

Treatment of Malaria: Guidelines for Clinicians (United States)

Related Pages Reporting

Malaria is a nationally notifiable disease. We encourage clinicians to report all cases of laboratory-confirmed malaria to their state health department to help CDC's surveillance efforts. Refer to the information on the [Malaria Case Surveillance Report Form](#) for instructions on how to report a malaria case.

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Evaluation and Diagnosis

Malaria is a common cause of febrile illness in areas where it is transmitted; therefore, the diagnosis and management of malaria should routinely be considered for any febrile person who has traveled to an area with malaria in the weeks to months preceding symptom onset. The CDC's [Algorithm for Diagnosis and Management of Malaria](#) [pdf icon](#) provides guidance on the recommended steps to adequately assess and treat malaria patients.

Symptoms of malaria are generally non-specific and most commonly consist of fever, headache, malaise, weakness, gastrointestinal distress (nausea, vomiting, diarrhea), neurologic complaints (dizziness, confusion, disorientation, coma), back pain, myalgia, chills, and/or cough. The diagnosis of malaria should also be considered in any person with fever of unknown origin regardless of travel history.

Patients suspected of having malaria should be urgently evaluated.

Laboratory diagnosis of malaria can be made through microscopic examination of thick and thin blood smears. Thick blood smears are more sensitive in detecting malaria parasites because the blood is more concentrated allowing for a greater volume of blood to be examined; however, they are more difficult to read. Thin smears aid in parasite species identification and quantification. Blood smears need to be done and read as soon as possible, within 24 hours of patient presentation; qualified personnel who can perform these tasks should always be on-call. A negative blood smear makes the diagnosis of malaria

unlikely. However, because non-immune individuals may be symptomatic at very low parasite densities which may be initially undetectable, blood smears should be repeated every 12–24 hours for a total of three sets before the diagnosis of malaria can be ruled out.

Once malaria parasites are detected on a blood smear, the parasite density should then be estimated. This can be done by looking at a monolayer of red blood cells (RBCs) on the thin smear using the oil immersion objective at 100x. The slide should be examined where the RBCs are more or less touching (approximately 400 RBCs per field). The parasite density can then be estimated from the percentage of infected RBCs, after counting 500 to 2,000 RBCs. [Gametocytes](#), the sexual stage of the parasite, are not responsible for clinical symptoms and should not be counted when determining parasite density. More information on diagnostic procedures for malaria can be found on [CDC's DPDx website](#).

In addition to microscopy, other laboratory diagnostic tests are available. Several antigen detection tests (rapid diagnostic tests or RDTs) using a “dipstick” or cassette format exist, but only one, BinaxNOW™, is approved for diagnostic use in the United States. RDTs can more rapidly determine that the patient has malaria, but they are less sensitive than microscopy and cannot confirm each specific species of the malaria parasite or the parasite density. Therefore, microscopy should also be done as soon as possible to confirm RDT results, and determine both species and parasite density. Laboratories that do not provide in-house, on-the-spot microscopy services should maintain a stock of malaria RDTs, so they will be able to perform malaria diagnostic testing urgently when needed.

Parasite nucleic acid detection using polymerase chain reaction (PCR) is more sensitive and specific than microscopy but results are often not available quickly enough for routine diagnosis. PCR is a very useful tool for confirmation of species and detection of mutations associated with drug resistance. CDC offers [malaria–drug-resistance testing](#) for all malaria cases diagnosed in the United States free of charge. Serologic tests are not recommended for diagnosis of acute malaria as they can remain positive for years after infection. Your state health department or CDC can be contacted for more information on utilizing one of these tests.

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General Approach to Treatment

Ideally malaria treatment should not be initiated until the diagnosis has been established by laboratory testing. “Presumptive treatment”, i.e., without prior laboratory confirmation, should be reserved for extreme circumstances, such as strong clinical suspicion of severe disease in a setting where prompt laboratory diagnosis is not available.

Once the diagnosis of malaria has been made, appropriate antimalarial treatment must be initiated immediately. The [Malaria Treatment Tables pdf icon](#) can be used as a guide for treatment of malaria in the United States. The drug or drug combination recommended for each specific situation is listed, as well as the adult and pediatric doses. It is important to note that the base/salt conversions for antimalarials are a recurrent source of confusion and can contribute to treatment errors. In the treatment table, where appropriate, the antimalarial dose is expressed in base with the salt equivalency noted in parentheses.

