

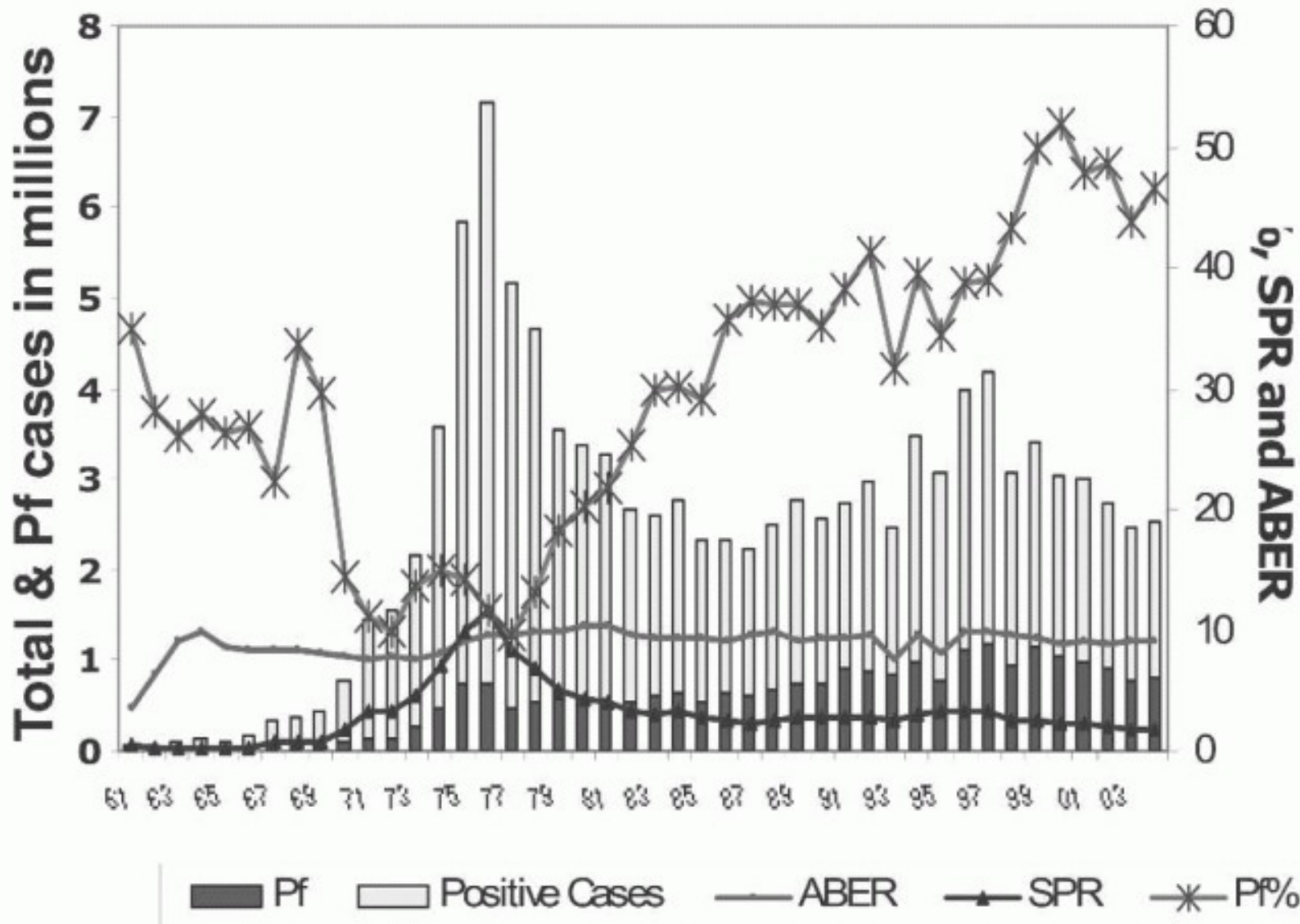
Malaria

**Dr Piyush Tailor
Associate Professor
Government Medical College
Surat**

- Vector-borne infectious disease
- **Caused** by protozoan parasites.
- **Transmitted**
 - Bite from an infective female Anopheles mosquito.
 - Anopheles must be infected through a previous blood meal taken from an infected person.

