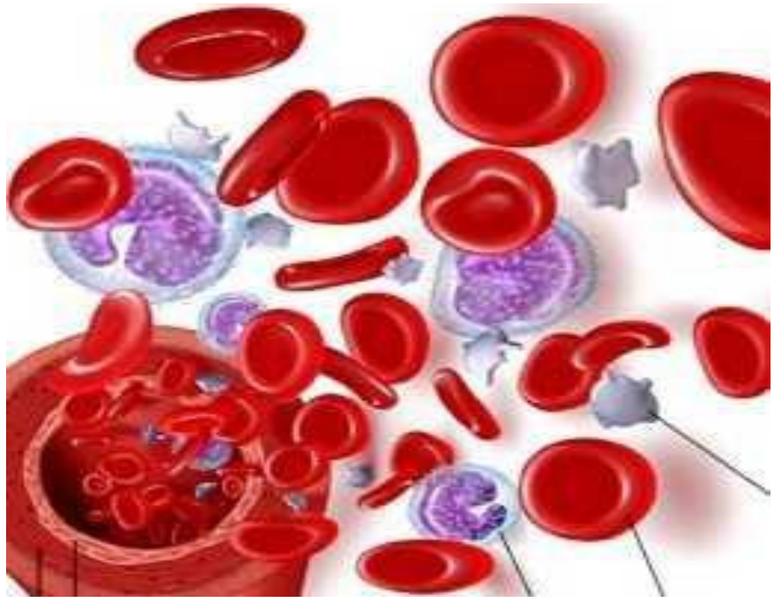


# Blood and Lymphatic System Block - HEM-210

## Parasitic infections of blood and lymphatic system lect. 1


by

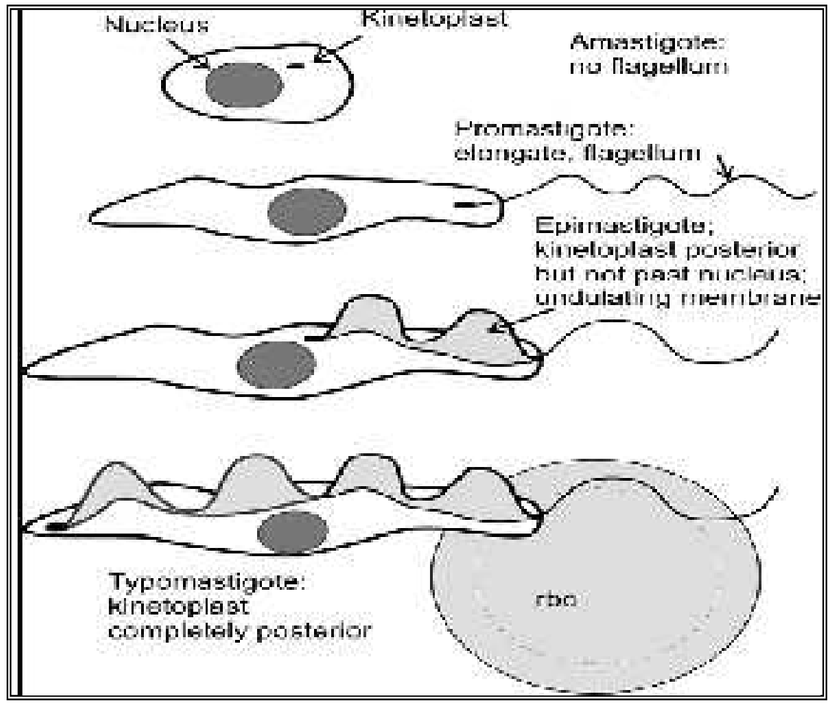
Dr. Nahed Elossily

Associate professor of
Medical Parasitology
Faculty of Medicine
Assiut University
Merit University

By the end of the lecture the student will be able to:

1. list the parasitic diseases which involved in blood and lypmhatic System pathology (Leishmania donovani, Toxoplasma gondii, Wuchereria bancrofti and Brugia malayi).
2. Describe the mode of infection, infective stage, diagnostic stages and life cycle of these parasites.
3. Describe the clinical picture and pathogenesis of each parasite
4. Describe diagnostic methods for each disease.
5. Describe the recommended treatment for each of the previous parasites.
6. Describe the preventive measures for each of the previous parasites.

