# Training Module for Trainers on Malariology

डा. ए. सी. धारीवाल
निदेशक
**Dr. A.C. Dhariwal**
*Director*

Tel. 91-11- 23918576
Fax : 91-11-23968329
E-mail : nvbdcp-mohfw@nic.in

भारत सरकार
राष्ट्रीय वैक्टर जनित रोग नियंत्रण कार्यक्रम
(स्वास्थ्य सेवा महानिदेशालय)
स्वास्थ्य एवं परिवार कल्याण मन्त्रालय
22–शाम नाथ मार्ग, दिल्ली–110054
**Government of India**
**NATIONAL VECTOR BORNE DISEASE CONTROL PROGRAMME**
**(Directorate General of Health Services)**
**Ministry of Health & Family Welfare**
**22-SHAM NATH MARG, DELHI-110054**

# Foreword

Malaria remains a major public health concern in India. About 80% of malaria reported in the country is confined to tribal, hilly, difficult and inaccessible areas. The north – eastern states having such geographical setting and approximately 4 per cent of country's population contribute 10 to 12 per cent of total malaria cases every year. Towards strengthening the national response for malaria, an intensified Malaria Control Project – II (IMCP – II) supported by the Global Fund to fight AIDS. Tuberculosis and Malaria (GFATM) Round 9 grant is being implemented by the National Vector Borne Diseases Control Programme (NVBDCP) of Government of India and other malaria endemic states supported by GOI under DBS. A non-government consortium led by Caritas India is complementing the efforts of the NVBDCP in selected areas in the North Eastern states.

Similarly, the Central and Eastern Malaria Endemic States were covered under the World Bank supported National Vector Borne Diseases Control Support Project (NVBDCSP) covering 9 states namely, Andhra Pradesh, Chhattisgarh, Jharkhand, Madhya Pradesh, Gujarat, Odisha, Karnataka, Maharashtra and West Bengal. Now, they are supported by the domestic budget.

In view of early diagnosis of both Pv and Pf malaria, the country has introduced bivalent RDTs in whole of the country from 2012. Further, anticipating the threat of SP-ACT combination drug used for treating Pf malaria, the Technical Advisory Committee has approved use of ACT –AL for all north east states which has been introduced in 2014.For effective program implementation, it is imperative that all malaria workers should be trained in the use of both bivalent RDT and ACT-AL.

For effective capacity building of the people, a comprehensive module is essential to facilitate both the trainees and trainers. This present module is one such component for training of master trainers including state officials and consultants, DMOs, block PHC MOs, Lab technicians and MTS. I wish to thank my officers namely Dr.G.S.Sonal, Additional Director and HOD Malaria Division, Dr. Avdhesh Kumar, Additional Director and Nodal Officer GFATM Project, Dr. Munish Joshi, National Consultant (training), Dr. H.G.Thakor, National Consultant (M & E) and Mr. Atul Kumar, Statistician for their sincere efforts to bring this module. I hope that this will go a long way in helping the trainees to understand the subject and thus prove to be effective implementation personnel foe the malaria control programme.

I wish the master trainers a successful training and fruitful activities in the field so as to achieve the goals for malaria control and finally elimination.

With best wishes.

**Date : 17th April, 2014**
**Place : Delhi**

Dhariwal

**(Dr.A.C.Dhariwal)**

# ABBREVIATIONS USED In The Module

| | |
|---|---|
| *ACT* | *Artemisinin-based Combination Therapy* |
| *API* | *Annual Parasite Incidence* |
| *ASHA* | *Accredited Social Health Activist* |
| *CHV* | *Community Health Volunteer* |
| *DMO* | *District Malaria Officer* |
| *FEFO* | *First Expiry First out* |
| *LT* | *Laboratory Technician* |
| *NVBDCP* | *National Vector Borne Disease Control Programme* |
| *Pf* | *Plasmodium falciparum* |
| *PHC* | *Primary Health Center* |
| *Pv* | *Plasmodium vivax* |
| *RDK* | *Rapid Diagnostic test Kits* |
| *RDT* | *Rapid Diagnostic Test* |
| *SPR* | *Slide Positivity Rate* |
| *SRL* | *State Reference Laboratory* |
| *TS-VBD* | *Technical supervisor-VBD* |

# CONTENTS

# *Chapter-1*
# *Introduction to malaria and Life Cycle of Malarial Parasite*

## What is Malaria?

Malaria is a disease transmitted by the female anopheles mosquito. The parasite which causes malaria is the plasmodium (a unicellular organism). Malaria is a global health problem; worldwide 300-500 million people develop malaria every year. In India the number of recorded cases is about 1.5 million per year, but it is estimated that the real number may be much higher. About thousand deaths due to malaria are reported every year by NVBDCP, but as many hospitals do not report malaria cases to the programme, the real number is thought to be much higher.

## Malaria Control programme in India

Malaria has been a problem in India for centuries. Details of this disease can be found in the ancient Indian Medical Literature like the *"Charaka Samhita".* In the 1930s there was no aspect of life in the country that was not affected by malaria. The annual incidence of malaria was estimated at around 75 million cases in 1953, with about 8 lakh deaths. To combat this menace, the Govt. of India launched the National Malaria Control Programme (NMCP) in April 1953. The programme was highly successful and within 5 years, the incidence dropped to 2 million cases. Encouraged by this, the programme was changed to a more ambitious National Malaria Eradication Programme (NMEP) in 1958. By 1961 the incidence dropped to a mere 50,000 cases a year. But since then the programme suffered repeated setbacks due to technical, operational and administrative problems, and cases started rising again. In the late 1960s malaria cases in urban areas started increasing and surges of malaria in rural areas were also widespread. As a result in 1976, 6.47 million cases were recorded by the malaria control programme, the highest since resurgence began. In the year 1995 Malaria Action Programme (MAP) was taken up in high risk areas. The National Malaria Eradication programme was renamed as National Anti Malaria Programme (NAMP) in 1999 covering the concept of effective control. In 2004 the programme was integrated with other vector borne disease control and was named as the National Vector Borne Disease Control Programme (NVBDCP).

The reported malaria incidence is now about 1.5 million cases per year. Over the last few decades, the proportion of falciparum malaria has increased; and the drug resistance of *P.falciparum* and insecticide resistance of vectors threatens to cause setbacks. Malaria therefore remains one of the most important public health problems of India, despite continuous efforts at its control.

The Strategy of malaria control in India is three pronged comprising of Early Diagnosis and Prompt Treatment (EDPT), Integrated Vector Management (IVM) and Supportive interventions like Training for capacity building, Behaviour Change Communication (BCC), intersectoral coordination, Public Private Partnerships (PPP), community participation and legislation. Integrated Vector management includes measures to control adult mosquitoes (Indoor Residual Spray), anti-larval measures (use of larvivorous fish, larvicides and source reduction) and personal protection measures (ITNs/LLINs). Indoor Residual Spray (IRS) and Long Lasting Insecticidal Nets (LLIN) are suggested for high risk areas having API>2.

## Types of Malarial Parasite

In India two types of plasmodia are responsible for most human malaria–They are *Plasmodium vivax P. vivax*, Pv) and *Plasmodium falciparum* ( *P. falciparum*, Pf). There are two other plasmodia (*Plasmodium malariae* and *Plasmodium ovale*) that cause malaria in humans, but they are rare and of practicably no public health importance in India. *P.falciparum* is the variety which is responsible for almost all the deaths due to malaria. *P. vivax* causes debilitating illness, but vivax malaria is rarely fatal, unless accompanied by some other problem like malnutrition. In many states of India, particularly the North Eastern states, Odisha and Chhattisgarh, a very high proportion of malaria cases are due to P. falciparum.

## Life Cycle of the Malarial Parasite

The malarial parasite undergoes 2 cycles of development – the human cycle (asexual cycle) and the mosquito cycle (sexual cycle). Man is the intermediate host and mosquito the definitive host.

