

MALARIA

Dr Sagar Sinha

MD, DNB General Medicine

FNB Critical Care Medicine

Head, Critical Care Unit

Assistant Professor, Emergency Medicine

MGM Medical College & Hospital, Navi Mumbai

Outline

- Etiology
- Epidemiology
- Pathphysiology and Life Cycle
- Clinical Features – Symptoms, Signs and Complications
- Diagnosis
- Treatment
- Prevention

ETIOLOGY

CAUSED BY 5 PROTOZOAN PARASITES....

- PLASMODIUM FALCIPARUM
- PLASMODIUM VIVAX
- PLASMODIUM OVALE
- PLASMODIUM MALARIAE
- PLASMODIUM KNOWLESI



TRANSMITTED THROUGH BITE OF AN INFECTED
FEMALE ANOPHELES MOSQUITO



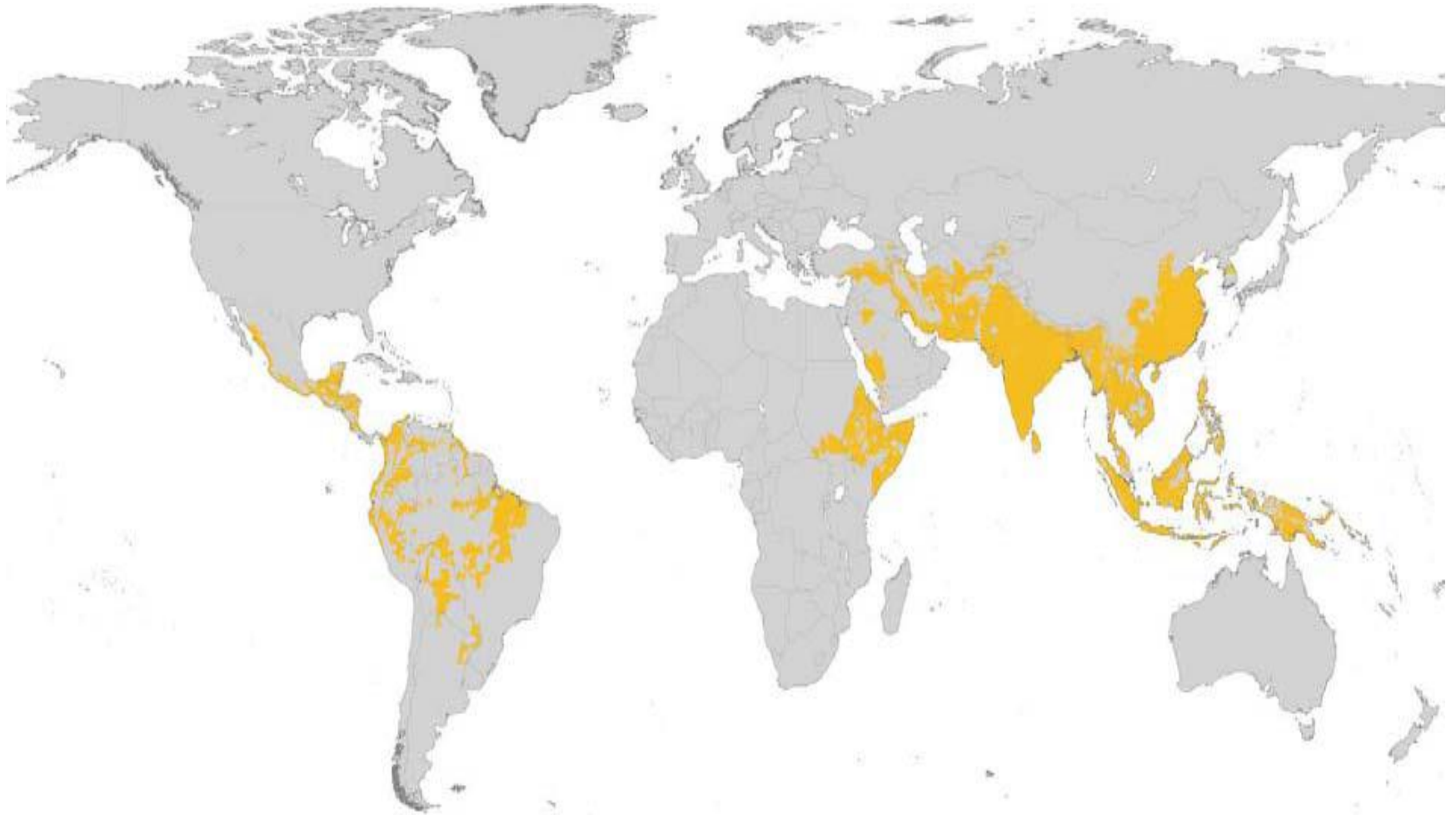


EPIDEMIOLOGY

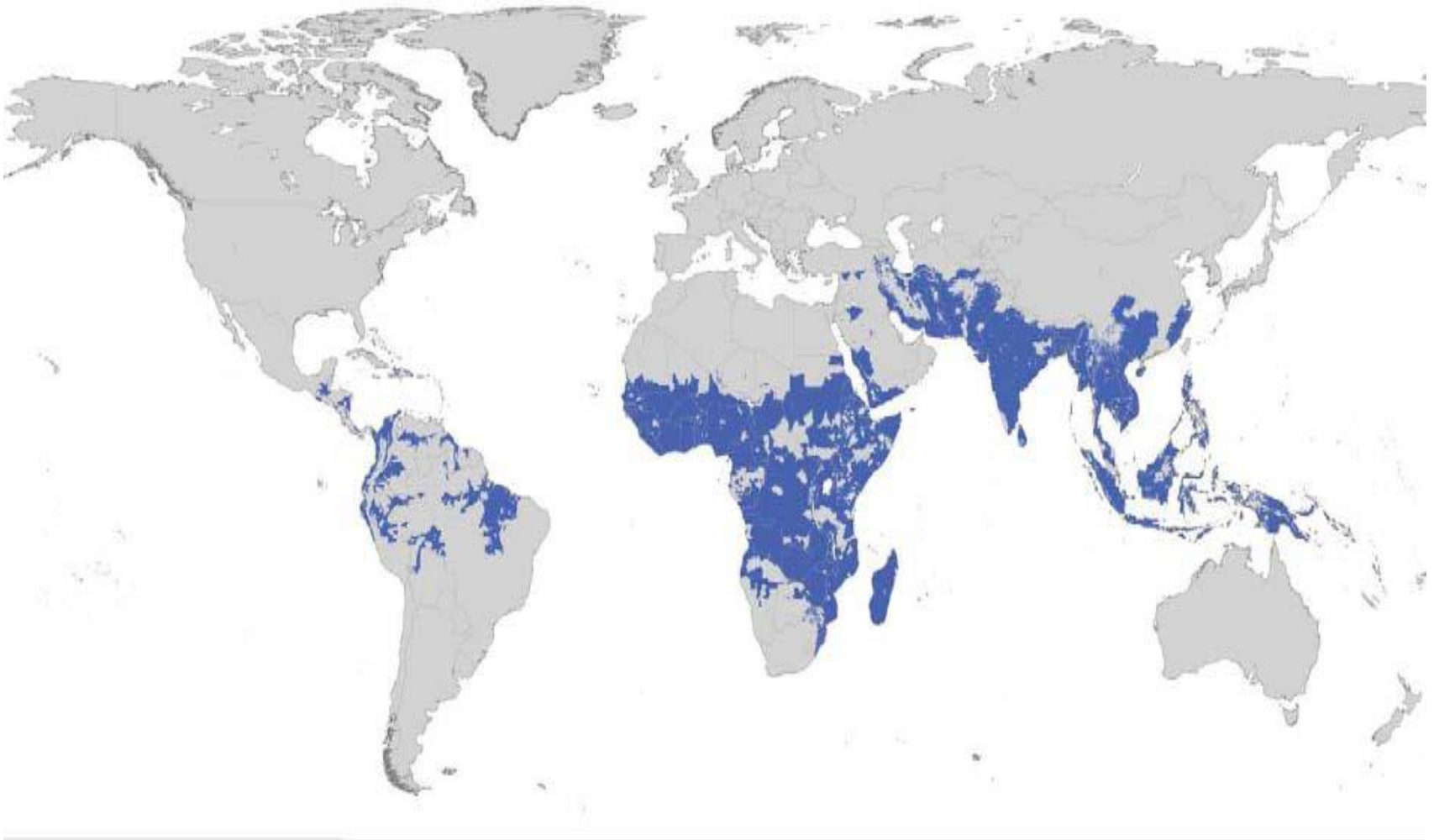
MALARIA PROBLEM

- IT IS THE MOST COMMON LIFE THREATENING PARASITIC INFECTION
- 1 MILLION DEATHS PER YEAR
- 3 BILLION @ Risk
- 300 TO 500 MILLION INFECTIONS PER YEAR
- Most DEATHS OCCUR IN SUB SAHARAN AFRICA
- Most VICTIMS ARE CHILDREN BELOW 5 YEARS OF AGE
- PREGNANT WOMEN ARE ALSO SPECIALLY VULNERABLE

Distribution Of Plasmodium vivax



Distribution of Plasmodium falciparum



Burden of Malaria in Asia

Burden In Asia under appreciated...

45% of all malaria is in SEARO (India / Indonesia)

