

Case Report: Fatal Outcome of Falciparum Malaria Acquired in Liberia, U.S. Navy Member, 2009

A male in his early twenties was deployed as a member of a Navy detachment to Liberia, near the capital city of Monrovia on the west coast of Africa. Approximately four months into the deployment, the sailor presented to his battalion aid station (BAS) with fatigue, malaise, and temperature of 101°F. He was treated for heat illness and responded well to intravenous (IV) fluids with complete resolution of symptoms. He reportedly ate dinner that night and continued to feel well the following morning; later in the day, however, he was found “walking through camp like he was drunk.” He was brought to the BAS with a temperature of 104°F. His fever continued despite direct cooling and IV fluids (Table 1).

The detachment corpsman contacted the unit’s medical officer and initiated medical evacuation procedures. The sailor was transferred to a local hospital outside Monrovia. At the local hospital, the sailor responded to voice “most of the time;” his urinalysis showed granular casts. By that evening, an American missionary physician had initiated antimalarial treatment with an IV quinine preparation.

The following day, while awaiting medical evacuation from Liberia, the patient developed jaundice; his mental status waxed and waned; and intermittent fevers continued. By the time he was evacuated to Dakar, Senegal, his mental status had declined, e.g., he responded only to pain. On arrival in Senegal, he received dialysis; he was then evacuated to the U.S. military’s Landstuhl Regional Medical Center in Germany.

En route to Landstuhl, the patient required endotracheal intubation due to his worsening mental status. Upon arrival, he was unstable and severely acidotic. On admission, he had anemia (Hct 19%), leukocytosis (WBC $31.5 \times 10^3/\text{mL}$) and thrombocytopenia (platelets $25 \times 10^3/\text{mL}$); blood smears and a rapid diagnostic test were positive for *Plasmodium falciparum*. The parasite burden was 1.8%, and a single blood culture ultimately grew out Gram positive cocci (speciation was not available; the isolate was deemed to likely be skin contaminant). He was started on IV quinidine and oral malarone in addition to broad spectrum antibiotics. Soon after admission, he developed disseminated intravascular coagulation and hepatic failure and was treated with pressors.

Within his first 36 hours at Landstuhl, his condition improved substantially. He was weaned off pressors and his mental status improved to the point where sedation was required for continued ventilator support. The following evening, his mental status declined despite a parasite burden approaching zero. Physical exam indicated fixed and dilated pupils with loss of brain stem reflexes. A CT scan

demonstrated cerebral edema. Imaging studies indicated no cerebral blood flow. The sailor succumbed to his illness eight days after initial presentation in theater. (Results of autopsy were not available at the time of this report.)

The sailor’s compliance with antimalarial chemoprophylaxis is unknown. He was prescribed doxycycline prior to deployment; when he initially presented at the BAS, he reportedly affirmed that he had been taking it. Directly observed therapy (DOT) was not in practice at the time (since then, it has been instituted for the unit). Prior to deployment, all personnel in the unit, including the leaders, were briefed at least twice by the medical officer. All were issued two permethrin treated uniforms, and DEET insect repellent was supplied. Bed nets were not issued prior to deployment; the unit had been informed they would receive them from their predecessors upon turnover. When no bed nets were turned over, they were procured locally within a few weeks of arrival. The permethrin status of these locally obtained bed nets is unknown.

The unit’s living conditions in Liberia were described as “austere at best.” Berthing spaces are in an uninsulated steel-framed, plastic-covered building with individually partitioned rooms; there was no air conditioning at the time

Table 1. Summary of clinical course, by day

Day 0:	Initial presentation with fatigue/malaise, T = 101°F Treated for heat illness Symptoms resolved entirely with IV fluids
Day 1:	Second presentation to BAS, now febrile to 104°F, and with mental status changes Transfer to local hospital Signs of acute renal failure Mental status changes persist IV quinine
Day 2:	Developed jaundice
Day 3:	Transfer to hospital in Senegal Dialysis Medevac to LRMC Endotracheal intubation en route to LRMC
Day 4:	Arrival to LRMC Unstable, acidotic Smear and rapid test positive for <i>P. falciparum</i> Antimalarials and broad spectrum antibiotics
Day 5:	Initial improvement in mental status
Day 6:	Decline in mental status (PM) CT shows cerebral edema Pupils fixed/dilated, loss of brain stem reflexes Parasite burden near 0%
Day 7:	Imaging indicates no cerebral blood flow
Day 8:	Brain death declared

the case developed. Living quarters are within one quarter mile of a saltwater lagoon; there was no obvious standing water in the camp (the case occurred during the dry season). An Environmental Health Officer reportedly visited the camp recently to set mosquito traps and test water; results are pending.

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Editorial comment:

This report highlights the severity of the *P. falciparum* threat to U.S. military members who conduct operations in falciparum malaria endemic areas. The case is a tragic reminder that preventing, diagnosing, and treating falciparum malaria are life-saving activities for deploying service members in all military occupations and grades.

The nature and intensity of the threat, and the potential medical and military operational consequences, of falciparum malaria in Liberia are well known to the U.S. military. In 2003, there was a large outbreak of falciparum malaria among members of a U.S. peacekeeping force in Liberia. Of 290 individuals who spent any time ashore in Liberia, 80 (clinical attack rate: 28%) were treated for malaria (positive smears and/or clinical indications); 43 were evacuated to U.S. military medical centers; several required intensive medical care; and at least two were diagnosed with cerebral malaria. There were no deaths.^{1,2}

The avoidance of severe medical and military operational consequences when operating in high falciparum malaria

risk areas requires comprehensive planning, thorough preparations, and uncompromising execution of prevention, diagnosis, and treatment regimens. For example, before deployment, all individuals (i.e., commanders, supervisors, and service members at all levels) must be informed in detail regarding the nature of the threat, personal and unit protection policies and practices, and the potential consequences of prevention failures. Before deploying, all individuals must initiate prescribed malaria chemoprophylaxis. All deployers must be provided the equipment (e.g., permethrin impregnated uniforms and bed nets) and supplies (e.g., DEET insect repellent) necessary to prevent the potentially lethal bites of malarious mosquitoes; and they must be trained to properly and consistently use all indicated personal protective measures. Before deploying, medical care providers should receive formal/refreshers training to clinically detect, diagnose, and begin treatment of falciparum malaria in its earliest stages. During deployment, supervisors must ensure 100% compliance with all indicated chemoprophylactic and personal protective measures.

References:

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2. Susi B, Whitman T, Blazes DL, et al. Rapid diagnostic test for *Plasmodium falciparum* in 32 Marines medically evacuated from Liberia with a febrile illness. *Ann Intern Med*. 2005. 142: 476–477.

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