1) **Asexual cycle in human being**

   The asexual cycle begins when an infected anopheles mosquito bites a person and injects sporozoites. There are 3 phases in the human cycle.

   a. **Hepatic Phase**

      The sporozoites disappear within 60 minutes from the peripheral circulation. Many of them are destroyed by phagocytes, but some reach the liver cells. After 1-2 weeks of development (depending upon the species), they become hepatic schizonts, which eventually burst releasing a shower of merozoites. In P. falciparum, the intrahepatic schizonts rupture almost simultaneously and there is no persistent tissue phase (exo-erythrocytic phase). In other species, the hepatic forms may remain dormant (hypnozoites) for long periods, liberating merozoites at various intervals, causing relapses of malaria.

   b. **Erythrocytic Phase**

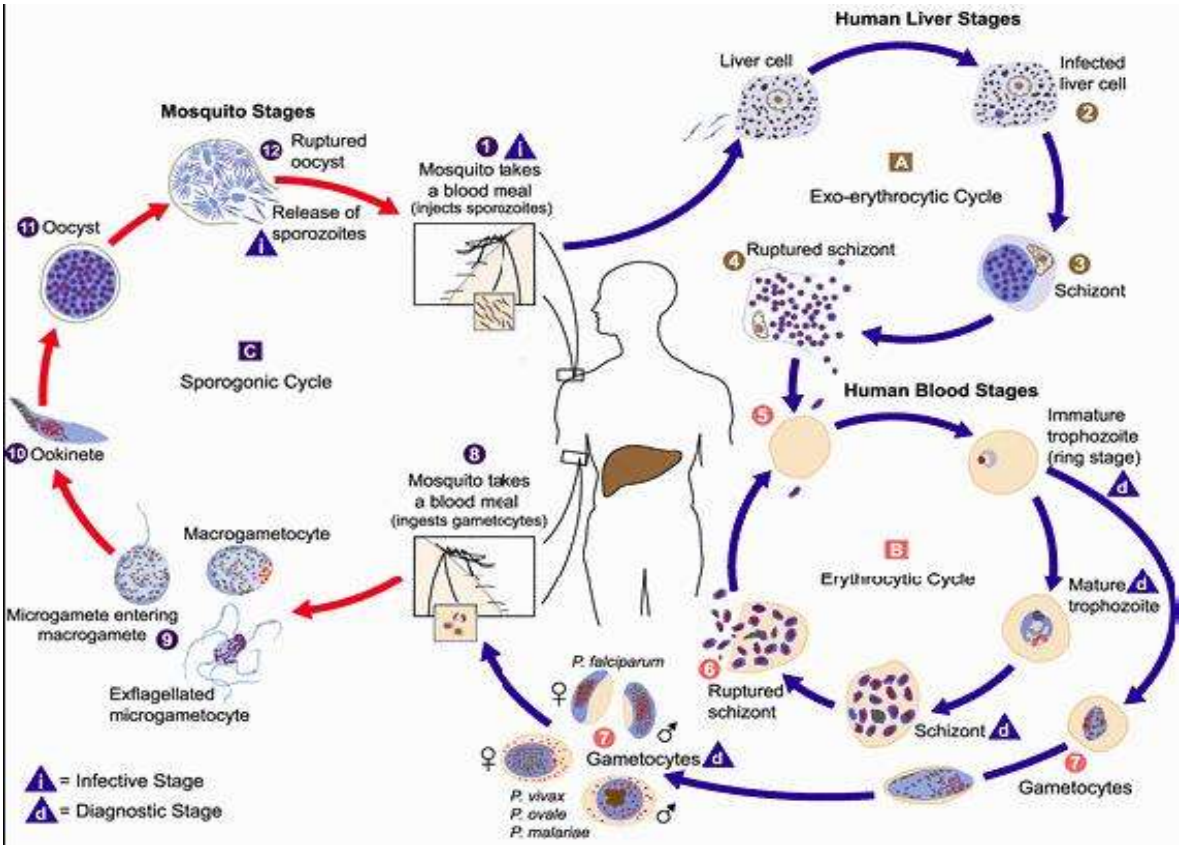
      Many of the merozoites released from the liver cells are quickly destroyed, but a significant number attach themselves to specific receptor sites on the RBCs, penetrate them and pass through various stages of trophozoite and schizont. The erythrocytic phase ends with the liberation of merozoites, which infect fresh RBCs. The clinical feature of fever with chills coincides generally with the rupture of RBCs. The cycle is repeated over and over again until the condition worsens or when it may be slowed down by the immune response of the host. The duration of each erythrocytic cycle varies between species – 48 hours for P. falciparum, P.vivax and P. ovale; and 72 hours for P. malariae.

   c. **Gametogony**

      Some of the erythrocytic forms of plasmodia do not divide further but develop into male and female gametocytes. Not all **infected** persons are **infectious** (can infect anopheline mosquitoes). The blood of the person has to have mature male and female gametocytes and the density should be minimum 12/ cumm of blood to be infective. These gametocytes take over a week to appear in the blood. Gametocytes do not cause any symptoms in humans. Most drugs like chloroquine kill the asexual forms that cause the

fever but leave intact the sexual forms that are infective especially in case of *P falciparum*. Thus an apparently normal person may harbour the disease and contribute to its spread.

**Figure 1. Life Cycle of *Plasmodium* species in man and the mosquito**




## Spread of malaria

The plasmodia spread from person to person by the bite of mosquitoes. This process is called the **transmission** of the disease, and the mosquitoes are the **vectors** of malaria. However, not all mosquitoes can act as malaria vectors. It is only mosquitoes belonging to the genus *Anopheles* - and that too the female of the species which can carry the parasite and infect. Male *Anopheles* mosquitoes only feed on plant juices and nectar and cannot transmit malaria.

## Sexual Cycle in Mosquito

The mosquito cycle (sporogony) begins when gametocytes are ingested by the vector mosquito while feeding on an infected person. The male gametocytes, after reaching the stomach of the mosquito, develop into 4-8 filaments called “microgametes”. The female gametocyte undergoes maturation to become a “macrogamete”. The microgametes get attracted to the macrogamete, and one of the microgametes fertilizes the macrogamete. The resulting zygote is at first motionless, but within 18-24 hours, becomes a motile ookinete, which penetrates the stomach wall of the mosquito and develops into an oocyst on the outer surface of the stomach. The oocyst further develops into numerous sporozoites, when the oocyst ruptures and releases the sporozoites into the body cavity of the mosquito. Many of the sporozoites migrate to the salivary glands and the mosquito becomes infective to man. The period required for the development of the parasite from the gametocyte stage

to sporozoite stage is about 10-20 days depending on atmospheric temperature and humidity. This period is known as the “extrinsic incubation period”. The sporozoites (the infective stage of Plasmodium) are injected with saliva when the mosquito next feeds.

In falciparum malaria, there may be involvement of the brain, and coma in addition to life threatening complications including kidney or liver failure. With early and effective treatment, the case fatality rates in *P.falciparum* malaria can be brought down from above 5% to close to zero. Malaria cases can be classified according to the parasite species causing them and according to the severity of the disease, as either uncomplicated or severe malaria. It should be understood that severe vivax malaria is very rare.

## Immunity to malaria

Repeated infections with malaria parasites lead to the acquisition of antibodies directed against various antigens of various stages of malaria parasites as well as cell-mediated immunity. The immunity is to a large extent, but not completely, specific to the species of malaria parasite. It is also to some extent strain-specific, meaning that a person, who has been exposed to malaria in a certain part of the world (or part of a large country like India) will have a higher degree of immunity to local malaria parasites than to those from a distant location. There is no perfect immunity to malaria: nobody acquires such a high level of protective antibodies that he or she can be certain not to contract malaria. Also, in contrast to many other communicable diseases, the immunity to malaria is time-limited: the person who has acquired a certain degree of immunity through repeated malaria attacks will lose that immunity in a few years, if the exposure is not maintained. For this reason, sometimes the terms semi-immunity or premunition are preferred to immunity.

Typically in areas with very intense transmission, persons who are heavily exposed, acquire some immunity in childhood. Then as adults, they get ill relatively rarely and when they do, the disease is mild and of short duration. It seems that in old age, immunity is lost again, but it is not clear whether this is a result of ageing processes or of old people being less exposed to malaria or both. Typically, people with a certain degree of immunity still harbour parasites: They are **asymptomatic carriers**. It can be difficult to detect such cases and this can have implications for malaria control. If a certain population is heavily exposed to malaria, so that some people have some immunity to the disease and exposure is reduced for some years as a result of control measures, the immunity will largely be lost. If control is then relaxed, malaria may return with occurrence of large number of cases. For this reason, sustainability is important in malaria control.