206 million *P.falciparum* per year

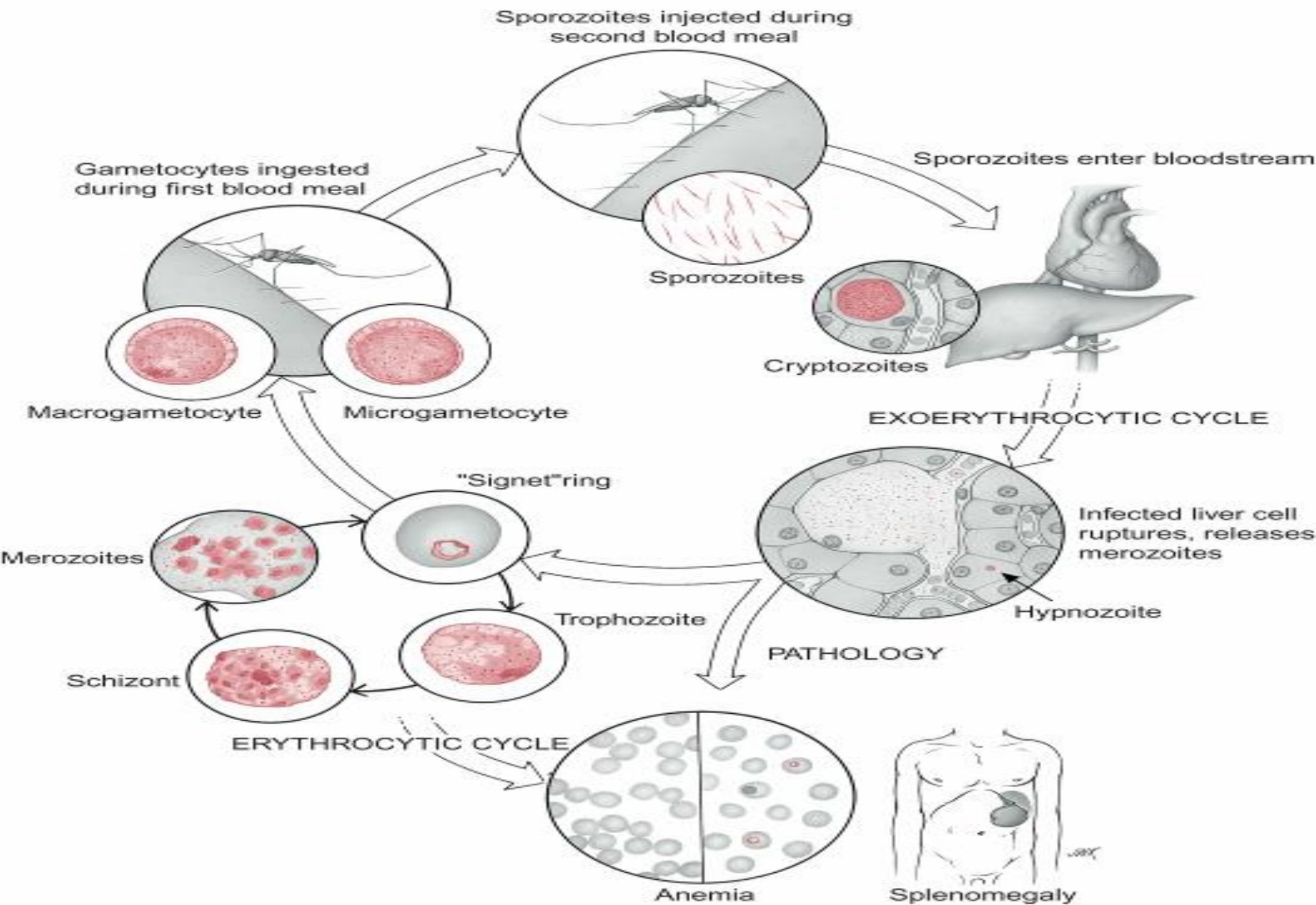
276 million cases of *P.vivax* per year

Indian Context

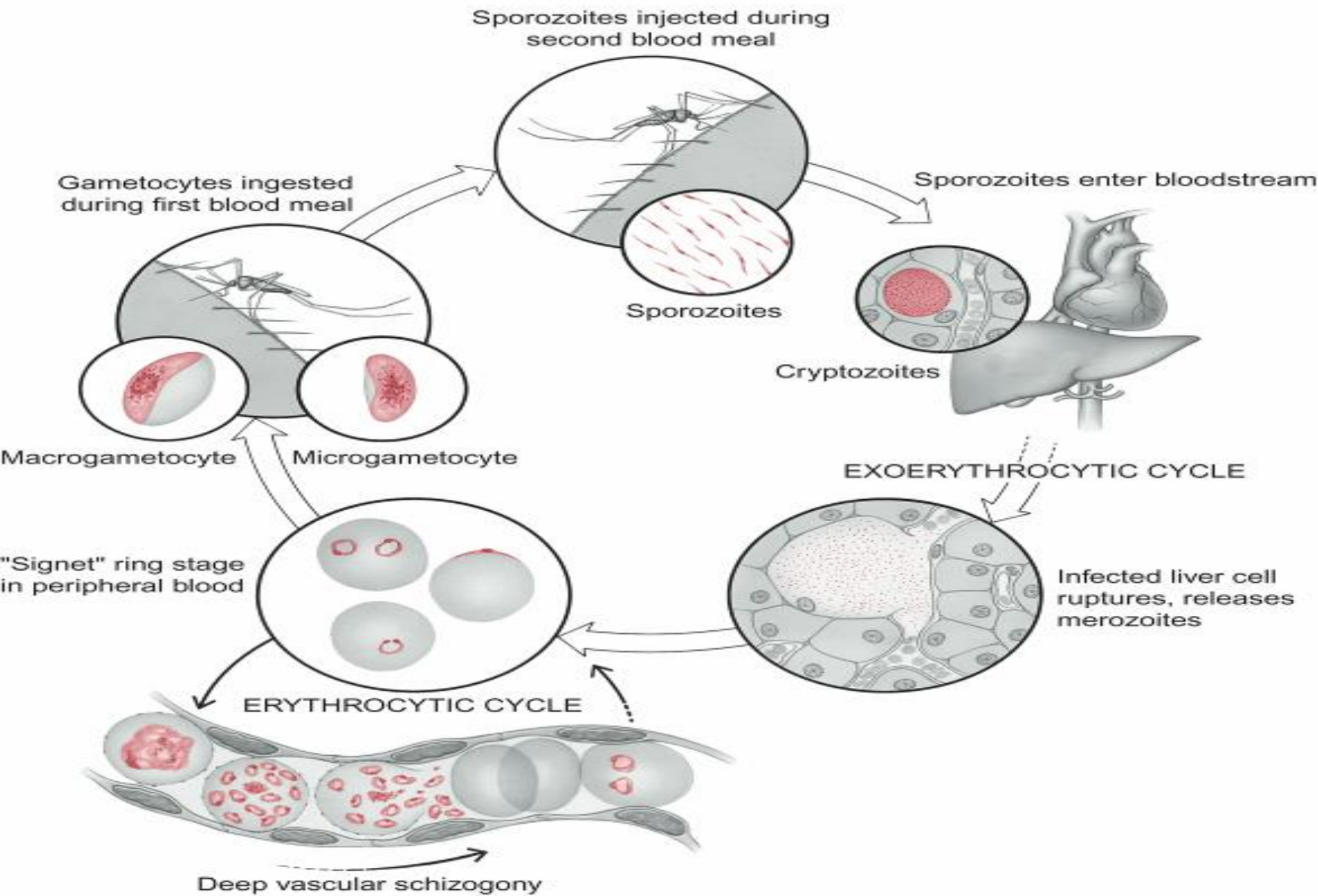
- Malaria is one of the major public health problems of the country. Around 1.5 million confirmed cases are reported annually by the National Vector Borne Disease Control Programme (NVBDCP), of which about 50% are due to *Plasmodium falciparum*
- A revised National Drug Policy on Malaria has been adopted by the Ministry of Health and Family Welfare, Govt. of India in 2010 and these guidelines have been prepared for healthcare personnel including clinicians involved in the treatment of malaria