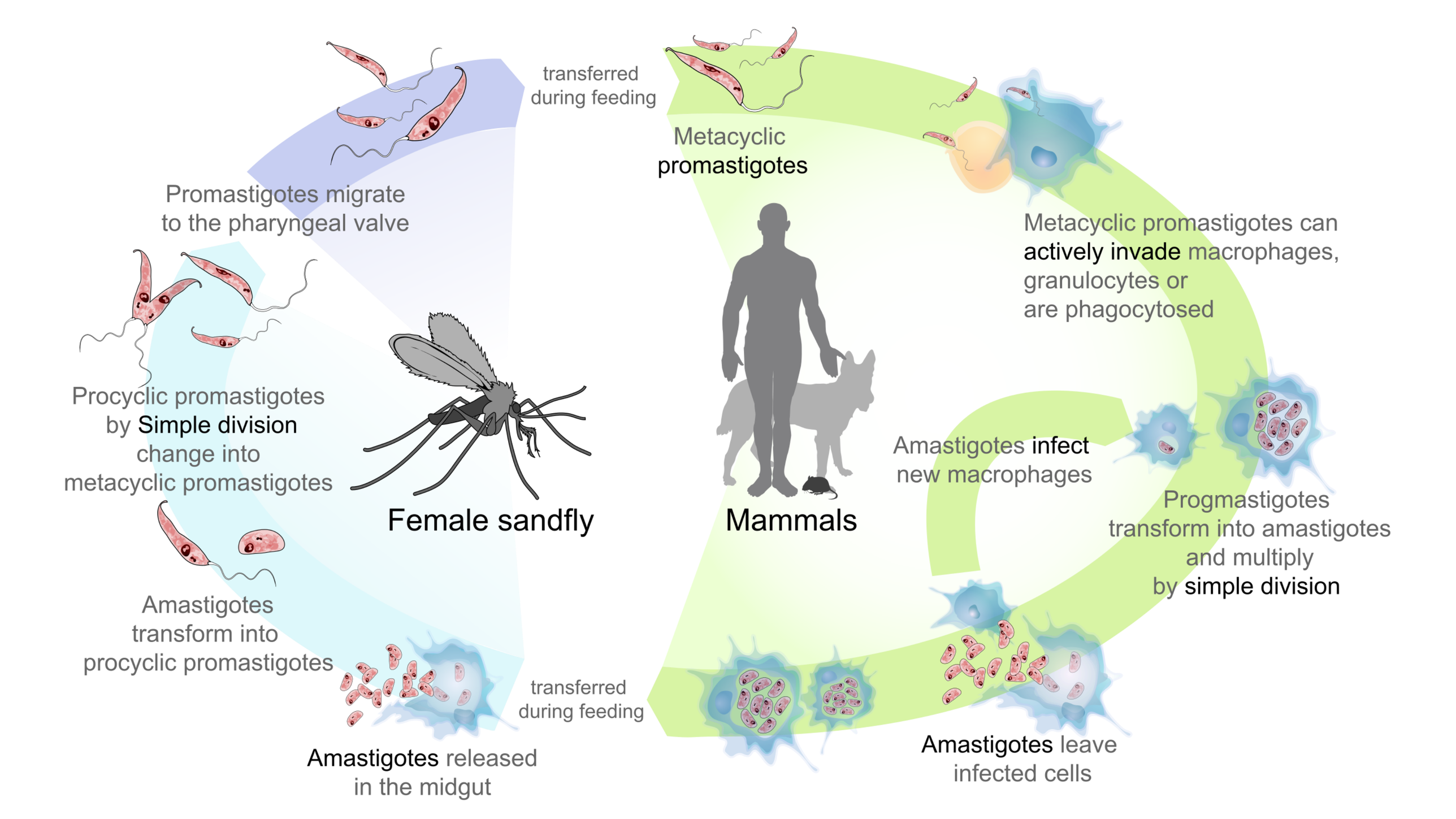
# Hemoflagellates




- Characters of Hemoflagellates:
  - Have Kinetoplast and flagella for motility.
  - Transmitted by insect vectors.
  - Their types are:
    - Amastigote (without apparent flagellum).
    - Promastigote (with anterior flagellum)
    - Epimastigote (flagellum and kinetoplast shifted posteriorly near the central nucleus).
    - Trypomastigote (kinetoplast and flagellum are at posterior end, flagellum goes anteriorly making an undulating membrane).

# 1. Visceral leishmaniasis

| | |
|---|---|
| **Causative protozoa :** | ***Leishmania donovani*** |
| **Definitive host:**<br><br>**vector** | Man and other mammalian hosts<br><br>***Phlebotomus papatasii* (sandfly)** |
| **Habitat:** | Intracellular found in reticuloendothelial cells of the spleen, bone marrow, leucocytes, liver cells and lymph nodes |
| **Infective stage:**<br><br>**Diagnostic stage:** | ➢ promastigotes)<br><br>➢ Amastigote forms |
| **Mode of infection:** | 1. Through the bite of Phlebotomus papatasii.<br><br>2. blood transfusion<br><br>3. Congenital transmission. |

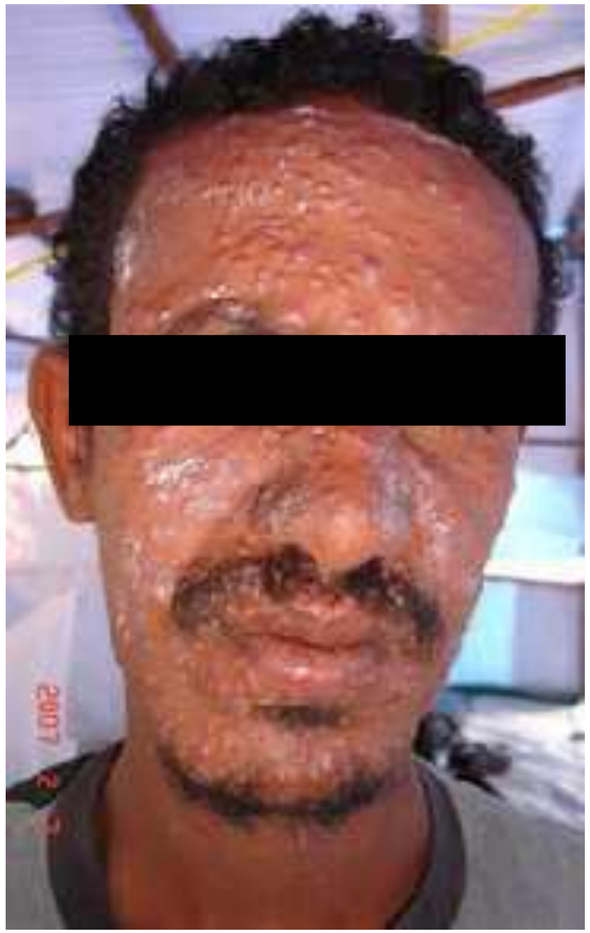

transferred
during feeding
Metacyclic
promastigotes
Promastigotes migrate
to the pharyngeal valve
Metacyclic promastigotes can
actively invade macrophages,
granulocytes or
are phagocytosed
Procyclic promastigotes
by Simple division
change into
metacyclic promastigotes
Female sandfly
Mammals
Amastigotes infect
new macrophages
Progmastigotes
transform into amastigotes
and multiply
by simple division
Amastigotes
transform into
procyclic promastigotes
transferred
during feeding
Amastigotes leave
infected cells
Amastigotes released
in the midgut

**Clinical picture**

1. Visceral leishmaniasis (VL), also known as kala-azar is fatal if left untreated
2. The incubation period usually ranges from 2 to 6 months.
3. It is characterized by irregular bouts of high fever, chills, anorexia, malaise, weight loss, anaemia and diarrhea.
4. Common clinical signs include an enlarged liver, a markedly enlarged spleen, femoral and inguinal lymphadenopathy.
5. Skin changes occur on the face, hands, feet, and abdomen, particularly in India, where patients acquire an earth-gray color; this darkening of the skin gave the name kala azar (black sickness).