Treatment should be guided by the following four main factors:

- Infecting *Plasmodium* species;

- Clinical status of the patient;
- Expected drug susceptibility of the infecting parasite as determined by the geographic area where the infection was acquired; and
- Previous use of antimalarials, including those taken for malaria chemoprophylaxis.

Infecting *Plasmodium* species: Determination of the infecting *Plasmodium* species for treatment purposes is important for four main reasons. Firstly, *Plasmodium falciparum* and *P. knowlesi* infections can cause rapidly progressive severe illness or death, while the other species, *P. vivax*, *P. ovale*, and *P. malariae*, are less likely to cause severe disease. Secondly, *P. vivax* and *P. ovale* infections also require treatment for the hypnozoites, which remain dormant in the liver and can cause relapsing episodes. Thirdly, *P. falciparum* and *P. vivax* species have different drug resistance patterns in different geographic regions of the world. Finally, for *P. falciparum* and *P. knowlesi* infections, the urgent initiation of appropriate therapy is especially critical.

Clinical status of the patient: Patients diagnosed with malaria are generally categorized as having either uncomplicated or severe malaria. Patients diagnosed with uncomplicated malaria can be effectively treated with oral antimalarials. However, patients who have one or more of the following clinical criteria (impaired consciousness/coma, severe anemia [hemoglobin <7 g/dL], acute kidney injury, acute respiratory distress syndrome, circulatory collapse/shock, disseminated intravascular coagulation, acidosis, jaundice [along with at least one other sign of severe malaria]) and/or parasite density of $\geq 5\%$ are considered to have manifestations of severe disease and should be treated aggressively with intravenous antimalarial therapy.

Drug susceptibility of the infecting parasites: Knowledge of the geographic area where the infection was acquired provides information on the likelihood of drug resistance of the infecting parasite and enables the treating clinician to choose an appropriate drug or drug combination. Information on malaria risk and parasite resistance can be found on the [CDC malaria website](#). If the diagnosis of malaria is suspected and cannot be confirmed or if the diagnosis of malaria is confirmed but species determination is not possible, antimalarial treatment effective against chloroquine-resistant *P. falciparum* must be initiated immediately and revisited once confirmatory results become available.

Previous use of antimalarials: It is important to consider if malaria occurred while an individual was taking a drug for malaria chemoprophylaxis. In this case, the treatment regimen should not include the drug or drug combination used for prophylaxis unless no other options are available.

After initiation of treatment, the patient's clinical and parasitological status should be monitored. In infections with *P. falciparum*, *P. knowlesi*, or suspected chloroquine-resistant *P. vivax*, blood smears should be repeated every 12–24 hours to monitor parasitological response to treatment, i.e., decrease in parasite density. It is recommended to document a negative malaria smear after treatment, but this could be done as an outpatient depending on clinical and parasitological response and the judgement of the treating clinician. Note that [gametocytes](#), the sexual stage of the parasite, are not targeted by most of the antimalarials and should not be counted in assessing parasite density.

CDC malaria clinicians are on call 24/7 to provide advice to healthcare providers on the diagnosis and treatment of malaria and can be reached through the CDC Malaria Hotline at (770) 488-7788 or (855) 856-4713 (toll free) Monday–Friday, 9 am to 5 pm EST. Off-hours, weekends, and federal holidays, healthcare providers can call (770) 488-7100 and ask to speak with the malaria clinician on call.

Treatment of Uncomplicated Malaria

***P. falciparum* or Species Not Identified — Acquired in Areas With Chloroquine Resistance**

For *P. falciparum* infections acquired in areas with chloroquine resistance, four treatment options are available. These include artemether-lumefantrine (Coartem™), which is the preferred option if readily available, and atovaquone-proguanil (Malarone™). These are fixed-dose combination therapies that can be used for pediatric patients ≥ 5 kg. Quinine sulfate plus doxycycline, tetracycline, or clindamycin is also a treatment option. For the quinine sulfate combination options, quinine sulfate plus either doxycycline or tetracycline is generally preferred to quinine sulfate plus clindamycin because there are more data on the efficacy of quinine sulfate plus doxycycline or tetracycline. Quinine should be given for 3 days, except for infections acquired in Southeast Asia where 7 days of treatment is required. The fourth option, mefloquine, is associated with rare but potentially severe neuropsychiatric reactions when used at treatment dose. We recommend this option only when the other options cannot be used. In addition, mefloquine is not recommended for infections acquired in certain parts of Southeast Asia due to drug resistance. Once a treatment regimen is started, if it is being tolerated, there is no need to switch regimens even if a preferred regimen becomes available.