PATHPHYSIOLOGY AND LIFE CYCLE

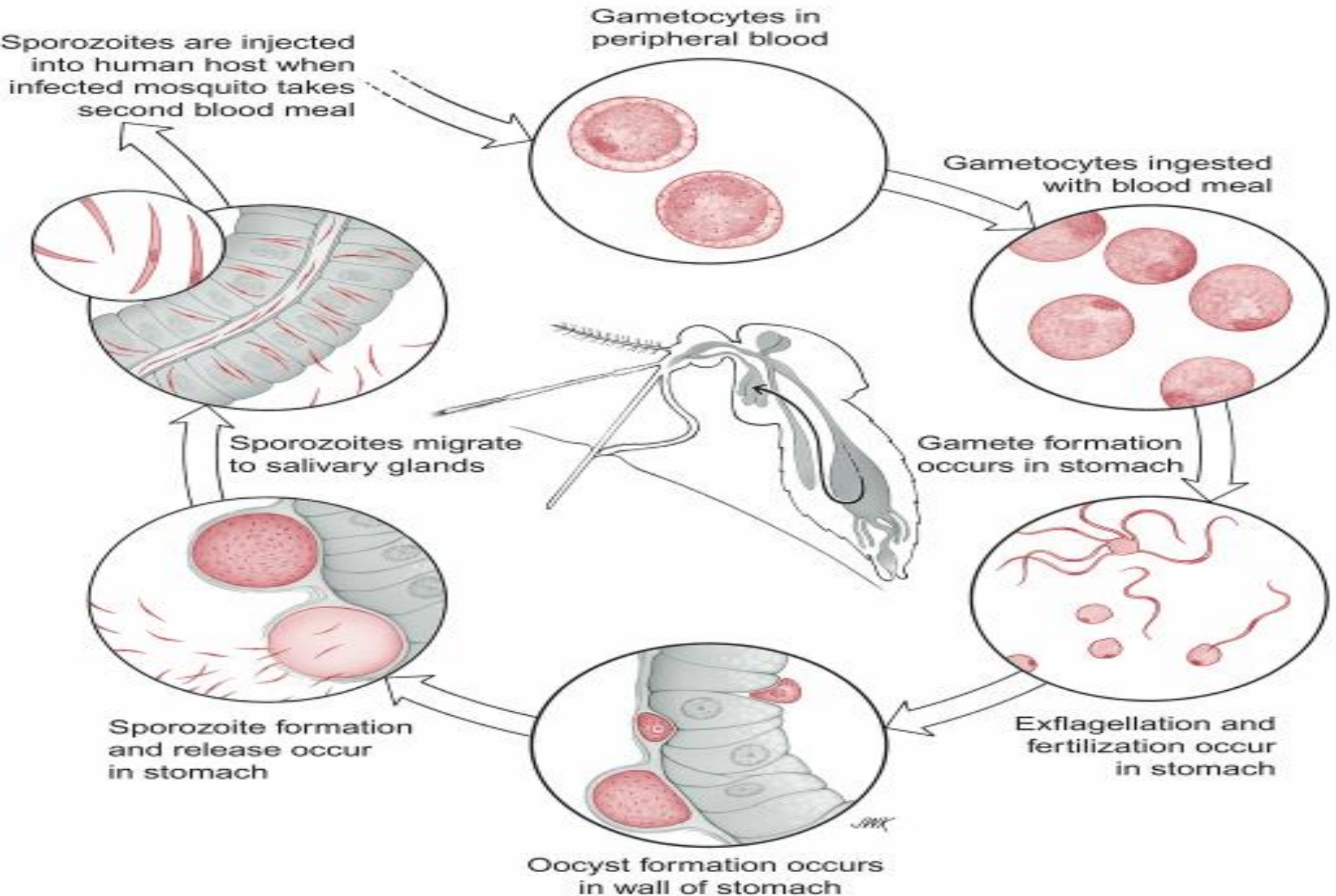
Plasmodium vivax



Plasmodium falciparum



Mosquito Cycle (Sporogony)



Erythrocyte Changes

- Consumes and degrades intracellular proteins principally **hemoglobin**
- Alters the RBC **membrane** by changing its transport properties, exposing cryptic surface antigens, and inserting new parasite-derived proteins. The RBC becomes more irregular in shape, more antigenic, and less deformable.
- Severe malaria is also associated with reduced deformability of the **uninfected erythrocytes**, which compromises their passage through the partially obstructed **capillaries** and **venules** and shortens RBC survival.

- In the other three ("benign") human malarias, **sequestration** does **not** occur, and all stages of the parasite's development are evident on peripheral-blood smears.

-

- Whereas *Vivax*, *Ovale*, and *Malariae* show a marked predilection for either young RBCs (*Vivax*, *Ovale*) or old cells (*Malariae*) and produce a level of parasitemia that is seldom >2%,

- **Falciparum** can invade erythrocytes of **all** ages and may be associated with very high levels of parasitemia.