Scientific work to develop a **malaria vaccine** has taken place for decades. One or two vaccines may well be marketed within the coming 5 years, but they are likely to have only a limited degree of effectiveness and would, at best, only be a supplement to other malaria control tools. Malaria is a serious disease, which has affected human populations for many thousands of years. It has therefore exerted a selective pressure, favoring certain genotypes in humans with some innate (in contrast to acquired, as described above) immunity to malaria. Among these conditions are sickle cell disease, thalassaemia and glucose-6-phosphate dehydrogenase deficiency, all of which are common in India, especially in populations which are or have in the past been heavily exposed to malaria.

## Malaria Control

Malaria control comprises all activities undertaken to reduce the burden of malaria in a given population. It includes diagnosis and treatment of malaria cases and prevention. Surveillance of the disease, prevention and control of epidemics and field studies to regularly assess the malaria situation and its determinants are essential components in a malaria control programme. The main methods of prevention aim to reduce the risk of humans being bitten by infected anopheline mosquitoes. The aim of malaria control is to reduce morbidity and mortality of malaria to the lowest possible levels locally. In some cases, the aim may be elimination, i.e. the interruption of transmission, where no new cases occur.

## Diagnosis and treatment

Uncomplicated malaria can become severe malaria within 1-2 days (shorter for young children) of onset of symptoms. Early and effective treatment will halt the progression of the disease, thereby preventing deaths from occurring. This could be achieved by treating everybody with a fever as malaria, and this was in fact done until recently as "presumptive treatment". Nowadays, because of drug resistance, it is necessary to use more expensive and differentiated treatment regimens. The strategy of presumptive treatment has therefore been replaced by early diagnosis (through RDTs or microscopy) followed by prompt, effective treatment. Early effective treatment benefits not only the individual patient, but also has the following advantages:

a) Lowering the infectivity of infected persons to the mosquito vector will contribute to reducing malaria transmission, and eventually the incidence of malaria.
b) Early diagnosis is important because in the early stages the infected persons have only asexual forms of plasmodia in blood, which are not infective to mosquitoes. It takes about 4 - 5 days after the person has developed fever to develop the sexual forms of *P. vivax* in blood; for *P. falciparum* it takes 8 -10 days. If blood is cleared of the parasites during this time, then transmission from that person is prevented.
c) In low transmission areas, where most infective people are symptomatic, treating all cases within the first week could cut transmission dramatically. In high transmission areas, where there are many asymptomatic carriers, case management alone has relatively little role in transmission control.
d) Most antimalarial medicines have no significant action on the gametocytes, whereas primaquine can effectively destroy them. Artemisinin derivatives have some effect on gametocytes, but it is not as constant as that of Primaquine. Therefore, Primaquine is included in the treatment of falciparum malaria, because some patients only report after they have developed gametocytes.

# *Chapter-2*
# *Case detection and Management*

People living in malaria-endemic areas need to be informed that any febrile disease might be malaria and that malaria can rapidly become a very dangerous disease. They also need to be informed about where they can obtain qualified care for malaria. This is particularly important for migrants to endemic areas (for example temporary labour), who may be ignorant both of what malaria is and where treatment is available.

## Diagnosis of malaria

A patient with fever and no other obvious cause is considered a case of *suspected malaria*. A more elaborate definition is presented in the table *Case definitions applied in* NVBDCP. In practice the ascertainment of an "obvious cause" can only be expected from well-trained and experienced health staff. A volunteer or health activist working in a high-risk area should be taught to consider any fever case in the absence of specified symptoms as suspected malaria.

Any volunteer, health worker or health professional observing a case of suspected malaria must immediately initiate a diagnostic test by

a. Microscopy of blood for malarial parasites and/or
b. Rapid Diagnostic Test

If a microscopy result can be made available to the provider managing the patient within same day, then only microscopy is done. Antimalarial treatment is given on the basis of a positive slide result. If a microscopy result cannot be available within same day, RDTs are to be used. RDTs are to be supplied and used for diagnosis in villages (or subcenter areas, where village data is not available) where

a. Pf % > 30 and SfR > 2%:
b. Consistently high API and deaths are reported
c. Inaccessible areas - cut off during transmission season
d. Limited road and public transportation facility for treatment of severe & complicated malaria requiring immediate medical attention

An RDT is done in front of the patient and a slide is taken. If the RDT is negative, the slide is sent for microscopy. If it is positive, the patient is treated according to diagnosis and the slide is discarded in order to reduce the load on microscopy services. Wherever a microscopy result **can** be made available within same day, microscopy should be maintained as the only routine method. RDTs should be used in PHC and other health facilities only in emergencies in the absence of the laboratory technician (LT).
It should be noted that these tests have a shelf-life of only 12 months and that they may deteriorate at high ambient temperatures.

## Interpretation of Rapid diagnostic tests

If a suspected malaria patient has a negative RDT, it can be assumed that the patient does not have malaria and another cause of the symptoms should be sought. If no other cause can be found and the clinical suspicion is high (e.g. intermittent fever with rigors and sweats), the test should be repeated after about 24 hours and special efforts should be made to obtain the microscopy result rapidly.

All fever cases diagnosed positive by either RDT or microscopy need to be promptly started on effective treatment. The treatment will depend upon the species of Plasmodium diagnosed.

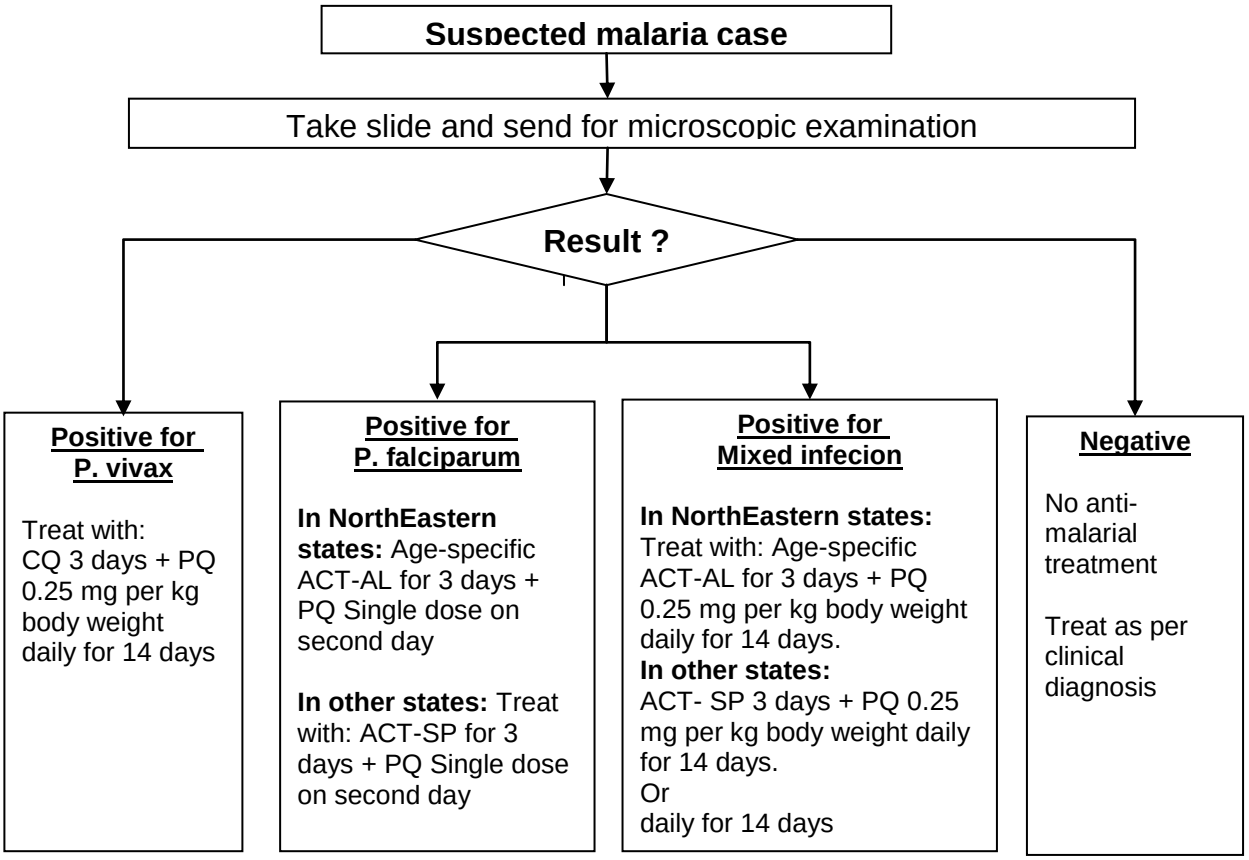
**The aims of the Malaria case management are:**

- To provide prompt and complete treatment to all suspected/ confirmed cases of malaria
- To prevent progression of mild cases of malaria to severe or complicated form of malaria
- To prevent deaths from severe and complicated malaria
- To prevent transmission of malaria
- To minimize risk of spread of drug resistant parasites by use of effective drugs in appropriate dosage by everyone.