Options for treatment of pregnant women are presented in the “Alternatives for Pregnant Women” section below. Due to the risk of progression to severe disease, uncomplicated malaria treatment should be initiated as soon as possible with the regimen that is most readily available. In addition, clinicians should hospitalize patients with *P. falciparum* infection to monitor clinical response and check parasite density every 12–24 hours. Once clinical presentation improves and a decrease in parasite density becomes apparent, treating clinicians can consider outpatient completion of treatment.

For pediatric patients, the treatment options are the same as for adults except the drug dose is adjusted by patient weight, and artemether-lumefantrine (Coartem™) and atovaquone-proguanil (Malarone™) can only be used in children ≥ 5 kg. The pediatric dose should never exceed the recommended adult dose. Pediatric dosing with quinine may be difficult due to unavailability of non-capsule forms of this antimalarial. If using a quinine-based regimen for children less than 8 years old, doxycycline and tetracycline are generally not recommended; therefore, quinine can be given in combination with clindamycin as recommended above. In rare instances, doxycycline or tetracycline can be used in combination with quinine in children less than 8 years old if other treatment options are not available or are not tolerated, and the benefit of adding doxycycline or tetracycline is judged to outweigh the risk.

For infections attributed to “species not identified” in areas with chloroquine resistance that are subsequently diagnosed as being due to *P. vivax* or *P. ovale*, additional treatment with primaquine or tafenoquine should be administered (see *P. vivax* and *P. ovale*, section below).

***P. falciparum* or Species Not Identified — Acquired in Areas Without Chloroquine Resistance**

For *P. falciparum* infections acquired in areas without chloroquine-resistant strains, which include Central America west of the Panama Canal, Haiti, and the Dominican Republic, patients can be treated with oral chloroquine, or, alternatively, hydroxychloroquine at recommended doses.

In addition, any of the regimens listed for the treatment of chloroquine-resistant malaria may be used for the treatment of chloroquine-sensitive *P. falciparum* malaria. Prompt initiation of an effective regimen is

vitaly important, so using any one of the effective regimens that is readily available would be the preferred strategy.

Due to the risk of progression to severe disease in patients with *P. falciparum* infection, patients should be hospitalized to monitor clinical response, and check parasite density every 12–24 hours until clinical presentation improves and a decrease in parasite density becomes apparent. Then, treating clinicians can consider outpatient completion of treatment for patients with improved clinical symptoms and decreasing parasite density. If infections initially attributed to “species not identified” are subsequently diagnosed as being due to *P. vivax* or *P. ovale*, additional treatment with primaquine or tafenoquine should be administered (see *P. vivax* and *P. ovale* section below).

P. malariae* and *P. knowlesi

There has been no widespread evidence of chloroquine resistance in *P. malariae* and *P. knowlesi* species; therefore, chloroquine (or hydroxychloroquine) may still be used for both of these infections. In addition, any of the regimens listed above for the treatment of chloroquine-resistant *P. falciparum* may be used for the treatment of *P. malariae* and *P. knowlesi* infections. Due to the risk of complications among patients with *P. knowlesi*, clinicians should consider hospitalization to monitor clinical response and check parasite density every 12–24 hours until clinical presentation improves and a decrease in parasite density becomes apparent.

P. vivax* and *P. ovale

Chloroquine (or hydroxychloroquine), remains an effective choice for *P. vivax* and *P. ovale* infections except for *P. vivax* infections acquired in Papua New Guinea or Indonesia, countries with high prevalence of chloroquine-resistant *P. vivax*. Rare cases of chloroquine-resistant *P. vivax* have also been documented in Burma (Myanmar), India, and Central and South America. Persons acquiring *P. vivax* infections from regions other than Papua New Guinea or Indonesia should initially be treated with chloroquine. If chloroquine is given and the patient has an inadequate response including persistence or worsening of clinical symptoms or no decrease in parasite density, treatment should be changed to one of the regimens recommended for chloroquine-resistant *P. vivax* infections (see below), and your state health department and CDC should be notified —CDC Malaria Hotline: (770) 488-7788, Monday–Friday, 9 am to 5 pm EST; (770) 488-7100 after hours, weekends, and holidays.

If chloroquine is not available, or for persons acquiring *P. vivax* infections in Papua New Guinea or Indonesia, treatment with a regimen recommended for chloroquine-resistant *P. vivax* infections is appropriate. These include artemether-lumefantrine, atovaquone-proguanil, **or** quinine sulfate plus doxycycline or tetracycline (or clindamycin for pregnant women and children <8 years old), and are equally recommended. Mefloquine can be used if no other options are available, because of rare but potentially severe neuropsychiatric reactions when used at treatment dose.

