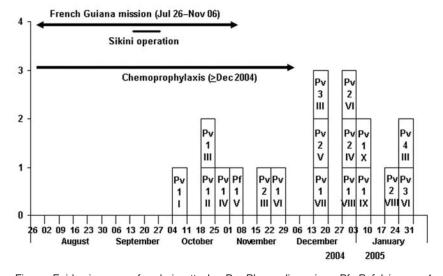


Figure. Epidemic curve of malaria attacks. Pv, *Plasmodium vivax*; Pf, *P. falciparum*; 1, access no.; I, case no.

contacts with clandestine gold panners, mainly Brazilian illegal residents. This population, in which malaria incidence is almost impossible to evaluate, comes from Amapa State, where the incidence of malaria is increasing (5). In 2003, 60.9% of patients with malaria cases at Cayenne Hospital had a Brazilian name compared with 35.4% in 2000 (6). Also, the gold panners diverted the river and built basins where vectors could easily multiply (7).

Initial malaria attacks were treated with chloroquine or quinine. Five patients experienced  $\geq 1$  relapses (maximum 3 relapses). The relapses were treated with 50-mg daily doses of primaquine for 4 patients and by chloroquine for the fifth patient. Two patients had relapses after receiving primaquine. Primaquine resistance information was not available. However, resistance to primaquine has emerged in *P. vivax* strains (8).

We recommended that pre-impregnated battlefield uniforms be available for French policemen and chemoprophylaxis adherence be reinforced by directly observed intake by supervisory staff. Relapses of *P. vivax* malaria are a major therapeutic problem, particularly after primaquine therapy.

#### Acknowledgment

We thank G. Debrabander for assistance with the preparation of this article.

Catherine Verret,\*
Béatrice Cabianca,†
Rachel Haus-Cheymol,\*
Jean-Jaques Lafille,†
Gisèle Loran-Haranqui,†
and André Spiegel\*

\*Ecole du Val-de-Grâce, Paris, France; and †Aquitaine Region of the French Police Force, Bordeaux, France

#### References

 Michel R, Guette C, Ollivier L, Meynard JB, Migliani R, Boutin JP. "Anaconda" operation and malaria. The snake defeated by the mosquito [French]. Med Armées. 2004;32:405-7.

- Carme B, Lecat J, Lefebvre P. Malaria in an outbreak zone in Oyapock (French Guiana): incidence of malaria attacks in the American Indian population of Camopi [French]. Med Trop (Mars). 2005;65: 149–54.
- Raccurt CP. Malaria, anopheles, the antimalaria campaign in French Guiana: between dogmatisme and judgement [French]. Med Trop (Mars). 1997;57: 401-6.
- Mouchet J, Nadire-Galliot M, Gay F, Poman JP, Lepelletier L, Claustre J, et al. Malaria in Guiana. II. Characteristics of different sources and antimalarial control [French]. Bull Soc Pathol Exot Filiales. 1989;82:393–405.
- Carme B. Substantial increase of malaria in inland areas of eastern French Guiana. Trop Med Int Health. 2005;10:154–9.
- Camargo LM, dal Colletto GM, Ferreira MU, Gurgel SM, Escobar AL, Marques A, et al. Hypoendemic malaria in Rondonia (Brazil, western Amazon region): seasonal variation and risk groups in an urban locality. Am J Trop Med Hyg. 1996;55:32–8.
- 7. Baird JK. Chloroquine resistance in *Plasmodium vivax*. Antimicrob Agents Chemother. 2004;48:4075–83.
- Spudick JM, Garcia LS, Graham DM, Haake DA. Diagnostic and therapeutic pitfalls associated with primaquine-tolerant *Plasmodium vivax*. J Clin Microbiol. 2005;43:978–81.

Address for correspondence: Catherine Verret, Departement d'Epidémiologie et de Santé Publique Nord, Ecole du Val-de-Grâce, Ilôt Bégin, batiment 18, 00498 Armées, France; email: desp.valecole@wanadoo.fr

## Instructions for Emerging Infectious Diseases Authors

Letters. Letters commenting on recent articles as well as letters reporting cases, outbreaks, or original research are welcome. Letters commenting on articles should contain no more than 300 words and 5 references; they are more likely to be published if submitted within 4 weeks of the original article's publication. Letters reporting cases, outbreaks, or original research should contain no more than 800 words and 10 references. They may have 1 figure or table and should not be divided into sections. All letters should contain material not previously published and include a word count.

# Plasmodium vivax Malaria Relapses after Primaquine Prophylaxis

To the Editor: Standard treatment of patients with Plasmodium vivax malaria includes chloroquine, followed by primaquine terminal prophylaxis. Reports of true primaquine failure and subsequent P. vivax relapse are unusual; most suspected cases can be ascribed to poor patient adherence, recrudescence of a chloroquine-resistant strain, or P. vivax reinfection. We report a case of P. vivax malaria relapse after therapy with quinine, doxycycline, and primaquine, and again after treatment with chloroquine and primaquine. P. vivax relapses after primaquine treatment are exceedingly rare in travelers to South America and are a serious therapeutic challenge. Our patient was subsequently treated with weekly, single-dose chloroquine without recurrence of symptoms.

A 77-year-old man had fever and chills 2 weeks after returning from Brazil. These symptoms were accompanied by sweating, fatigue, and a mild, productive cough. Review of systems was notable for dark, concentrated urine and a 10-lb weight loss. The patient's 25-day journey included Salvador, Manaus, and a 2-day stay in the Amazon River basin. He did not take malaria prophylaxis during his trip.

On physical examination, the patient was afebrile with blood pressure of 90/53 mm Hg. Cardiovascular, pulmonary, and abdominal examination results were unremarkable. Several petechiae were noted on both lower extremities. Laboratory tests showed the following: leukocyte count 6,300 cells/µL, hemoglobin level 13.7 g/dL, platelet count 40,000 cells/µL, serum creatinine level 1.2 mg/dL, serum alanine aminotransferase level 63 IU/L, and serum