Parasitic Infections Affecting CNS and Special senses

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Case Scenario

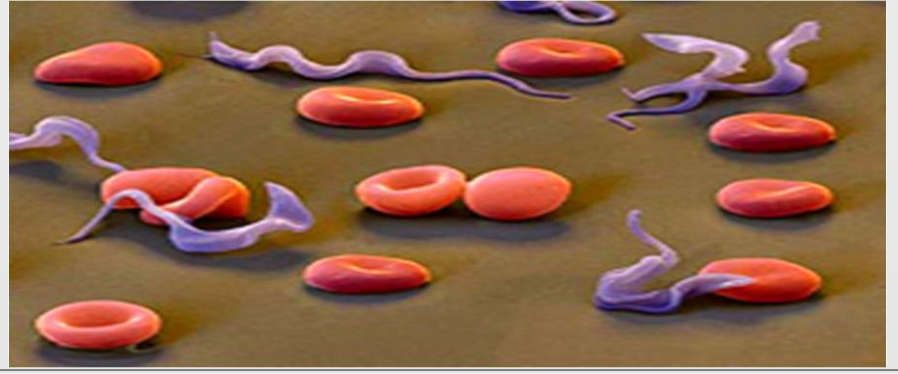
Patient presented with enlarged cervical lymph nodes, **hepato-splenomegaly**, fever and generalized weakness. The condition started when he went for a trip in **Africa**, where he was exposed to numerous **insect bites**. He had a history of having indurated painful **swelling** on his face before his complaints. Then, he suffered fever, chills, aches, night sweats, and nausea. After that he developed cognitive deterioration, ataxic gait and **sleepiness**.

What is the most likely parasitic diagnosis?

➢Parasitic Infections Affecting CNS :

Free living amoeba:	• Primary Amoebic Meningoencephalitis • Granulomatous Amoebic Meningoencephalitis
***Trypanosoma bruci* :**	• Sleeping Sickness
Entamoebae histolytica	• Secondary Amoebic Cerebral Abscess
Taenia solium:	• NeuroCysticercosis

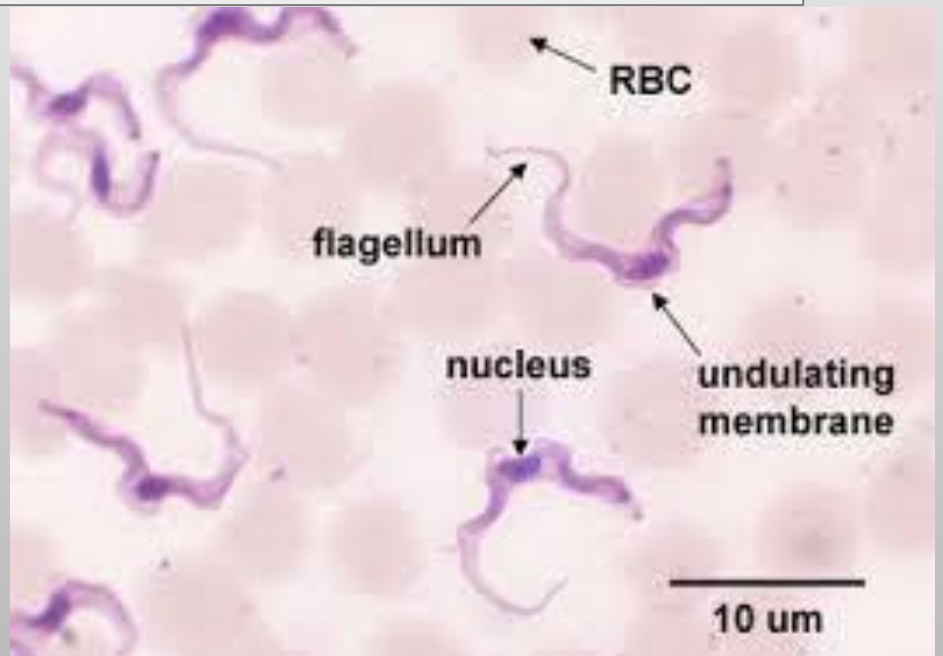
4) African Trypanosomiasis
Sleeping sickness



