MAYO CLINIC LABORATORIES

Test Definition: MAL

Malaria/Babesia Smear

Overview

Useful For

Rapid and accurate detection and species identification of *Plasmodium*

Detection of *Babesia*, trypanosomes, and some species of microfilariae

Testing Algorithm

See Malaria Laboratory Testing Algorithm in Special Instructions.

Special Instructions

- Malaria Laboratory Testing Algorithm

Method Name

Giemsa Stain

NY State Available

Yes

Specimen

Specimen Type

Varies

Ordering Guidance

Malaria is a potentially life-threatening disease and testing for this infection should be performed as rapidly as possible. **Therefore, this test should not be used as a primary screening test for malaria, except for clients in the immediate Rochester, Minnesota area when the specimen can be delivered within several hours of collection.** Laboratories that are unable to deliver a specimen within this time frame should provide an initial screen for malaria and other blood parasites in their laboratory prior to sending a specimen to Mayo Clinic Laboratories. This test is used for confirmation of a presumptive malaria diagnosis and determination of infecting *Plasmodium* species and percent parasitemia.

If filarial infection is suspected, FIL / Filaria, Blood is recommended since it is more sensitive than the traditional blood smear examination.

Specimen Required

Both blood and slides are required.

Specimen Type: Blood

Container/Tube: Lavender top (EDTA)

Specimen Volume: 1 mL

Collection Instructions:

1. Invert several times to mix blood.

2. Do not transfer blood to other containers. Send specimen in original tube.

Specimen Type: Blood films

Slides: 2 thin blood films and 2 thick blood films

Container/Tube: Plastic slide container

Collection Instructions:

1. Slides must be clean and grease-free.

2. Blood films should be made from fresh blood using fingerstick or drops of blood from needle following venipuncture. However, EDTA anticoagulated blood is also acceptable.

3. Prepare thin blood films as follows:

a. Prepare 2 thin smears with the mini prep-slide machine. OR

b. Prepare a thin film with a "feathered edge" that is no more than a single cell thick.

c. Allow the film to thoroughly air dry and then fix by briefly immersing in either absolute or 95% methyl alcohol.

d. Allow to air dry after fixation.

4. Prepare thick blood films as follows:

a. Place a large drop of blood (approximately the size of a dime and preferably from a fingerstick) on a slide.

b. Using a corner of a second slide spread the drop in a circular motion while applying firm pressure to literally scratch the blood onto the carrier slide. This technique allows the blood to dry quickly and adhere well to the slide. Use approximately 20 circular sweeps with the second slide. The drop of blood should be about the size of a quarter when

finished.

c. **Do not fix.** Air dry thoroughly (approximately 45 minutes) before placing in transport container.

Forms

If not ordering electronically, complete, print, and send a Microbiology Test Request (T244) with the specimen.

Reject Due To

Gross hemolysis	Reject
Gross lipemia	Reject

Specimen Minimum Volume

Blood: 0.5 mL

Slides: See Specimen Required.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Varies	Refrigerated (preferred)		
	Ambient		

Clinical & Interpretive

Clinical Information

Malaria is a mosquito-transmitted disease caused by apicomplexan parasites in the genus *Plasmodium.* It is an important cause of morbidity and mortality worldwide, with the World Health Organization (WHO) estimating 219 million cases and 435,000 malaria-related deaths in 2017. Malaria disproportionately affects individuals living in Africa (90% of cases), with individuals living in southeast Asia and the eastern Mediterranean regions next most affected. Malaria is also encountered outside of endemic regions such as the United States, usually in returning travelers.

Malaria is caused primarily by 4 species of the protozoa *Plasmodium*: *P falciparum*, *P vivax*, *P malariae*, and *P ovale.* A fifth *Plasmodium* species, *P knowlesi,* is a simian parasite that may be an important source of human infection in some regions of Southeast Asia. Differentiating *P falciparum* and *P knowlesi* from other species is important since both can cause life-threatening infections. In addition, *P falciparum* is typically resistant to many commonly used antimalarial agents such as chloroquine.

