Malaria

- *P falciparum* is the commonest cause of malaria in Kenya (98.2%); *P malariae* and *P ovale* is 1.8%, often occurring as mixed infections. (Surveys have not identified the presence of *P vivax* in Kenya)
- Endemic areas are around Lake Victoria in Western Kenya and coastal regions; other areas have seasonal transmission depending on temperature and rainfall; central highlands area (Nairobi and Kijabe) is a low-risk malaria area

Severe malaria

(one or more of the following parameters, occurring in the absence of an identified alternative cause and in the presence of P. falciparum asexual parasitaemia)

Clinical parameters
- Impaired consciousness
- Prostration
- Convulsions
- Pulmonary oedema
- Significant bleeding
- Shock

Lab/clinical parameters
- Acidosis (respiratory distress)
- Hypoglycaemia
- Severe anaemia
- Renal impairment
- Jaundice
- Hyperparasitaemia (>10%)

- Malaria is classified as **either uncomplicated or severe**, based on clinical presentation (see table)
- Artemether-Lumefantrine (AL) is first-line treatment for all types of uncomplicated malaria. Once commenced, the 3 days must always be completed.
- New advice: **first line treatment for pregnant women** with uncomplicated *P. falciparum* malaria in the first trimester is now AL (and no longer quinine)

Diagnosis and treatment of malaria

Fever of unknown origin or suspicion of malaria
Check RDT
Other tests as indicated
Transfer to casualty if unstable

→ RDT negative – look for other causes of illness, repeat test if concerns of malaria remain

↓ If RDT positive, start antimalarial treatment but also send blood for malaria smear to identify species and parasite load

↓ Signs of severe malaria? (see table above)

YES ↓

Severe Malaria
- Give ARTESUNATE IV – weight <20kg 3ml/kg; weight>20kg 2.4ml/kg at 0, 12 and 24 hours and then daily until the patient can take oral medication
- Check glucose; send blood for CBC, clotting, creatinine, electrolytes, cultures; crossmatch if indicated
- Blood gas if unconscious, hyperventilating or in shock
- L/P if unconscious to exclude bacterial meningitis
- Empirical broad-spectrum antibiotics in severely ill child
- Maintenance fluids/feeds - care with fluid balance, DO NOT give IV fluid by rapid bolus
- Monitor urine output
- Supportive care, management of any complications (see page 2); continue to monitor glucose every 4h, especially if unconscious
- After a minimum of 24 hours treatment with artesunate and once patient can take oral medication, switch to AL. **Parenteral treatment must *always* be followed by the 3-day course of AL**

NO ↓

Uncomplicated malaria
- Treat with AL for 3 days (or oral second line if AL not available)
- If vomiting occurs within 30 minutes after taking the medication, the dose should be repeated. If vomiting persists, the patient should return for review
- Fever management, continue fluids and food
- Advise patients to return immediately if the condition deteriorates at any time, or if symptoms have not resolved after 3 days (note: if further testing is required, do a malaria smear as RDTs remain positive, even after successful treatment)

Dosing schedule for Artemether Lumefantrine (6 doses over 3 days at 0h, 8h, 24h, 36h, 48h, 60h)

Weight	Age	Dose of AL (ALL doses must be taken)
5 - 14 Kg	5 months – 3 years	20mg / 120mg
15 - 24 Kg	3 – 7 years	40mg / 240mg
25 - 34 Kg	8 – 11 years	60mg / 360mg
≥ 35 Kg	≥ 12 years	80mg / 480mg

Immediate clinical management of severe manifestations and complications of *P. falciparum* malaria (WHO)