## Diagnosis and Treatment for Malaria

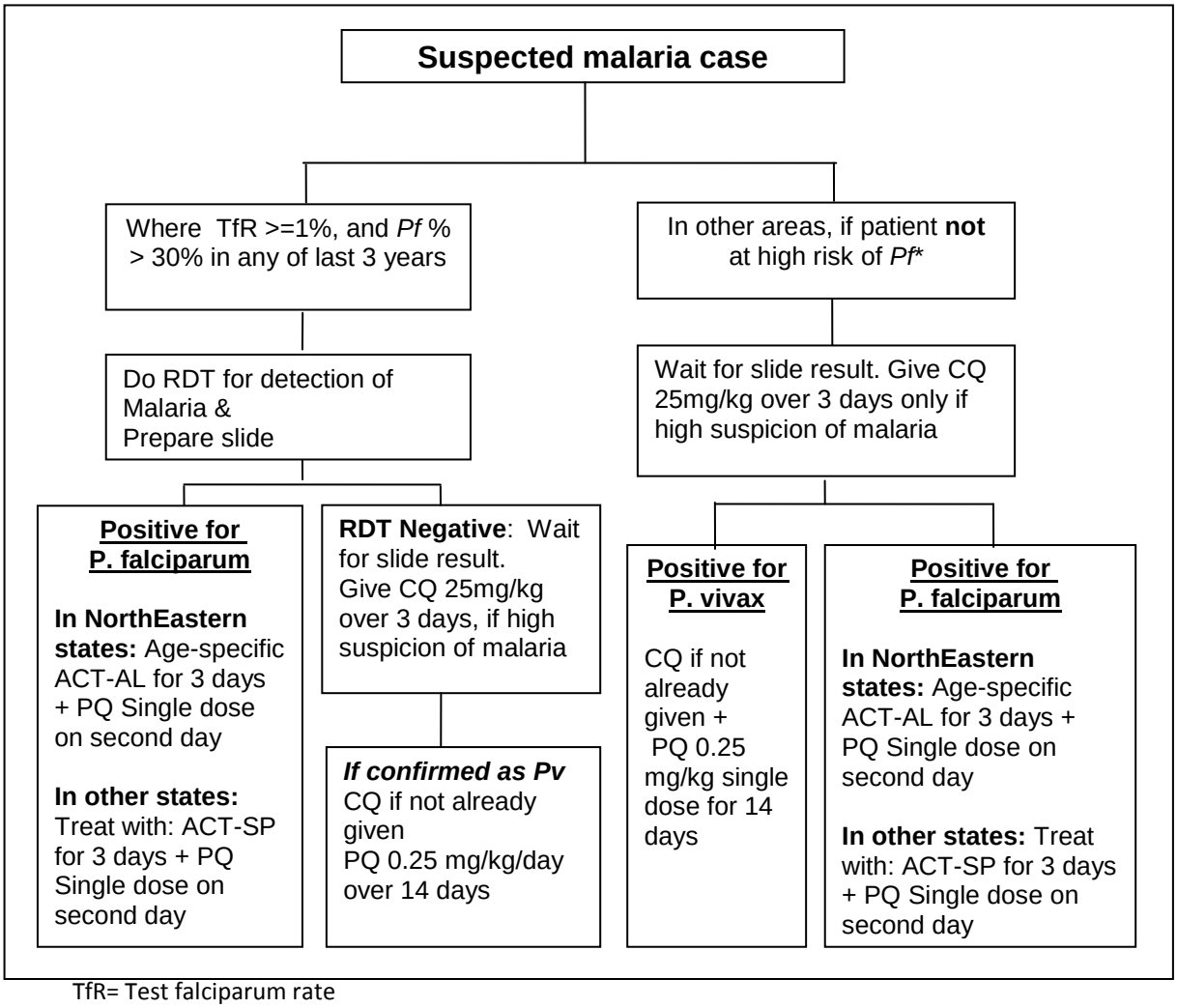
All fever cases diagnosed as malaria by either RDT or microscopy should be promptly given effective treatment. The medicine chosen will depend upon whether the patient has vivax malaria or falciparum malaria as diagnosed by the blood test. The flow charts in different settings for diagnosis and drug selection for the treatment of malaria are as under:

### Where microscopy result is available within same day




**ACT-AL -** Artemisinin-based Combination Therapy- Artemether - Lumefantrine
**ACT-SP**- Artemisinin-based Combination Therapy (Artesunate+Sulfadoxine-Pyrimethamine)
**CQ -** Chloroquine
**PQ -** Primaquine

## Where microscopy result is not available within same day and Monovalent RDT is used




TfR= Test falciparum rate

**Note: if a patient has severe symptoms at any stage, then immediately refer to a nearest PHC or other health facility with indoor patient management or a registered medical doctor.**

**Note: PQ is contra-indicated in pregnancy and in children under 1 year (Infants).**

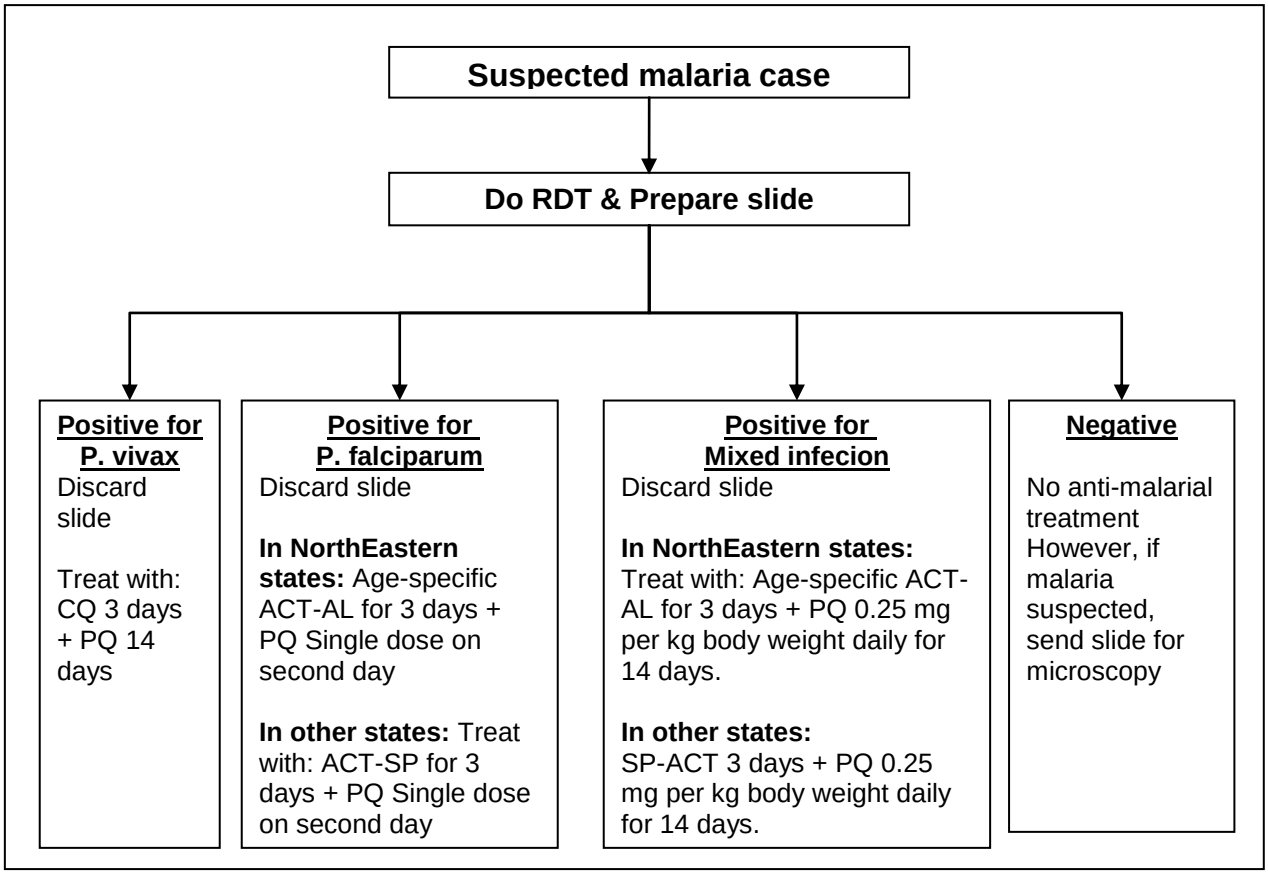
**ACT-AL -** Artemisinin-based Combination Therapy- Artemether - Lumefantrine

