CASE REPORT

A Case of Imported Malaria in California: An Overview of a Globally Widespread Disease

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INTRODUCTION

Malaria kills 1.5-2.7 million people every year and approximately half of the world population lives at risk. There are 300 to 500 million new infections annually.[1] The majority of new infections are from M. falciparum and M.vivax and occur in tropical latitudes. However, M.vivax can also be found in temperate areas such South America, East Africa, China, Russia and Korea.[2] In the 19th century Malaria was endemic in areas of the U.S., however, today only rare cases have been acquired in California, Texas, Michigan, New Jersey and New York City.[3] The majority of cases currently encountered in the U.S. come from travelers returning to the U.S. from high risk areas with inappropriate malaria chemoprophylaxis and those travelers visiting the U.S. from endemic areas.[4] In addition, surveys at international airports reveal many instances in which live mosquitoes have been found aboard aircrafts returning from countries where malaria is endemic, thereby coining the term "airport malaria."[5] This report demonstrates a case of malaria in an individual moving to the U.S. from a country in which malaria is commonly encountered.

Case

A 24 year-old male arriving to the U.S. from Nicaragua five months ago presented to the emergency department complaining of intermittent fever and chills for the last month. The patient reported having approximately six hour episodes of shaking chills followed by fever. These episodes repeated every two days. The fever was accompanied by abdominal pain, nausea, vomiting, and a headache. The patient states feeling well between episodes and had his last occurrence just prior to presenting to the emergency department. He denied any cough, shortness of breath, chest pain, hematemesis, bright red blood per rectum and had no recent ill contacts.

When questioned further, the patient admits to having malaria ten years ago in Nicaragua that was treated with a medicine that made him feel "crazy." He then developed malaria again six months ago and was treated with an "injection" before coming to U.S. The patient has had no follow up since that time and he reports no other medical history. He had no previous surgeries, takes no medications, drinks six beers a week, is a smoker and does not use recreational drugs.

His vital signs were blood pressure of 98/65 mm Hg, pulse rate of 85 beats/min, respiratory rate 16 breaths/min, and temperature 37.0 °C. The patient was noted to be in no apparent distress, alert and oriented and appeared well nourished. His eyes were icteric and his mucous membranes dry. Lungs were clear to auscultation and his heart rate was regular rate and rhythm with no murmur appreciated. His abdominal exam did not reveal any hepatosplenomegaly, ascites or masses, however, the patient's abdomen was diffusely tender to palpation. The stool was negative for occult blood. His neurological exam was unremarkable and the patient had no signs of clubbing, cyanosis or edema of the extremities.

Chemistry results revealed the following: sodium 137 mmol/L, potassium 4.0 mmol/L, chloride 98 mmol/L, bicarbonate 31 mmol/L, blood urea nitrogen (BUN) 17mg/dL, creatinine 1.1 mg/dL, and glucose 107 mg/dL, calcium of 8.6 mmol/L. Liver function tests showed: total protein 6.9 g/dL, albumin 3.5 g/dL, alkaline phosphatase 62 U/L, aspartate aminotransferase 28 U/L, alanine aminotransferase 30 U/L, and total bilirubin 1.7 mg/dL. His prothrombin time was 12.7 sec and INR of 1.06. Urinalysis revealed protein 15 mg/dL, ketones 5 mg/dL and a pH of 7.0. A complete blood count showed a white blood count of 9.800/µL, hemoglobin of 14.8 g/dL with a hematocrit of 43.3 %, platelets of 131.000/µL. A thick and a thin smear were positive for malaria.

The patient was admitted to the internal medicine service for treatment and supportive care with pain control. During his stay a Giemsa stain was performed and it revealed plasmodium vivax ring forms, trophozoites and gametocytes. Blood cultures were negative for bacterial growth and the complete blood count remained stable. Treatment consisted of chloroquine 1g orally followed by 500 mg six hours later, then 500 mg each day for two days as well as primaquine 26.3 mg orally each day for 14 days. The patient was also diagnosed with genital herpes and started on Acyclovir 400 mg tablets four times a day for ten days. The patient remained in the hospital for three days without any further complications.

