Urinary Systems Block -RRS-205

Parasitic Infections of the Renal System

Learning objectives

By the end of this lecture, students should be able to:

- ✓ List parasites causing urinary tract infections.
- ✓ Recall and differentiate the infective and diagnostic stages of each parasite.
- ✓ Identify mode of infection for each parasite
- ✓ Demonstrate the pathological lesions caused by each parasite on the urinary system.
- ✓ Explain host-parasite relationships (pathogenesis and main clinical presentations)
- ✓ Describe laboratory diagnosis, imaging and pathological studies of the disease related to each parasite
- ✓ recall treatment and prevention of them.

The most common parasitic infection that may affect the Urinary tract are:

A. Helminthes include:

1. *Schistosoma haematobium*
2. *Wuchereia bancrofti*
3. *Enterobius vermicularis*
4. hydatid disease

B. Protozoa include:

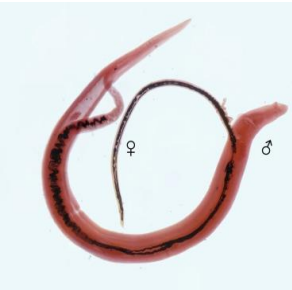
1. Trichomonas vaginalis (trichomoniasis)
2. Plasmodium spp. (malaria)
3. Entamoeba histolytica (amoebic abscess)
4. Rare (leishmaniasis, toxoplasmosis)

C. Urogenital myiasis

- **Parasites causing focal renal pathology including**

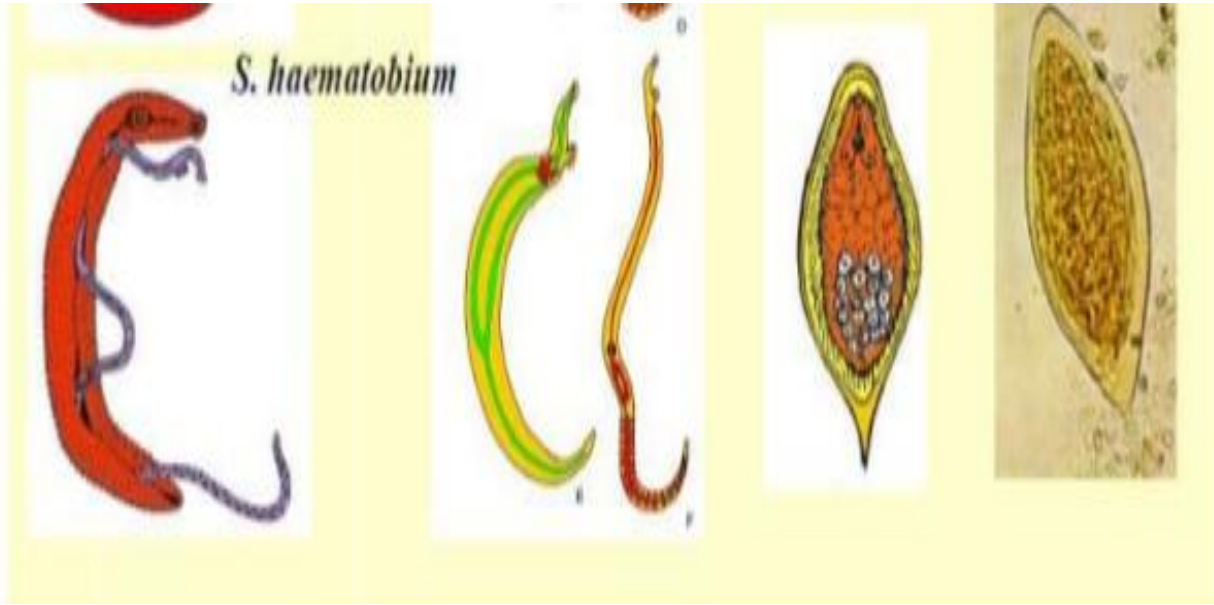
hydatid disease and amoebic abscess.

- **Parasites causing diffuse renal pathology including**
  - Schistosomiasis (schistosoma haematobium)
  - Malaria (Plasmodium spp)
  - Trichomoniasis (Trichomonas vaginalis)
  - Enterobiasis (Entrobius vermicularis)
  - Urogenital myiasis,
  - Ther rare causes including: leishmaniasis and toxoplasmosis.



1 .Urinary Schistosomiasis

- Causative trematode :	*Schistosoma haematobium* **(Blood fluke)**
- Geog. Dist.	Africa, South America, Middle East, Turkey, Southern Europe and India.
- Definitive host: **- Habitat:**	Man. Adults → Portal veins. Oviposition → Vesical submucosal venules.
- Intermediate host:	***Bulinus truncatus*** (freshwater snail)
- Mode of infection:	Cercariae penetrate the skin or buccal mucous membrane during contact with infected water or with drinking.


S. haematobium

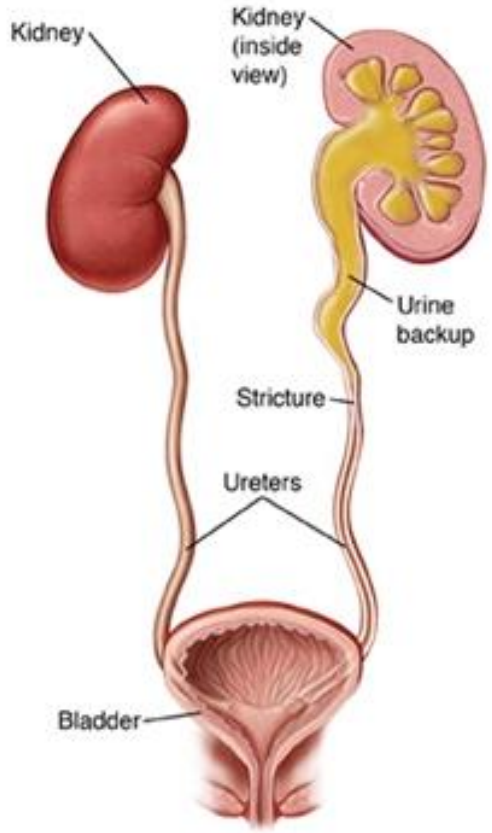
Pathogenesis and clinical picture:

