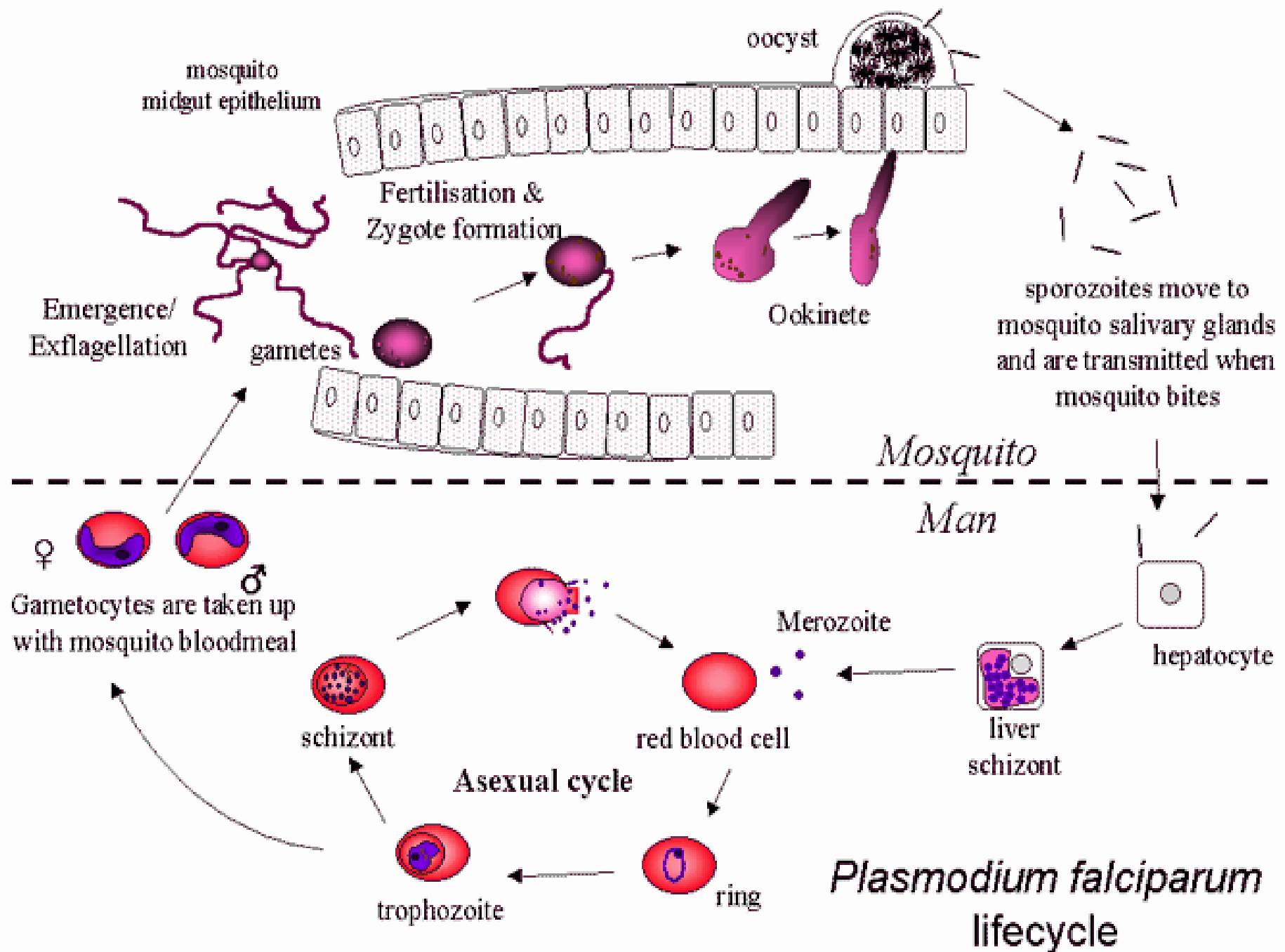


MALARIA IN CHILDREN

Dr Akwila Temu
Paediatric Dept

- Malaria is an acute disease(a serious and sometimes fatal disease) caused by a parasite .
- Patients usually present with fever, chills and profuse sweating.
- The clinical features of malaria vary from mild to severe, according to the species of the parasite present, the patient's state of immunity, the intensity of the infection and the presence of accompanying conditions such as malnutrition, anaemia and other disease.
- Four kinds of malaria parasites can infect humans: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*.
- Infection with any of the malaria species can make a person feel very ill