Parasitic diseases caused by *Trypanosoma brucei*. There are 2 main forms:

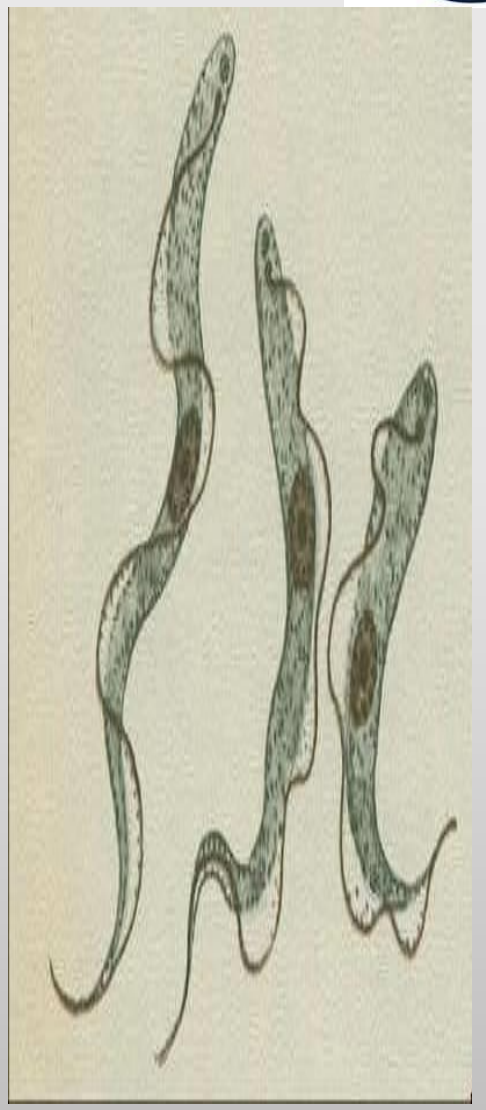
- **Chronic Sleeping sickness: caused by *Trypanosoma brucei gambiense***
- **Acute Sleeping sickness: caused by *Trypanosoma brucei rhodesiense***

Trypomasitogtes (flagellated form): Motile (with anterior flagellum & undulating membrane).



