

Plasmodium Species - Malaria

Clinical Background

Malaria is caused by the protozoan parasite *Plasmodium* spp and is transmitted by infected mosquitos.

Epidemiology

- Incidence
 - Worldwide distribution in tropical areas; more than 500 million cases reported every year
- Transmission
 - Vector is the *Anopheles* mosquito

Organism

- Protozoan species that cause most malarial infections in humans include:
 - *P. vivax*
 - *P. falciparum* (~80% of cases)
 - *P. ovale*
 - *P. malariae*
 - *P. knowlesi*

Pathophysiology

- Accumulation and sequestration of parasite-infected red blood cells in various organs, such as the heart, brain, lungs and kidneys, create characteristic features of the disease

Clinical Presentation

- May be nonspecific – malaise, fever, myalgias
 - Typically occurs 7-30 days after mosquito bite
- Progresses to splenomegaly, anemia, jaundice
- Severe infection, usually from *P. falciparum* species, may cause:
 - Cerebral encephalopathy
 - Hypoglycemia
 - Hypotension
 - Liver dysfunction
 - Renal failure
 - Liver dysfunction
- Dormant infections can occur with *P. vivax* and *P. ovale*
- Complications in pregnant patients
 - Spontaneous abortion
 - Preterm labor
 - Low birth weight
 - Congenital infection

Treatment

- Drug treatment depends on *Plasmodium* species, drug-resistance patterns, clinical condition of patient, and drug allergies, among other factors

Prevention

- Personal protection measures that are helpful
 - Use repellents containing DEET or picaridin

- Avoid outdoor activities during mosquito feeding times (dusk to dawn)
- Wear appropriate clothing for protection from mosquito bites
- Prophylaxis for travel to endemic countries is usually successful in the following cases:
 - Appropriate drugs are selected for area visited
 - Patient is compliant

Diagnosis

- Indications for testing – clinical history and symptoms with residency or travel to endemic area
- Laboratory testing
 - Giemsa-stained blood smear
 - Demonstration of intraerythrocytic parasites is diagnostic
 - Should be collected when patient's temperature is rising
 - Malaria antibody testing
 - Not useful in acute disease
 - Provides evidence of past exposure
 - Does not provide definitive identification of *Plasmodium* spp
 - Rapid antigen testing
 - In U.S., the Centers for Disease Control and Prevention (CDC) recommends follow-up confirmation of rapid testing
 - Nucleic acid testing
 - Very sensitive and specific
 - Ability to accurately quantify parasitemia depends on platform

Lab Tests

Indications for Laboratory Testing

Tests generally appear in the order most useful for common clinical situations. For test-specific information, refer to the test number in the ARUP Laboratory Test Directory on the ARUP Web site at www.aruplab.com.

Test Name and Number	Recommended Use	Limitations	Follow Up
Parasites Smear (Giemsa Stain), Blood 0049025 Method: Stain	Diagnose acute cases of malaria Detect blood parasites, including species of <i>Plasmodium</i> and <i>Babesia</i> , microfilaria, trypanosomes Confirm positive ELISA result for malaria antibodies	Blood collection during fever usually yields highest parasite numbers Time sensitive	Sequential blood samples may be required for diagnosis due to cyclical nature of disease
Malaria Antibody, IgG 0051356 Method: Enzyme Linked Immunosorbent Assay	Retrospectively diagnose malaria in a previously non-immune individual Screen for chronic malaria	False-positive results for malaria antibodies seen in up to 18% of antinuclear antibody positive or rheumatoid factor positive patients Serologic results from assay should not be used as sole method of diagnosis	

<p>Malaria, Rapid Screen (Includes Giemsa stain 0049025) 2001547 Method: Stain</p>	<p>Screen for malaria</p>	<p>Rapid screen does not detect parasitemia less than 0.5% Rapid screen should not be used for therapeutic monitoring</p>	<p>All rapid antigen test results are confirmed by blood smear examination</p>
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General References

Centers for Disease Control and Prevention: Malaria References and Resources. Centers for Disease Control and Prevention. Atlanta: Georgia [Last Updated: 30 Jun 2008; Accessed: 20 Apr 2009]

Collins WE, Jeffery GM. Plasmodium malariae: parasite and disease. Clin Microbiol Rev. 2007; 20 (4) 579-592.

Conway DJ. Molecular epidemiology of malaria. Clin Microbiol Rev. 2007; 20 (1) 188-204.

Greer JP et al. eds. Wintrobe's Clinical Hematology, 11th ed. Philadelphia: Lippincott Williams and Wilkins, 2003.

Hymel P, Yang W. Review of malaria risk and prevention for use in corporate travel. J Occup Environ Med. 2008; 50 (8) 951-959.

Lagerberg RE. Malaria in pregnancy: a literature review. J Midwifery Womens Health. 2008; 53 (3) 209-215.

Laloo DG, Hill DR. Preventing malaria in travellers. BMJ. 2008; 336 (7657) 1362-1366.

Mishra SK, Mohanty S, Mohanty A, Das BS. Management of severe and complicated malaria. J Postgrad Med. 2006; 52 (4) 281-287.

Murray CK, Gasser RA Jr, Magill AJ, Miller RS. Update on rapid diagnostic testing for malaria. Clin Microbiol Rev. 2008; 21 (1) 97-110.

Ochola LB, Vounatsou P, Smith T, Mabaso ML, Newton CR. The reliability of diagnostic techniques in the diagnosis and management of malaria in the absence of a gold standard. Lancet Infect Dis. 2006; 6 (9) 582-588.

Tuteja R. Malaria - an overview. FEBS J. 2007; 274 (18) 4670-4679.

Wongsrichanalai C, Barcus MJ, Muth S, Sutamihardja A, Wernsdorfer WH. A review of malaria diagnostic tools: microscopy and rapid diagnostic test (RDT). Am J Trop Med Hyg. 2007; 77 (6 Suppl) 119-127.

World Health Organization: Malaria fact sheet. World Health Organization. Geneva: Switzerland [Accessed: 7 Jun 2008]

References from the ARUP Institute for Clinical and Experimental Pathology®

Petti CA, Polage CR, Quinn TC, Ronald AR, Sande MA. Laboratory medicine in Africa: a barrier to effective health care. Clin Infect Dis. 2006; 42 (3) 377-382.

Polage CR, Bedu-Addo G, Owusu-Ofori A, Frimpong E, Lloyd W, Zurcher E, Hale D, Petti CA. Laboratory use in Ghana: physician perception and practice. Am J Trop Med Hyg. 2006; 75 (3) 526-531.

She RC, Rawlins ML, Mohl R, Perkins SL, Hill HR, Litwin CM. Comparison of immunofluorescence antibody testing and two enzyme immunoassays in the serologic diagnosis of malaria. J Travel Med. 2007; 14 (2) 105-111.

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