DISCUSSION

Malaria is produced by intraerythrocytic parasites of the genus Plasmodium. Four plasmodia produce malaria in humans: Plasmodium falciparum, P. vivax, P. ovale, and P. malariae.[3,6] The clinical manifestations of malaria are determined by the infecting species, as well as by the magnitude of the parasitemia, the metabolic effects of the parasite, and the cytokines released as a result of the infection.

Life Cycle

The life cycle of plasmodium is complex and is best understood by beginning with the synchronous asexual replication of the parasite within the erythrocyte. The asexual erythrocytic cycle involves

the maturation of the parasites from rings to trophozoites to schizonts, which ultimately rupture the red cell and release merozoites.[6,7] However, there are also some erythrocytic parasites that will mature to sexual forms, which may then be ingested by the female anopheline mosquito.[3,6,8] Once in the mosquito the intermediate host, the male and female gametocytes mature and fuse forming a zygote, which ultimately produces the sporozoites that are infectious for humans. The infectious sporozoites are transferred when the infected mosquito bites a human.[3] The sporozoites then travel via the bloodstream to the liver, where they enter hepatocytes and mature to tissue schizonts, which release merozoites that are infectious for red cells beginning the asexual erythrocytic cycle once again.[6,8] The four species that infect humans can be broken up into two functional groups; those that are relapsing (P. vivax and P. ovale) and those that are non-relapsing (P.falciparum and P.malariae). The relapsing species produce dormant (hypnozoite) forms in the liver, which may mature two to eleven months or more after the initial infection and seed the blood stream with proliferative merozoites, thus producing relapsing malaria.

Clinical Manifestations

The hallmark of malaria is the cyclic fever, which typically occurs shortly before or at the time of red blood cell lysis as schizonts rupture to release new infectious merozoites. This occurs every 48 hours with P. vivax or P. ovale infection (and thus is called tertian malaria) and every 72 hours with P. malariae infection (quartan malaria). In addition, P.falciparum has a 48-hour parasitic cycle but tends to cause continuous fevers with intermittent irregular spikes rather than a regular 48-hour cycle, especially in persons with no immunity, such as expatriate travelers.[6] It is important to understand that only the asexual intraerythrocytic parasite is responsible for the symptoms and pathophysiologic consequences.[8]

Laboratory Findings

Malaria has traditionally been diagnosed by microscopic examination of a thin or thick smear, however alternative techniques of similar (or greater) sensitivity are now available for the diagnosis of P. falciparum infection. These include genetic testing using malaria DNA or mRNA and enzyme testing.[6] In addition, nonspecific laboratory findings such as hemolysis and hyperbilirubinemia may be associated with malaria.[7]

Treatment of Malaria

Antimalarial agents as well as a full array of supportive strategies are necessary to effectively treat persons with malaria. In addition, important issues include the management of hypoglycemia, seizures, pulmonary edema, renal failure, and lactic acidosis. In fact, physicians in countries such as the United States should hospitalize persons with P. falciparum infection who have no immunity until a response to treatment has been observed and enough time has elapsed to be certain that cerebral, renal, pulmonary, or other complications are not likely.[6-8]

In addition, exchange transfusion is a potentially useful adjunct in the treatment of hyperparasitemia, although there are no levels of parasitemia at which survival does not occur without exchange transfusion. Survival has been reported without exchange transfusion despite parasitemias greater than 50%.[9] Persons with partial immunity and uncomplicated P. falciparum infection and some persons with no immunity and P. vivax or P. malariae infection can be treated as outpatients if reliable follow-up is possible.[6,8] A comprehensive review of malaria prophylaxis and the treatment of resistant forms can found in the literature.[6-8]

Diagnosis of Malaria

Malaria often presents with typical manifestations such as fever, chills, joint pain and flu-like symptoms as seen in this patient. However, the diagnosis of malaria can still be easily missed during the first medical visit, especially since it is not a common disease in the U.S. Other differential diagnoses include early bacterial sepsis, viral illnesses, leptospirosis, and other tropical and exotic parasitoses. In cases where the patient does not know his or her disease, a travel history maybe the only clue in establishing the correct diagnosis. A work history may also be important.