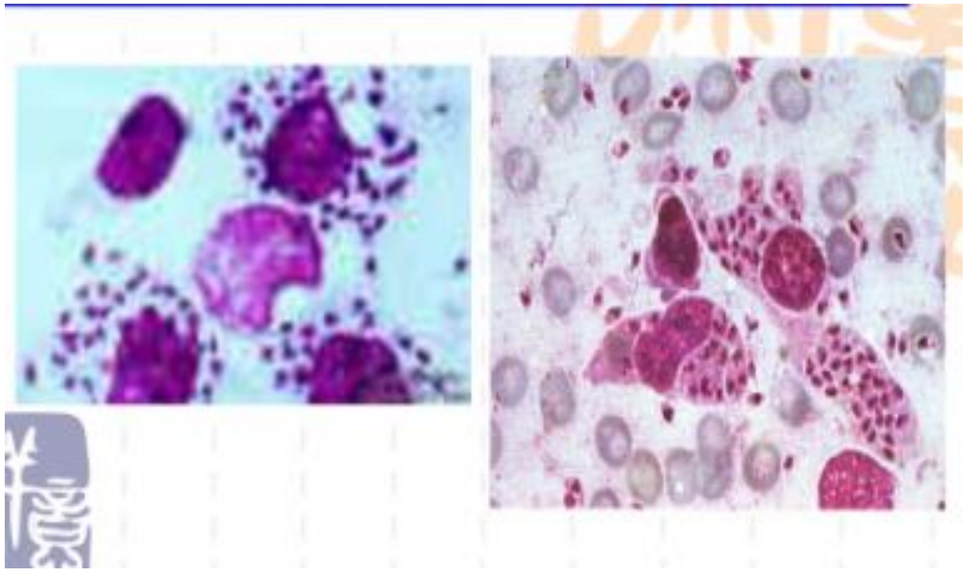
- **Post-Kala Azar Dermal Leishmaniasis.** PKDL usually develops after apparent successful cure from VL and is confined to two distinct zones, namely South Asia and East Africa, mainly Sudan.

Macules and papules usually appear first around the mouth and spread to the face and then to the extensor surface of the arms, the trunk, and the legs. They enlarge, fuse and may resemble leprosy. These patients may serve as reservoirs of infection.



## Diagnosis:

1. Clinical picture with presence of anemia (normocytic and normochromic), leukopenia and thrombocytopenia.
2. Demonstration of the amastigotes in tissues or clinical specimens



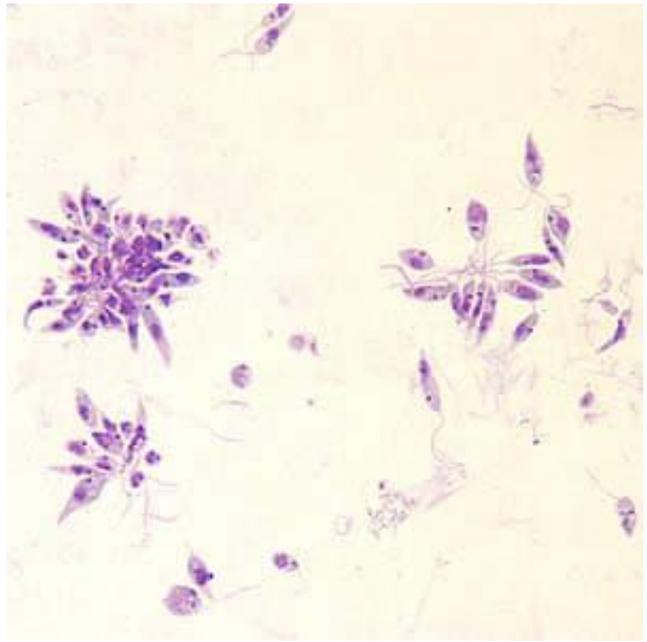
3. Splenic puncture (highest rate of organism detection (98%), but with high degree of risk for the patient) and , liver biopsy,
4. Tissue aspirate: lymph nodes and bone marrow (to differentiate it from lymphomas and leukemia in children).

5. Culture on NNN media. the promastigotes are detected in the culture.

6. Formol-Gel Test (Hypergammaglobulinemia) the patient's serum becomes solid if mixed with formalin,

7. skin test (Montenegro or LST).

8. Detection of parasite genetic material by PCR or antigen detection (ELISA, IHAT, FAT) is sufficient for confirmation.



## Treatment

1. Patients should receive supportive care.
2. Pentavalent antimony compounds have been the drugs of choice.
3. Rcent treatment is lipid-associated Amphotericin B.

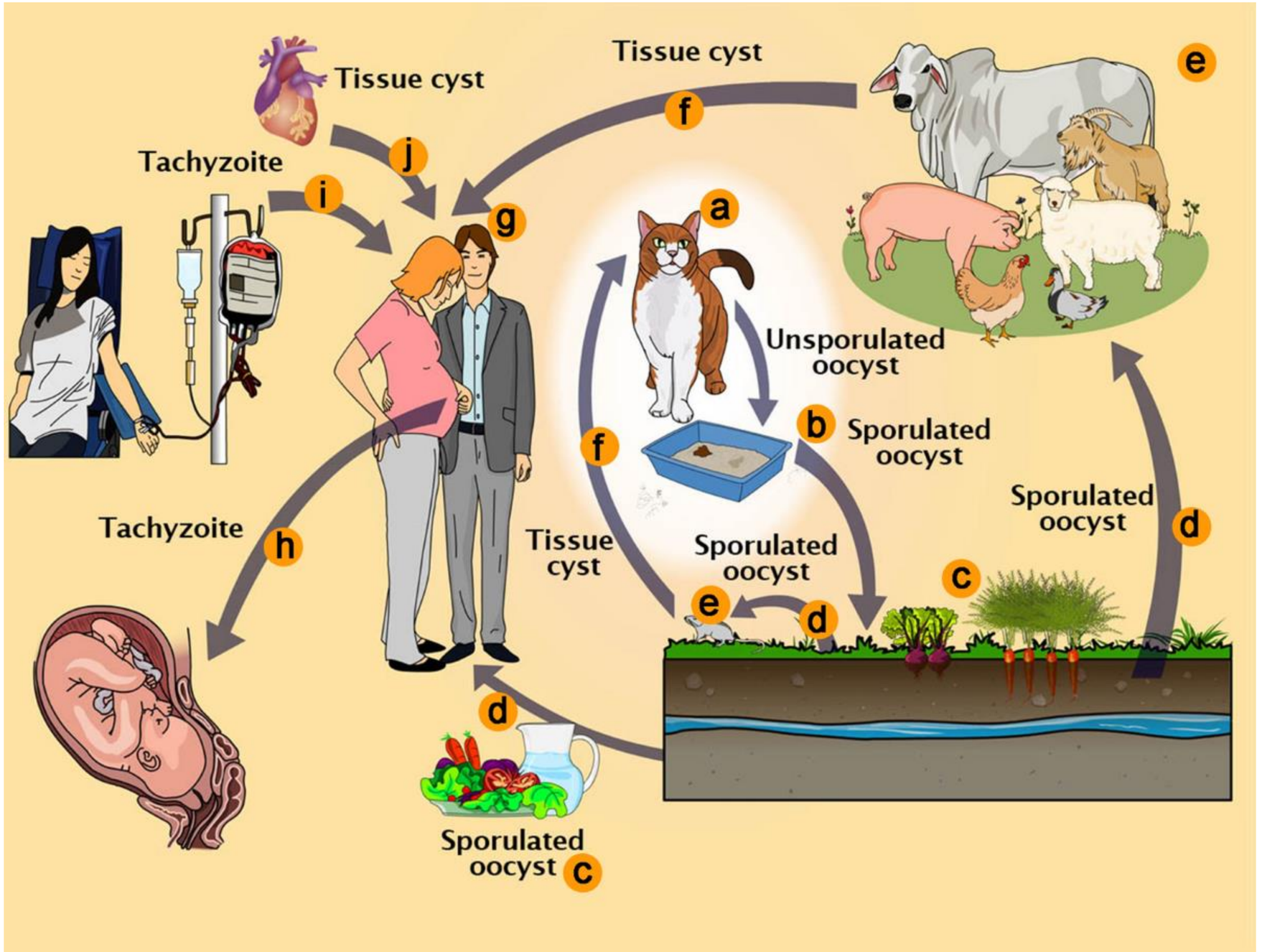
## Epidemiology and prevention:

