Case Presentation

The patient was a twenty-one year old Sudanese male admitted to the hospital after a one week history of joint and back pain, myalgias, headache, and a five day history of fevers and chills. He had developed these symptoms at the time when he had emigrated to the U.S. Three days prior to admission he had been evaluated in the emergency room for similar symptoms, at which time careful examination of the peripheral smear for malarial organisms was negative. On admission, the temperature was 103 F, pulse 108, BP 90/70. The liver was 10 cm and tender; the spleen was non-palpable. Hemoglobin was 12.6 g/dl, hematocrit 38.6%, white blood cell count 5,700/µl with 50% PMN's, 32% bands and 16% lymphs, and platelets 27,000/µl. Examination of the peripheral smear demonstrated parasitism of 12% of the red blood cells by malarial ring forms with frequent multiply-infected cells. No gametocytes were noted. Total bilirubin was 1.9 mg/dl and liver function tests revealed AST 310 Iu/l, ALT 583 Iu/L. He was given Chloroquine, 600 mg p.o. initially and then switched to Quinine 600 mg p.o. TID for three days and Tetracycline 250 mg p.o. QID for ten days. His hospital course was characterized by gradual clinical improvement, with the degree of parasitemia decreasing from 12% to 1% over the first two days. He was afebrile by day four. The hemoglobin dropped to 9 g/dl then stabilized with no further evidence of hemolysis, and he was discharged in good condition.

Method

Two types of Wright-stained blood films are helpful—thick smears and thin smears. On the thick smear, relatively large volumes of red cells are lysed, and the parasite morphology is assessed. Thin smears examine less specimen but demonstrate both parasite morphology and characterization of the parasitized red cells. Serologic confirmation by immunofluorescent or hemagglutination techniques is available.

Limitations of the technique

On occasion, platelets or intracellular inclusions such as Howell-Jolly bodies or Cabot rings may be mistaken for trophozoites, and platelet clumps can be confused with schizonts or gametocytes. Misidentification can occur with Babesia species of parasites, especially B. microti, a rodent parasite which can look like malarial ring forms. The greatest limitation of the technique is that meticulous examination of numerous fields on the peripheral smear may be necessary to detect a rare parasitized red cell; this is due to the cyclic presence of parasitized cells in the periphery and sequestration in venules of many organs. Repeated smears over a period of several days may be necessary to reliably rule in or rule out malaria.
Interpretation of the smear

Evaluation of both the parasitized red cells and the malarial organisms (intracellular trophozoites and merizoites, extracellular gametocytes) is helpful in distinguishing between the four commonly-occurring human plasmodial infections: *P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae* (1,2). In practical terms, the important distinction needed for appropriate treatment is between *P. falciparum* and the other three organisms. The erythrocytic phase of *P. falciparum* involves red cells of all ages, the majority of parasitized cells being of normal size. Young erythrocytes are thought to be the most susceptible (3). Multiply-infected cells are common. Usually the only parasite stages detected are the intracellular ring forms and the extracellular crescent-shaped (banana) macrogametocytes. Ring trophozoites frequently are seen at the periphery of the red cell, are generally small with delicate threadlike cytoplasm, and can demonstrate coarse, dark malarial hematin pigment. High parasitemia is common with *P. falciparum* and, if noted, should raise doubts about a diagnosis of non-falciparum malaria. The other three malarial organisms are generally found in low or moderate numbers. *P. vivax* parasitizes primarily young, large (1 1/2 to 2 times normal size) red cells. Red Schuffner's dots are frequently seen in the erythrocytes. Trophozoites characteristically have irregular amoeboid cytoplasm. Schizonts and round gametocytes are also commonly seen. Malarial pigment is seen but often is inconspicuous. *P. ovale* parasitizes young, oval macrocytes, often containing Schuffner's dots. All parasite stages may be found in a smear. Intracellular organisms are generally round with compact cytoplasm, and brown malarial pigment is conspicuous. *P. malariae* parasitizes older, small to normal size erythrocytes. All parasite stages are often seen. Trophozoites are generally round and compact, and merizoites characteristically are noted in rosette formation surrounding dark, course malarial pigment.

Several non-specific hematologic findings may also be present. Schistocytes are occasionally noted on the smear but this is rare as massive intravascular hemolysis is infrequent. A normocytic, normochromic anemia is often present, and there may be monocytosis with occasional erythrophagocytosis or hematin pigment-containing monocytes noted. Leukocytosis, plasmacytosis and thrombocytopenia can also be seen, especially in severe acute illness.

Value of the blood smear evaluation for malaria

There are three major uses of blood film examination: rapid detection of malaria as the infectious agent, specific recognition of *P. falciparum*, and monitoring of response to therapy. Malaria has been seen with steadily increasing frequency in the last ten to fifteen years and in many infectious disease cases needs to be considered and evaluated. Poor vector control of the female Anopheles mosquito, mosquito resistance to DDT and Plasmodial organism resistance to antimalarials have all contributed to the problem (4). Immunofluorescence or hemagglutination assays are not extensively available for the diagnosis of malaria, and the examination of the peripheral smear is rapid, reasonably easy, and inexpensive. The specific recognition of *P. falciparum* is of paramount importance for several reasons. First, a clinically stable patient can deteriorate quickly, and falciparum malaria can be a fatal disease. Second, diverse organ system complications, seen primarily with *P. falciparum*, must be anticipated and recognized. These complications include
severe anemia, acute renal failure, pulmonary edema, tissue necrosis, gastrointestinal hemorrhage and cerebral ischemia. Finally, falciparum malaria requires different antimalarial treatment than the other three species (5,6). An adequate response to antimalarial therapy is best evaluated by examination of the peripheral smear. Persistence of parasites beyond four–five days indicates inadequate therapy despite clinical improvement in fever and other parameters.

References