Babesiosis is an emergent zoonosis caused by an intraerythrocytic protozoan in the genus *Babesia. Babesia microti* is

responsible for the vast majority of human cases in the United States, with "hot spots" of disease along the Northeast Coast (eg, Martha's Vineyard, Long Island, and Nantucket) and Midwest states, although the distribution of disease is spreading. In addition, a small number of cases of *Babesia duncani* and *Babesia duncani*-like human infection (WA and CA strains) have been reported along Pacific Coast states from Washington to northern California, and *Babesia divergens/B divergens*-like strains have been isolated from humans in Missouri (MO-1 strain), Kentucky, and Washington. At this time, only *Babesia microti* is a nationally notifiable disease.

Babesia microti shares a tick vector with *Borrelia burgdorferi* and *Anaplasma phagocytophilum*, the causative agents of Lyme disease and human granulocytic anaplasmosis (HGA), respectively. Recent studies suggest that exposure to *Babesia microti* is quite common in areas endemic for Lyme disease and anaplasmosis, so it is prudent to consider testing for all 3 diseases concurrently. Less commonly, babesiosis may be acquired through blood transfusion, and therefore the FDA approved testing for this parasite in donor units in 2018.

Most patients with babesiosis have a mild illness or are asymptomatic, but some develop a severe illness that may result in death. Patient symptoms may include fever, chills, extreme fatigue, and severe anemia. The most severe cases occur in asplenic individuals and those over 50 years of age. Rare cases of chronic parasitemia, usually in immunocompromised patients, have been described.

Microscopy of Giemsa-stained thick and thin blood films is the standard laboratory method for diagnosis and differentiation of *Plasmodium* and *Babesia* species. Under optimal conditions, the sensitivity of the thick film microscopy is estimated to be 10 to 30 parasites per microliter of blood. This test can also detect trypanosomes that cause Chagas disease (*Trypanosoma cruzi*) and African sleeping sickness (*T brucei*), as well as some species of filariae. If filarial infection is suspected, FIL / Filaria, Blood is recommended since it is more sensitive than the traditional blood smear examination.

Examination of the thin film allows for calculation of malaria percent parasitemia, which can be used to predict prognosis and monitor response to treatment for patients with malaria and babesiosis. The percentage parasitemia represents the percentage of infected red blood cells. This is calculated from representative microscopic fields on the thin blood film. Malarial gametocytes are not included in the calculation since they are not infectious to humans and are not killed by most antimalaria drugs.

Reference Values

Negative

If positive, organism identified and percent parasitemia calculated, if applicable.

Interpretation

A positive smear indicates infection with the identified species of *Plasmodium* or with *Babesia*.

Species identification can indicate the appropriate antimalarial therapy.

Cautions

For most sensitive detection of *Plasmodium*, thick smears must be examined.

Any exam that does not include a thick smear cannot be considered adequate.

Since the degree of parasitemia may change rapidly due to natural parasite replication and administration of antimalarial therapies, it is most useful to calculate the percentage of infected cells immediately after the blood is drawn and malaria parasites are detected. A percent parasitemia that is calculated more than 8 hours after the blood is drawn will not accurately reflect the patient's current state of parasitemia.

Calculation of the percent parasitemia may not be possible or may be inaccurate if malaria parasites have degraded or have altered morphology due to age of the specimen or suboptimal transportation conditions.

Clinical Reference

Mathison BA, Pritt BS: Update on Malaria Diagnostics and Test Utilization. J Clin Microbiol 2017 Jul;55(7):2009-2017

Performance

Method Description

The thin blood film is fixed in methyl alcohol and stained with a Giemsa stain. The thick films are not fixed and are directly stained with Giemsa stain. The thick films are used for screening. When the thick film is positive, the thin films are used for species identification and the determination of the percent of infected red blood cells. The percentage of infected cells (percent parasitemia) is calculated by counting the number of infected red blood cells among 3,000 to 100,000 red blood cells on the thin blood film. The result is expressed as a percentage (% parasitemia = number of infected red blood cells/total number of red blood cells counted x 100).(Unpublished Mayo method)

PDF Report

No

Specimen Retention Time

Until reported

Performing Laboratory Location

Rochester

Fees & Codes

Test Classification

This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information

87207

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
MAL	Malaria/Babesia Smear	51714-4

Result ID	Reporting Name	LOINC®
MAL	Malaria/Babesia Smear	51714-4