1. Depends on a number of factors including the interaction between sand flies, reservoir hosts, and susceptible humans.
2. **Use of residual insecticides** is the main preventive measure.

# 2. Toxoplasmosis

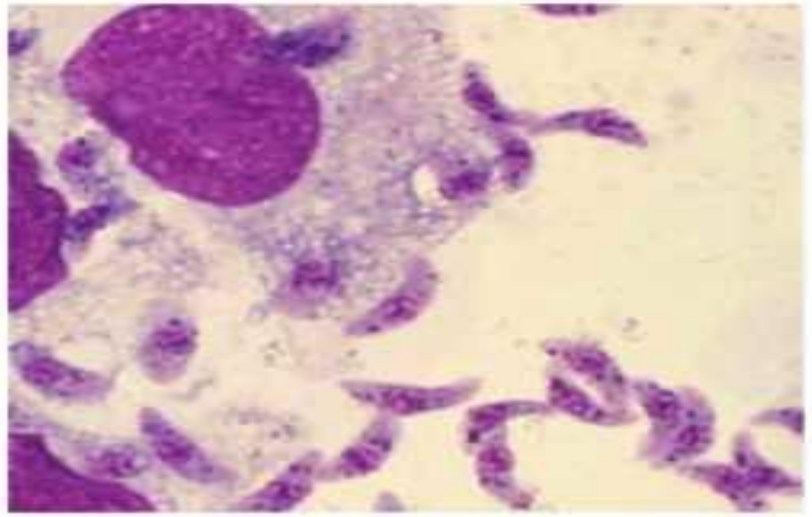
| | |
|---|---|
| **Causative parasite:** | **Toxoplasma gondii** |
| **Geog. Dist.** | cosmopolitan distribution |
| **Definitive host:**<br>**Intermediate host:** | The domestic cat **(predator)**<br>All vertebrate hosts including humans serve as **prey hosts.** |
| **Habitat** | obligate intracellular parasites and are found in all nucleated cells |
| Mode of infection | 1. Ingestion of sporulated oocysts in contaminated vegetables or water or during handling of litter trays or by aids of flies<br>2. Ingestion of tachyzoites or bradyzoites in cysts in undercooked meat or during handling infected raw meat.<br>3. Blood transfusion and organ transplant.<br>4. Congenital transmission |
| Infectious stages | the tachyzoites, the bradyzoites (in tissue cysts), and the sporozoites (in oocysts in cat feces). |

# The life cycle of *Toxoplasma gondii*

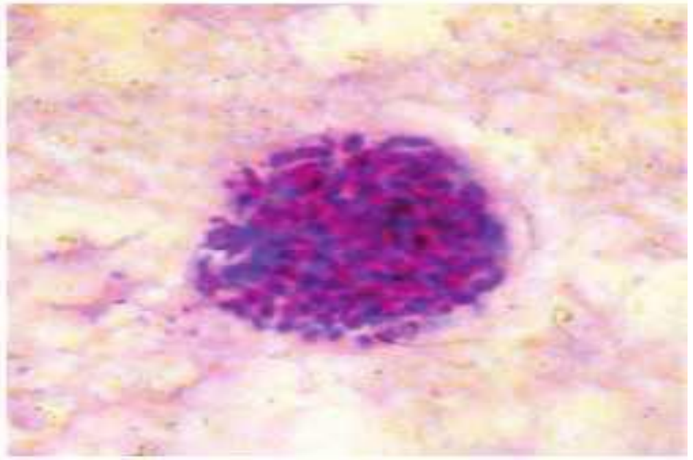


**The organisms are obligate intracellular parasites and are found in two forms:**

1. The actively proliferating trophozoites or tachyzoites are usually seen in the early, more acute phases of the infection, they invade any tissue, proliferating in the macrophages
2. The resting forms or cysts are found primarily in muscle and brain, probably as a result of the host immune response.



*Toxoplasma* tachyzoites



*Toxoplasma* tissue cyst

## Pathogenesis and clinical picture:

A. **Congenital infection from mother to fetus** results from primary acquired maternal infection during prgnancy.

1. Fetal abnormalities could occur depending on the stage of pregnancy. The infection is more severe in the first trimester of pregnancy causing abortion or stillbirth.
2. Neurological affection includes hydrocephalus, microcephaly, intracranial calcifications with epilepsy, psychomotor or mental retardation.
3. Chorioretinitis, strabismus, or even blindness.
4. Hepatic enlargement, ascites, cardiomegaly, thrombocytopenia, and anemia.
5. Low birth weight and preterm labor

**B. Acquired toxoplasmosis**

1. Usually asymptomatic or mononucleosis-like syndrome (fever, rash, lymphadenopathy, hepatosplenomegly and pneumonia) in immune- competent patient.
2. Infection remains latent for life unless reactivation due to immunosuppression.

**C. Immunocompromised (most commonly AIDS )**

1. Encephalitis with focal CNS lesions seen as single or multiple ring- enhancing masses on CT (and focal neurological signs)
2. Lymph node, liver, and spleen enlargement and pneumonitis, may proceed to heart failure and death.
3. Chorioretinitis.

## Diagnosis:

1. History and clinical picture
2. Serological tests: ELISA and Indirect immunofluorescence tests can be used for the detection of IgM (acute infection) and IgG antibodies (chronic infection).
3. PCR technique.
4. Biopsy from liver or lymph node aspirates stained with Giemsa to detect the parasite.
5. Ultrasonography for detection of congenital infection and intracranial calcification.