**ACT-SP**- Artemisinin-based Combination Therapy (Artesunate+Sulfadoxine-Pyrimethamine)

**CQ -** Chloroquine

**PQ -** Primaquine

## Where microscopy result is not available within same day and Bivalent RDT is used




**Note: if a patient has severe symptoms at any stage, then immediately refer to a nearest PHC or other health facility with indoor patient management or a registered medical doctor.**

**Note: PQ is contra-indicated in pregnancy and in children under 1 year (Infant).**
**ACT-AL -** Artemisinin-based Combination Therapy- Artemether - Lumefantrine
**ACT-SP**- Artemisinin-based Combination Therapy (Artesunate+Sulfadoxine-Pyrimethamine)
**CQ -** Chloroquine
**PQ -** Primaquine

## Treatment of *Vivax* Malaria

Diagnosis of *vivax* malaria may be made by the use of RDT (Bivalent) or microscopic examination of the blood smear. On confirmation following treatment is to be given:

## Drug schedule for treatment of *P vivax* malaria:

**1. Chloroquine:** 25 mg/kg body weight divided over three days i.e.
10 mg/kg on day 1,
10 mg/kg on day 2 and
5 mg/kg on day 3.

**2. Primaquine*:** 0.25 mg/kg body weight daily for 14 days.

**Primaquine is contraindicated in infants, pregnant women and individuals with $G_6$PD deficiency.** Primaquine causes hemolysis in G6PD deficient persons, resulting in dark coloured urine, yellow conjunctiva, bluish discoloration of lips, abdominal pain, nausea and vomiting, and should be reported to the doctor immediately.

14 day regimen of Primaquine should be given under supervision.

## Dosage Chart for Treatment of *Vivax* Malaria

| Age | Day 1 | | Day 2 | | Day 3 | | Day 4 to 14 |
|---|---|---|---|---|---|---|---|
| | CQ (250 mg) | PQ (2.5 mg) | CQ (250 mg) | PQ(2.5 mg) | CQ (250 mg) | PQ(2.5 mg) | PQ(2.5 mg) |
| Less than 1 yr | ½ | 0 | ½ | 0 | ¼ | 0 | 0 |
| 1-4 years | 1 | 1 | 1 | 1 | ½ | 1 | 1 |
| 5-8 years | 2 | 2 | 2 | 2 | 1 | 2 | 2 |
| 9-14 years | 3 | 4 | 3 | 4 | 1½ | 4 | 4 |
| 15 yrs or more* | 4 | 6 | 4 | 6 | 2 | 6 | 6 |
| Pregnancy | 4 | 0 | 4 | 0 | 2 | 0 | 0 |

CQ 250 mg tablet having 150 mg base

## Treatment of *Falciparum* Malaria

Diagnosis of *falciparum* malaria may be made by the use of RDT (Monovalent or Bivalent) or microscopic examination of the blood smear. It is imperative to start the treatment for falciparum malaria immediately on diagnosis. The treatment for falciparum malaria is as follows:

## In North-Eastern States (NE States):

**1. ACT-AL Co-formulated tablet of ARTEMETHER( 20 mg) - LUMEFANTRINE (120 mg)**

**(Not recommended during the first trimester of pregnancy and for children weighing < 5 kg)**

## Recommended regimen by weight and age group

The packing size for different age groups based on Kg bodyweight

| Co-formulated tablet ACT-AL | 5–14 kg( > 5 months to < 3 years) | 15–24 kg (≥ 3 to 8 years) | 25–34 kg (≥ 9 to14 years) | > 34 kg (> 14 years) |
|---|---|---|---|---|
| Total Dose of ACT-AL | 20 mg/ 120 mg twice daily for 3 days | 40 mg /240 mg twice daily for 3 days | 60 mg /360 mg twice daily for 3 days | 80 mg /480 mg twice daily for 3 days |
| | Pack size | | | |
| No. of tablets in the Packing | 6 | 12 | 18 | 24 |
| Give | 1 Tablet twice daily for 3 days | 2 Tablets twice daily for 3 days | 3 Tablets Twice daily for 3 days | 4 Tablets Twice daily for 3 days |
| Colour of the pack | Yellow | Green | Red | White |

**2. Primaquine*:** 0.75 mg/kg body weight on day 2

### In other States:

1. **Artemisinin based Combination Therapy (ACT-SP)***

Artesunate (AS), available as 50 mg tablets are given for three days, and Sulfadoxine-Pyrimethamine (S-P) tablets, containing 500 mg Sulfadoxine and 25 mg pyrimethamine are given for one day, as shown in the dosage chart below. All tablets for a day should be taken together, swallowed with water. In addition, Primaquine (PQ Large) tablets should be given on the second day.

**Dose schedule for Treatment of uncomplicated *P.falciparum* cases:**

a. **Artemisinin based Combination Therapy (ACT-SP)***

Artesunate 4 mg/kg body weight daily for 3 days Plus Sulfadoxine (25 mg/kg body weight) – Pyrimethamine (1.25 mg/kg body weight) on first day.

* ACT is not to be given in 1st trimester of pregnancy.

b. **Primaquine*:** 0.75 mg/kg body weight on day 2.

**With the introduction of different coloured Blister Packs for different age groups, treatment by the field level staff has been made easy. The colour code for different age groups for Packing of Tablet ACT+SP has been given as follows:**

## Dosage Chart for Treatment of *falciparum* Malaria with ACT-SP

| Age Group (Years) | 1st day | | 2nd day | | 3rd day |
|---|---|---|---|---|---|
| | AS | SP | AS | PQ | AS |
| 0-1 Pink Blister | 1 (25 mg) | 1 (250 +12.5 mg) | 1 (25 mg) | Nil | 1 (25 mg) |
| 1-4 Yellow Blister | 1 (50 mg) | 1 (500+25 mg each) | 1 (50 mg) | 1 (7.5 mg base) | 1 (50 mg) |
| 5-8 Green Blister | 1 (100 mg) | 1 (750+37.5 mg each) | 1 (100 mg) | 2 (7.5 mg base each) | 1 (100 mg) |
| 9-14 Red Blister | 1 (150 mg) | 2 (500+25 mg each) | 1 (150mg) | 4 (7.5 mg base each) | 1 (150 mg) |
| 15 & Above White Blister | 1 (200 mg) | 2 (750+37.5 mg each) | 1 (200 mg) | 6 (7.5 mg base each) | 1 (200 mg) |

### Treatment of uncomplicated *P.falciparum* cases in pregnancy:

**1st Trimester** : **Quinine** salt 10mg/kg 3 times daily for 7 days.

Quinine may induce hypoglycemia; pregnant women should not start taking quinine on an empty stomach and should eat regularly, while on quinine treatment.