Dr. Divyansh Tailor

Burden of Malaria



Who has more burden?

COVID-19

Vs

Malaria

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Four type of Protozoan parasites

1. Plasmodium falciparum

- most common
- deadly type of malaria infection
- can lead to cerebral malaria

2. Plasmodium vivax

- most common
- causes relapse if treatment was not completed

3. Plasmodium ovale.

4. Plasmodium malaria

Life cycle of Plasmodium Parasite

1. Asexual Cycle in Human
2. Sexual Cycle in Anopheles Mosquito

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Asexual Cycle in Human

➤ Liver Stage.

- Mosquito bite and inject infected saliva
- **Sporozoites** enter the circulatory system
- within 30-60 minutes will invade a liver cell.
- In hepatocyte, single “**Sporozoites**” converted to
 - multiple “**Schizonts**” and
 - later to multiple “**Cryptozoits**”.
- Which burst hepatic cell and comes out from hepatocyte.
- Cryptozoits can infect another neighbouring hepatocyte.
- This replicative stage is called **Pre-erythrocytic schizogony**.
- After multiplication , Cryptozoits release in blood in form of **Metacryptozoits**

Asexual Cycle in Human

- In *P. vivax* and *P. ovale*, some of the sporozoites do not immediately undergo asexual replication.
- Few enter into a dormant phase – “**Hypnozoite**”
- Hypnozoite at later time
 - Reactivate and undergo schizogony
 - Resulting in a relapse.

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Asexual Cycle in Human

➤ Blood Stage.

- **Metacryptozoits** enter RBC .
- Metacryptozoits converted to **Trophozoits (ring form)**
- It ingests RBC cytoplasm and breaks down the hemoglobin.
- By-product of the hemoglobin is the malaria pigment - **hemozoin (golden-brown to black granules)**
- After 48 hours , it converted and release as **Merozoites**
- Merozoites may invade again new Hepatocyte & new RBC.
- Repeat erythrocytic cycle.
- After Several erythrocytic cycle, Merozoites develop in to **Gametaocyte.**