## Treatment and Prevention:

1. There is no completely satisfactory treatment. The damage caused by transplacental infection is irreversible.
2. Spiramycin could be used to prevent transplacental transmission pyrimethamine + sulfadiazine (add folinic acid).
3. Prvention is perfoemed through proper hand hygiene and cooking meat thoroughly to the proper temperature.

# 3. Filarial Nematodes

General characters of filarial worms:

1. The filarial nematodes are arthropod-borne worms that reside in the subcutaneous tissues, deep connective tissues, lymphatic system, or body cavities of humans.
2. The female worms produce large numbers of microfilaria, which are highly motile, threadlike prelarvae that in some species maintain the egg membrane as a sheath and are called sheathed forms. Microfilariae can be detected in the peripheral blood or cutaneous tissues, depending on the species.
3. The infections are transmitted to humans by the bites of blood- sucking arthropods that take microfilariae in a blood meal.
4. In the insect the microfilariae develop into infective larvae which stay in the insect mouthparts for next infection.

5. Depending on the species, microfilariae s h o w periodicity in the circulation. When the largest number of microfilariae occurs in the blood at night is called nocturnal periodicity.

6. When the largest number of microfilariae occurs in the blood at daytime is called diurnal periodicity.

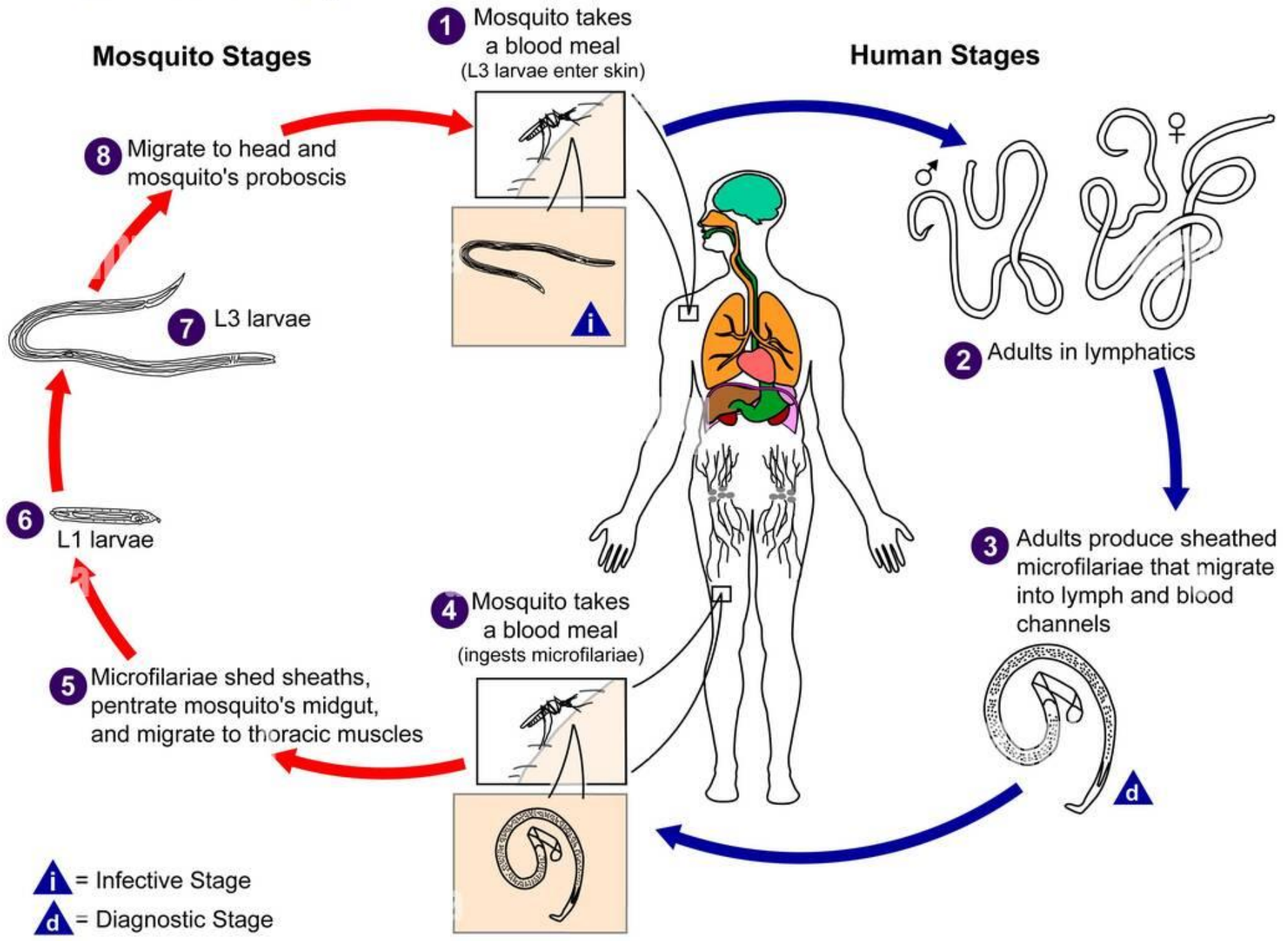
7. When not in the peripheral blood, the microfilariae are found primarily in the capillaries and blood vessels of the lungs. The basis for filarial periodicity is unknown; however, it may be an adaptation to the biting habits of the relevant vector

# *I. Wuchereria bancrofti* (elephantiasis)

| | |
|---|---|
| **Causative parasite:** | *Wuchereia bancrofti* |
| **disease** | Elephatiasis |
| **Habitat** | lymphatics of the lower limbs mainly, sometimes affect genital organs , upper limbs and the breast. |
| **Mode of transmission** | by bite of female mosquitoes as *Culex* , *Anopheles*, and *Aedes* spp. |
| **Infective stage** | 3rd stage larva (filariform or emberyofilaria) |
| **Diagnostic stage** | microfilaria |