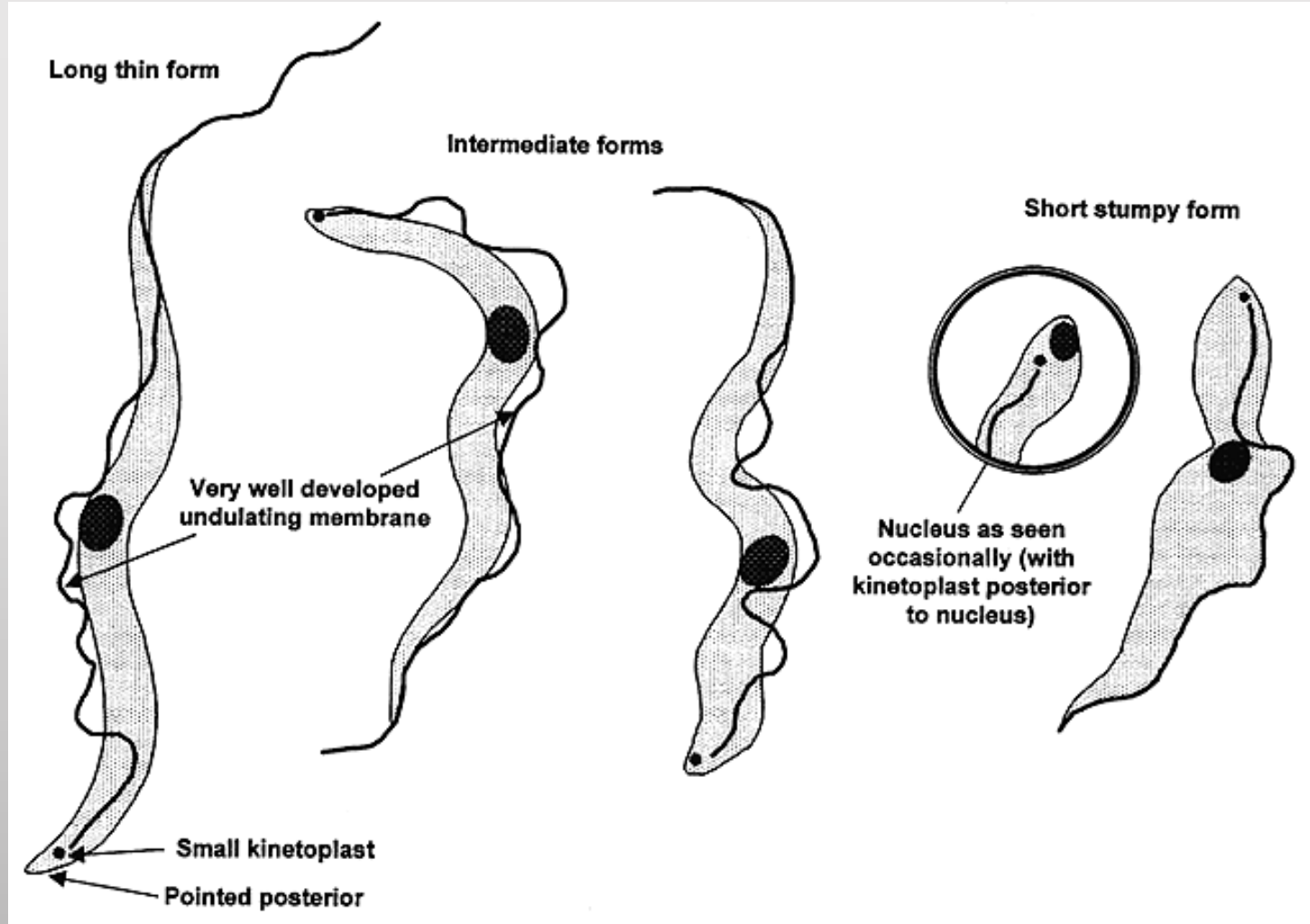
Trypomastigote has 3 forms in vertebrate host

