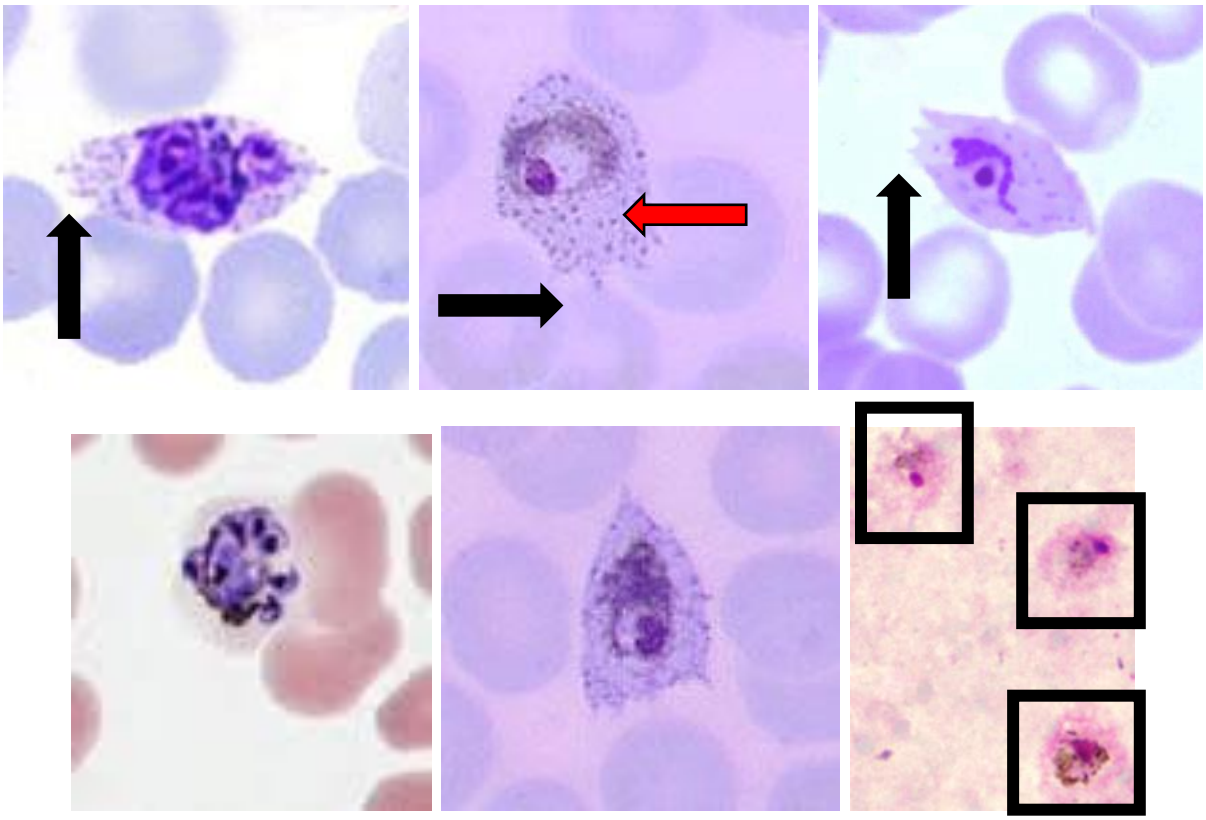
**PARASITOLOGY CASE HISTORY #14 (BLOOD PARASITES)**
**(Lynne S. Garcia)**

A 37-year-old woman, who had traveled to New Guinea for several weeks, presented to the medical clinic with fever, chills, and rigors within three days after returning to the U.S. Although she had obtained the appropriate malaria prophylaxis, the medications were not taken correctly. Blood smears were ordered, stained with Giemsa, and examined at 1000x oil magnification. The following images were seen on thick and thin blood films:



What infection most likely matches these images? What key characteristics support your diagnosis?

**Answer and Discussion of Blood Parasite Quiz #14**

The images presented in this quiz are the following: This was a case of malaria caused by *Plasmodium ovale*. Diagnostic morphologic features included the following:

1. enlarged infected RBCs with Schüffner's stippling (red arrow).