- The World Health Organization estimates that each year 300-500 million cases of malaria occur and more than 1 million people die of malaria.
- Fever is the most common feature of malaria.
- It may persist for several days, accompanied by headache, aching joints and general discomfort.
- The classic presentation of malaria with high fever, chills, shivering and sweating however may not occur.
- The onset of malaria symptoms may resemble a flu-like illness. In infants the early symptoms of malaria may be quite variable and difficult to recognize.
- They may be limited to poor appetite, restlessness and loss of normal interest in the surroundings.
- Some patients, especially children, may present with a cough and/or vomiting and diarrhoea



- In *P. falciparum* infections (which constitutes more than 90% of the cases in Tanzania), the headache, nausea and vomiting are usually more severe than in other malarial infections and there is a greater tendency towards the development of delirium, haemolytic jaundice and anaemia.
- Malaria typically is found in warmer regions of the world -- in tropical and subtropical countries. Higher temperatures allow the *Anopheles* mosquito to thrive. Malaria parasites, which grow and develop inside the mosquito, need warmth to complete their growth before they are mature enough to be transmitted to humans.

Clinical features of uncomplicated malaria

- Fever
- Headache
- Joint pains
- Malaise
- Body weakness
- Vomiting/Diarrhoea
- Chest pains
- Poor appetite
- Anaemia
- Hepato-splenomegaly especially in children
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Clinical assessment

- A detailed history should be taken and a thorough physical examination made in order to diagnose diseases other than malaria. A careful assessment of a patient with suspected malaria is essential in order to differentiate between uncomplicated and severe disease. Laboratory investigations are done to complement clinical diagnosis. In health care facilities without laboratory services, diagnosis is based only on signs and symptoms.

Urgent laboratory investigations:

- Thick and thin blood smears for malaria parasites (for reporting of results see Appendix 1)
- Blood glucose estimation in patients with altered consciousness
- Haematocrit and/or haemoglobin
- Lumbar puncture to exclude meningitis at hospital and health center levels (if facilities for LP are available)

Other laboratory investigations:

- The following investigations if available are also helpful in the management of severe malaria and for prognostic value:
- Serum creatinine or urea. There is no need to measure both, as creatinine is more useful
- Electrolytes. These may occasionally reveal a correctable abnormality such as hyponatraemia. Both creatinine and electrolytes are most valuable when acute renal failure threatens or develops
- Full blood cell count and differential white cell count. Sometimes these may indicate the possibility of an additional diagnosis
- Blood gases, pH and anion gap. Acidaemia is an indicator of severe disease in both conscious and unconscious patients
- Chest X-ray. May identify pulmonary oedema or lobar consolidation. It may be of value in assessing respiratory distress syndrome
- Plasma and cerebrospinal fluid lactate concentrations. These are raised in lactic acidosis. High levels are associated with a poor prognosis
- Improvements to conventional microscopic techniques for identifying malaria parasites may be available. These techniques include the **Quantitative Buffy Coat** (QBC) and the **Acridine Orange** (AO) methods.

MANAGEMENT OF UNCOMPLICATED MALARIA AT ALL LEVELS

- The management of a patient with malaria will be determined by the clinical presentation and the diagnosis of either uncomplicated or severe disease.
- **Treatment of uncomplicated malaria using combination therapy**
 - Combination therapy refers to the use of two or more antimalarial drugs with independent mode of action and different biochemical targets in the parasite, which are synergistic or additive, or complementary in their effect.

Combination therapy can be either:

- fixed combination therapy, where all components are co-formulated in a single tablet/capsule like Artemether-Lumefantrine (ALu)
- co-administered therapy, where the components are simultaneously administered in separate tablets/capsules
- The aim of combination therapy is to improve treatment efficacy and also delay the development of drug resistance.

