

How to Prevent Malaria

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Introduction

Malaria is a serious tropical disease and it continues to pose a major public health threat in the world. It is the most widespread parasitological infection transmitted by the bite of mosquito *Anopheles* that merely acts as a vector, i.e., it only carries the parasite responsible for malaria but does not suffer from it (Figure 1). Parasite causing malaria is of genus *Plasmodium* (P.). Parasite means an organism which lives on another individual in such a way that it itself gains but the other is injured. The mosquito gets malarial parasites in its body when it bites a person suffering from malaria. Later such a mosquito transmits the disease by the bite to a healthy person passing malarial parasites into his blood stream.



Figure 1: *Anopheles* mosquito.

There are four types of malarial parasite: *P. vivax*, *P. falciparum*, *P. malariae* and *P. ovale*. Out of all these, *P. vivax* is widespread globally and *P. falciparum* is most fatal. The most important cause of global spread is through air travel by infected persons.

The malarial parasite once it enters the human blood stream does not cause symptoms of malaria as such. It has to undergo different stages of development in the Red Blood Cells (RBCs) for a period of 48 h except in *P. malariae* where the cycle is of 72 h. Finally, 'merozoites' (i.e., the last developmental stage of malarial parasite responsible for the symptoms of the disease) are shed in the blood stream with the rupture of RBCs, causing symptoms of malarial. It may be noted that parasite grows inside the RBCs at the expense of haemoglobin and that is the cause of anaemia in such cases.

How a Patient of Malaria Presents

The patient comes with recurrent symptoms or cycles of fever with chills, rigors (cold stage for 30-60 min), very high temperature of 104-106°F (called hot stage that lasts 1-4 h) and followed by sweating stage lasting 2-4 h when the patient gets profuse sweating. Such paroxysms continue every 3rd or 4th d depending upon the type of malarial infection or more precisely the time period required for development of malarial parasite inside the RBCs. Interestingly, between the paroxysms of fever the patient feels absolutely alright and may even go to his work. This may cause delay in treatment in a patient who is not aware of such a cycle or periodicity in cases of malaria.

Examination of the Patient by the Physician

The patient shall be anaemic. Herpetic eruptions may be seen on the lips called herpes labialis that may soon disappear with the treatment of malaria. On examination of the abdomen, the liver shall be slightly enlarged and tender in early cases but with repeated attacks, it may become firm and enlarged as result of fibrosis. Likewise, spleen shall be a bit enlarged, tender and soft in the beginning but in chronic cases it may become hard and markedly enlarged. It may become friable and prone to rupture with a little trauma, say, a blow over it.

Laboratory Tests

Routine tests shall show low haemoglobin. Leucocyte count may rise with the onset of febrile paroxysm with marked rise in polymorphs. However, leucocyte count may vary. In chronic cases, it may be somewhat low. Serum creatinine, one of the vital kidney tests, serum bilirubin and other liver enzymes may be a little elevated. However, blood sugar may be low. Urine test may show albumin during febrile stage.

Peripheral blood film examination

It is the cheapest and widely used method of diagnosis of malaria, of course by an experienced examiner. This test can easily detect the types of malarial parasite. Much more, this test shall quantify the density of parasites that helps to assess the seriousness of the patient from the beginning.

Dip rapid diagnostic tests

Though these tests give quick results but do not give quantitative assessment of parasitaemia that is equally important. That is, these tests can determine if parasites are present in blood, but are unable to tell how many parasites are there. However, there is a benefit of these tests that in peripheral/rural areas where facilities of microscope and much more the trained technician are not there, these tests can at least detect the patients of malaria.

Other laboratory tests

Tests like fluorescence microscopy, Polymerase Chain Reaction (PCR) are also available. Besides being costly, they have their own limitations.

Treatment

Uncomplicated malaria should not have any problem in treatment, provided the patient is diagnosed early and treatment started within 24 h. These patients can even be treated at home. During the paroxysm of fever, patient should be given bed rest providing blankets, etc., in cold stage, and changing of clothes after sweating stage. Patient needs to be given oral chloroquine as a single drug or in combination of other drugs depending upon the case and drug resistance. There is a caution that if *falciparum* malaria is detected one needs to be alert as a stable patient of this type may have rapid worsening, requiring urgent hospitalization.

Severe *falciparum* malaria

Since it is the most fatal one, it needs special mention. In case, particularly, if it is not timely detected and treatment is delayed, and complications like cerebral malaria, low blood sugar and black water fever, etc., start, mortality rate increases. In this type, there is a high level of parasitaemia involving large number of RBCs releasing more merozoites responsible for the symptoms of malaria and these liberated merozoites further infect RBCs and thus one can imagine the seriousness of the infection.