# Filariasis

*(Wuchereria bancrofti)*

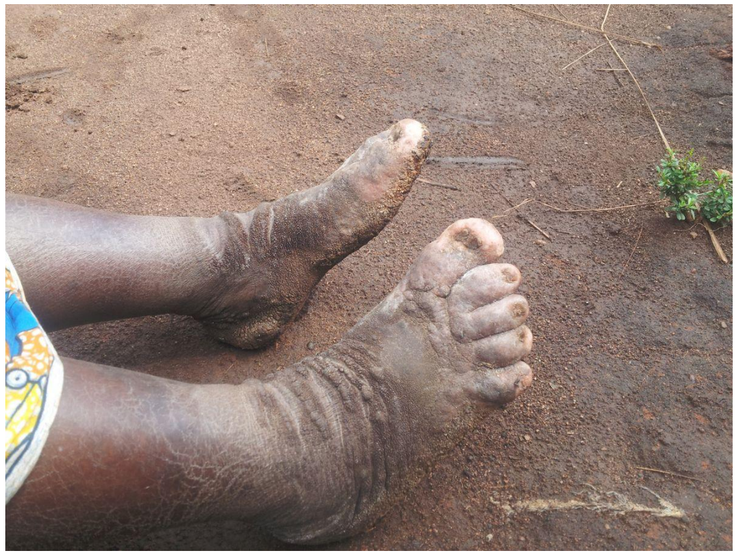


## Clinical Disease

1. Early symptoms: high fevers (filarial or elephantoid fever), lymphangitis, and lymphadenitis especially inguinal nodes.
2. Filarial fever usually begins with a high fever and chills that last 1 to 5 days before spontaneously subsiding
3. The lymphangitis extends in a distal direction from the infected nodes (in thigh and legs).
4. Lymphadenitis and lymphangitis develop in the lower extremities more commonly than in the upper. genital (scrotal) involvement could occur particularly in W. bancrofti infection). The affected lymph nodes are firm, discrete, enlarged and tender

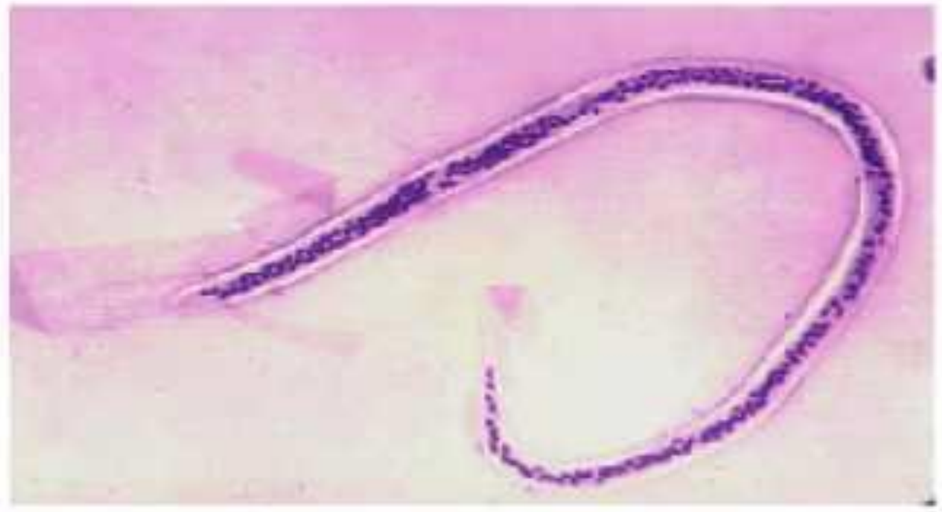
5. Repeated inflammatory attacks lead to fibrosis and obstruction of lymphatics, distally lymphedema occurs with hard, brawny edema, thickening and verrucous changes in the skin, also known as **elephantiasis**

**6. Tropical Eosinophilia:** characterized by pulmonary infiltrates, peripheral eosinophilia, cough and asthmatic like attacks (especially at night). These patients have high IgE levels, high antifilarial antibody titers, and no microphilaria in peripheral blood (amicrofilaremic filariasis). It is considered a hyperimmune reaction against lymphatic filariasis. The patients improve with antifilarial treatment dramatically.



## Diagnosis:

1. Detection of microfilariae in peripheral blood at mid night. Microfilariae may also be found in hydrocele fluid and urine in patients with hydrocele or those having chyluria.
2. Provocative test has been used to induce microfilariae to appear in the blood during daytime, through treatment with a single dose of DEC. Blood should be drawn within 15 min to 1 h.
3. Serology for detection of antibodies or circulaing antigens using ELISA, IHAT, IFAT and immunoblt tests.
4. PCR , useful also to detect the species, a rapid test is used recently using strips for epidemiologic screening.



**Treatment:**

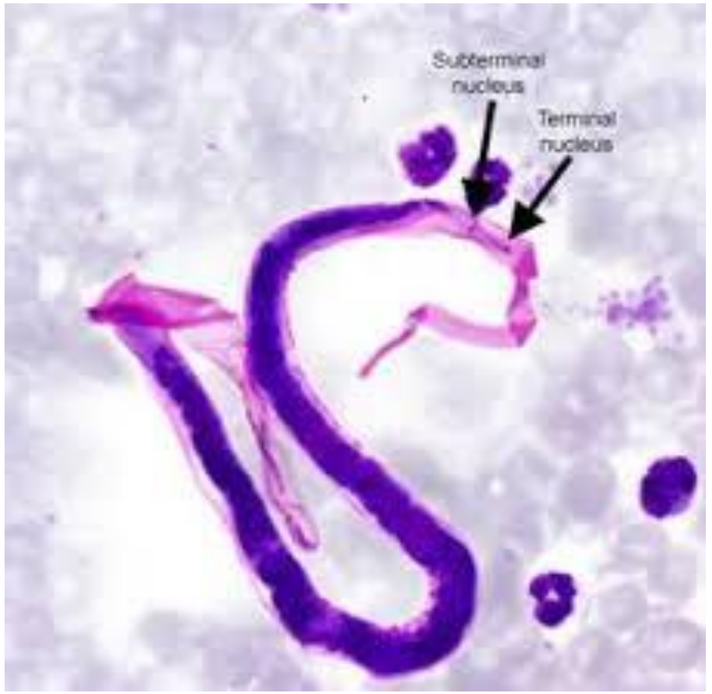
1.Diethylcarbamazine (DEC) in three divided doses of 6 mg/ kg/day for 12 days kills adults and microfilariae.

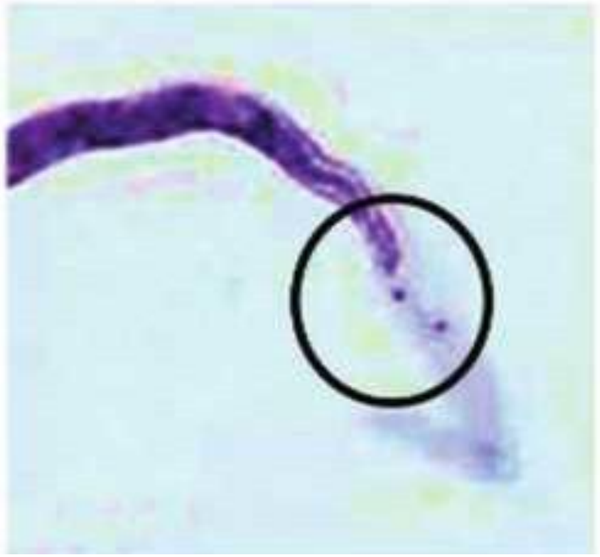
2.Ivermectin is effective only against microfilariae and has an important role in control programmes.