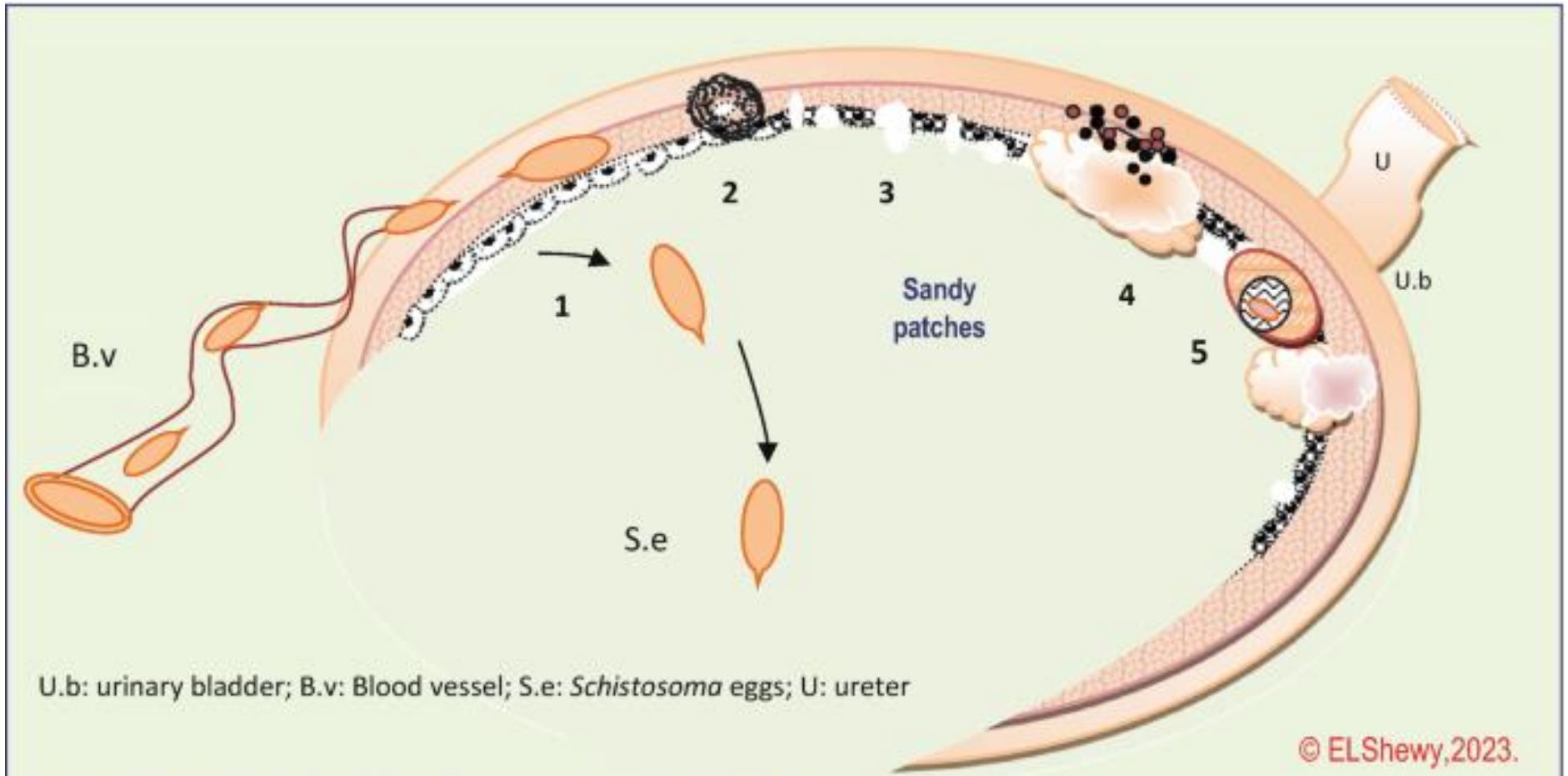
- After egg laying; eggs attach to the blood vessels by their spines on blood vessel walls.
- These eggs are squeezed through the wall of the urinary bladder leading to terminal hematuria, burning micturition and dysuria and discharged into urine.
- some eggs become trapped under the mucosa causes cellular infiltration reaction and granuloma formation, followed by calcification and fibrosis
- Occurrence of calcification and fibrosis cause pressure atrophy and ischemia of the overlying mucosa giving it a sandy patches appearance.

- The trapped eggs also induce repeated granuloma formation leading to development of nodules and polypoid masses (cauliflower polypi) in the bladder mucosa.
- Ulcerative lesions: caused by shedding of the atrophic mucosa of sandy patches and those of the polypi. induce scar tissue, the bladder wall becomes thicker and loses its elasticity.

- Ureteric inflammation and fibrosis result in stricture which might obstruct the ureter → hydroureter → hydronephrosis + infection → pyonephrosis → reflux nephropathy and renal failure may occur.

- Urinary schistosomiasis is a predisposing factor for neoplasia of the bladder (squamous or transitional cell carcinoma).





U.b: urinary bladder; B.v: Blood vessel; S.e: *Schistosoma* eggs; U: ureter

1. **Egg deposition** in the urinary mucosa and submucosa.
   (During urinary contraction, some eggs escape to the lumen to pass with urine, causing hematuria).
2. **Granuloma** formation around eggs in the submucosa.
3. **Sandy patches** with multiple small ulcers.
4. Urinary **papilloma** and polyposis.
5. Ureteric stenosis due to **fibrosis** of the ureteric opening.

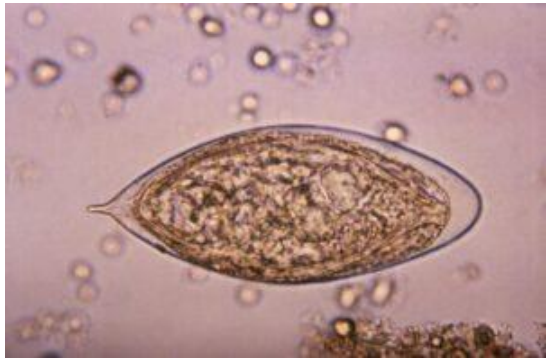
Diagnosis:

A. clinical picture and history
B. laboratory
1. direct

- Examination of urine sample, containing the last drops of urine, for characteristic eggs. In mild cases centrifugation is done.
- Egg counting technique: to estimate the worm burden or heaviness of infection and to assess the effect of the drug.

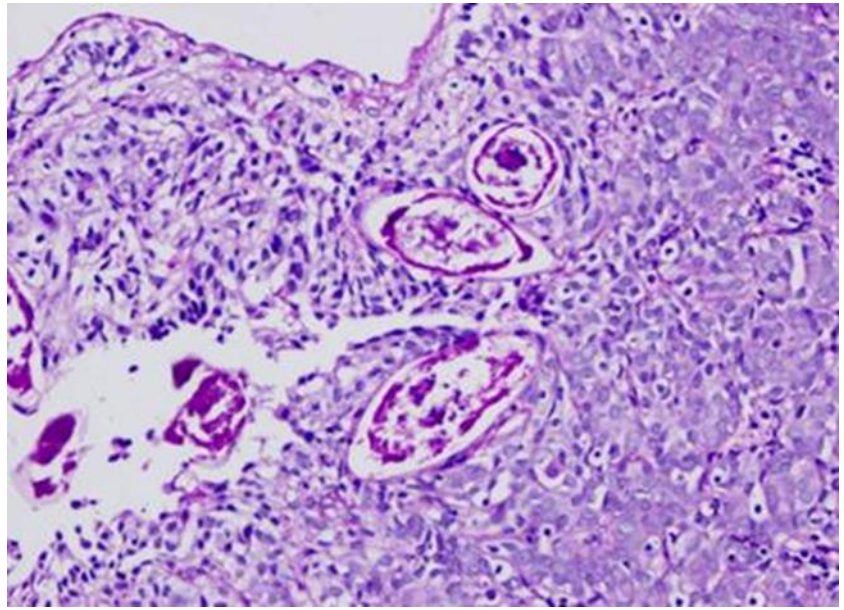
2. indirect

- Serological test: ELISA, Indirect fluorescent antibody test (IFA) and Indirect haemagglutination test (IHA).



Diagnosis:

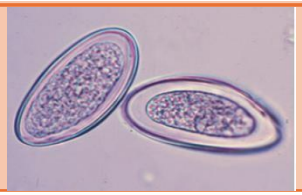
3. Histopathological examination: in chronic or closed cases: biopsy from the bladder, eggs may be found even within carcinoma tissue.



Treatment : praziquantel

Previntion and control:

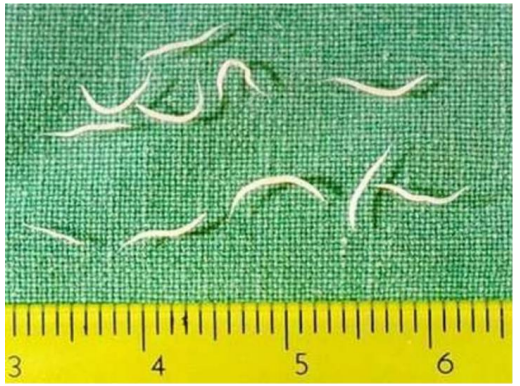
2. Enterobius vermicularis
(Pin worm, Seat worm, Family worm)

Geog. Dist.:	Cosmopolitan
Habitat:	Large intestine mainly caecum, colon, rectum and appendix
Final host	Human specially children
Infective stage	embryonated eggs containing fully developed larvae.
Mode of infection:	➢ **Ingestion** of eggs through contaminated food and drink. ➢ **Autoinfection (external):** eggs are carried under fingernails to the mouth. ➢ **Internal autoinfection (Retro-infection):** eggs hatch on the perianal region and larvae migrates back through the anus to the rectum and caecum. ➢ **Air-borne infection**: inhalation of infective eggs
Diagnostic stage:	Fully embryonated eggs containing fully developed larvae. 

- **Pathogenesis and clinical picture:** Worms may migrate to the urethra and urinary bladder leading to irritation and inflammation (urethritis and cystitis).
- **Clinically;** dysuria, increased frequency of urination and pruritus are the common presentations.