- Artemisinin_- based combination therapy (ACT) refers to combinations comprising_of an artemisinin derivative and another antimalarial drug. Examples of artemisinin derivatives are artemether, artesunate and dihydroartemisinin. Artemisinin derivatives are efficacious, short acting and generally safe. The partner drug should be as well efficacious, safe and compatible. Some examples of partner drugs are Lumefantrine, Amodiaquine, Chlorproguanil-Dapsone and Mefloquine.

Treatment of uncomplicated malaria with first line drug: Artemether/Lumefantrine

- The first line drug for the treatment of uncomplicated malaria is **Artemether - Lumefantrine** (ALu).
- **Available formulations**
 - Tablets: Fixed formulation Artemether 20 mg, Lumefantrine 120mg
- **Indications:**
 - First line treatment of uncomplicated malaria
- **Contraindications**
 - Hypersensitivity to either Artemether or Lumefantrine
- **Not recommended**
 - Children below 5kg body weight
 - First trimester of pregnancy

Non response to ALu may be due to:

- Vomiting the drug
- Poor quality of the drug
- Inadequate dosage
- Fever/symptoms from a cause other than malaria
- Parasite resistance to the drug (rare)

Management of non-response to malaria treatment with ALu

- Where a patient returns within 3 to 14 days after treatment with ALu complaining of continued symptoms of malaria, non-response should be considered and the following recommendations followed after a full history and examination:
- Where laboratory facilities are not available and malaria is still suspected, treatment with Quinine should be started immediately with strict follow up
- Where laboratory facilities are available, a blood smear (and not RDT) should be examined. If parasites are found treatment with Quinine should be started and treatment failure recorded. If parasites are not found other causes for the symptoms should be sought and treated accordingly

Treatment of uncomplicated malaria with second line drug: Quinine

- **Indications**
- Second line treatment of uncomplicated malaria
- First line treatment of uncomplicated malaria in pregnancy, lactating mothers and in children under 5 Kg
- Treatment of uncomplicated malaria where ALu is contraindicated
- Drug of choice for treatment of severe malaria
- **Contraindications**
- Hypersensitivity to quinine
- Optic neuritis
- Myasthenia gravis
- **Use in pregnancy and lactation**
- Quinine is safe in pregnancy. In therapeutic doses it does not induce labour. Uterine contractions and fetal distress associated with the use of quinine, may be attributable to fever and effects of malaria disease. The risk of quinine induced hypoglycaemia is however greater in pregnant women than in non-pregnant women.

MANAGEMENT OF SEVERE MALARIA

- Severe *Plasmodium falciparum* malaria is a medical emergency.
- Delay in diagnosis and provision of appropriate treatment may lead to serious complications and even death.
- In Tanzania the commonest forms of severe malaria are severe anaemia and cerebral malaria

Features of severe malaria

- One or more of the following features indicate severe malaria:
 - Prostration/extreme weakness
 - Impaired consciousness
 - Change of behaviour
 - Convulsions
 - Respiratory distress (lactic acidosis)
 - Bleeding tendency/DIC
 - Jaundice
 - Circulatory collapse/shock
 - *Vomiting everything
 - Inability to drink or breast feed

Laboratory indices

- Severe anaemia, Hb <5mg/dl or Hct <15%
- Haemoglobinuria
- Pulmonary oedema(radiological)
- Hyperparasitaemia(>5000 asexual parasites per 200 WBC (>200,000 asexual parasites per μ L)
- Metabolic acidosis(Arterial pH <7.3, Bicarbonate <15 mmol/L)
- Acute renal failure(Oliguria urine output <0.3 ml/kg/hr in children and <17ml/hr in adults;Raised serum creatinine >130 mmol/L)
- Hypoglycaemia (Glucose <2.5 mmol/L)

The drug of choice for treatment of severe malaria is parenteral ***Quinine*** preferably given by intravenous infusion.