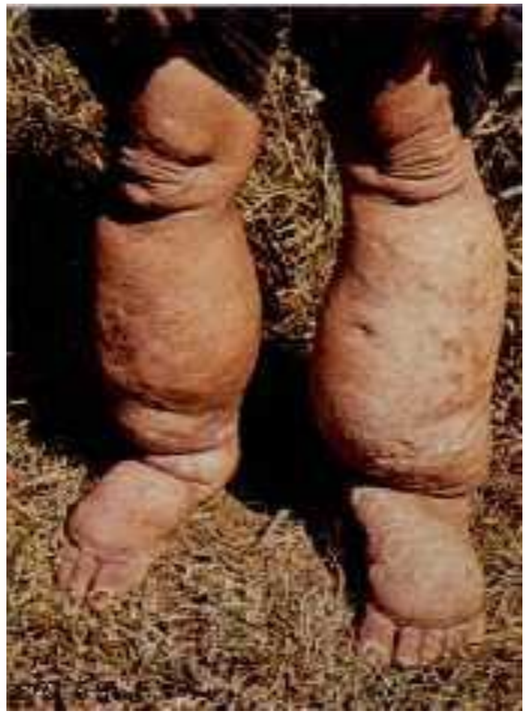
3.Surgery for scrotal elephantiasis.

# II. Brugia malayi

- The life cycle of *B. malayi* is similar to that of *W. bancrofti*
- There is some morphologic difference, e.g. the miccrofilaria has 2 separate terminal nuclei.
- If elephantiasis occurs, the swelling is restricted to the lower extremities below the knee.





# III. *Loa loa* (African eye worm)

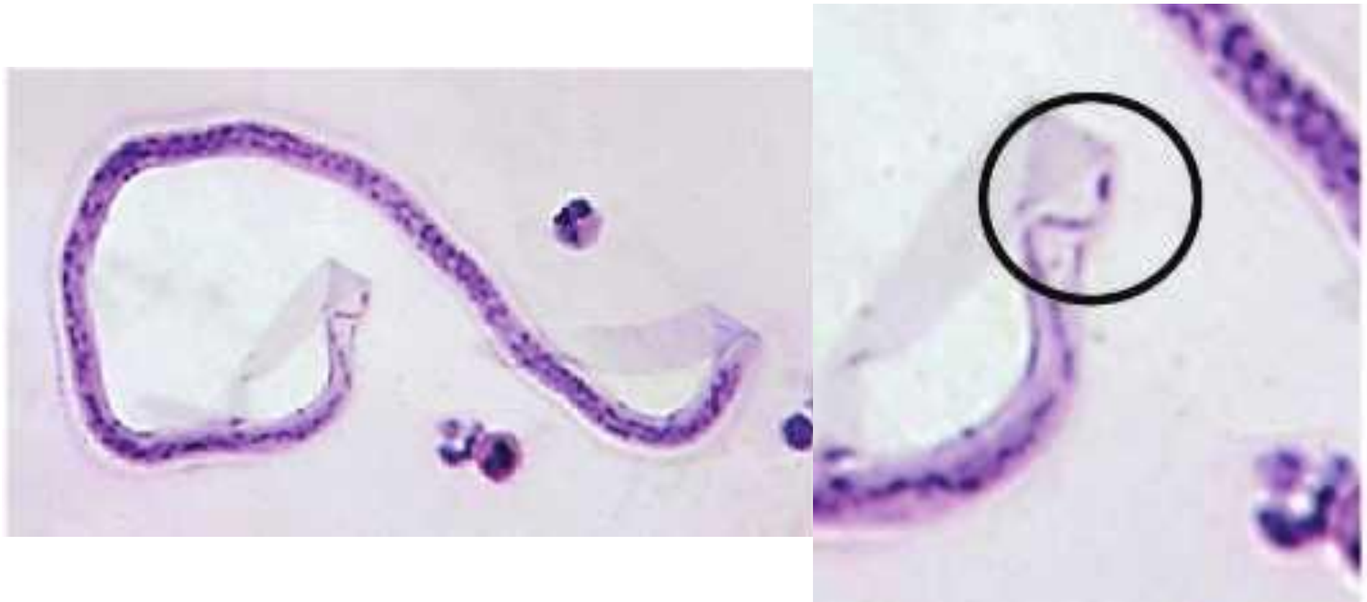
**Habitat:** **Adult worm** → in subcutaneous tissues and eyes. **Microfilariae** → in blood and show diurnal periodicity

**Infective stage:** filariform 3rd stage larvae (emberyofilaria).

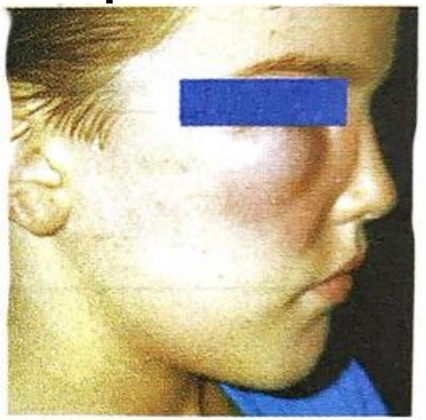
**Mode of infection:** through bite of infected ***Chrysops*** spp,

**Diagnostic stage:** adult may be seen crossing the conjunctiva and microfilare in blood (diurnal)

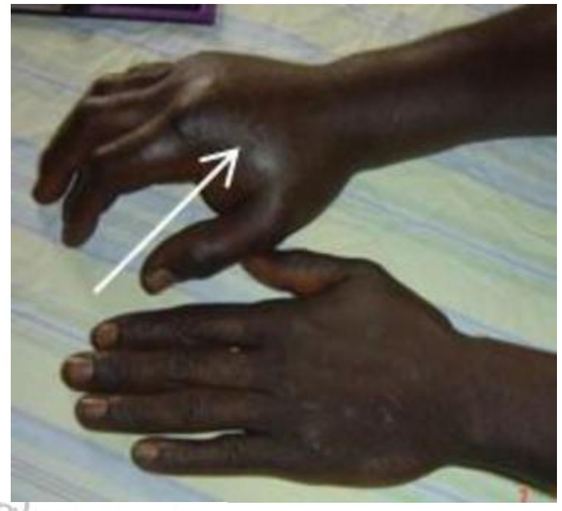
- The microfilariae have a diurnal periodicity and are sheathed , the body nuclei are continuous to the tip of the tail .