Diagnosis:

1. **Urine examination**: *eggs* and adult worms
2. **Immunodiagnosis** ELISA.
3. **Molecular Diagnosis:** PCR

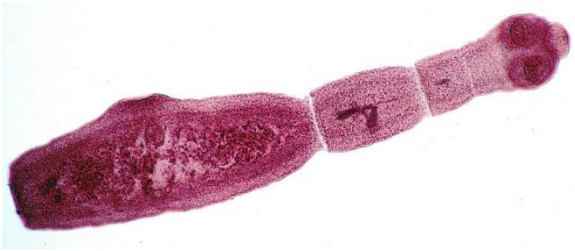



Treatment: Flubendazole or Mebendazole as a single oral dose. A second dose should be given after 2 weeks.

Prevention and control:

1. Personal hygiene.
2. Cutting nails short.
3. Thorough washing of hands after using a toilet and before meals.
4. Infected children should wear tight-fitting trousers (clothes).
5. Infected persons should sleep alone, their underwear and bedding carefully handled & washed.
6. Food and drink should be protected from dust & hands.
7. Mass treatment of all persons in any infected community, e.g. family or school.

3. Renal Hydatid Disease



Causative parasite:	*Echinococcus granulosus* (cystic or unilocular hydatid cyst) *E. multilocularis* (alveolar or multilocular hydatid cyst).
Geog. Dist.	*E. granulosus*: Cosmopolitan specially sheep-herding areas *E. multilocularis*: Europe, Asia, North America, Russia.
Definitive host	*E. granulosus*: dogs *E. multilocularis*: foxes, dogs, cats, wolves
Habitat	Small intestine of definitive host
Intermediate host	*E. granulosus*: Herbivorous animals, man (blind intermediate host) *E. multilocularis*: Rodents , accidentally man

Pathogenesis and Clinical picture:

- **Renal hydatid cyst** commonly occurs with systemic diseases and the isolated form is very rare.
- **It could involve other organs in the genitourinary system e.g. urinary bladder, prostate, testes, and seminal vesicules.**
- **Renal haydatid cyst is usually a single and cortical located lesion.**
- **The disease usually asymptomatic.**
- **Symptoms occur when the cyst enlarges. The most common symptoms are abdominal mass ,flank pain, haematuria and hydaturia which occur with the connection of cyst and collector system.**
- **Anaphylactic shock and sepsis if the cyst ruptured.**

Diagnosis:

- Hydaturia is specific to disease.
- Renal biopsy specimen with characteristics of hyatid cyst morphology.
- Radiologic methods include Ultrasonography, CT, and MRI showing a space-occupying lesion, especially if calcification of cyst wall occur.
- Serologic and molecular tests.

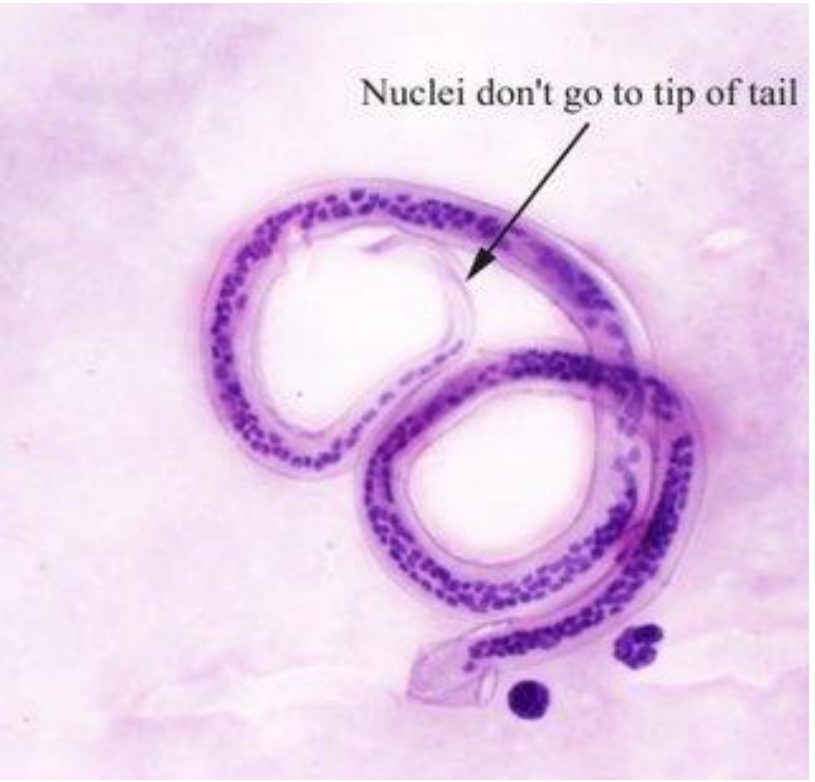
Treatment:

- Medical, surgical, and PAIR (puncture, aspiration, injection, reaspiration) methods.

Prevention and control :similar to what was mentioned in respiratory tract parasites.

4. *Wuchereia bancrofti* (Filariasis)

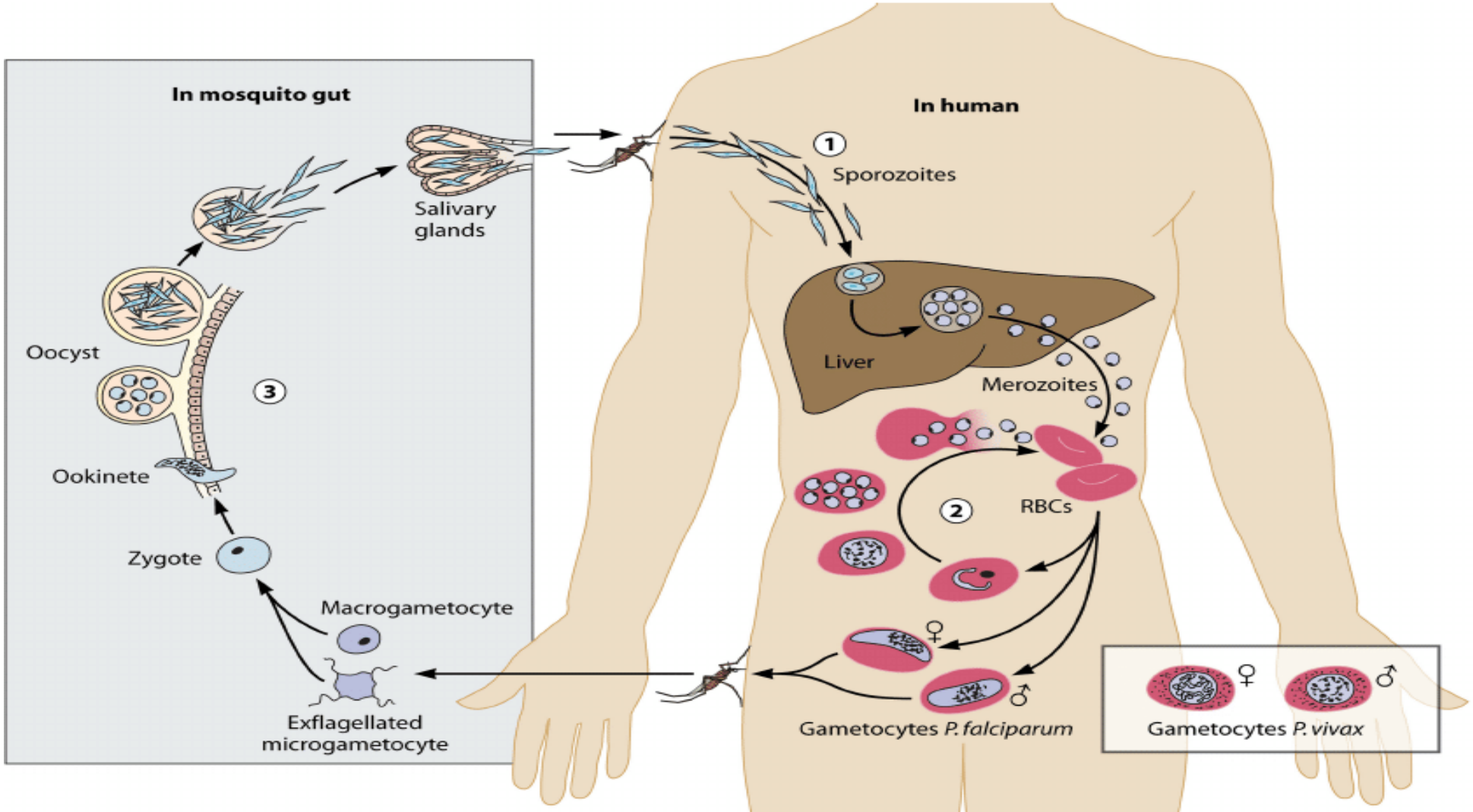
- The disease has a long latency period, it can also be asymptomatic.
- Recurrent lymphadenitis, lymphangitis, and fever cause swelling especially in the legs and feet (elephantiasis).
- Acute glomerulonephritis occurs which is immune complex mediated.
- In severe disease, obstruction of major lymphatic vessels may cause chyluria with elephantiasis.
- Chyluria (the presence of chyle in the urine "milky urine") is caused by rupture of dilated abdominal lymphatics into the urinary system.
- The diagnosis is established clinically, microscopically by detection of microfilaria and serologically