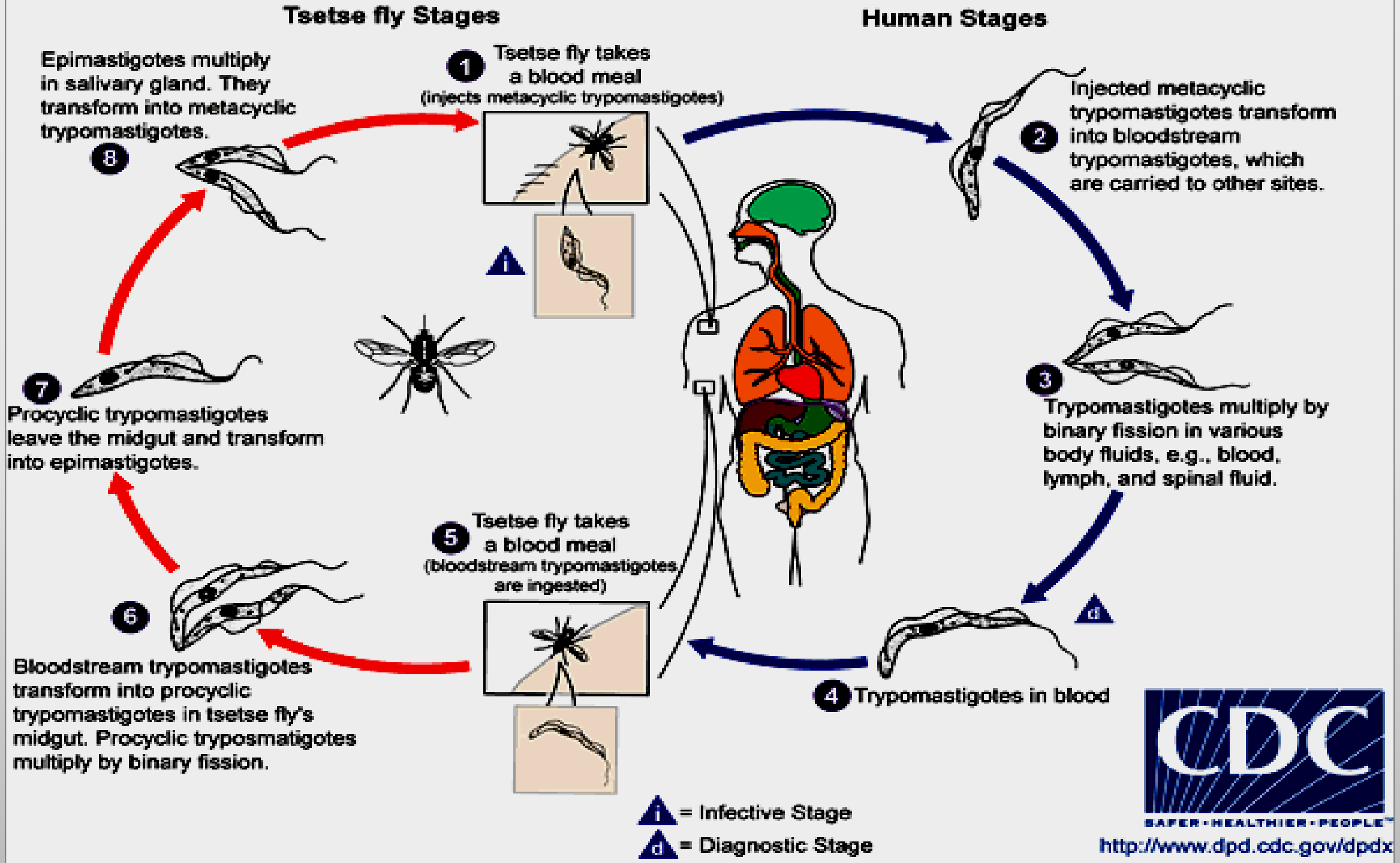
Morphological form	Characters
1- Long slender form	30 u in length, with a free flagellum& actively motile
2- Intermediate form	22 u in length, with a short free flagellum
3- Short stumpy form	15 u in length, without a free flagellum



- **In Vector (Glossina fly)→ Metacyclic trypomastigote**

(infective stage) in salivary gland.




Tsetse fly Stages
Human Stages
Epimastigotes multiply in salivary gland. They transform into metacyclic trypomastigotes.
8
1 Tsetse fly takes a blood meal
(injects metacyclic trypomastigotes)
i
2 Injected metacyclic trypomastigotes transform into bloodstream trypomastigotes, which are carried to other sites.
3 Trypomastigotes multiply by binary fission in various body fluids, e.g., blood, lymph, and spinal fluid.
d
4 Trypomastigotes in blood
5 Tsetse fly takes a blood meal
(bloodstream trypomastigotes are ingested)
6 Bloodstream trypomastigotes transform into procyclic trypomastigotes in tsetse fly's midgut. Procyclic tryposmatigotes multiply by binary fission.
7 Procyclic trypomastigotes leave the midgut and transform into epimastigotes.
i = Infective Stage
d = Diagnostic Stage
CDC
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http://www.dpd.cdc.gov/dpdx

Life Cycle:

- **Habitat**
- During the early stages of the disease; *Trypanosomes* are found extracellular in the peripheral blood. Then, RECs (Liver, Spleen, Lymph nodes, Bone marrow).
- In the terminal stages; in CNS

D.H. (man)

R.H. (animals) as, antelopes, pigs, goats, dogs.

I.H. (Vector) Glossina fly.

Mode of transmission:

1-Bite of the fly, infective stages in the Saliva of infected vector.

2-Blood transfusion

3-Organ transplantation

4- Congenital

Clinical picture of African Trypanosomiasis :

1- *Trypanosoma* chancre [skin]

Trypomastigotes multiply at the site of bite >>> a local inflammatory nodule [Painful, red]. It is a local inflammatory response at the site of tsetse bite with intense cellular infiltration, oedema and divided trypomastigotes.