In addition to requiring treatment for the blood stage parasites, i.e. acute phase of malaria, *P. vivax* and *P. ovale* infections can relapse due to hypnozoites, which are dormant forms that remain in the liver. To eradicate the hypnozoites, patients should be treated with either primaquine phosphate or tafenoquine (Krintafel™). Primaquine phosphate can be used in combination with any of the drug options for treatment of the acute phase of infection. CDC recommends a primaquine phosphate dose of 30 mg (base) by mouth daily for 14 days. Due to reduced efficacy of primaquine in patients ≥ 70 kg, the total dose of primaquine should be adjusted in these patients to 6 mg/kg, then divided into daily doses of 30 mg for the number of days needed to complete the total dose. A daily dose > 30 mg is not recommended

due to safety concerns. Tafenoquine can be used only in patients who received chloroquine for treatment for the acute phase, and in patients who are at least 16 years old. Because both tafenoquine and primaquine can cause hemolytic anemia in persons with glucose-6-phosphate-dehydrogenase (G6PD) deficiency, quantitative G6PD testing must occur prior to starting treatment with these drugs, and only patients with normal activity should receive these drugs. G6PD quantitative testing varies greatly across laboratories and assays used, so clinicians should follow reference ranges provided by each laboratory.

For persons with intermediate G6PD deficiency, clinicians may consider giving primaquine at 45 mg (base) po once per week for 8 weeks with close monitoring for hemolysis. Consultation with an expert in infectious disease and/or tropical medicine is advised if this alternative regimen is considered in intermediate G6PD-deficient individuals. Primaquine and tafenoquine must not be used during pregnancy (see section on alternatives for pregnant women below). Tafenoquine must not be used in children less than 16 years old, or in those with a history of a psychotic disorder. Patients with G6PD deficiency who are not expected to tolerate primaquine or tafenoquine should be put on chloroquine prophylaxis (300 mg [base] po once a week) for 1 year from the acute infection, as most of the relapses resulting from hypnozoite reactivation occur within this timeframe.

For pediatric patients ≥ 5 kg, the treatment options for the acute phase are the same as for adults except the drug dose is adjusted by patient weight. The pediatric dose should never exceed the recommended adult dose. In addition, for children < 8 years of age, doxycycline and tetracycline are generally not recommended; therefore, the other treatment options should be used. For pediatric patients < 5 kg, either mefloquine or quinine plus clindamycin are the only options. If those are not available or tolerated and if the treatment benefits outweigh the risks, atovaquone-proguanil or artemether-lumefantrine could be used in those instances. Primaquine should be given to pediatric patients only after they have been screened for G6PD deficiency, and tafenoquine can only be used in patients 16 years or older who received chloroquine.

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Alternatives for Pregnant Women

Malaria in pregnant women is associated with high risks of both maternal and perinatal morbidity and mortality. While the mechanism is poorly understood, pregnant women have a reduced immune response and, therefore, less effectively clear malaria infections. In addition, malaria parasites sequester and replicate in the placenta. Pregnant women are three times more likely to develop severe disease than non-pregnant women who acquire malaria in the same geographic area. Malaria infection during pregnancy can lead to miscarriage, premature delivery, low birth weight, congenital infection, and/or perinatal death.

Pregnant women diagnosed with uncomplicated malaria caused by chloroquine-resistant *P. falciparum* infection in the second and third trimesters can be treated with artemether-lumefantrine. Artemether-lumefantrine may be used during the first trimester if other treatment options are not available, and if the potential benefit is judged to outweigh the potential risks. In addition, pregnant women of all gestational ages can be treated with mefloquine or a combination of quinine sulfate and clindamycin. Quinine treatment should continue for 7 days for *P. falciparum* infections acquired in Southeast Asia and for 3 days for infections acquired elsewhere; clindamycin treatment should continue for 7 days regardless of where the infection was acquired.

For pregnant women diagnosed with uncomplicated malaria caused by *P. malariae*, *P. ovale*, chloroquine-sensitive *P. vivax*, or chloroquine-sensitive *P. falciparum* infection, prompt treatment with chloroquine or hydroxychloroquine (treatment schedule as for non-pregnant adult patients) is recommended. For chloroquine-resistant *P. vivax* infections, quinine plus clindamycin, or mefloquine should be given instead. For women in their second or third trimesters, artemether-lumefantrine is an additional option.