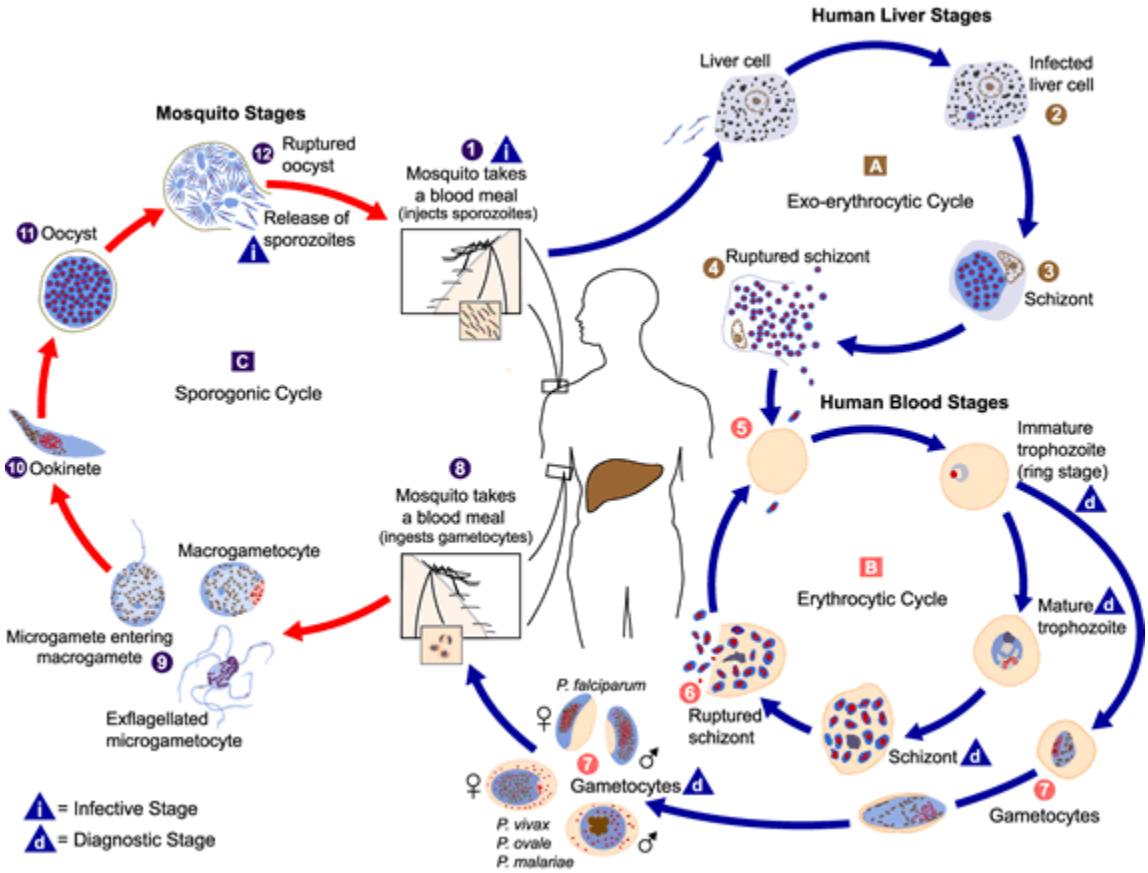
2. fimbriated (rough, spiked edges) infected RBCs (black arrows).

3. large, slightly amoeboid trophozoites (larger than uninfected RBCs).

4. thick film – morphology more difficult to see (squares)

***Plasmodium ovale.***

Molecular methods have confirmed the existence of two distinct non-recombining species of *Plasmodium ovale* (classic type *Plasmodium ovale curtisi* and variant type *Plasmodium ovale wallikeri*). In one study, a significant finding was more severe thrombocytopenia among patients with *P. ovale wallikeri* infection than among those with *P. ovale curtisi* infection. Recent epidemiologic studies conducted by using PCR techniques have found *P. ovale* infections in most of sub-Saharan Africa, Southeast Asia, and the Indian subcontinent including prevalence as high as 15% according to results of studies conducted in rural Nigeria and Papua New Guinea. In addition, severe complications such as spleen rupture, severe anemia, or acute respiratory distress syndrome may occur in patients with *P. ovale* malaria. Thus, the global burden of *P. ovale* infection might have been underestimated.



**Clinical Disease**. Although *P. ovale* and *P. vivax* infections are clinically similar, *P. ovale* malaria is usually less severe, tends to relapse less frequently, and usually ends with spontaneous recovery, often after no more than 6 to 10 paroxysms. **True relapses occur as early as 17 days after treatment of the primary attack to as late as 255 days.** Delayed primary attacks occur when the primary attack has been eliminated, usually with antimalarial drugs. Such infections have been reported after 4 years.

The incubation period is similar to that seen in *P. vivax* malaria, but the frequency and severity of the symptoms are much lower, with a lower fever and a lack of typical rigors. *P. ovale* infects only the reticulocytes (as does *P. vivax*), so that the parasitemia is generally limited to around 2 to 4% of the available RBCs.