Sexual Cycle in Anopheles Mosquito

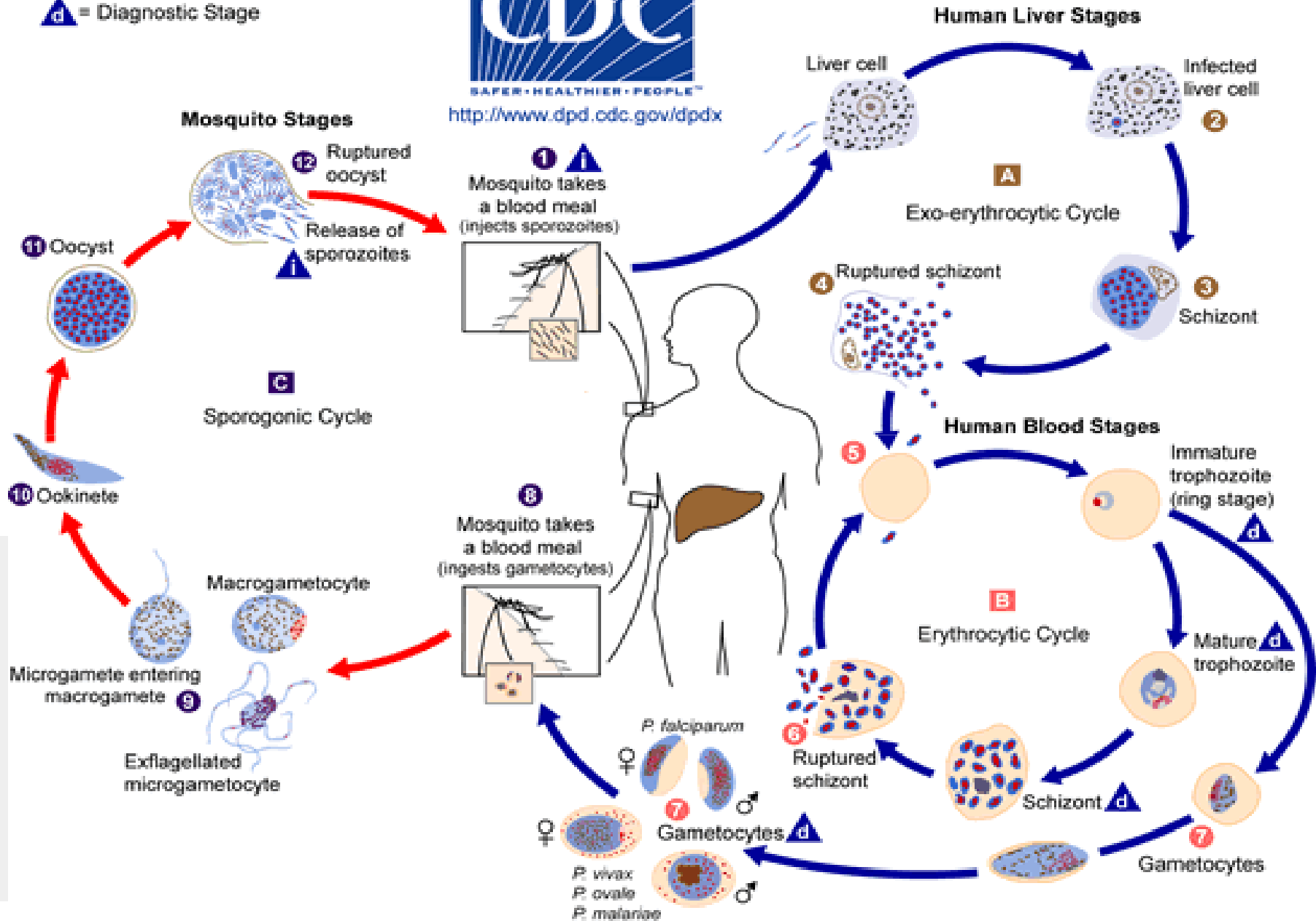
- Female anopheles mosquito bite to infected person.
- All stage of parasite in enter in mosquito stomach.
- In stomach, all the stage of parasite get digested except Gametocyte.
- Gametocyte develop in Spozoit in mosquito.

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i = Infective Stage
d = Diagnostic Stage



<http://www.dpd.cdc.gov/dpdx>



CYCLE IN BRIEF

Mosquito to Human Liver

- Sporozoites
- Multiple Schizonts
- Cryptozoites
- Metacryptozoites
- Hypnozoites

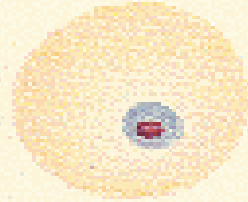
Liver to RBC

- Trophozoites (ring form)
- Merozoites
- Gametocyte.