CLINICAL FEATURES

Symptoms of **Malaria**

Central
- Headache

Systemic
- Fever

Muscular
- Fatigue
- Pain

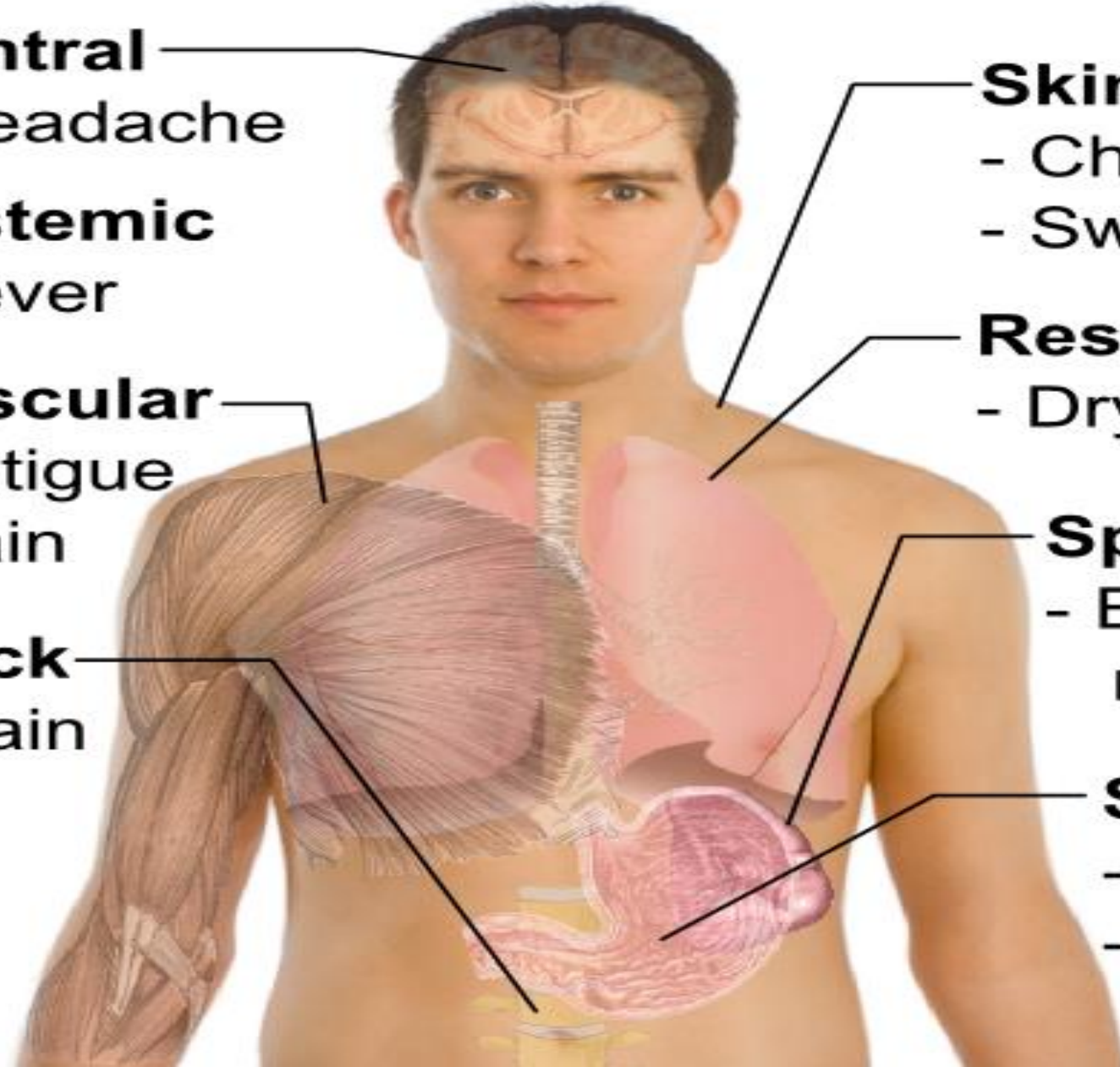
Back
- Pain

Skin
- Chills
- Sweating

Respiratory
- Dry cough

Spleen
- Enlarge-
ment

Stomach
- Nausea
- Vomiting



Fever is the cardinal symptom of malaria.

It can be intermittent with or without periodicity or continuous. Many cases have chills and rigors.

The fever is often accompanied by headache, myalgia, arthralgia, anorexia, nausea and vomiting.

The symptoms of malaria can be non-specific and mimic other diseases like viral infections, enteric fever etc.

Duration of Erythrocytic Cycle (hours)

Falciparum 36-48 h

Vivax 48 h

Ovale 50 h

Malariae 72 h

Tertian, every 2 days

Quartan, every 3 days

are seldom seen today

CLINICAL FEATURES

- **COLD STAGE**
- **HOT STAGE**
- **SWEATING STAGE**



***AN ABRUPT ONSET OF INITIAL “COLD STAGE”
ASSOCIATED WITH DRAMATIC RIGORS IN
WHICH THE PATIENT VISIBLY SHAKES***



AN INSUING HOT STAGE IN WHICH THE PATIENT MAY HAVE A TEMP OF MORE THAN 104' F , MAYBE RESTLESS AND EXICTABLE, AND MAY VOMIT OR CONVULSE



FINALLY THE SWEATING STAGE, DURING WHICH THE PATIENT DEFERVESCES AND MAY FALL ASLEEP

SIGNS WHICH REQUIRE FURTHER INVESTIGATION FOR OTHER CAUSES OF FEVER

Running nose, cough and other signs of respiratory infection

Diarrhoea/dysentery

Burning micturition and/or lower abdominal pain

Skin rash/infections

Abscess

Painful swelling of joints

Ear discharge

Lymphadenopathy

SEVERE MALARIA: Complications

- *Impaired consciousness/coma*
- *Repeated generalized convulsions*
- *Renal failure*
- *Jaundice*
- *Severe anaemia*
- *Acute respiratory distress syndrome*
- *Hypoglycaemia*
- *Metabolic acidosis*
- *Circulatory collapse/shock*
- *Abnormal bleeding and DIC*
- *Haemoglobinuria*
- *Hyperthermia (Temperature >104F)*
- *Hyperparasitaemia*

THROMBOCYTOPENIA

DIAGNOSIS





CLINICAL DIAGNOSIS

clinically suspected mostly on the basis of fever or a history of fever

The WHO recommendations for clinical diagnosis/suspicion of uncomplicated malaria in different epidemiological settings are as follows:

- in settings where the risk of malaria is low, clinical diagnosis of uncomplicated malaria should be based on the possibility of exposure to malaria and a history of fever in the previous three days with no features of other severe diseases
- in settings where the risk of malaria is high, clinical diagnosis should be based on a history of fever in the previous 24 h and/or the presence of anaemia