Nuclei don't go to tip of tail

5. Malaria

Causative protozoa :	*Plasmodium vivax, Plasmodium ovale,* *Plasmodium malariae, Plasmodium falciparum*
Geog. Dist.	Tropics and subtropics.
Definitive host:	Man
Habitat:	Liver cells and R.B.Cs
Infective stage: **Diagnostic stage:**	➢ Sporozoites ➢ blood stages.
Mode of infection:	1. Through the bite of female Anopheles mosquitoes. 2. blood transfusion 3. Congenital transmission.

- All four species of *Plasmodium* have complex sexual cycles in their insect vectors (anopheline mosquitoes) and asexual cycle in the human host.
- Only two of the malaria parasites, namely, *P. malariae* (quartan malaria) and *P. falciparum* (malignant subtertian malaria), are clearly associated with renal disease,



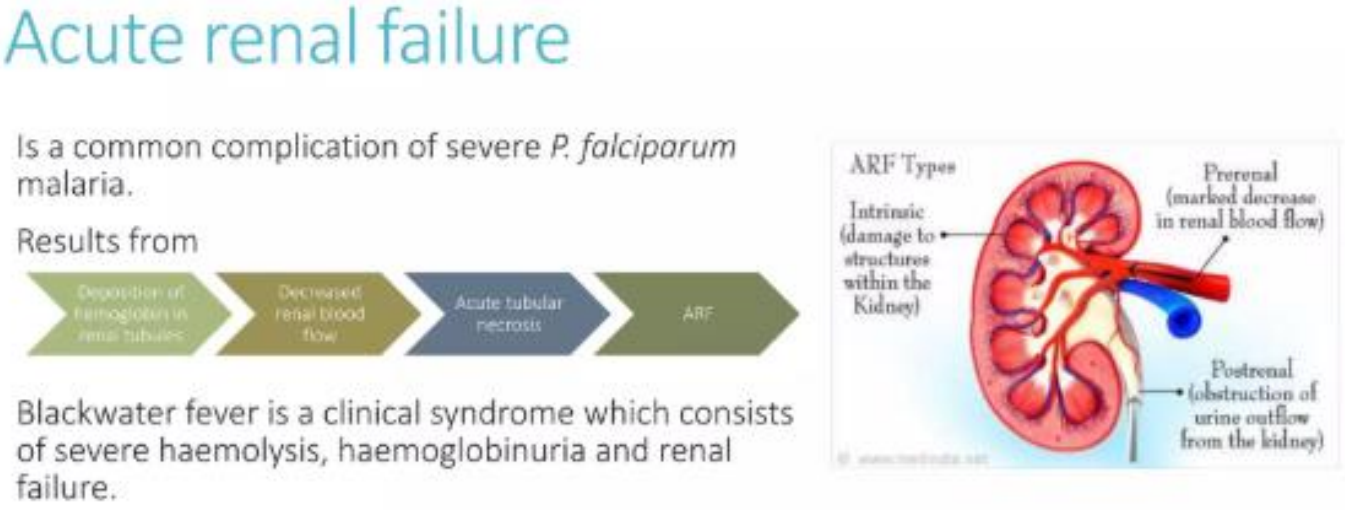
Pathogenesis and clinical picture:

- In *P. malariae*; renal involvement characterized by membrano-proliferative type of glomerulonephritis with relative proliferation of endothelial and mesangial cells. Focal and segmental glomerulosclerosis are generally superimposed on due to deposition of immunoglobulin IgM and IgG.
- Clinically the patient presents by nephrotic syndrome, periorbital swelling and lower limb edema, foamy urine due to presence of excess protein in urine, weight gain due to fluid retention, fatigue, loss of appetite.

- In *Plasmodium falciparum* the renal affection characterized by **tubulo-interstitial damage (tubular necrosis, formation of hemoglobin and cellular casts in tubules and interstitial edema).** These lesions resulted from erythrocytic sequestration, intravascular coagulation, decreased blood flow in the microcirculation. This followed by acute renal failure

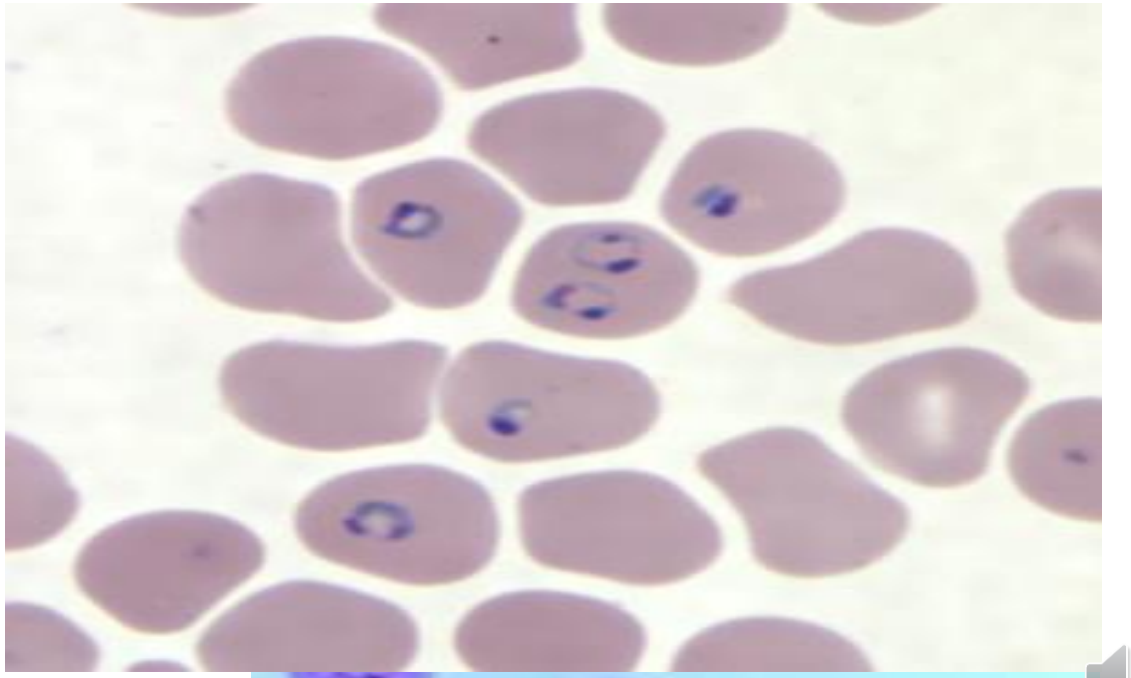
- **Clinically** the patient presents by acute renal failure manifested by reduced urine production, fluid retention, lower limb edema, shortness of breath, exhaustion, disorientation, nausea, weakness.