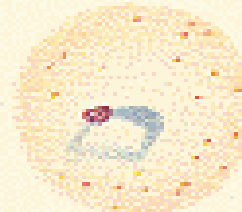
Human RBC to Female Mosquito

- Gametocyte
- Sporozoites

P. vivax



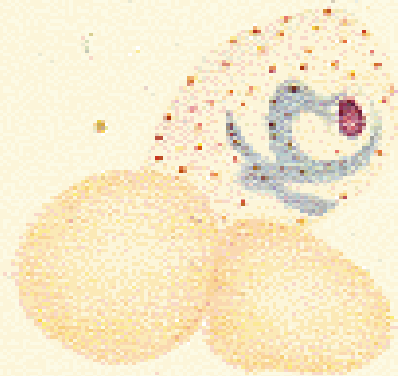
ring form



mature ring form



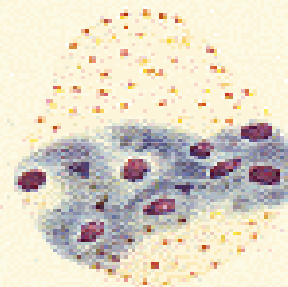
trophozoite



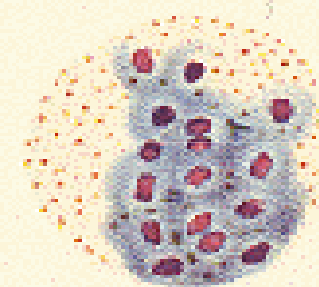
trophozoite



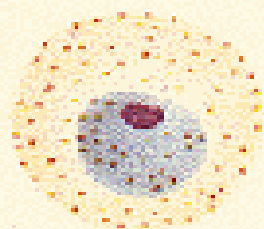
early schizont



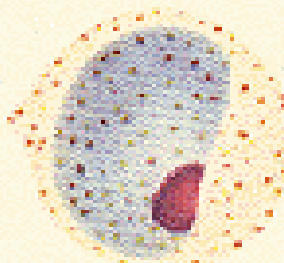
schizont



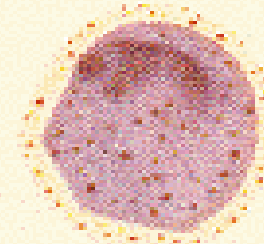
mature schizont



developing gametocyte



female gametocyte



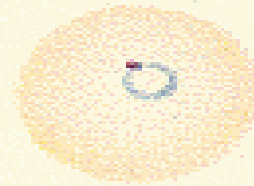
male gametocyte



P. falciparum



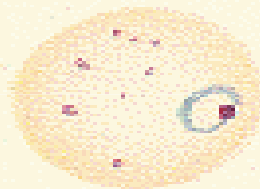
marginal form



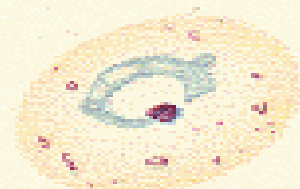
ring form



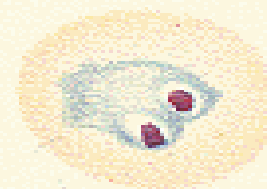
double dotted rings



ring form



young trophozoite



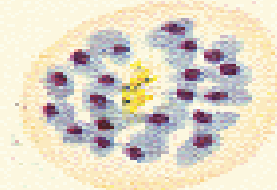
trophozoite



early schizont



schizont



mature schizont



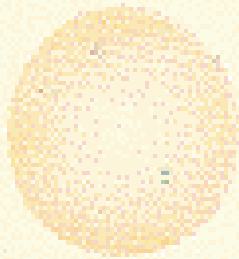
female gametocyte



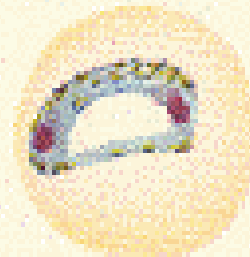
male gametocyte



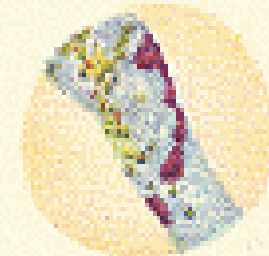
P. malariae



ring form



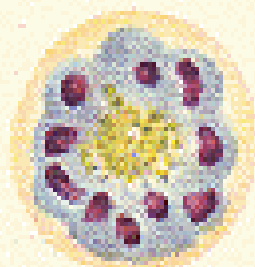
early band form



band form



early schizont



mature schizont



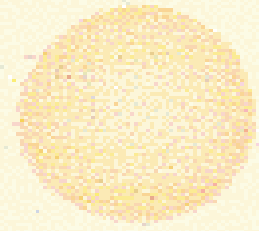
female gametocyte



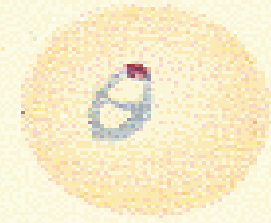
male gametocyte



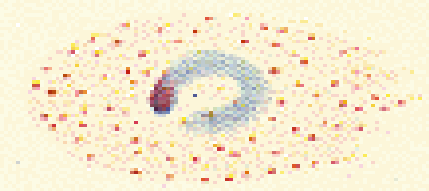
P. ovale



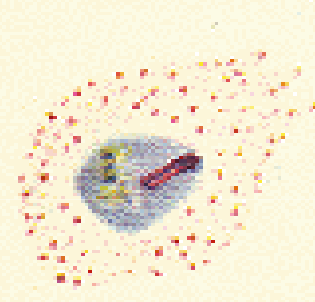
young ring



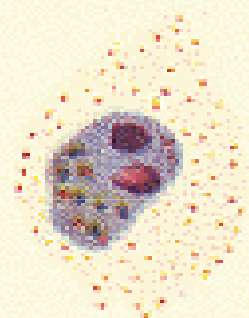
older ring



comet form



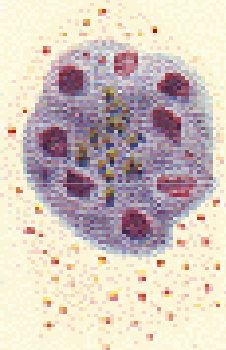
trophozoite



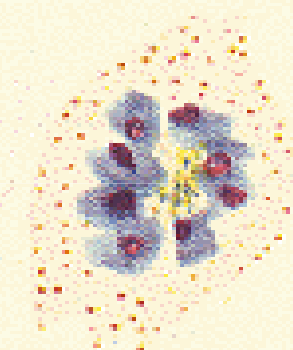
trophozoite



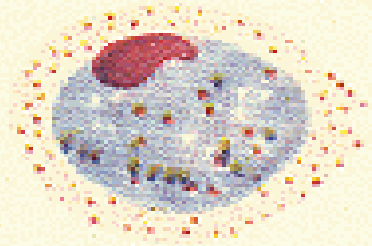
young schizont



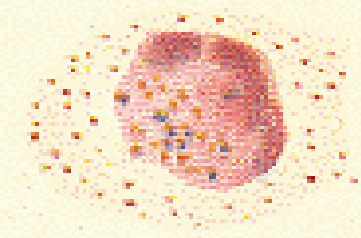