For *P. vivax* or *P. ovale* infections, primaquine phosphate and tafenoquine for radical treatment of hypnozoites should not be given during pregnancy. Pregnant patients with *P. vivax* or *P. ovale* infections should be maintained on chloroquine chemoprophylaxis for the duration of their pregnancy. The chemoprophylactic dose of chloroquine phosphate is 300 mg base (500 mg salt) orally once per week. After delivery, for pregnant patients with normal G6PD activity infected with *P. vivax* or *P. ovale* infections, subsequent treatment with primaquine phosphate or tafenoquine as described above is needed, but will depend on breastfeeding. If not breastfeeding, either drug can be used depending on the regimen used to treat the acute malaria episode (see section on *P. vivax* and *P. ovale* above). For women who are breastfeeding, infants should be tested for G6PD deficiency and if found to have normal activity, oral primaquine phosphate can be given to the mother. Tafenoquine is not recommended during breastfeeding. Women who after delivery cannot take primaquine or tafenoquine should be maintained on weekly chloroquine chemoprophylaxis for a total of 1 year after the acute malaria episode.

Pregnant women diagnosed with severe malaria should be treated aggressively with parenteral antimalarial therapy as described below.

Doxycycline and tetracycline are generally not indicated for use in pregnant women. However, in rare instances, doxycycline or tetracycline can be used in combination with quinine if other treatment options are not available or are not being tolerated, and the benefit of adding doxycycline or tetracycline is judged to outweigh the risks.

Atovaquone-proguanil is not indicated for use in pregnant women because of the paucity of data on its safety in pregnant women. However, for pregnant women diagnosed with uncomplicated malaria caused by chloroquine-resistant *P. falciparum* infection, atovaquone-proguanil may be used if other treatment options are not available or are not being tolerated, and if the potential benefit is judged to outweigh the potential risks.

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Treatment of Severe Malaria

Patients with any manifestations of severe malaria, e.g. impaired consciousness/coma, hemoglobin <7 g/dL, acute kidney injury, acute respiratory distress syndrome, circulatory collapse/shock, acidosis, jaundice (with other signs of severe malaria), disseminated intravascular coagulation, and/or parasite density of $\geq 5\%$ should be treated promptly and aggressively with parenteral antimalarial therapy regardless of the species of malaria seen on the blood smear. If severe malaria is strongly suspected but a laboratory diagnosis cannot be made at that time, blood should be collected for diagnostic testing to be done as soon as it becomes available and parenteral antimalarial drugs should be started.

All patients with severe malaria, regardless of infecting species, should be treated with intravenous (IV) artesunate. Clinicians caring for patients with severe malaria at a hospital where commercially-available IV artesunate cannot be obtained within 24 hours, should call CDC to obtain IV artesunate, which is

available through CDC as part of an expanded-use investigational new drug (IND) protocol. The CDC Malaria Hotline, (770) 488-7788 or toll free (855) 856-4713, is available Monday–Friday, 9 am–5 pm EST. Outside those hours, providers should call (770) 488-7100 and ask to speak with the CDC Malaria Branch clinician on call.

Severe malaria can progress to a fatal outcome rapidly, so its treatment should be initiated as soon as possible. Clinicians at hospitals where IV artesunate is not in stock should consider interim treatment with an effective oral antimalarial while obtaining IV artesunate from a commercial source or CDC, whichever is fastest. If the patient is unable to tolerate oral medications, clinicians will need to consider alternative ways to administer oral medications while awaiting IV artesunate. For example, for patients with nausea and vomiting, an anti-emetic preceding the antimalarial may help, and, for comatose patients, a nasogastric tube can be considered.

The preferred antimalarial for interim oral treatment is artemether-lumefantrine (Coartem™) because of its fast onset of action. Other oral options include atovaquone-proguanil (Malarone™), quinine, and mefloquine. Intravenous or oral clindamycin and tetracyclines, such as doxycycline, are not adequate for interim treatment. These drugs are slow-acting antimalarials that would not take effect until well after 24 hours, and they are not effective antimalarials for treatment of severe malaria when used alone. As for any malaria treatment, the interim regimen should not include the medication used for chemoprophylaxis if possible.

When IV artesunate arrives, immediately discontinue the oral medication and start parenteral treatment. Each dose of IV artesunate is 2.4 mg/kg. A dose of IV artesunate should be given at 0, 12, and 24 hours.

