MAYO CLINIC LABORATORIES

Test Definition: BABPB

Babesia species, Molecular Detection, PCR, Blood

Overview

Useful For
Initial screening or confirmatory testing for suspected babesiosis during the acute febrile stage of infection in patients from endemic areas, especially when Giemsa-stained peripheral blood smears do not reveal any organisms, or the organism morphology is inconclusive

Method Name
Real-Time Polymerase Chain Reaction (PCR)/DNA Probe Hybridization

NY State Available
Yes

Specimen

Specimen Type
Whole Blood EDTA

Ordering Guidance
This is a qualitative assay, and the results are reported either as negative or positive for targeted *Babesia* species DNA.

Specimen Required
Container/Tube:
Preferred: Lavender top (EDTA)
Acceptable: Royal blue top (EDTA), pink top (EDTA), or sterile vial containing EDTA-derived aliquot
Specimen Volume: 1 mL
Collection Instructions: Send whole blood specimen in original tube (preferred).

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

Specimen Minimum Volume
0.5 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole Blood EDTA	Refrigerated (preferred)	7 days	
	Frozen	7 days	

Clinical & Interpretive

Clinical Information

Babesiosis is a tick-transmitted zoonosis caused by intraerythrocytic protozoa in the genus *Babesia. Babesia microti* is responsible for the vast majority of human cases in the United States, with most cases occurring along the Northeast Coast and the upper Midwestern states. A small number of cases of *Babesia duncani* human infection have also been reported along Pacific Coast states from Washington to northern California, and *Babesia divergens/B divergens*-like strains have been detected in humans in Missouri (MO-1 strain), Kentucky, and Washington. In Europe, *B divergens* and *Babesia venatorum* are the primary causes of human babesiosis.

Humans most commonly acquire infection through the bite of an infected tick. The most common tick vectors in the United States are *Ixodes scapularis* and *Ixodes pacificus*, while *Ixodes ricinus* and other ticks transmit the parasite in Europe and Asia. Less commonly, babesiosis may be acquired through blood transfusion and across the placenta from the mother to the fetus.

Most patients with babesiosis are asymptomatic or have only a self-limited, mild, flu-like illness, 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. Rare cases of chronic parasitemia, usually in immunocompromised patients, have been described.

Babesiosis is conventionally diagnosed through microscopic examination of Giemsa-stained thick and thin peripheral blood films looking for characteristic intraerythrocytic *Babesia* parasites. This method is relatively rapid, widely available, and capable of detecting (but not differentiating) human-infective *Babesia* species. It is also necessary for calculating the percentage of parasitemia, which is used to predict prognosis, guide patient management, and monitor response to treatment. However, microscopic examination requires skilled microscopists and may be challenging in the setting of low parasitemia or prior drug therapy. Also, *Babesia* species may closely resemble those of *Plasmodium falciparum*.

The Mayo Clinic real-time polymerase chain reaction assay provides a rapid and more sensitive alternative to blood film examination for detection and differentiation of *B microti, B duncani,* and *B divergens/B divergens*-like parasites. It does not cross-react with malaria parasites.

Reference Values

Negative
Reference values apply to all ages.

Interpretation

A positive result indicates the presence of *Babesia* species DNA and is consistent with active or recent infection. While

positive results are highly specific indicators of disease, they should be correlated with blood smear microscopy, serological results, and clinical findings.

A negative result indicates absence of detectable DNA from *Babesia* species in the specimen but does not always rule out ongoing babesiosis in a seropositive person since the parasitemia may be present at a very low level or may be sporadic.

Other tests to consider in the evaluation of a patient presenting with an acute febrile illness following tick exposure include serologic tests for Lyme disease (*Borrelia burgdorferi*) and molecular detection (polymerase chain reaction: PCR) for ehrlichiosis/anaplasmosis. For patients who are past the acute stage of infection, serologic tests for these organisms should be ordered prior to PCR testing.

Cautions

While this assay is designed to detect symptomatic infection with *Babesia microti, Babesia duncani*, and *Babesia divergens/*MO-1, it may detect low-grade asymptomatic parasitemia in individuals in babesiosis-endemic areas. Thus, it should only be used for testing patients with a clinical history and symptoms consistent with babesiosis.

Inhibitory substances may cause false-negative results.