This patient was diagnosed relatively fast with malaria because of his medical history. He knew of his diagnosis and he had a positive travel history. A thick and thin smear were positive for malaria and the Giemsa blood stain revealed M. vivax ring forms, trophozoites and gametocytes. Our patient's blood cultures were negative for bacterial growth and with the exception of a mild hyperbilirubinemia all other tests were negative.

CONCLUSION

A reported 1,000 and an estimated 3,000 individuals returning or visiting the U.S. suffer from clinical attacks of malaria.[3] Despite attempts at chemoprophylaxis for individuals traveling to countries where malaria is endemic, malaria continues to be an emerging disease in the U.S. and one of the most widespread diseases on a global basis.[2,3,6-8,10]

There has been a great deal of criticism towards physicians for a lack of awareness with regards to the magnitude of this disease and appropriate preventative measures. Therefore, physicians need to be suspicious for exotic infectious diseases in cases of continued flu-like symptoms in travelers and recent immigrants. Health care providers should also be aware of the possibility "airport malaria" and the potential for small outbreaks in airport employees and in those areas situated near international airports.[5] Lastly, if a patient is traveling to an area were malaria is endemic, it is important that the physician consult appropriate references, such as the CDC website, to find out what the resistances are with respect to chemoprophylaxis so that the patient is adequately protected.

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CAL/AAEM Announcement:

CAL/AAEM's Executive Committee appointed in April 2002 its Immediate Past President A. Antoine Kazzi, MD, FAAEM to the position of Executive Director, replacing Dr. Boris Lubavin who had reached the end of his term.

CAL/AAEM and AAEM wish to thank Dr. Lubavin for his outstanding service to CAL/AAEM during his 2 year term. Dr. Lubavin served in that role while training as a resident in Emergency Medicine at UC Irvine.

Holding On To Your Kids: A Report on Car Seat Safety in San Francisco

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On January 1, 2002, California was the first state to extend the mandatory use of car seats to children up to age six, or weighing up to 60 lbs.[1] Previous regulation stopped at age four, or 40 lbs, leaving a gap of "forgotten children," those too big for rear-facing or forward-facing car seats, yet too small for the vehicle's standard lap and shoulder belts.[1,2] Many parents and caregivers are unaware that a vehicle's standard lap and shoulder belts are designed for persons older than eight years of age or weighing more than 80 lbs.[1] Booster seats provide protection by lifting the child up so that the safety belt fits correctly and prevents the child from being propelled during a car crash.[1,3,4]

Motor vehicle crashes remain the leading cause of death for children 1-14 years of age.[5-7] Riding unrestrained is the single greatest risk factor for death and injury among child motor vehicle occupants. Unrestrained children in vehicles are *twice* as likely to die or be injured as those who are restrained.[8-11] Despite the proven effectiveness of car seats and booster seats in saving lives, their use is far from universal, particularly as children grow older.[12]

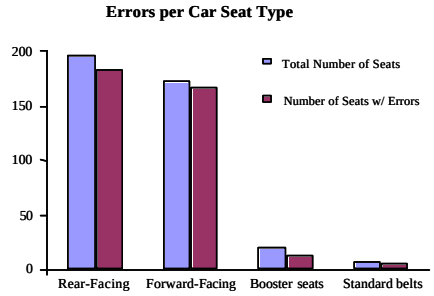

Figure 1. Car seat errors in installation and use.

Even though more people are buckling up their children in car seats, as well as booster seats, errors in their installation and positioning can cause them to be ineffective in preventing injuries or death.[13,14] To look at this problem, the San Francisco Injury Center, in partnership with the San Francisco Safe Kids Coalition and the San Francisco Police Department, completed a series of car seat safety checks throughout the city. Of the 396 rear-facing, forward-facing, and booster car seats checked by certified technicians, 93% were either misused or incorrectly installed – a percentage much higher than the national average of 85%.[7,14-16] See Figure 1. Of the 93% misused or incorrectly installed car seats, we found an average of four errors per seat. With rear-facing and forward-facing car seats, technicians found that a majority of the errors occurred with the car seat harness,