**Endemic Area.** The geographic range has been thought to be limited to tropical Africa, the Middle East, Papua New Guinea, and Irian Jaya in Indonesia. However, infections with *P. ovale* in Southeast Asia may be the cause of benign and relapsing malaria in this region. In both Southeast Asia and Africa, two different types of *P. ovale* circulate in humans. Human infections with variant-type *P. ovale* are associated with higher parasitemias and thus have possible clinical relevance.

The **Duffy blood group** does not appear to be a controlling factor for infections with *P. ovale* as it does with *P. vivax*. There appears to be no difference in susceptibility to infection between Caucasians and African-Americans. Because of the resistance of individuals with negative Duffy blood group to infection with *P. vivax* and the high prevalence of negativity in populations of West Africa, surveys reporting *P. vivax* may actually represent infections with *P. ovale*.

## Diagnosis

**Patient Information.** When requests for malarial smears are received in the laboratory, some patient history information should be made available to the laboratorian. This information should include the following. **Although there are two species of *P. ovale*, they look the same microscopically, and the diagnosis would be *Plasmodium ovale*.**

1. Where has the patient been, and what was the date of return to the United States? (“Where do you live?” – this has relevance to “airport” malaria)

2. Has malaria ever been diagnosed in the patient before? If so, what species was identified?

3. What medication (prophylaxis or otherwise) has the patient received, and how often? When was the last dose taken?

4. Has the patient ever received a blood transfusion? Is there a possibility of other needle transmission (drug user)?

5. When was the blood specimen drawn, and was the patient symptomatic at the time? Is there any evidence of a fever periodicity?

Answers to such questions may help eliminate the possibility of infection with *P. falciparum* or *P. knowlesi*, usually the only species that can rapidly lead to death.

## KEY POINTS — LABORATORY DIAGNOSIS

### Malaria

1. Blood films should be prepared on admission of the patient (ordering, collection, processing, examination, reporting on a STAT basis). A fever pattern may not be apparent early in the course of the infection (immunologically naïve patient – travelers); symptoms may be completely random and may mimic any other condition with vague complaints.

2. Both thick and thin blood films should be prepared. At least 200 to 300 oil immersion fields (X 1,000) on both thick and thin films should be examined before the specimen is considered negative.

3. Wright's, Wright-Giemsa, Giemsa, or a rapid stain can be used. The majority of the original organism descriptions were based on Giemsa stain. However, if the white blood cells appear to be well stained, any blood parasites present will also be well stained. The WBCs on the patient smear serve as the QC organism; there is no need to use a Plasmodium-positive slide for QC.

4. **Malarial parasites are often missed with the use of automated differential instruments**. Even with technologist review of the smears, a light parasitemia is very likely to be missed.

5. The number of oil immersion fields examined may have to be increased if the patient has had any prophylactic medication during the past 48 h (the number of infected cells may be decreased on the blood films).

6. One negative set of blood smears does not rule out malaria. Quantitate organisms from every positive blood specimen. The same method for calculating parasitemia should be used for each subsequent positive blood specimen.

7. In spite of new technology, serial thick-film parasite counts are a simple, cheap, rapid, and reliable method for identifying patients at high risk of recrudescence due to drug resistance and treatment failure.

8. If you are using any of the alternative methods (rapid tests), make sure you thoroughly understand the pros and cons of each compared with the thick and thin blood film methods**.**

**Therapy**

**Radical Cure**. Treatment for the RBC stages usually involves a drug like chloroquine; however, this drug alone will not eliminate the possibility of a relapse.

The radical-cure approach to therapy eradicates all malarial organisms, both the liver and the RBC stages, from the body (usually requiring two drugs). Therapy is usually given to individuals who have returned from areas where malaria is endemic; it prevents relapses with *P. vivax* or *P. ovale* infection, although relapses with both *P. vivax* and *P. ovale* infections occasionally occur after treatment with primaquine. The gametocytes are also eliminated, thus stopping the chain of transmission to the mosquito vector. The drugs used are primaquine and other 8-amino-quinolones. Treatment with primaquine is usually not necessary for malarial cases acquired by transfusion or contaminated needles or passed from mother to child as a congenital infection (no liver stages; thus no possibility of a relapse).

**References:**


1. **Garcia, LS**, 2016. *Diagnostic Medical Parasitology*, 6th Ed., ASM Press, Washington, DC.

2. **Collins. WE, GM Jeffery**. 2005. *Plasmodium ovale*: parasite and disease. Clin Microbiol Rev 18:570-581.