- **General management**
- **Assessment and resuscitation**
- Airway – ensure airway is open with no foreign objects,
- Put the patient in semi prone position
- Breathing – ensure there is adequate respiratory movement
- Blood slide for malaria parasites
- Blood glucose estimation by glucose strips

- **Insert nasogastric tube**
- **Feeding and medication**
- **Insert urethral catheter if indicated**
- Urine for dipstick
- Urinary output measurement
- **Nursing care and monitoring**
- Fluid input and output chart
- Level of consciousness
- Temperature, PR, RR and BP
- Investigations: Hb, Glucose, Creatinine, electrolytes if indicated

Administration of intravenous quinine

- **Dose**
- Quinine 10 mg/kg body weight of salt
- Diluted in 5-10 ml/kg body weight of 5% Dextrose or dextrose-saline
- Infused over 4 hours and repeated every 8 hours.
- The total volume given will depend on the patient's overall fluid balance
- **Drip rate**
- This is calculated as follows:
- Drip rate per minute =
$$\frac{\text{amount of fluid to be infused} \times 20 \text{ (drop factor)}}{\text{time period to be infused (in minutes)}}$$

- Infusions should be discontinued as soon as the patient is able to take oral medication.
- Patients should be properly instructed to complete the 7-day treatment.
- Alternatively, a full course of ALu may be administered to complete treatment
- ***Oral Quinine maintenance doses should be 7 mg/kg body weight in patients with impaired renal function***

Non-response to quinine therapy

Indications of non-response to quinine

- Persistence of clinical features of severe malaria
- Failure of clearance of parasites after 3 days of treatment.
- Other possible causes of illness/ which have not been investigated
- Patients with malaria who have not responded to quinine therapy should be given parenteral Artemether.

Dose:

- 3.2 mg/kg (loading dose) I.M. followed by 1.6 mg/kg I.M. daily for 6 days

Emergency management of convulsions in severe malaria

- **Convulsion**
- Convulsions are common in children with severe *P. falciparum* malaria but are relatively rare in adults. The general principles for the care of patients with convulsions should be as follows.
- Maintenance of a clear airway
- Monitoring of vital signs temperature, pulse rate, respiratory rate and blood pressure
- Nurse the patient in a semi-prone position
- Recheck blood glucose
- **Anticonvulsant drug**
- Diazepam 0.15 mg/ kg (maximum 10 mg for adults.) slow bolus injection
- In children diazepam rectal route should be used_Give a dose of 0.5-1.0 mg/ kg. Draw the IV preparation into a small syringe and remove the needle. Insert 5 cm of a nasogastric tube into the rectum. Inject the diazepam into the nasogastric tube and flush it with 5 mls water. If a nasogastric tube is not available, use a syringe without a needle. Hold buttocks together for few minutes to ensure retention and absorption of the drug.
- If convulsions persist after 10 minutes repeat rectal diazepam treatment as above. Should convulsions continue despite a second dose, give a further dose of rectal diazepam or phenobarbitone 20 mg/ kg IM or IV after another 10 minutes

- *Diazepam should not be used in infants below 1 month of age. Instead use phenobarbitone 20mg/ kg IM or IV. If convulsions persist, repeat phenobarbitone 10 mg/ kg after 30 minutes.*

Hypoglycaemia

- Check blood glucose 4 hourly. If < 2.5 mmol/l or level of consciousness deteriorates
- In children
 - Give 5 mls/kg of 10% dextrose OR 2.5 mls/kg of 25% dextrose OR 0.5 – 1 ml/kg of 50% dextrose as bolus
 - The 50% solution should be diluted to make 25% by adding an equal volume of water for injection or normal saline
- In adults
 - Give 125 mls of 10% dextrose OR 50 mls of 25% dextrose OR 25 mls of 50% dextrose as bolus

Where dextrose is not available, sugar water should be prepared by mixing 20 gm of sugar (4-level tea spoons) with 200 ml of clean water. 50 ml of this solution is given ORALLY or by naso-gastric tube if unconscious