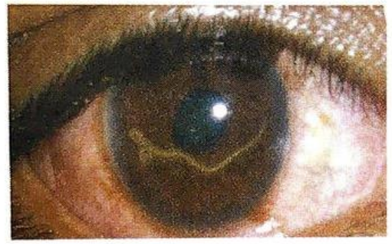


- Pathogenesis:
- Adult worms wander through subcutaneous connective tissues causing inflammatory and allergic reactions in the form of painless fugitive swelling called Calabar swelling. This swelling disappears spontaneously in a few days and reappears at another site.
- The adult worms may migrate across the conjunctiva where they can be seen. They can cross the bridge of the nose to the other eye (hence the name eye worm).



Calabar Swelling





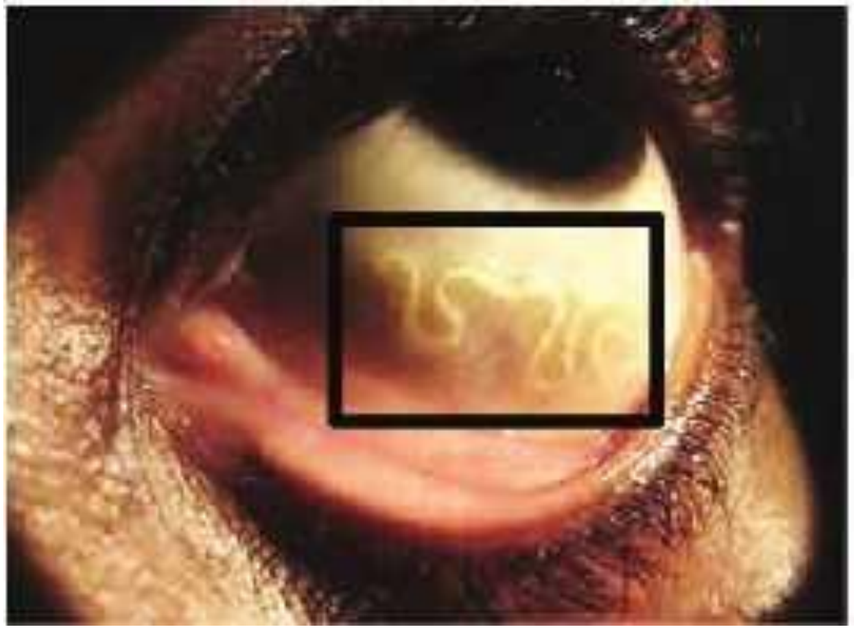
Loa-Loa in eye

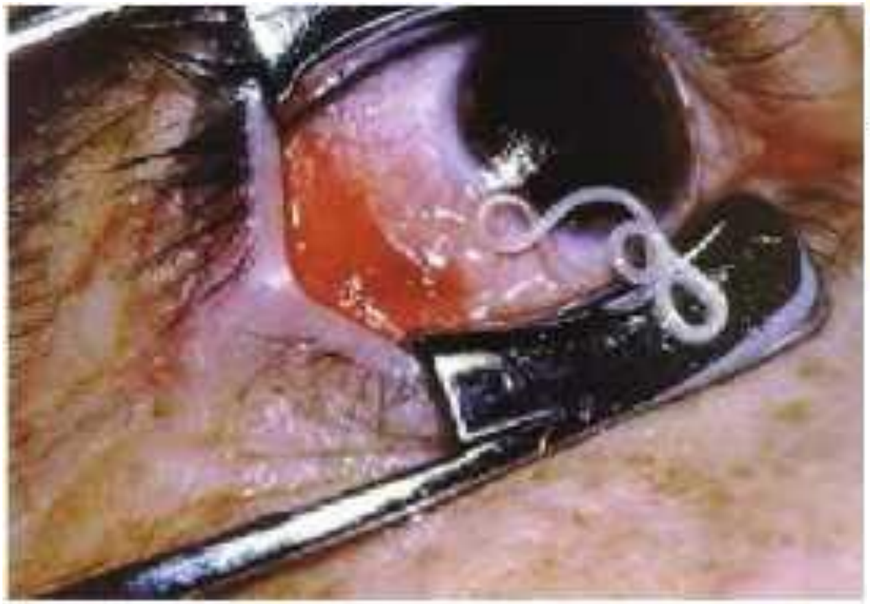
- Diagnosis:

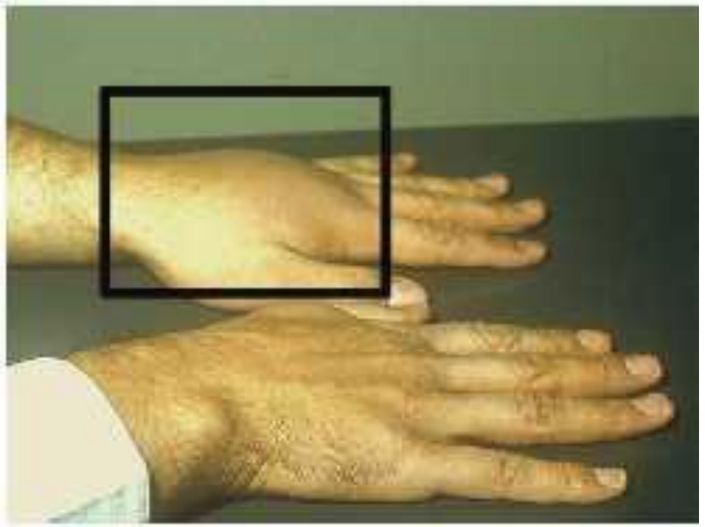
1. Clinical picture (In endemic areas).

2. Laboratory diagnosis:

- Demonstration of microfilariae: Detection of micr[illegible] film taken in the daytime (diurnal periodicity).








QUIZ!

**1. The definitive host of *Toxolasma gondii* is:**

a) Human b) Cat.,

c) Cattle d) Sheep.

*2. T. gondii* in human occurs as either …… or ……..

3. **What is the infective stage in filariasis:**

a)Micsrofilaria, b) Third stage larva

c) Second stage larva, d) Embryonated egg

**4. Scrotal swelling and inguinal lymph node enlargement is characteristic of infection with:**

*a) Wucerieria bancrofti* b) *Loa loa*,

c) Leishmania donovani. d) Toxplasma gondii

**5. Kala azar caused by which of the following parasite?**

*a) Wucerieria bancrofti* b) *Loa loa*,

c) Leishmania donovani. d) Toxplasma gondii


thank
you