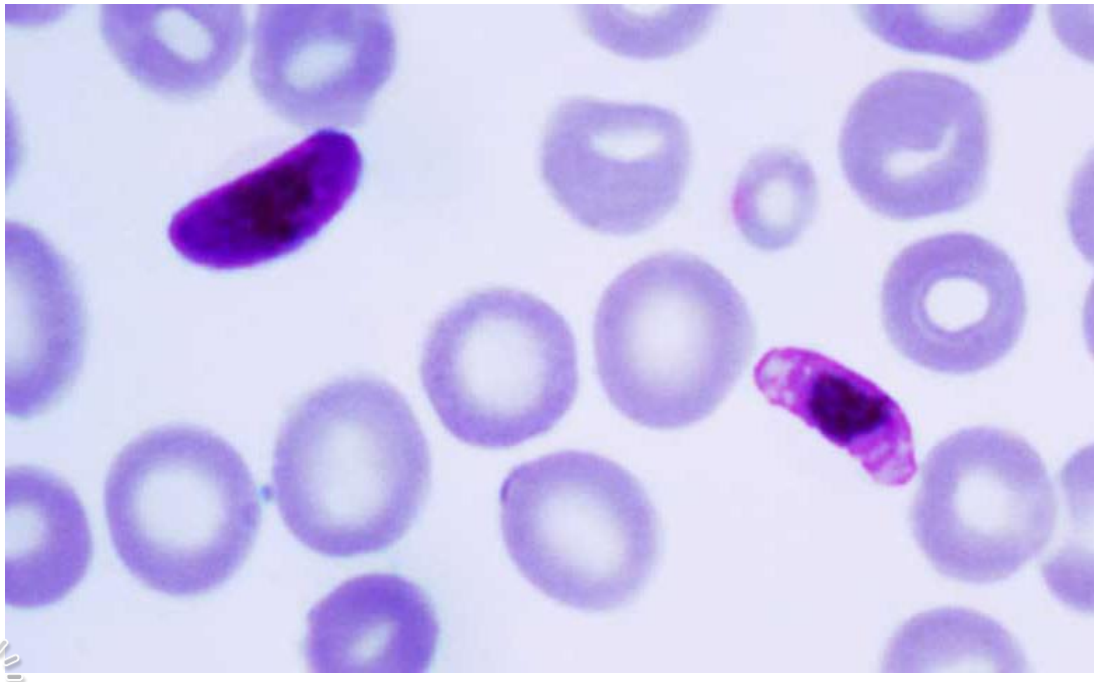
- **black water fever. Due to hemoglobinuria**

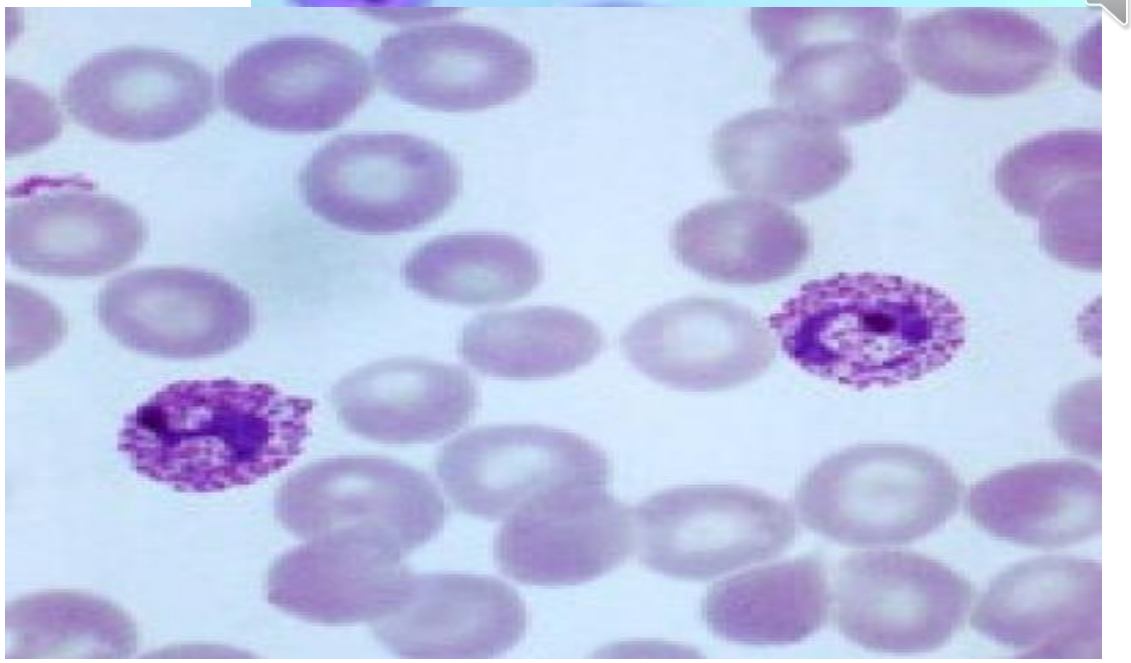


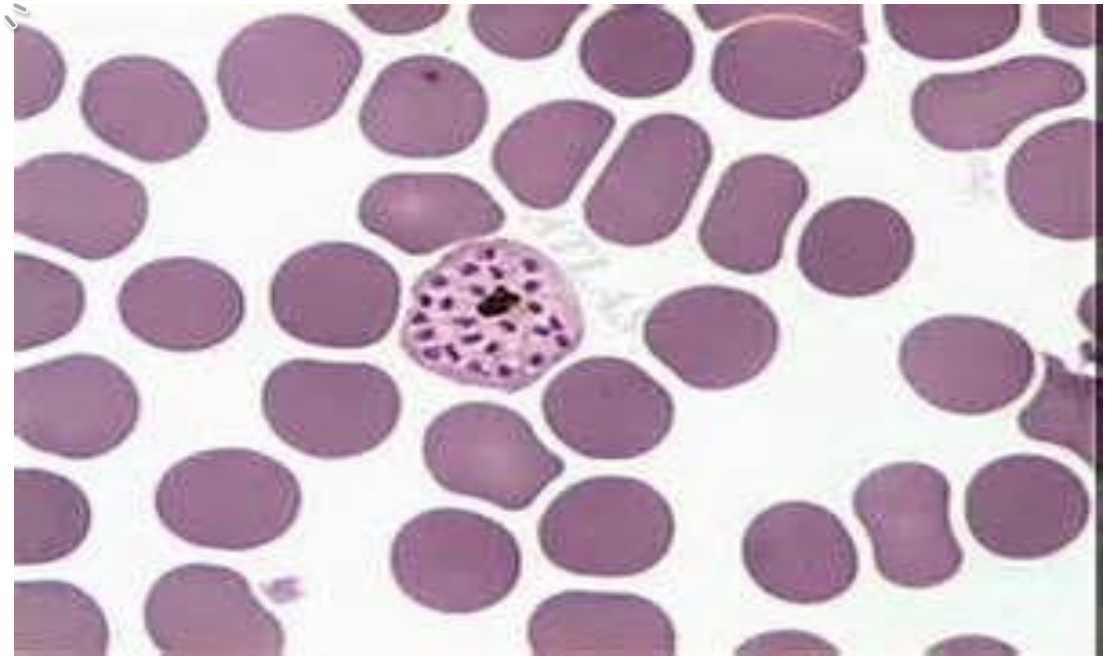
Diagnosis:

- **Clinical picture:** The characteristic paroxysms of cold stage (a shaking chills), followed by a fever stage (40–41°C), and finally a wet stage (profuse sweating). Other symptoms include tender splenomegaly and anemia.
- **Standard diagnostic method** is thin blood film for characteristic erythrocytic stages.
- **Sternal puncture examination** in case of malignant malaria when the parasite does not appear in blood films.
- **Serological tests:** Fluorescent antibody test and ELISA.









Treatment:

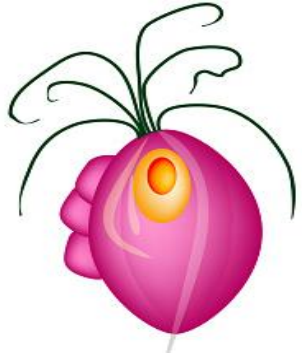
- **Prophylaxis:** proguanil, daraprim, resochin.
- **Clinical cure:** chloroquine.
- **Radical cure:** Primaquine.
- **Drug resistance:** a combination of pyrimethamine + sulphadoxin.