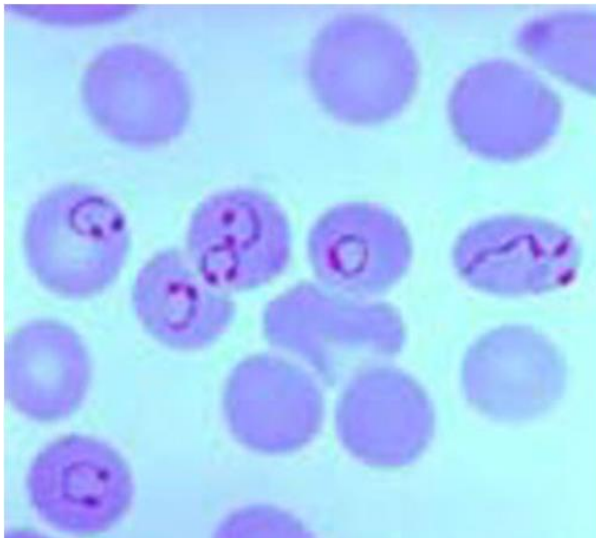
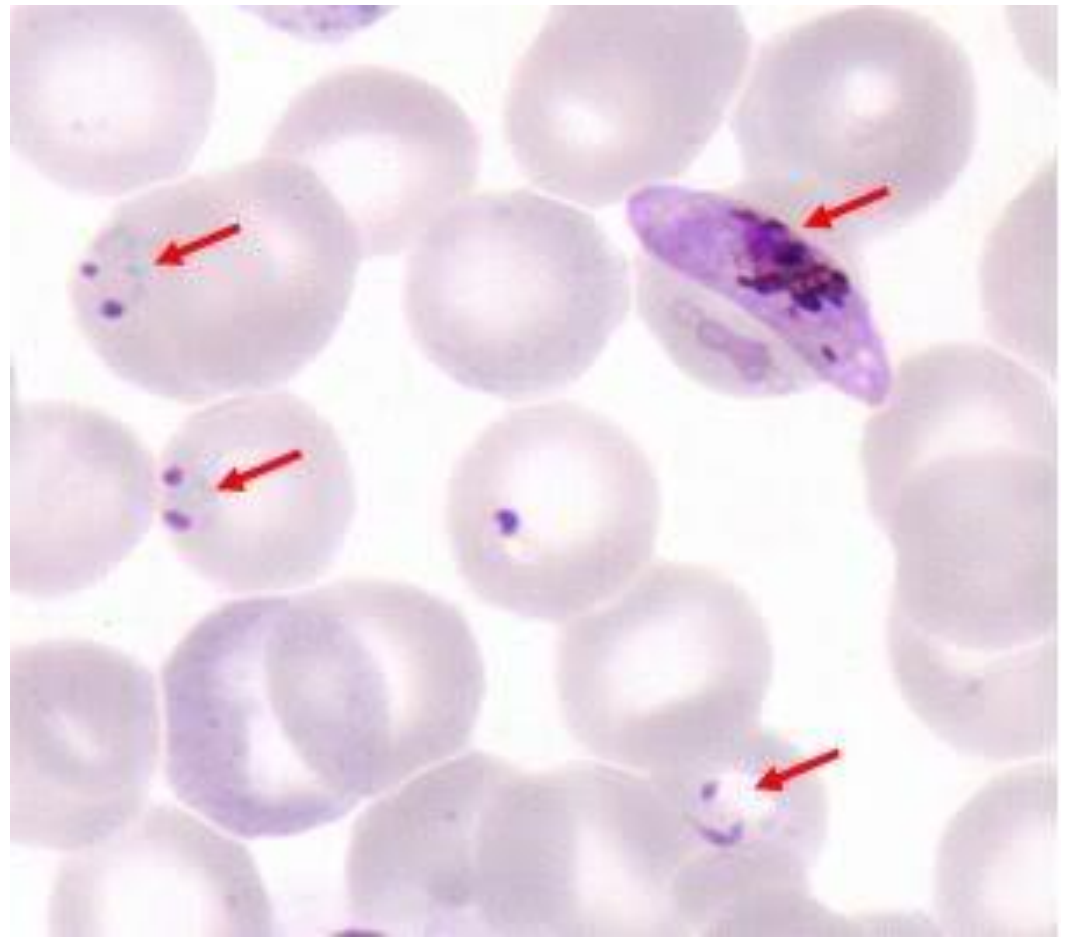
Lab Diagnosis

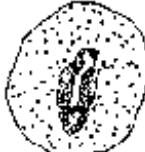
- PERIPHERAL BLOOD SMEAR
(THICK AND THIN BLOOD FILMS)
- QUANTITATIVE BUFFY COAT (QBC)TEST
- RAPID DIAGNOSTIC TESTS (RDT) e.g. MAT
- OTHER TESTS: PCR, MALARIAL ANTIBODIES,
INTRALEUCOTIC MALARIAL PIGMENT,
FLOWCYTOMETRY, MASS SPECTROMETRY

Microscopy of stained thick and thin blood smears remains the gold standard for confirmation of diagnosis of malaria.