**2nd and 3rd trimester**: **Area-specific ACT** as per dosage schedule given above.

i.e. **ACT-AL in North Eastern States**

**ACT-SP in Other States**

Primaquine (PQ) prevents transmission of falciparum malaria to others by its ability to kill gametocytes. PQ tablets should be taken after a meal; not on an empty stomach. Children less than the age of one year and pregnant women should not be given Primaquine. As pregnant women having falciparum malaria require different medicines, they should be directed to go to the nearest PHC or hospital immediately, without delay.

### Treatment of mixed infections (*P.vivax* + *P.falciparum)* cases:

All mixed infections should be treated with full course of ACT and Primaquine 0.25 mg per kg body weight daily for 14 days.

**In North-Eastern States:** Treat with: Age-specific ACT-AL for 3 days + Primaquine 0.25 mg per kg body weight daily for 14 days.

**In Other States:** SP-ACT 3 days + Primaquine 0.25 mg per kg body wt. daily for 14 days.

## Dosage Chart for Treatment of mixed (*vivax and falciparum*) Malaria with ACT-SP

| Age | Day 1 | | | Day 2 | | Day 3 | | Days 4-14 |
|---|---|---|---|---|---|---|---|---|
| | AS tablet (50 mg) | SP tablet | PQ (2.5 mg) | AS tablet (50 mg) | PQ (2.5 mg) | AS tablet (50 mg) | PQ (2.5 mg) | PQ (2.5 mg) |
| Less than 1 yr | ½ | ½ | 0 | ½ | 0 | ½ | 0 | 0 |
| 1-4 years | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5-8 years | 2 | 1½ | 2 | 2 | 2 | 2 | 2 | 2 |
| 9-14 years | 3 | 2 | 4 | 3 | 4 | 3 | 4 | 4 |
| 15 yrs or more | 4 | 3 | 6 | 4 | 6 | 4 | 6 | 6 |

## Treatment of mixed infections:

All cases of mixed infection are to be treated as Pf as per the drug policy applicable in the area plus Primaquine for 14 days

## Use of Paracetamol

Paracetamol tablets are available as part of the ASHA kit also in the health facilities. Paracetamol usually brings down fever from any cause within half an hour. However, Paracetamol does not cure the disease that is causing the fever. So, its effect does not last long. The fever remains low for about 4-6 hours, and then the fever can rise again. Paracetamol can be safely given at any age and even during pregnancy, in the dose shown in the dosage chart. In this dose, it can be given 3-4 times a day if needed. If the fever is not very high, and the patient is able to tolerate the fever, there is no need to give paracetamol.

### Dosage chart for use of Paracetamol

| Age | No. of Tablets of Paracetamol (500 mg tablets) |
|---|---|
| Less than 1 yr | ¼ |
| 1-4 years | ½ |
| 5-8 years | ¾ |
| 9-14 years | 1 |
| 15 yrs or more | 1 or 2 |

## Initiation of treatment and advice to the patient/caretaker

Once a suspected case is diagnosed positive by RDT or microscopy, treatment is started. The first dose is always taken in the presence of the health volunteer/worker. The blister pack with remaining tablets is given to the patient/caretaker to take home with clear instructions.

Caution: If the patient is a child under 5 years or pregnant, ask the patient to wait for 15 minutes after taking the first dose. If it is vomited within this period, let the patient rest for 15 minutes, and then give the first dose again i.e. open a new blister-pack and discard what remains of the old. If the patient vomits the first dose again, it is considered a case of severe malaria, refer the patient immediate to the nearest Block PHC/ CHC/ Hospital.

Explain to the patient/caretaker:

- That if the treatment is not completed as prescribed, the disease may manifest again with more serious features and more difficult to treat.
- To come back immediately, if there is no improvement after 24 hours, if the situation gets worse or the fever comes back.
- That regular use of a mosquito net (preferably insecticide treated net) is the best way to prevent malaria.

## Resistance to anti-malarial drugs

Resistance can be defined as either the ability of a parasite strain to survive and/or multiply despite the administration and absorption of a drug given in doses equal to or higher than those usually recommended, but within the limits of tolerance of the patient. One of the commonest reasons for the development of drug resistance is that the parasites are exposed to insufficient amount of the drug due to:

- Low prescription dosage
- Lesser amount of drug dispensed
- Incomplete treatment taken by the patient
- Drug vomited out
- Low absorption due to any reason, for example, diarrhea.

The course of action when a patient has persistent symptoms is:

- Ask the patient and the family a series of questions to help rule out some of the causes listed above - Did the patient get the drug from an authentic, designated provider? Did the patient get the right amount of the drug? Was all of it swallowed as prescribed? Was the drug vomited out? How many days has it been since drug treatment was begun, if it is not yet 72 hours, one can wait. Can you see the packing to check the expiry date? Are there symptoms of other obvious causes of fever? If the symptoms had disappeared and then reappeared, how long was the interval, if more than 15 days, it could be a fresh infection?
- If it appears that the drug was not adequately taken or retained, a fresh course may be given at home unless the patient has symptoms of severe malaria. Take a fresh blood smear (take two, for checking in different laboratories, if need be), and ask the nearest health care provider to keep an eye on the patient.
- Refer any patient who has symptoms despite taking and retaining a full course of treatment, or who has developed symptoms of severe malaria.

## Severe and complicated malaria

**A case** of uncomplicated malaria usually presents with fever, rigors, headache, bodyache, fatigue, anorexia and nausea.
Serious complications can arise in *P.falciparum* infection and rarely in *P. vivax*. They may sometimes develop suddenly over a span of time as short as 12 -24 hours and may lead to death, if not treated promptly and adequately. Severe malaria is clinically characterized by confusion or drowsiness with extreme weakness (prostration). In addition, the following may develop:

- Cerebral malaria with generalized convulsions
- Pulmonary oedema
- Severe anaemia
- Renal failure
- Hypoglycaemia
- Metabolic acidosis
- Circulatory collapse/shock
- Spontaneous bleeding and laboratory evidence of DIC
- Macroscopic haemoglobinuria
- Hyperthermia
- Hyperparasitaemia

In children, febrile convulsions, repeated vomiting and dehydration are common if the temperature is high due to any cause. Therefore, these symptoms are not necessarily indicative of severe malaria. However, children with such symptoms should be managed as severe malaria in routine program situations, and a diagnosis of malaria should be confirmed at the earliest.

In pregnancy, malaria, especially *P.falciparum* is a serious disease because with each bout of malaria, there is a reduction in haemoglobin and profound anaemia may develop rapidly. They are also at high risk of abortions or intrauterine growth retardation because sequestration of parasites in placenta restricts oxygen and flow of nutrients to the fetus.
The management of severe malaria is possible in health facilities which are equipped with the following:

- Parenteral Antimalarials , antibiotics, anticonvulsants, antipyretics
- Intravenous infusion equipment and fluids
- Special nursing for patients in coma
- Facilities for blood transfusion
- Well equipped laboratory
- Oxygen respirator

Often these items are not available at the PHC level. Under such circumstances, the Medical Officer, PHC and paramedical staff should be able to administer emergency treatment and refer the case without delay to other institutions where such facilities are available.
A list of all health care facilities in the district where emergency care for severe malaria is available should be kept in PHCs and with Community Workers like ASHA. MO-PHC will maintain liaison with all these institutions. For timely referral of severe cases, transportation arrangements should be made with the use of untied funds available under NRHM.

## The role of peripheral workers

The community comes in contact with ASHA and MPW (M&F) as a routine. They depend on these persons for advice and treatment of different diseases, malaria being one of them. Therefore, while training these workers the need to recognize a serious case of malaria should be emphasized. These workers should be conversant with the signs and symptoms of malaria and those which are likely to indicate serious complications.