Clinical picture of African Trypanosomiasis :

2- Haemolymphatic stage [Blood & Lymph nodes]:

- Toxic manifestations: irregular fever, headache, joint & muscle pain and rash.
- Lymphadenopathy especially in posterior triangle of neck >>> "**Winterbottom's sign**"
- Hepatosplenomegally,

- Bone marrow affection: Anaemia, leukopenia and thrombocytopenia.

3- Meningoencephalitis stage [CNS] (Sleeping Sickness)

Trypomastigotes invade CNS >> Inflammatory cells (morula cells of Mott)>> ischaemia & haemorrhage >> neuronal degeneration >> Meningoencephalitis

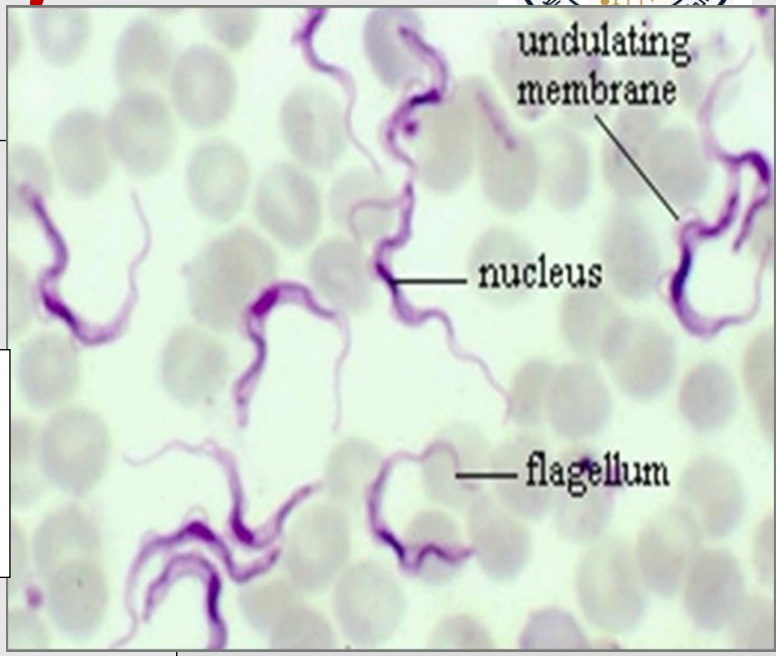
- Patient suffers of: Severe headache, mental apathy, slow speech, tremors, involuntary movements & convulsions.
- **Sleeping stage** >> Coma & death [from disease or infections as pneumonia].

Acute sleeping sickness (*Trypanosoma rhodesiense*)

Clinical features of Rhodesian disease are similar to Gambian but they cause severe fatal disease in short duration. Acute course; patients usually die rapidly.

Diagnosis of African Trypanosomiasis :

- **Clinical diagnosis**
- History of Residence or traveling to endemic area. Clinical picture.

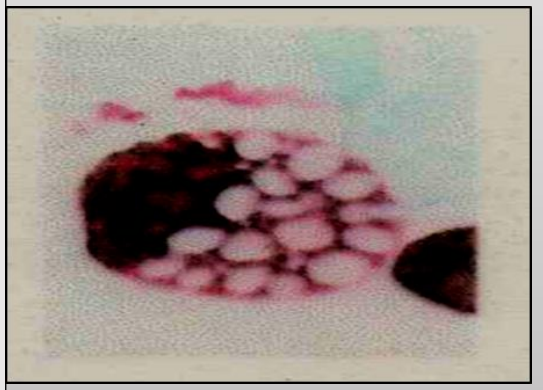


Polymorphic Trypanosomes in blood film

- **Laboratory Diagnosis:**
- 1- Direct Microscopic Examination of fresh or Giemsa stained films :

To demonstrate the **parasite** in **blood**, **aspirate** (chancre, lymph node, bone marrow) & lumber puncture for **CSF** : >>> **polymorphic trypomastigote**

- CSF examination: Trypomastigotes, and Morula cells of Mott.