The advantages of microscopy are:

- The sensitivity is high. It is possible to detect malaria parasites at low densities. It also helps to quantify the parasite load
- It is possible to distinguish the various species of malaria parasite and their different stages



	vivax	ovale	malariae	falciparum
Ring Stage				
Trophozoite				
Schizont				
Segmenter				
Gametocytes				
				

sequestered

Morphology

Falciparum

Usually only ring forms; Banana-shaped gametocytes

Vivax

Irregularly shaped large rings and trophozoites; enlarged erythrocytes; Schüffner's dots

Ovale

Infected erythrocytes, enlarged and oval with tufted ends; Schüffner's dots

Malariae

Band or rectangular forms of trophozoites common

Other Tests

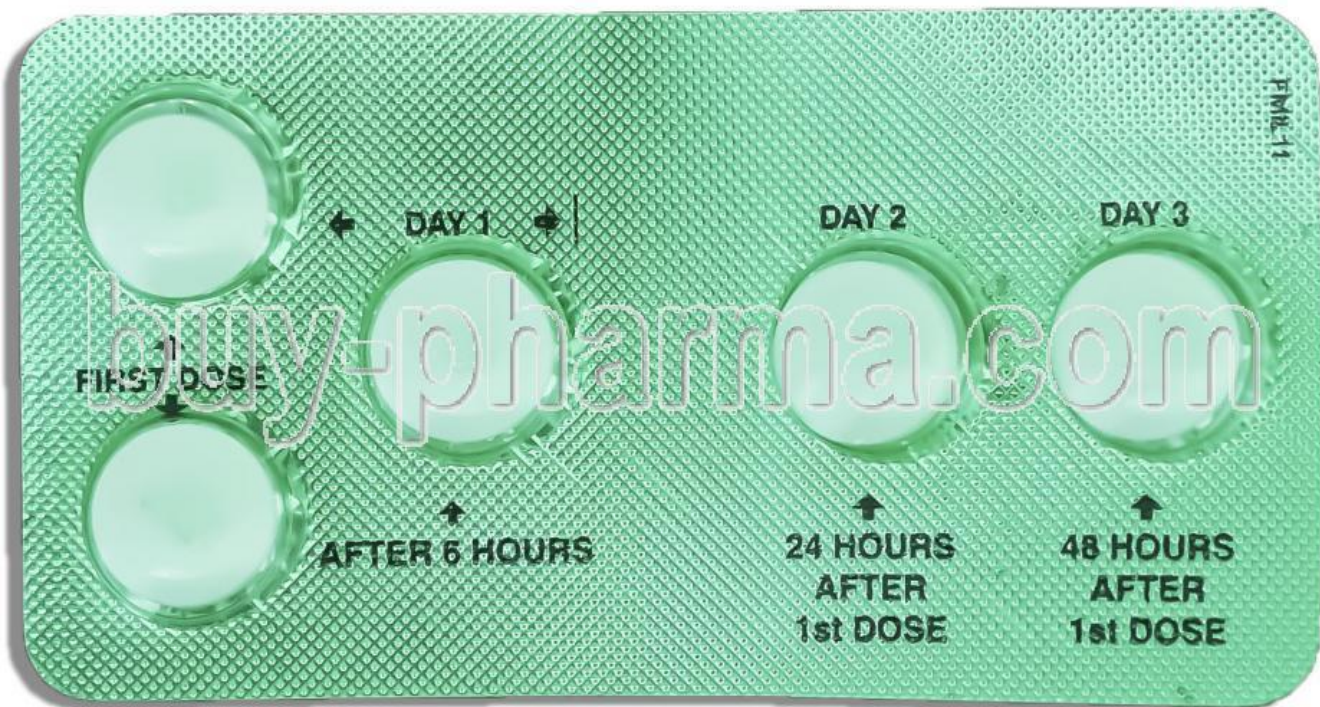
- Liver Function Test
Bilirubin (Jaundice)>> Direct- hepatitis, Indirect- hemolysis
Enzymes- malarial hepatitis (r/o Dengue)
- Renal Function Test
creatinine>> acute renal failure
- Electrolytes
dyselectrolemia, fluid status, hypovolemia
- Imaging-
Abdominal USG: spleno-/hepato-megaly
Chest X-Ray: ARDS
Brain
- Urine Routine
- Arterial Blood Gas, Blood Sugar Charting

TREATMENT



Treatment of *P. vivax* malaria

- Confirmed *P. vivax* cases should be treated with chloroquine in full therapeutic dose of 25 mg/kg divided over three days.
- A form of *P. vivax* or *P. ovale* parasites called as hypnozoites remain dormant in the liver cells. These hypnozoites can later cause a relapse. For its prevention, primaquine should be given at a dose of 0.25 mg/kg body weight daily for 14 days under supervision. Primaquine is contraindicated in known G6PD deficient patients, infants and pregnant women.
- In mild G6PD deficiency, 0.75 mg of base/kg can be given once weekly for 6–8 weeks



mg/kg body wt

250 (300) DS tablet

BASE - 10

2

6 hrs - 5

1

24 hrs - 5

1

48 hrs - 5

1

Treatment of *P. falciparum* malaria

- Artemisinin Combination Therapy (ACT) should be given to all confirmed *P. falciparum* cases found positive by microscopy or RDT.
- This is to be accompanied by single dose primaquine (0.75 mg/kg body weight) on Day 2.
- ACT consists of an artemisinin derivative combined with a long acting antimalarial (amodiaquine, lumefantrine, mefloquine or sulfadoxine-pyrimethamine).

Artemisinin Combination Therapy

- Artesunate (4 mg/kg body weight) daily for 3 days **and** Sulfadoxine (25 mg/kg body wt) and Pyrimethamine (1.25 mg/kg body wt) on Day 0.
- Artemether (1.5 mg/kg body wt) and Lumefantrine (9 mg/kg body wt) (available in multiples of 20/120 mg)
> 35 kgs wt= 80/480mg twice a day x 3days

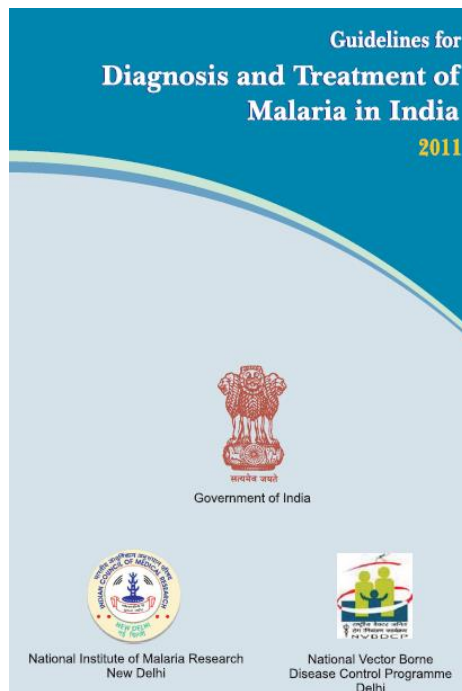


Supplementary Therapy

> Doxycycline 3 mg/kg per day for 7 days.