Manifestation or complication	Immediate management (It is assumed that appropriate antimalarial treatment will have been started in all cases)
Coma (cerebral malaria)	Maintain airway, place patient on his or her side, exclude other treatable causes of coma (e.g. hypoglycaemia, bacterial meningitis); avoid harmful ancillary treatments (corticosteroids NOT indicated), intubate if necessary.
Hyperpyrexia	Administer tepid sponging, fanning, a cooling blanket and paracetamol.
Convulsions	Maintain airways; treat promptly with intravenous or rectal diazepam, lorazepam, midazolam or intramuscular paraldehyde. Check blood glucose.
Hypoglycaemia	Check blood glucose, correct hypoglycaemia and maintain with glucose- containing infusion. Although hypoglycaemia is defined as glucose < 2.2 mmol/L, the threshold for intervention is < 3 mmol/L for children < 5 years and <2.2 mmol/L for older children and adults.
Severe anaemia	Transfuse with screened fresh whole blood. In high-transmission settings, blood transfusion is generally recommended for children with a haemoglobin level of <5 g/100 mL (haematocrit < 15%). In low-transmission settings, a threshold of 20% (haemoglobin, 7 g/100 mL) is recommended. (Many anecdotal reports and several series have claimed the benefit of exchange blood transfusion in severe malaria, but there have been no comparative trials, and there is no consensus on whether it reduces mortality or how it might work.)
Acute pulmonary oedema	(Prevent by avoiding excess hydration) Prop patient up at an angle of 45 degrees, give oxygen, give a diuretic, stop IV fluids, intubate and add positive end-expiratory pressure or CPAP in life-threatening hypoxaemia.
Acute kidney injury	Exclude pre-renal causes, check fluid balance and urinary sodium; if in established renal failure, add haemofiltration or haemodialysis.
Spontaneous bleeding and coagulopathy	Transfuse with screened fresh whole blood (cryoprecipitate, fresh frozen plasma and platelets, if available); give vitamin K injection.
Metabolic acidosis	Often associated with severe anaemia in children and needs to be treated by blood transfusion (10mg/kg whole blood). Also exclude or treat hypoglycaemia, hypovolaemia and septicaemia. If severe, add haemofiltration or haemodialysis.
Shock	Suspect septicaemia, take blood for cultures; give parenteral broad- spectrum antimicrobials, correct haemodynamic disturbances.
Fluid therapy	Fluid requirements should be assessed individually. Adults with severe malaria are very vulnerable to fluid overload, while children are more likely to be dehydrated. Rapid bolus infusion of colloid or crystalloids is contraindicated. Need for blood in metabolic acidosis (respiratory distress) with anaemia in children. In adults there is a thin-line between overhydrating, producing pulmonary oedema, and underhydrating. Careful, frequent evaluation of JVP, peripheral perfusion, venous filling, skin turgor and urine output should be made.
Antibiotics	The threshold for administering antibiotic treatment should be low in severe malaria. Septicaemia and severe malaria are associated, and there is substantial diagnostic overlap, particularly in children in areas of moderate and high transmission. Thus broad-spectrum antibiotic treatment *should be given* with antimalarial drugs to all children with suspected severe malaria in areas of moderate and high transmission until a bacterial infection is excluded, so consider in our context. Watch for secondary pneumonia.
Note: use of corticosteroids increases the risk for gastrointestinal bleeding and seizures and has been associated with prolonged coma resolution times when compared with placebo.	

Preventing relapse in *P. ovale* (and *P vivax)* malaria

After treatment of *P ovale* (and *P vivax)* infection with AL, patients should be treated to prevent relapse:

- **Non-pregnant and non-lactating patients**: check G6PD status, if no deficiency give primaquine (0.5mg base/kg daily for 14d
- **Pregnant women:** Chloroquine 300mg/week for the duration of the pregnancy, then test baby and mother for G6PD deficiency
- **Breast-feeding women:** check G6PD status of infant and mother and give primaquine if no deficiency
- **Mild-moderate G6PD deficiency:** can give 0.75mg primaquine once weekly for 8 weeks
- **Severe G6PD deficiency:** primaquine contraindicated

Chemoprophylaxis against falciparum malaria:

- For those from a non-endemic area who are travelling into an endemic area.
- Also advise early medical care if they develop fever within 3 months of travel to an endemic area, and **to use barrier methods.** Travellers may want to take RDTs with them and a course of AL, especially if going to a remote area.
- Chemoprophylaxis is also used in endemic areas of Kenya for those with sickle cell disease and those with tropical splenomegaly syndrome (TSS) – currently proguanil
- Intermittent preventive treatment of malaria in pregnancy (IPTp) is recommended in areas of high malaria transmission in Kenya

Drug	Length of treatment	Dosage	Use in pregnancy	Notes
Atovaquone/ proguanil (Malarone)	Start 1-2d before entering endemic area; continue for 7d after leaving	250/100mg tablets Adults (weight ≥40kg): 1 tablet per day Weight 30-39kg: ¾ tablet per day Weight 20-29kg: ½ tablet per day 62.5/25mg tablets: Weight 10-19kg: 1 tablet per day Weight 8-9kg: ¾ tablet per day Weight 5-7kg: ½ tablet per day	Small studies show no problems, but larger studies are needed. Risk of malaria needs to be balanced with possible risk of medication https://www.medicinesinpregnancy.org/Medicine--pregnancy/Malarone/	Side effects: abdo pain, nausea, vomiting, diarrhoea, headache, anorexia, coughing, depression, Contraindicated: renal failure
Doxycycline	Start 1-2d before entering endemic area; continue for 4 weeks after leaving	Adults (children ≥50kg): 100mg per day If tablets are available, smaller doses can be given to children (approx. 2mg/kg, max 100mg) Age 11-13 (36-50kg): 75mg/d Age 8-10 (25-35kg): 50mg/d Age <8: contraindicated	No	Side effects: GI irritation, increased vulnerability to sunburn, discolouration of growing teeth Contraindicated: liver disease
Mefloquine	Start 2-3 weeks before entering endemic area; continue for 4 weeks after leaving	Adults (weight ≥45kg): 250mg once weekly Weight 25-44kg: 187.5mg once weekly Weight 16-24kg: 125mg once weekly Weight 5-15kg: 62.5mg once weekly <3 months (<5kg): not recommended	Yes	Avoid if history of seizures or psychiatric disorders (including depression). Do not administer with quinine Side effects: sleep disturbance, anxiety, depression, diarrhoea, dizziness, abdo pain, headache, nausea

References

WHO guidelines for malaria, March 2023
Basic Paeditric Protocols 2016 4th Edition
National guidelines for the diagnosis, treatment and prevention of malaria in Kenya, 5th edition, MOH 2016
UpToDate accessed 12/6/23