schizont



mature schizont



female gametocyte



male gametocyte

Clinical Features

- Some time – Flu like symptoms
- High Grade Fever With Chills
 - Cyclic Presentation
 - Coldness - Shivering – Fever - Sweating
 - In P. Vivex - Classically Alternate day Fever **?????**
 - In P. Falciparum – Continues Fever **????**
- Headache
- Joint pain
- Hepatomegally
- Splenomegally

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Relapse

- In Plasmodium vivax
 - Due to “Hypnozoites”
 - Hepatic Sporozoites
- Episodes of Relapse may happen upto 5 years.
- Eradication treatment is require in P.Vivax

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Complication

- Severe anaemia.
- Haemolytic Jaundice
- Hypoglycemia
- Blackwater Fever – Renal Failure
- Cerebral malaria
- Respiratory distress
 - pulmonary oedema
 - Pneumonia
- Coagulopathy – Bleeding tendency
- Shock

Black water fever

- Due to *P. falciparum*
- Massive intravascular hemolysis
- Severe acute hemolytic anemia
 - Hemoglobinuria
 - Increase Billirubin
- Acute tubular necrosis
- Acute Renal Failure

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Diagnosis

- Peripheral Blood Smear Examination
 - Thick Smear Examination
 - Thin Smear Examination
- Antibody Test –
 - IgM Antibody for P. Vivex
 - IgM Antibody for P. Falciparum
- PCR

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Investigation to evaluate complication

➤ To know extent of hemolysis

- ✓ Hemoglobin
- ✓ Serum LDH
- ✓ Serum Billirubin

➤ To evaluate renal involvement

- ✓ Serum Creatinine
- ✓ Serum electrolyte

➤ To evaluate liver involvement

- ✓ Serum ALT
- ✓ BT , CT , APTT (Activated Partial Thromboplastin Time)
- ✓ Blood Glucose