Note that the weight-based dosing applies to both adults and children. Previously, weight-based dosing was differentiated between children <20kg and those ≥20kg. Current dosing in small children <20kg is based on an unpublished FDA analysis modeling pharmacokinetics in this population using available data. Patients on treatment for severe malaria should have one set of blood smears (thick and thin smear) performed every 12–24 hours until a negative result (no *Plasmodium* parasites are detected) is reported.

After the initial course of IV artesunate is completed, if parasite density is ≤1% (assessed on a blood smear collected 4 hours after the last dose of IV artesunate) and patient can tolerate oral treatment, a full treatment course with a follow-on regimen must be administered. Artemether-lumefantrine (Coartem™) is the preferred follow-on treatment but adequate alternatives are atovaquone-proguanil (Malarone™), quinine plus doxycycline or clindamycin, or mefloquine. Because of a risk of severe neuropsychiatric adverse events at treatment doses, mefloquine should only be used if other options are not available. If the patient received oral treatment prior to receiving IV artesunate, the same medication can be used as follow-on treatment, but a full regimen is required. As for any malaria treatment, the regimen selection should not include the medication used for chemoprophylaxis.

If, after the 3rd IV artesunate dose, the patient's parasite density is > 1%, IV artesunate treatment should be continued with the recommended dose once a day for a maximum of 7 days until parasite density is ≤1%. Doses given at 0, 12, and 24 hours count as 1 day, which means up to 6 additional days. Clinicians should proceed with full course of oral follow-on treatment as above as soon as parasite density ≤1% and the patient is able to tolerate oral medications. Clinicians can consider placement of nasogastric tube or use of antiemetics to facilitate administration of oral treatment. Call CDC Malaria Hotline if additional artesunate is needed and/or advice on treatment.

For those patients with parasite density $\leq 1\%$ but who still cannot tolerate oral medications after completing IV artesunate treatment, clinicians can continue IV artesunate, 1 dose daily not to exceed a total course of 7 days. Clinicians should call CDC Malaria Hotline if advice on treatment is needed.

Intravenous artesunate is safe in infants, children, and pregnant women in the second and third trimesters. There are limited clinical data on women taking IV artesunate in the first trimester of pregnancy, but no harmful effects have been observed. Given that severe malaria is especially life threatening for pregnant women and their fetuses, and the lack of other treatment options for severe malaria in the United States, the benefits of treatment with IV artesunate outweigh the risks and IV artesunate should not be withheld. The only formal contraindication to IV artesunate treatment is known allergy to IV artemisinins.

IV artesunate is well tolerated. While rare, delayed post-artemisinin hemolytic anemia has been noted in published case reports following treatment of severe malaria with IV artesunate. Persons with higher parasite density seem to have a higher likelihood of delayed hemolytic anemia after treatment. **All persons treated for severe malaria with IV artesunate should be monitored weekly for up to four weeks after treatment initiation for evidence of hemolytic anemia.** Weekly laboratory evaluation should include hemoglobin measurement, reticulocyte count, haptoglobin, lactate dehydrogenase (LDH), and total bilirubin. Depending on the intensity of hemolysis and presence of anemia signs and symptoms, blood transfusion may be needed. Cases of delayed post-artemisinin hemolytic anemia in those receiving IV artesunate from CDC should be reported to CDC no longer than 24 hours after diagnosis. Cases of delayed post-artemisinin hemolytic anemia in patients who received Artesunate for Injection™ should be reported to MedWatch, FDA's Safety Information and Adverse Event Reporting Program.

Previously, CDC recommended exchange transfusion be considered for certain severely ill persons. However, exchange transfusion has not been proven beneficial in an adequately powered randomized controlled trial. In 2013, CDC conducted an analysis of cases of severe malaria treated with exchange transfusion and was unable to demonstrate a survival benefit of the procedure. Considering this evidence, CDC no longer recommends the use of exchange transfusion as an adjunct procedure for the treatment of severe malaria.

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Drug Side Effects

Healthcare providers can report serious side effects to antimalarials to FDA via [MedWatchexternal icon](#), FDA's Safety Information and Adverse Event Reporting Program, or by phone at (800) FDA-1088 (800-332-1088) or fax at (800) FDA-0178 (800-332-0178).

All Serious Adverse Events (SAE) associated with IV artesunate acquired from CDC must be reported to CDC within 24 hours by telephone. The CDC Malaria Hotline, (770) 488-7788 or toll free (855) 856-4713, is available Monday–Friday, 9 am–5 pm EST and (770) 488-7100 during off-hours, weekends, and federal holidays.

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