Morula cells

- 2- Culture (NNN media)
- 3- Animal inoculation
- 4. Antibodies or Antigen detection by ELISA.
- 5. Blood examination: Anaemia, thrombocytopenia. ↑immunogobulins (IgM).
- 7. Molecular diagnosis.
- 8. Imaging: CT scan & MRI of the brain show cerebral oedema.

Treatment of African Trypanosomiasis :

Treatment:

- Early

  Suramin & Pentamidine

- Late (Drugs that pass CNS barrier)

  Melarsoprol

- Treatment of anaemia, dehydration and concurrent infections.

Melarsoprol

➢ Parasitic Infections Affecting special sense :

***Acanthamoeba castellani*:**	• Keratitis & corneal ulcers
Taenia solium:	• NeuroCysticercosis
Onchocerca volvulus	• Onchocerciasis

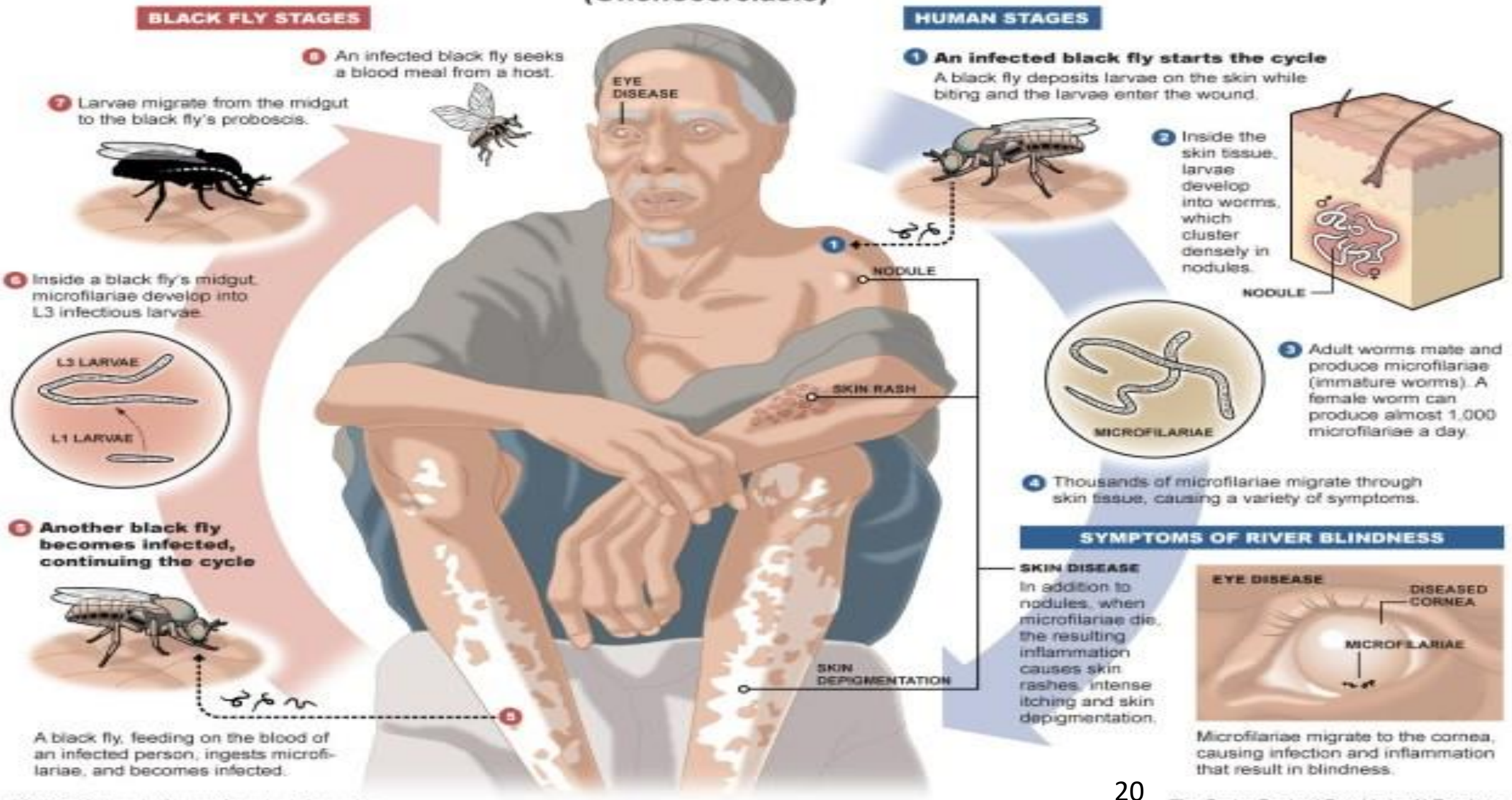
Onchocerciasis

- Infection of human skin and subcutaneous tissue by ***Onchocerca volvulus*** adult and microfilaria (Nematode).

- **Mode of infection**: through inoculation of the **infective filariform larva** (**Infective stage**) present in the mouth of intermediate host (*Simulium* fly) into skin bite.

- Adult worms live in fibrous subcutaneous nodules from the host reaction (not tender).

The Life Cycle of River Blindness
(Onchocerciasis)



Onchocerca volvulus
Pathogenicity and clinical picture:

Skin manifestations:

- Onchocerca nodule (onchocercoma): Smooth firm, painless fibrous nodule in the subcutaneous tissue surrounding one to several adults
- Severe dermatitis: Oedema and inflammatory cellular infiltration of against microfilaria with subsequent fibrosis.
- Disturbed pigmentation: dermatitis with pruritus, pigmentation, atrophy and fibrosis

Onchocerca volvulus
Pathogenicity and clinical picture:

River blindness (or Sudan blindness)

- This is a serious complication of onchocerciasis resulting in blindness.
- Common when the nodules are in the scalp, neck and shoulders.
- The microfilariae have great affinity to the eye tissues.