➤ To know metabolic alteration

- ✓ Arterial Blood Gas Analysis

➤ To know pulmonary involvement

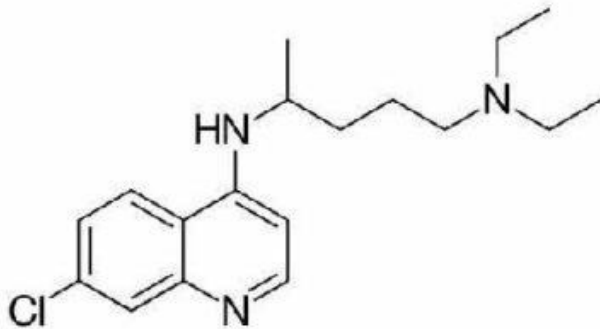
- ✓ X-ray Chest

Management

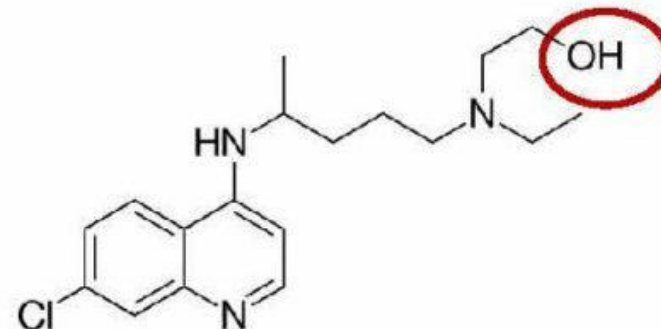
Is it same or different?

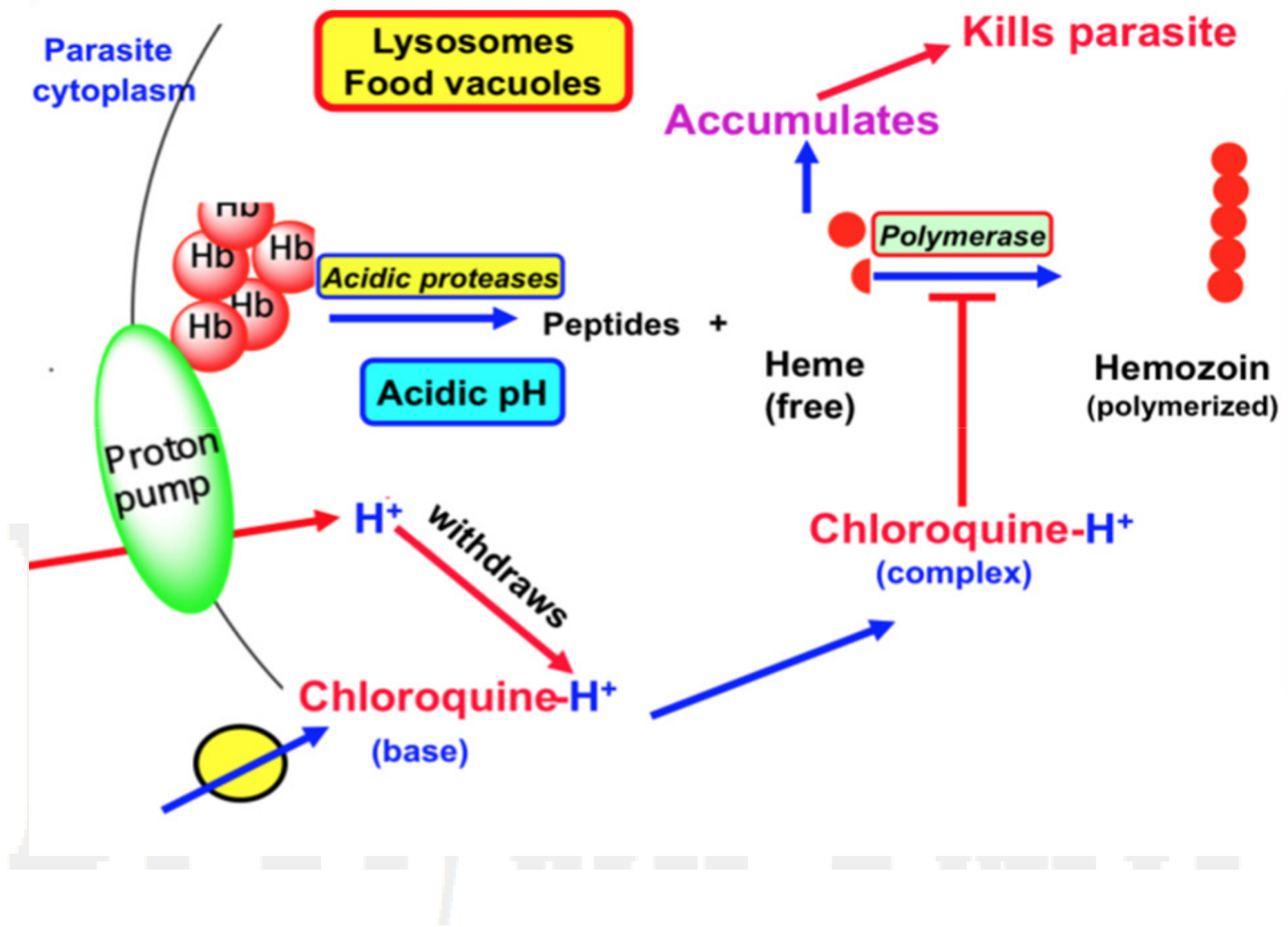
- Chloroquine
- Hydroxychloroquine (HCQ)