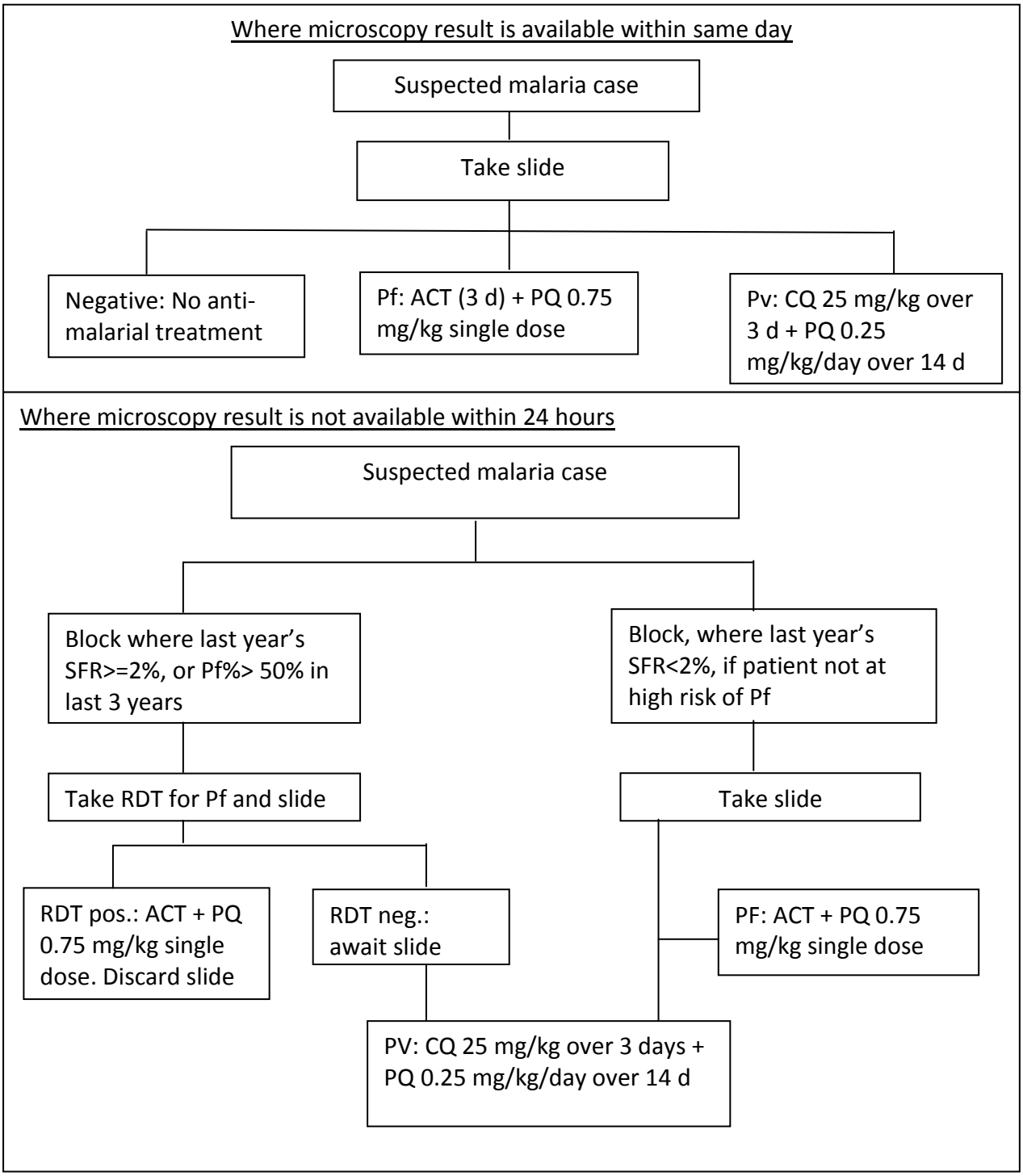
Severe malaria may be suspected, if the patient does not get relief from symptoms of malaria within 24 hours, and/or headache/fever continues to increase. Such patients should be referred immediately to the nearest PHC/CHC/Hospital.

## Criteria for immediate referral to Primary Health Centre:

a) Persistence of fever after 24 hours of initial treatment.
b) Continuous vomiting and inability to retain oral drugs.
c) Headache continues to increase
d) Severe dehydration – dry, parched skin, sunken face
e) Too weak to walk in the absence of any other obvious reason
f) Change in sensorium e.g. confusion, drowsiness, blurring of vision, photophobia, disorientation
g) Convulsions or muscle twitchings
h) Bleeding and clotting disorders
i) Suspicion of severe anaemia
j) Jaundice
k) Hypothermia

An algorithm for the diagnosis and treatment of fever cases for malaria is given figure:

## Fever Diagnosis and Treatment Algorithm




ACT= Artemisinin-based combination therapy (Artesunate + sulfadoxine-pyrimethamine); CQ= Chloroquine; PQ= primaquine

Note that PQ is contra-indicated in pregnancy and in children less than 1 year.

## Initiation of treatment and advice to the patient/caretaker

Once a suspected case is diagnosed positive by RDT or microscopy, treatment is started. The first dose is always taken in the presence of the health volunteer/worker. If the patient is a child under 5 years or pregnant, ask her or him to wait for 15 minutes after taking the first dose. If it is vomited within this period, let the patient rest for 15 minutes, then give a first dose again (i.e. open a new blister-pack and discard what remains of the old. If the patient vomits the first dose again, it is considered a case of severe malaria.

The remaining part of the treatment is given to the patient/caretaker to take home with clear instructions.

Explain to the patient/caretaker:

- That if the treatment is not completed as prescribed, the disease may recur, possibly being more serious and more difficult to treat.
- To come back immediately, if there is no improvement after 24 hours, if the situation gets worse or the fever comes back.
- That regular use of a mosquito net is the best way to prevent malaria.

## Recording of treatment

The result of RDT or slide should be entered by ASHA/ Health Worker/ MO in column 14 of M1. In case of Blood slide the date of receipt of result is to be entered in column 11. This will indicate the time lapse between the date of slide collection and receipt of results. If RDT has not been performed simply mark a cross (X). Now depending upon the species, ASHA/ Health worker/ MO will decide the anti-malarials to be administered. These will be entered in column 15 or 16 of M1. Suppose ACT has been selected then the entry will be made in column 16 while a cross (X) will be put in column 15. The date of starting and completing the treatment will be entered in column 17 and 18. During supervisory visits the time lag between slide collection or RDT and initiation of treatment should be identified.

# ***Chapter 3***
# ***Blood smear preparation and performing RDTs***

## Blood smear preparation

For preparation of blood smears, clean glass slides, disposable lancet, and spirit swab for cleaning the finger, cotton, a clean piece of cotton cloth and lead pencil are required. After the patient information has been recorded on the appropriate form, a clean glass slide free from grease and scratches is taken and the finger of the patient is cleaned by using a spirit swab.

| | |
|---|---|
|  | Select the second or third finger of the left hand. |
|  | The site of the puncture is the side of the ball of the finger, not too close to the nail bed. |
|  | Allow the blood come up automatically. Do not squeeze the finger. |
|  | Hold the slide by its edges. |
|  | The size of the blood drop is controlled better if the finger touches the slides from below. |
|  | Touch the drop of blood with a clean slide; three drops are collected for preparing the thick smear. |
|  | Touch another new drop of blood with the edge of a clean slide for preparing the thin smear. |
|  | Spread the drop of blood with the corner of another slide to make a circle or a square about 1 cm. |
|  | Bring the edge of the slide carrying the second drop of blood to the surface of the first slide, wait until the blood spreads along the whole edge. |
|  | Holding it at an angle of about 45o push it forward with rapid but not too brisk movement. |

Write with a pencil the slide number on the thin film, Wait until the thick film is dry. The thin film is always used as a label to identify the patient.

- The blood should not be excessively stirred. Spread gently in circular or rectangular form with 3 to 6 movements.
- The circular thick film should be about 1 cm in diameter.
- Allow the thick film to dry with the slide in the flat, level position protected from flies, dust and excessive heat.
- Label the dry thin film with a soft lead pencil by writing in the thicker portion of the film the blood slide number and date of collection.

The lancet and cotton swab should be disposed off as per the standard hospital waste management policy. The SOPs on laboratory work and universal precautions for blood collection are to be followed. Non-disposable needles should not be used and only disposable lancets should be used for finger pricking.