- It is characterized by keratitis, iritis, uveitis, choroiditis, retinitis and optical atrophy which end in blindness. **The most common early finding is conjunctivitis with photophobia**
- Causes:

-Hypersensitivity to toxins liberated from living and dead microfilariae.

-Mechanical action of the moving microfilariae in the eye tissues.

➢Diagnosis

➢Clinical diagnosis.

➢Laboratory diagnosis:

- Detection of **microfilaria** (**Diagnostic stage**) or adult in Skin-snip biopsy or aspiration from the nodules or tissue biopsy.
- **In patients with ocular manifestations**, microfilariae may be found in conjunctival biopsies.
- **PCR** of skin snips.
- **Patch skin test:** 10% of Hetrazan in lanolin cream is applied to an area of skin. In positive cases; papular eruption develop after 8-24 hours.

➢ Treatment:

1 - Ivermectin against microfilaria.

2- Doxycycline against adult worm.

3- Surgical removal of the nodules.

➢ Prevention and control:

1- Control of Simulium by insecticides application to water running streams and spraying insecticides along riverbanks by airplanes.

2- Mass chemotherapy by ivermectin.

3- Mass nodulectomy.

MCQ 1: Patient went to Africa and subjected to numerous insect bites. He developed enlarged cervical lymph nodes, hepato-splenomegaly, cognitive deterioration, ataxic gait, and finally sleepiness.

What is the most likely parasitic diagnosis?

a) primary amoebic meningioencephalitis

b) African trypanosomiasis

c) Onchocerciasis

a) Secondary amoebic meningioencephalitis

d) Neurocysticercosis

MCQ 2: What is the most common early ocular finding in Onchocerca volvulus infection?

a) blindness

b) optical atrophy

c) keratitis

d) conjunctivitis with photophobia

e) iritis

MCQ 3: Which stage is the infective stage of Trypanosoma brucei?

a) Metacyclic trypomastigote

b) Intermediate trypomastigote

c) amastigote

d) Long slender trypomastigote

e) promastigote

Discussion & Feedback

10 minutes