Prevention and control:

1. Treatment of patients.
2. Destruction of breeding places by draining ponds or by filling them with earth or by using larvicidal oil.
3. The use of small fish (Gambusia) which eat mosquito larvae.
4. The use of insecticides on the inner walls of houses to destroy adult mosquitoes.
5. Screening of houses and the use of bed nets.
6. Application of skin repellents over exposed areas of skin.

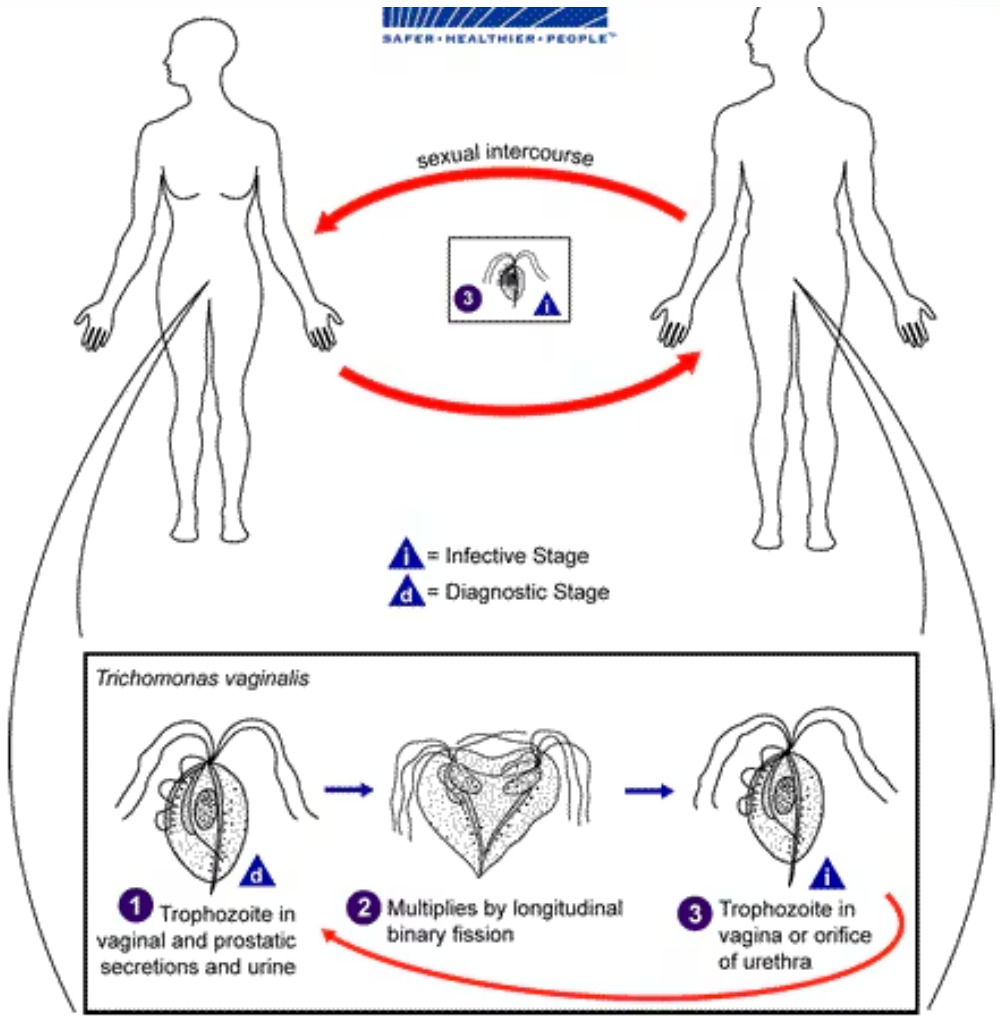
6. *Trichomonas vaginalis*

Trichomoniasis



Causative protozoa :	*Trichomonas vaginalis* (Urogenital flagellates)
Geog. Dist.	Cosmopolitan.
Definitive host:	Man
Habitat:	➢ Vagina and urethra of female ➢ Prostate, seminal vesicles and urethra of male
Infective stage: **Diagnostic stage:**	➢ Trophozoites. ➢ Trophozoites.
Mode of infection:	➢ Sexually Transmitted Infection (STI). ➢ Contaminated toilet articles and toilet seats.

Trichomonas vaginalis Life Cycle



Pathogenesis and clinical picture:

Trichomonas vaginalis affects the urogenital system of both sex; females more affected. The parasite find its way to the lower urinary tract causing profuse purulent urethritis and cystitis.

Clinically

1. Infection is usually asymptomatic.
2. The common presentation: dysuria, pruritus and white and fuzzy urethral discharge.
3. Complications associated with trichomoniasis include, prostatitis, epididymitis, Low birth weight and infertility.

Diagnosis:

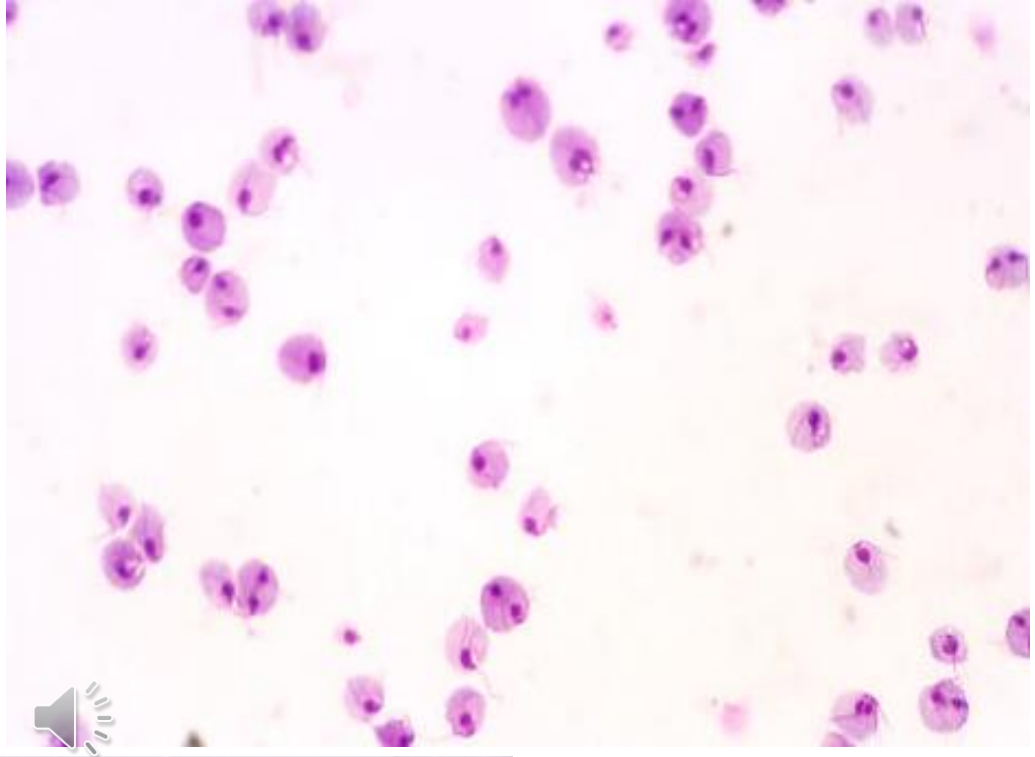
1. **Examination of** urine or prostatic secretions samples for *Trichomonas* trophozoites.
2. **In vitro Culture**: from urine sediment performed on CPLM (Cysteine, Peptone, Liver, and Maltose) media.
3. **Immunodiagnosis** of suspicious urine sample; ELISA.
4. **Molecular Diagnosis**: **PCR.**

