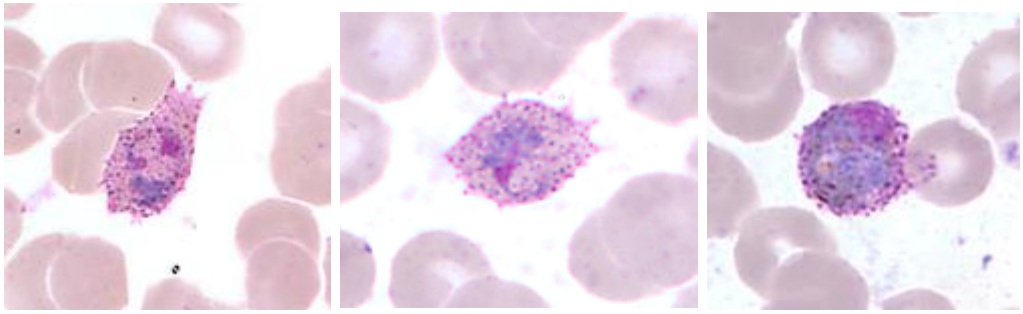
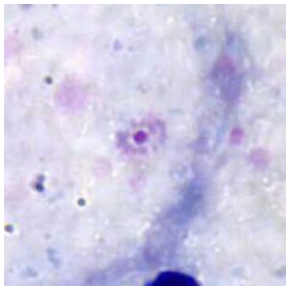
PARASITOLOGY CASE HISTORY #7 (BLOOD PARASITES)
(Lynne S. Garcia)

A 42-year-old male returned from visiting family in Rwanda; he presented with symptoms including headache, fevers, chills, and diarrhea. Blood films were ordered; the following images were seen on manual examination of the stained thick and thin films.

Please comment on the possible diagnosis.





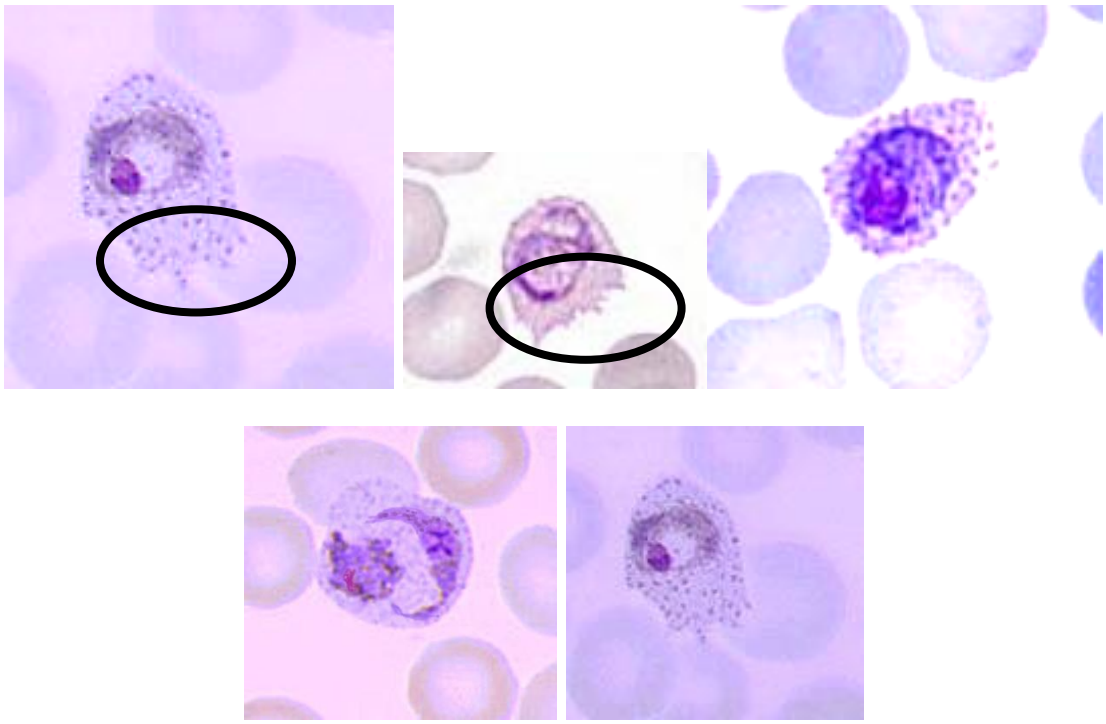
Thick film

What infection most likely matches these images?

Answer and Discussion of Blood Parasite Quiz #7

The images presented in this quiz are the following: *Plasmodium ovale.*

Note the key characteristics seen below: RBCs with fimbriated edges (left and middle images – edges seen within ovals) and Schüffner's dots, enlarged RBCs, oval-shaped RBCs (left image), and macrogametocyte filling the RBC – also note this organism is not usually oval in shape. (right image). Also note non-ameboid developing trophozoites (see second row below – comparison of ameboid ring of *P. vivax* and non-ameboid ring of *P. ovale*).



P. vivax ameboid ring *P. ovale* non-ameboid ring

Comments on the Patient:

***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. Note that the infection is reported as: *Plasmodium ovale* (morphology can't be used to differentiate the two).

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. 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.

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*.

Key Points - Laboratory Diagnosis

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 may be 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.

Radical Cure. The radical-cure approach to therapy eradicates all malarial organisms, both the liver and the RBC stages, from the body. 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.

Epidemiology and Prevention:

Malaria is primarily a rural disease and is transmitted by the female anopheline mosquito. There are great variations in vector susceptibility to infection with the parasite, with many variations being related to differences in parasite strain. Even when the vector is present in an area, an average number of bites per person per day must be sustained or the infection gradually dies out. This critical level can be influenced by a number of factors, including the vector preference for human blood and habitation and the duration of infection in a specific area. Once an area is clear of the infection, there may also be a drop in population immunity, a situation that may lead to a severe epidemic if the infection is reintroduced into the population.

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.

3. **Win, T. T., A. Jalloh, I. S. Tantular, T. Tsuboi, M. U. Ferreira, M. Kimura, and F. Kawamoto.** 2004. Molecular analysis of *Plasmodium ovale* variants. Emerg. Infect. Dis. 10:1235–1240.