Further, in this type of malaria small blood vessels called capillaries are involved and there may develop occlusion or blockage of these tiny vessels called microcirculatory occlusion. Such blockage adds to the severity of the disease and since capillaries of brain are more involved, cerebral malaria may occur. In cerebral malaria patient may become unconscious. In children, on recovery, the child may develop permanent weakness of one half of the body (hemiplegia), disturbances in speech/hearing/vision, etc. Such a child may remain handicapped forever. However, in very severe cases, vital organs of the body may fail threatening the life of the patient.

How to manage the emergency of *falciparum* malaria

Such severe cases are dealt in the Intensive Care Unit (ICU) of a well-equipped hospital. Patient is given oxygen, intravenous fluids of various types to manage blood pressure and loss of fluids. Blood transfusion, either whole blood or packed red cells only may be required in severe anaemia.

Other treatment depends upon the symptoms of the patient e.g. if the patient gets seizures, antiepileptic drugs may be required. Likewise, early haemodialysis may be essential in case kidneys start failing. In the same way intravenous mannitol is administered to reduce intracranial tension. Immediate intravenous glucose is the rule if blood sugar deeply falls as it is also a serious complication of *falciparum* malaria.

As far drugs are required, intravenous quinine infusion is required along with intravenous glucose to manage the low blood sugar that occurs with quinine infusion. Quinine is preferred so as to avoid the risk of chloroquine resistance in this grave emergency. Usually, there is no resistance to quinine. Combination of antimalarial drugs is given, keeping in view of multiple-drug resistance.

Severe *vivax* malaria

Some serious complications have also been reported of this type requiring emergency treatment as out-lined above.

Other forms of malaria: *P. malariae* and *P. ovale*

These are not very common. Severe cases of *P. malariae* may lead to renal damage. *P. ovale* may be self-limited. It is a rare parasite and is almost confined to tropical Africa.

Other Manifestations of Malaria

It includes transfusion malaria that is transmitted by blood transfusion, infected needles of drug addicts, organ transplant. These are managed like routine cases of malaria following mosquito bite.

Malaria during pregnancy, in children, congenital malaria needs special consideration. Tropical splenomegaly syndrome is a chronic type of malaria in which spleen is massively enlarged. Marked regression of spleen may be possible with long antimalarial therapy.

Relapse of Malaria

After an interval of weeks or months, relapse of malaria may occur especially when the resistance of the patient is lowered. However, in *falciparum* malaria relapse usually does not occur. It is more in *vivax* malaria.

Prognosis of Malaria

Falciparum malaria may have a poor prognosis. Late diagnosed and later treated patients may suffer more. Children, pregnant woman, if not cared well may suffer from a serious attack of malaria.

The patient is more likely to get malaria in case his/her immunity is low as a result of poor diet or one is already suffering from uncontrolled chronic diseases like diabetes, high blood pressure, tuberculosis, to name a few. Likewise, foreigners with low immunity are more prone to suffer from malaria.

Chemoprophylaxis

Chloroquine may be used to prevent infection of malaria among healthy people especially in endemic areas. Also, in people going to endemic areas drug may be started a week before leaving the endemic area and continuing for about a month after the return from endemic area. However, this chemoprophylaxis may not be full-proof method of controlling malaria and possibility of malaria must be kept if the person gets fever etc.

Preventive Measures and Malaria Vaccine

(i) Mosquitoes that transmit malaria breed on stagnant water. Drain stagnant water or pools. DDT powder may be sprinkled. Also, avoid construction of man-made breeding places.

(ii) Wear clothes that cover maximum parts of the body. Wear socks, full sleeved shirts, trousers. Insect repellent creams may be used. More vigilance is required from dusk to dawn as during this period mosquito bites.

(iii) Insecticide-nets may be used. These nets are soaked six monthly in a specific insecticide solution. Insecticide-treated nets are often used

in endemic areas. Electronic mosquito repellents devices may also be used.

(iv) If possible, people may avoid malaria-endemic areas.

(v) People should be educated about control measures, recognizing the disease early, covering water tanks, various vessels containing water for drinking, washing, etc., and also about chemoprophylaxis.

(vi) Mass survey should be conducted for diagnosis of undetected cases by doing peripheral blood film examination. *Falciparum* malaria, if detected, should be immediately treated being fatal.

(vii) Municipal corporations should start de-weeding, filling pits, cleaning open areas and spraying anti-larval insecticides. Speedier disposal of refuse and additional refuse collection sites need to be planned.

(viii) Antimalarial drug resistance, fake antimalarial drugs, including insecticide resistance need to be kept in mind.

(ix) Infants need much more specialized precautions.

(x) Malaria vaccine: International collective research is being done for an effective malaria vaccine as a lasting solution to this malady.