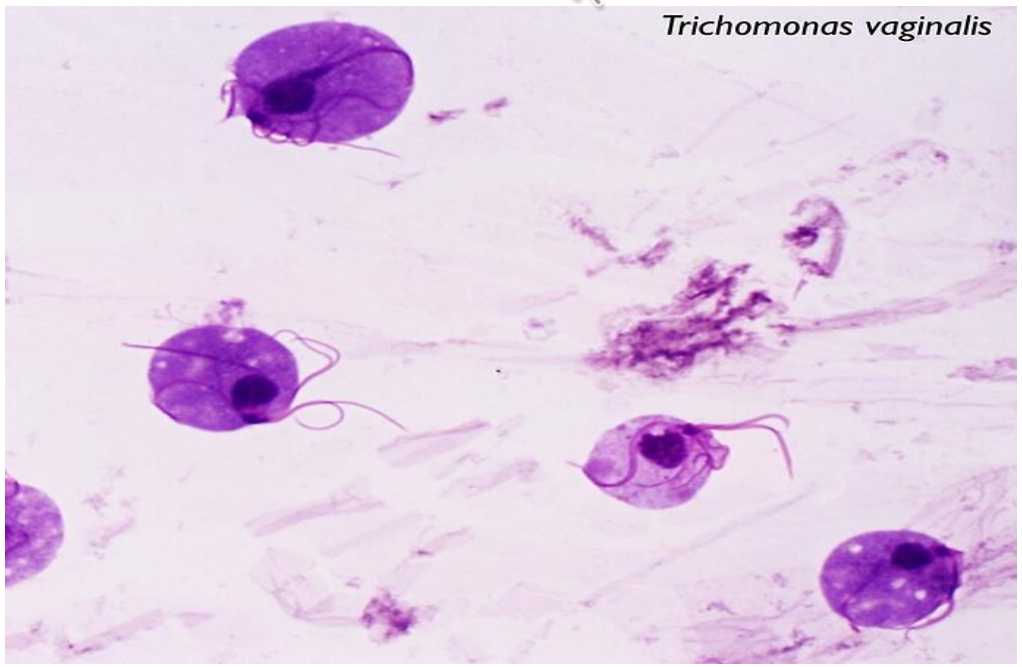
Treatment: The most effective drug for both sexes is Metronidazole.

Prevention and control:

1. Attention to personal hygiene is the most important preventive measure.
2. Detection and treatment of infective asymptomatic carriers' partner help in reducing infections.

SALINE WET MOUNT





7. Enatamoeba histolytica
Amoebic Abscess

- The kidney is the fifth most common site for amebic abscess.
- It is most prevalent in developing countries and tropical areas with poor sanitary conditions.

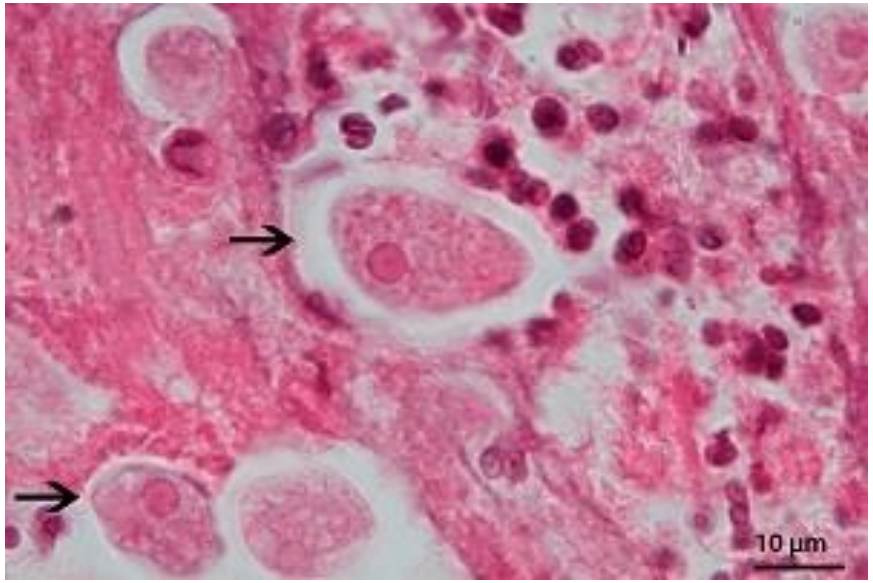
Pathogenesis and clinical picture:

1. Blood-borne spread of the trophozoites to extraintestinal sites may lead to the formation of an amoebic renal abscess.
2. A highly virulent invasive *E. histolytica* affecting the liver may have extended to produce a renal abscess
3. Secondary bacterial infection is a common complication of the condition.
4. The disease can be asymptomatic, or the patient complain of loin tenderness and pain, fever, abdominal pain and distention, weight loss and lethargy.

Diagnosis:

1. History of dysentery within the last few months can be obtained.
2. Microscopic examination of renal biopsy or aspirated fluid from the abscess reveal of anchovy sauce-liked pus with trophozoites.
3. Urinalysis may show turbid cloudy appearing urine ,positive for leucocytes.
4. CBC shows peripheral blood eosinophilia and leukocytosis.
5. Serological tests eg: ELISA, indirect fluorescent antibody test (IFAT) and indirect hemagglutination test (IHA) could be used.

6. PCR.
7. **Pelvic radiologic methods include** Ultrasonography, CT and MRI showing a space-occupying lesion.



8. Leishmaniasis

- Glomerular lesions are observed with visceral leishmaniasis (kala-azar) caused by *Leishmania donovani*.
- Patients with kala-azar have mild proteinuria with microscopic hematuria and leukocyturia.
- The pathological picture is a glomerulonephritis with nephrotic syndrome.
- Kala-azar is usually associated with hyperimmunoglobulinemia with high IgG levels and circulating immune complexes.
- Serologic and molecular tests are the most diagnostic methods.

Treatment:

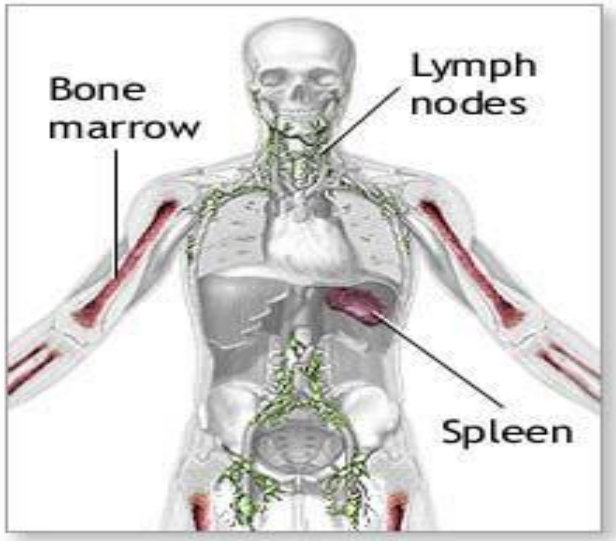
- Liposomal amphotericin-B is the drug of choice.
- Pentostam is an alternative therapy.

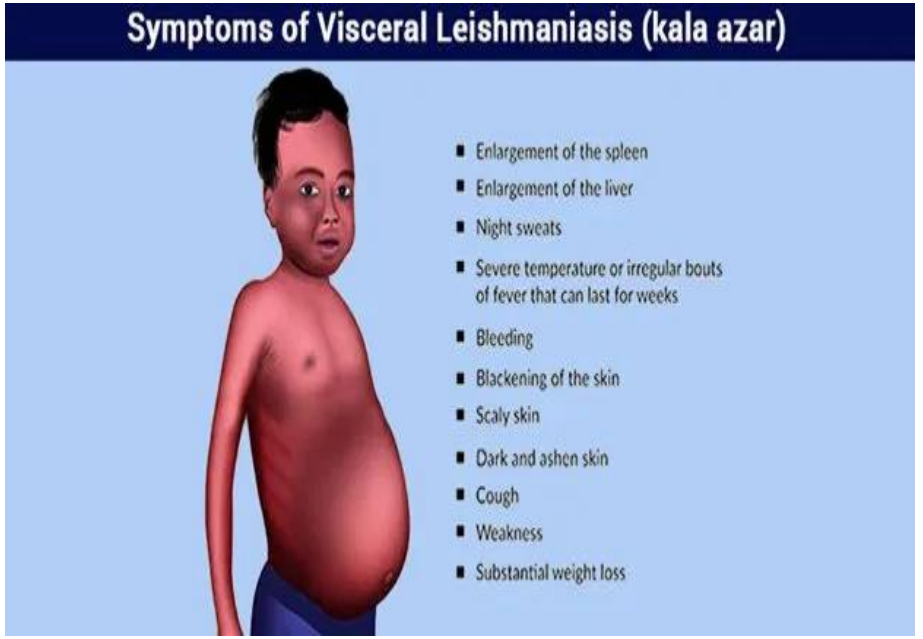
Prevention and control :