- ***Hypotension***
- **Give** colloid fluids (plasma expander) or blood if haemoglobin is less than 5g/dl.
- **5.11.4 Pulmonary oedema**
- **Check for**
- Restlessness
- Frothy sputum
- Basal crepitations
- Low oxygen saturation (< 95%)
- **Give**
- Oxygen
- IV frusemide
- Mechanical ventilation may be needed.
 - Metabolic acidosis (Lactic acidosis)
- In malaria patients metabolic acidosis is attributed to lactic acidosis
- **Check for**
- **Respiratory distress, deep and laboured breathing**
- Give
- Oxygen
- Correct hypovolaemia

- **Classification of anaemia according to severity**
- **Mild anaemia (compensated) Hb>7g/dl**
- Pallor
- **Severe anaemia Hb<7g/dl**
- Excessive tiring
- Dyspnoea or breathlessness
- Warm hands
- Peripheral oedema: Pedal pitting
- Tachycardia, collapsing pulse, wide pulse pressure and gallop rhythm.
- Ejection systolic murmur ('flow' murmur)
- **Life threatening anaemia Hb<5g/dl**
- ***Respiratory distress***
- Nasal flaring
- Chest indrawing
- Deep breathing or grunting
- ***Congestive heart failure***
- Pulmonary oedema: basal crepitations
- Peripheral oedema: pedal, periorbital, sacral.
- Circulatory congestion: raised jugular venous pressure and enlarged tender liver
- Tachycardia
- Gallop rhythm

Management of life threatening anaemia (Hb <5g/dl) associated with malaria

- **Features**
- *Respiratory distress:*
- *Congestive heart failure*, peripheral oedema and circulatory congestion, raised JVP and enlarged tender liver
- **Treatment**
- This is a medical emergency.
- Admit the patient
- Treat malaria as severe malaria with parenteral anti malarials (see management of severe malaria)
- Prop the patient up with pillows or clothing
- Administer oxygen 2.5 L/min to improve oxygen delivery
- Draw blood for grouping and cross matching

- **Indications for urgent blood transfusion**
- Hb equal or less than 4 g/dl and/or
- Signs of heart failure
- Signs of respiratory distress
- **Administration of blood**
- Use packed cell (10 ml/kg in children) or whole blood 20 ml/kg body weight
- Transfuse slowly (4-6 hours per unit)
- *Drip: drops/min = $\frac{\text{volume to be transfused in ml}}{\text{time of transfusion in hours (4-6 hours)} \times 60 \text{ minutes}} \times 20(\text{or } 15) \text{ drop factor}$*
- *time of transfusion in hours (4-6 hours) x 60 minutes*
- *1ml whole blood= 20 drops*
- *1ml packed cell= 15 drops*

- **Management of severe anaemia (HB<7g/dl) associated with malaria**
- **Features**
- Excessive tiring, dyspnoea or breathlessness, warm hands, peripheral oedema: pedal pitting, tachycardia, collapsing pulse, wide pulse pressure and gallop rhythm, ejection systolic murmur ('flow' murmur)
- **Management**
- This condition can be managed as an outpatient with close monitoring
- Treat malaria
- Perform full blood count to investigate morphological type
- Do other investigations to identify other underlying causes of anaemia e.g. stool sample for hookworm and treat accordingly
- Give oral haematinics
- Advise to return immediately if condition worsens
- Follow up after 14days
- **6.7 Management of mild/moderate anaemia (Hb 7g/dl – 11g/dl) associated with malaria**
- **Features**
- Some pallor, body weakness
- Body weakness
- **Management**
- Patients with some pallor or moderate anaemia (Hb >7g/dl) need to be treated for malaria, as persistent parasitaemia is a cause of anaemia by dyserythropoiesis and haemolysis. Iron and folic acid speed up haematological recovery after malaria and should be given at least for three months. It is also important to treat hookworm infestation in children, as this a common cause of iron deficiency anaemia.
- **Folic acid tablets administration**
- Start a 3 months treatment course (5 mg/daily)
- **Ferrous sulphate tablets administration**
- Start a three months course at dose of 6 mg/kg of elemental iron daily

Asanteni Sana...