## Rapid Diagnostic Test

The materials in the RDT kit are as follows:

- Spirit (alcohol) swab (one for each patient)
- Disposable lancet (one for each patient)
- Capillary tube (one for each patient)
- Test strip (one for each patient)
- One multiple well plastic plate
- Test tube (one for each patient)
- Buffer solution or reagent solution
- Dessicant

## Procedure

- Check that the test kit is within its expiry date; if not discard it. Read the instructions of the test kit, as there may be minor variations in the procedure between different kits. Place a small box, jar or bottle for trash next to the kit.
- Open a foil pouch and check that the dessicant inside it is still blue; if not, discard the test.
- Remove the test strip and the small glass tube or loop from the foil pouch and place them on a clean dry surface.
- Take out the buffer solution and the dropper. Place a new test tube in the multiple well plate.
- Clean a finger with the swab and let the skin dry completely in the air. Prick finger on the side with a lancet. Discard lancet in trash container. Let a drop of blood come out on the skin.
- Touch the tip of the glass tube or the loop to the blood drop on the finger and let a small quantity of blood (a small drop) come up in the tube or the loop.
- Touch the tube or the loop to the test strip just below the arrow mark to place the blood there. If there is a paper, where Plasmodium falciparum is written, remove it and place the blood where it was. Discard tube/loop in trash container.
- Using the dropper, place 4 drops of buffer solution into a new test tube. After this, place the test strip containing blood in the buffer solution with the arrow pointing down.While waiting, a slide can be prepared.
- Observe after 15 minutes - if no red line appears in the test strip, then the kit is not working; discard it and use another one. If a single red line appears, it is not falciparum malaria. If two red lines appear, the test result is falciparum malaria.
- The test should be read 15 to 20 minutes after blood was taken; earlier or later readings may lead to false results.
- Discard the test strip and test tube in trash container. Make sure this container is kept out of reach of children. When it is full, if in a village, bury it in the ground, or send it with the MPW to the PHC for safe disposal.

## Guidelines for Proper Storage of Drugs and Commodities

The main purpose of storage is to protect the quality of products and its packaging throughout the supply chain. The brief guidelines for storage of drugs/commodities are mentioned below:

1. Clean and disinfect the store room regularly and monitor the storage conditions
2. Clean receiving, storage, packing areas and remove the garbage and also keep the stores away from rodents, insects and termites
3. Safely handle the health commodities while loading and unloading from the transport vehicle
4. Clean bins, shelves and cupboards, if needed
5. Store supplies in a dry, well-lit and well ventilated store room and out of the direct sunlight
6. Ensure adequate ventilation and temperature control (not more than $40^0$ C).
7. Store supplies in a manner that is accessible for FEFO, counting, and general management. Use First Expiry First out (FEFO) principle. Please issue the drugs which are going to expire first.
8. Store medical supplies separately, away from insecticides, chemicals, old files, office supplies, and other materials.
9. Arrange cartons so that arrows point up, and ensure that identification labels, expiry dates, and manufacturing dates are visible.
10. Monitor store security and safety to avoid theft/pilferage
11. Secure store room from water penetration and from any seepage in the walls, roof, doors & windows, especially during rainy season
12. Monitor product quality (visually inspect commodities and check expiry dates) and physical verification of quantities
13. Ensure that fire safety equipment (fire extinguisher) is available and accessible and that personnel are trained to use it.
14. Ensure fire proof electrical fittings and appliances for any fire due to short circuit and keep the stocks away from the electrical sockets
15. Separate damaged and expired stocks from the usable stock and move the expired stock to secure area and dispose of these products without delay as per the established procedure
16. Monitor stock levels, stock quantities and safety stocks and update stock ledger/records regularly and maintain the files in safe custody.

# *Chapter-4*
# *Model Question Paper for Pre & Post Test*

**Maximum Marks: 50**
**Time Allotted: 45 Mins.**

**Note:**

1. **All questions are Compulsory**
2. **Please answer in a concise & relevant manner. Don't waste time on unnecessary & unwanted explanations.**

**Marks**

## Multiple Choice Question.

**1.** The basis for selection of the Sub-Centre for RDT is: **1**
   - **a.** Pf % > 30 and SPR > 2%
   - **b.** Pf% > 20 and SPR > 5%
   - **c.** Pf % > 35 and SPR > 10%
   - **d.** Pf% > 25 and SPR >15%

**2.** RDT shall be provided to Health Facilities which are: **1**
   - **a.** Far-flung, Remote areas.
   - **b.** Difficult to reach, villages far away from PHCs & CHCs
   - **c.** For conducting Malaria diagnosis in emergency, off-duty hours.
   - **d.** All of the above
   - **e.** None of the above

**3.** The parenteral treatment, if started, should be given for minimum of: **1**
   - **a.** 12 Hrs.
   - **b.** 32 Hrs.
   - **c.** 48 Hrs.
   - **d.** 24 Hrs.

**4.** Tablet of ACT-AL for the treatment of Pf cases is not recommended for children weighing: **1**
   - **a.** < 2.5 Kg.
   - **b.** < 5 Kg.
   - **c.** < 3 Kg.
   - **d.** < 4.5 Kg.

**5.** The criterion for identifying high risk areas (for IRS and LLIN) is: **1**
   - **a.** API > 5
   - **b.** API > 3
   - **c.** API > 2
   - **d.** API > 10

**6.** Which is preferred method of vector control in rural areas: **1**

- **a.** Indoor Residual Spray.
- **b.** Long Lasting Insecticidal Nets
- **c.** Both **a & b**
- **d.** None of the above

**7.** The shelf-life of rapid diagnostic test kits (RDKs) is. **1**

- **a.** 12 month**s**
- **b.** 18 months.
- **c.** 24months.
- **d.** 36 months.

**8.** If no other cause can be found and the clinical suspicion is high **1**
(e.g. intermittent fever with rigors and sweats), the test should be repeated after:

- **a.** 12 Hrs.
- **b.** 6 Hrs.
- **c.** 24 Hrs.
- **d.** 2 Days.

**9.** Which drug is to be stopped in case of haematuria or high colored **1**
urine / cyanosis or blue coloration of lips:

- **a.** Chloroquine.
- **b.** Primaquine
- **c.** Both **a & b**
- **d.** None of the above.

**10.** What is the (gold) Standard Diagnostic Tool for diagnosis of Malaria? 1

- **a.** Rapid Diagnostic Test
- **b.** Microscopy
- **c.** Clinical method
- **d.** Biochemical Diagnostic Method

**11.** Which drug is contra-indicated in children under 1 year? **1**

- **a.** ACT-AL
- **b.** ACT-SP
- **c.** CQ
- **d.** All the above
- **e.** None of the above

**12.** The order of the color of the pack in the ascending order of age group is: **1**

- **a.** Yellow, Green, Red & White.
- **b.** Green, White, Yellow & Red.
- **c.** Yellow, Red, White & Green.
- **d.** Yellow, Green, White & Red.

**13.** Bivalent RDT detects: **1**

**a.** Pv & Pf Infection

**b.** Pf Infection

**c.** Pv Infection

**d.** Pv, Pf & Mixed Infection.

**14.** What should not be done in severe malaria case management: **1**

**a.** Use corticosteroids

**b.** Administer adrenaline

**c.** Use heparin as anticoagulant

**d.** None of the above.

**15.** Which treatment regimen is no more recommended in Revised Drug Policy 2013: **1**

**a.** Treatment for Vivax Malaria

**b.** Treatment for Falciparum Malaria

**c.** Treatment for Mixed Malaria Infection

**d.** Presumptive treatment for Malaria.

## Answer the following questions in about 25-50 words:

**1.** If the patient is found positive for Pf infection. What treatment should be given? **4**

**Ans.**

**2.** What is **FEFO** Principle? **2**

Ans.

**3.** Write a note on the storage of Rapid Diagnostic Kits. **3**

Ans.

**4.** What is the strategy of Malaria Control in India? **4**

Ans.

**5.** What is the treatment of P. Vivax Malaria? **2**

Ans.

**6.** Write the full course of Anti-Malarials after Parenteral Artemisinin Therapy? **2**

Ans.

**7.** What is mixed infection? What is the treatment for the mixed infection? **3**

Ans.

**8.** Write about the steps and Interpretation of rapid diagnostic tests? **2**

Ans.
Steps:

Interpretation:

**9.** Mention few of the guidelines for the proper storage of Drugs and Diagnostics. **3**

Ans.

**10.** Write the full forms of the acronyms given below: **10**

a. **ACT:**
b. **GFATM:**
c. **IMCP:**
d. **IRS:**
e. **LLIN:**
f. **LQAS:**
g. **PSCM:**
h. **QA:**
i. **RDT:**
j. **SOE:**