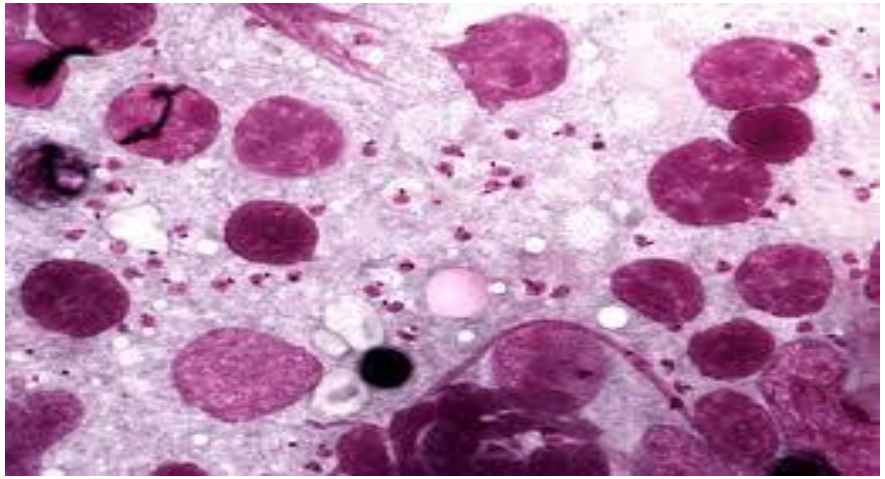
- Vaccination (against parasite surface proteins, sand fly saliva).
- Personal protection (reduce contact with vectors).
- Elimination of vectors.
- Elimination of reservoir hosts.

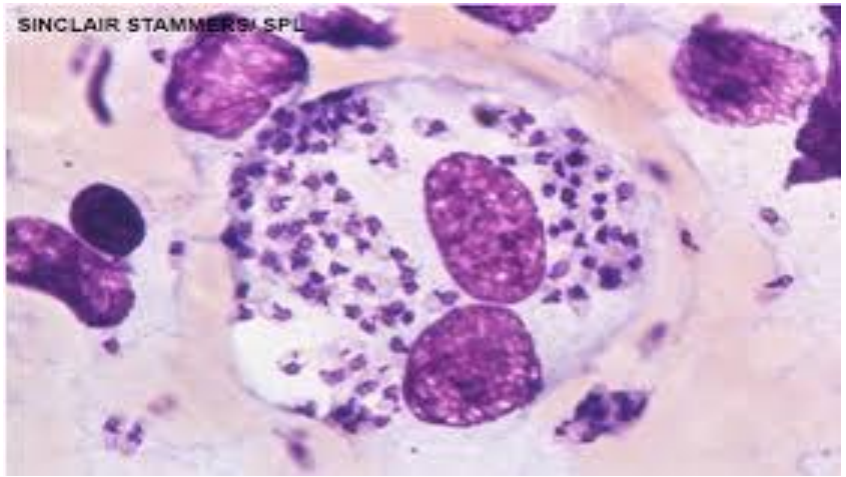

Sandfly


Sandfly bite

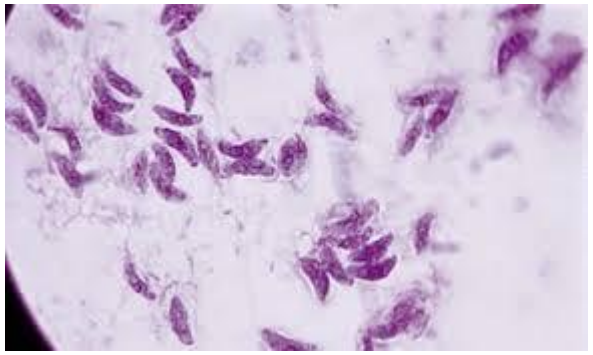

Bone marrow
Lymph nodes
Spleen
A.D.A.M.


Symptoms of Visceral Leishmaniasis (kala azar)
Enlargement of the spleen
Enlargement of the liver
Night sweats
Severe temperature or irregular bouts of fever that can last for weeks
Bleeding
Blackening of the skin
Scaly skin
Dark and ashen skin
Cough
Weakness
Substantial weight loss




SINCLAIR STAMMERS/ SPL

9. *Toxoplasma gondii* Toxoplasmosis



- Most renal diseases associated with T. gondii infections are caused by mesangioproliferative glomerulonephritis, which leads to renal failure.
- Glomerular immune complexes were shown to contain *Toxoplasma* antigen when serologically tested.
- Also, congenital glomerulosclerosis due to congenital toxoplasmosis is reported.
- Serological diagnosis is the best method.

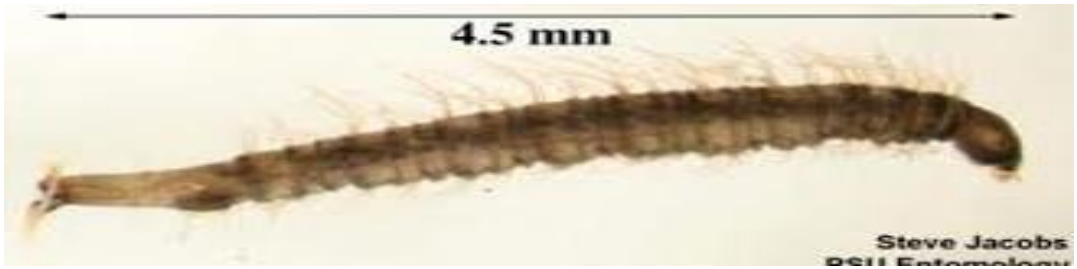
10. Myiasis

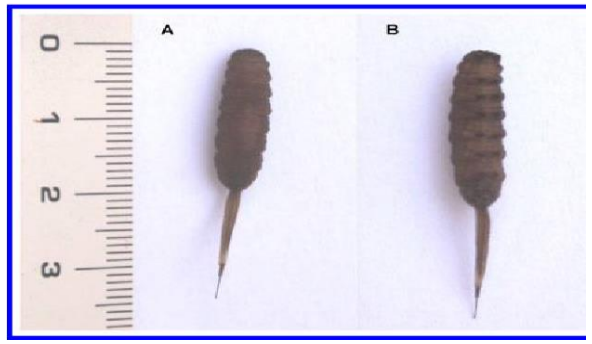
Definition: It is an infestation of human's urogenital organs by larvae of diptrous flies.

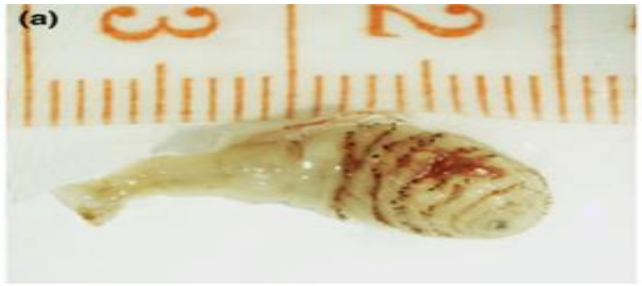
E.g.: *Eristalis tenax and , Dermatobia hominis*

Pathogenesis and clinical picture:

- Adult flies oviposit on external offices of urinary tract, eggs hatch and larvae lives on live cells or dead tissues.
- Habitation and living of larvae into the lower urinary system occur.
- Urogenital myasis usually is a self-limited disease.
- If symptomatized, it is usually associated with poor general health and hygiene, restricted mobility, and ulcerating lesions.







Clinically; patients presented with itching, dysuria, polyuria (bladder irritative symptoms) and haematuria.

Patient complains sometimes of passing living larvae in urine.

Diagnosis:

1. Identification of fly either by:
    - Characteristic morphological features of the larvae.
    - Rearing of larvae to adult stage and identification of the adult.
2. Cystoscopy to reveal any complications

Treatment: Bladder wash, antibiotic and ivermectin.

Prevention and control:

- Personal hygiene.
- Using insecticides for adult flies.


ANY
QUESTIONS


Thank
you!!!