Doxycycline is contraindicated in pregnant women and children under 8 years of age; instead,

> Clindamycin 10 mg/kg bw 12 hourly for 7 days should be used



Where microscopy result is available within 24 hours

Clinically suspected malaria case

Take slide for microscopy

P. vivax
CQ 3 days +
PQ 14 days

P. falciparum
ACT 3 days + PQ single dose

Negative
Needs further
evaluation*

Where microscopy result is not available within 24 hours

Clinical suspected malaria case

Perform RDT

RDT for *Pf*, Also
prepare blood smear

RDT for *Pf* & *Pv*

***Pf* RDT positive**
ACT 3 days +
PQ single dose
on Day 2

***Pf* RDT Negative**
Send blood slide to laboratory
Give CQ for 3 days, and await
microscopy result
Microscopy result

- + ve for *Pv* - PQ for 14 days under supervision.
- + ve for *Pf* - ACT 3 days + PQ single dose on Day 2

Positive: Treat according
to species
Negative: Needs further
evaluation*



Standard adult prescription (uncomplicated OPD basis)

Vivax

- Tab Chloroquine 300mg 2tabs stat, 1 tab at 6 hrs, then od for 2 days
- Tab Primaquine 7.5mg bd for 15 days
- Tab Doxycycline 100 mg bd for 5 days

PREGNANT/LACTATING

- Tab Chloroquine 300mg 2tabs stat, 1 tab at 6 hrs, then od for 2 days
- Cap Clindamycin 300mg tds for 5 days
- Tab Chloroquine 300mg every Sunday till 6 weeks/ duration of pregnancy

Falciparum

- Tab Artemether/ Lumefantrine (80/480mg) bd for 3 days
- Tab Primquine 7.5mg, 6 tabs on day 2
- Tab Doxycycline 100 mg bd for 5 days

PREGNANT/LACTATING

- Tab Artesunate 200mg od for 3 days (after discarding the S and P from SP kit)
- Cap Clindamycin 300mg tds for 5 days

MANAGEMENT OF SEVERE MALARIA

For management of severe malaria, health facilities should be equipped with the following:

- Parenteral antimalarials, antibiotics, anticonvulsants, antipyretics
- Intravenous infusion equipment and fluids
- Special nursing for patients in coma
- Blood transfusion
- Well-equipped laboratory
- Oxygen



MANAGEMENT OF SEVERE MALARIA

Parenteral artemisinin derivatives or quinine should be used irrespective of chloroquine sensitivity

- **Artesunate:** 2.4 mg/kg i.v. or i.m. given on admission (time=0), then at 12 hours and 24 hours, then once a day (Care should be taken to dilute artesunate powder in 5% Sodium bi-carbonate provided in the pack).
- **Quinine:** 20 mg quinine salt/kg on admission (i.v. infusion in 5% dextrose/dextrose saline over a period of 4 hours) followed by maintenance dose of 10 mg/kg 8 hourly.

NEVER GIVE BOLUS INJECTION OF QUININE. Beyond 48 hours, dose should be reduced to 7 mg/kg 8 hourly.

- **Artemether:** 3.2 mg/kg i.m. given on admission then 1.6 mg/kg per day.
- **Arteether:** 150 mg daily i.m. for 3 days in adults only (not recommended for children)

Management of complications

Hyperpyrexia

Dehydration, Algid Malaria

Acute renal failure, Blackwater fever

Hypoglycemia, Dyselectrolytemia

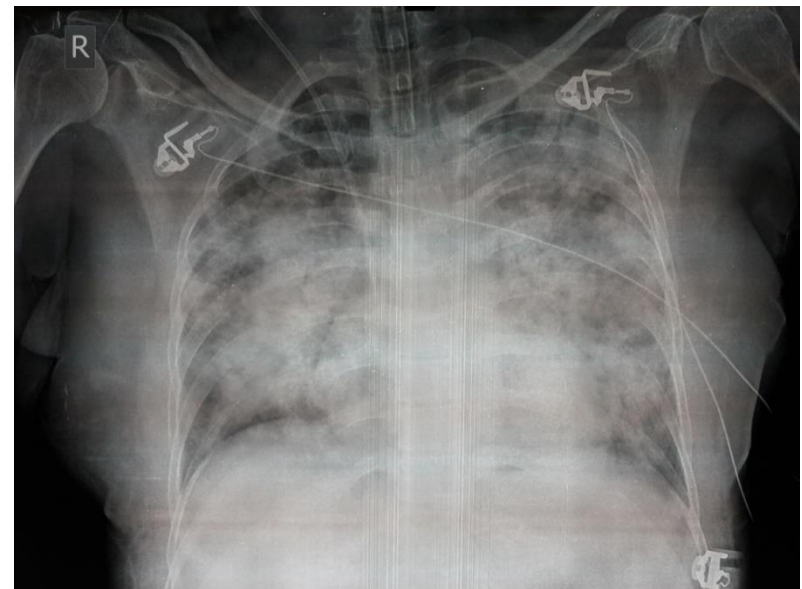
Cerebral Malaria, Seizures

Bleeding, Anemia

Shock

ARDS

Hyperparasitemia



Prevention

- Physical (bed-nets, repellants, oil in water)
- Biological (larva-eating fish)
- Chemical (insecticides)
- General (water hygiene)
- Vaccine (in development)
- **CHEMOPROPHYLAXIS**



Chloroquine- 300mg weekly 1 week prior and upto 4 weeks after return

Doxycycline- 100mg daily 3 days prior and upto 3 weeks after return

Mefloquine

THANK YOU