Chloroquine



Hydroxychloroquine





Mechanism of Chloroquine

- Broken Haemoglobin is taken by parasite
- Hb enter in “Food Vacuole of Parasite” (pH-5.0)
- Protease remain active
- Heme get polymerized(non-toxic form)
- CHQ enter – RBC – Parasite – Food Vacuole
 - Change pH from 5.0 – to alkaline
 - Bind with Free Heme
 - CHQ – Heme complex
- Make it alkaline – Protease inactive
- Heme remain free – More peroxidase
- Heme & Heme-CHQ complex swell the cell - lysis

Traditional Chloroquine Therapy

- Famous Trade Name : “Lariago” & “Lariago-DS”
- 1 Lariago-DS = 500 mg = 300 mg Chloroquine

Regimen

Day – 1 = 600 mg (2 tabs)

= 300 mg (1 tabs) after 6 hrs of first dose

Day – 2 = 300 mg (1 tabs) after 24 hrs of first dose

Day – 3 = 300 mg (1 tabs) after 48 hrs of first dose

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Management

- **Quinine & Chloroquine**
 - Found resistance now
- **Artemisinin derivatives (Artemether & Arteether)**
 - Made up from “Sweet wormwood” ????
 - In combination with other antimalarials
 - Artemisinin-combination therapy = ACT
- **Lumefantrine**
- **Mefloquine**
- **Sulfadoxine + Pyrimethamine**

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Treatment of *P. vivax*

- Treatment of blood stages
 - Chloroquine or ACT
- Treatment for Clearance of hepatic phase
 - Need to prevent relapse of P.Vivex (Radical Cure)
 - **Primaquine**
 - 30 mg once in day for 14 days

Treatment for severe malaria

- I.V. use of antimalarial drugs - Quinine
- Parenteral Artesunate

Treat malaria during pregnancy

- 1st trimester = Quinine + Clindamycin
- 2nd & 3rd trimesters = ACT

Management

Adjuvant Therapy

- **NSAID**
 - For fever
- **Proton Pump Inhibitor**
 - Omerazole / Pantoprazole
 - Prevent gastritis due anti-malarial drugs
- **Glucose**
 - Prevent hypoglycemia due to malaria as well as antimalarial drugs
- **Plenty of Fluid**
 - Prevention of renal toxicity
 - Prevent black water fever
 - Help to ease excretion of hemoglobin

Prevention

- Mosquito Net
- DDT spray (Dichloro-diphenyl-trichloroethane)
- Repellant
- Water management
 - Guppi fish
 - Oil cover on water
- Medical management
 - Chloroquine (300 mg base) once in week

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Question from Topic

- Which malaria is prevented in sickle cell disease patient? And Why?
- What type of modification is needed in management of plasmodium vivex patient with G-6PD deficiency?

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Question from Present Scenario

- Is HCQ has same mechanism action like CHQ?
- How much is it safe to take HCQ / CHQ for prevention of diseases?
- What is “Sweet wormwood”? (आत्मनिर्भर्ता)

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