Inadequate specimen collection or improper storage may invalidate test results.

Supportive Data

The following validation data supports the use of this assay for clinical testing.

Accuracy/Diagnostic Sensitivity and Specificity:
Ninety-six whole blood specimens were tested by this real-time polymerase chain reaction (PCR) assay and another real-time PCR assay. Concordance was 99%.

Analytical Sensitivity/Limit of Detection:
The limit of detection established using whole organism spiked into specimen matrix (whole blood) is as follows:
-*Babesia microti*, ATCC PRA 99-2670 target copies/mL
-*Babesia duncani* ATCC PRA 302-1540 target copies/mL
-*Babesia* MO-1 positive patient DNA-10,700 target copies/mL
-*Babesia divergens* positive patient DNA-5270 target copies/mL

Serial 10-fold dilutions of microscopy-positive specimens were also tested in a blinded fashion using conventional thick and thin blood films and the Mayo Clinic *Babesia* species PCR test. The PCR test was able to consistently detect two 10-fold dilutions lower than using microscopy.

Analytical Specificity:
No cross-reactivity was noted using a panel of 34 bacteria, viruses, parasites, and fungi were detected by the *Babesia* species PCR.

Precision:

Interassay and intra-assay precision was 100% precision.

Reference Range:
The reference range is negative. This was confirmed by testing 93 blood specimens from asymptomatic individuals for the presence of *Babesia* species by the *Babesia* species PCR assay. All 93 specimens were negative.

Reportable Range:
This test is a qualitative assay, and results are reported as positive or negative for *Babesia* species (*B microti*, *B duncani*, *B divergens*, and *Babesia* MO-1).

Clinical Reference

1. Krause PJ, Auwaerter PG, Bannuru RR, et al. Clinical Practice Guidelines by the Infectious Diseases Society of America (IDSA): 2020 Guideline on Diagnosis and Management of Babesiosis. Clin Infect Dis. 2021;72(2):185-189
2. Kumar A, O'Bryan J, Krause PJ. The Global Emergence of Human Babesiosis. Pathogens. 2021;10(11):1447
3. Mareedu N, Schotthoefer AM, Tompkins J, Hall MC, Fritsche TR, Frost HM. Risk factors for severe infection, hospitalization, and prolonged antimicrobial therapy in patients with babesiosis. Am J Trop Med Hyg. 2017;97(4):1218-1225
4. Vannier E, Krause PJ. Human babesiosis. N Engl J Med. 2012;366(25):2397-2407

Performance

Method Description

Nucleic acid is extracted from EDTA whole blood using the automated MagNA Pure bead-based system (Roche Molecular Systems). The extract is then transferred to individual self-contained capillary cuvettes for amplification. The LightCycler is an automated instrument that amplifies and monitors the development of target nucleic acid (amplicon) after each cycle of polymerase chain reaction (PCR).

The DNA target for PCR assay is a gene encoding the nuclear small subunit ribosomal RNA (SS-rDNA). This assay consists of 2 forward primers, 1 reverse primer, and 2 probes that are specific for the *Babesia* species target DNA. The specific base pair DNA target sequence is first amplified by PCR using the target-specific primers. Amplicon is then detected during melting curve analysis using fluorescence resonance energy transfer probes, which utilizes one hybridization probe with a donor fluorophore, fluorescein, at the 3' end and a second hybridization probe with an acceptor fluorophore, LC-Red 640, at the 5' end. Fluorescence is produced when the 2 probes anneal to the target sequence in close proximity to one another. The LC-Red 640 then emits a measurable and quantifiable light signal at a specific wavelength.(Burgess MJ, Rosenbaum ER, Pritt BS, et al. Possible transfusion-transmitted *Babesia divergens*-like/MO-1 infection in an Arkansas patient. Clin Infect Dis. 2017;64[11]:1622-1625)

PDF Report

No

Day(s) Performed

Monday through Sunday

Report Available
Same day/1 to 4 days

Specimen Retention Time
1 week

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification
This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information
87798 x2
87469
87999 (if appropriate for government payers)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
BABPB	Babesia species PCR, B	88461-9

Result ID	Test Result Name	Result LOINC® Value
618317	Babesia microti	88452-8
618318	Babesia duncani	88451-0
618319	Babesia divergens/MO-1	88450-2