Lymphatic Filariasis & Toxoplasmosis

Dr. Hala Mahmoud Altarawneh

Bachelor degree in Medicine and Surgery - Mutah university MSC Medical Microbiology – University of Manchester PhD Medical Microbiology - University of Manchester



Outlines

- Lymphatic filariasis:
 - Etiology and life cycle
 - Clinical features
 - Diagnosis, treatment, and prevention
- Toxoplasmosis
 - Etiology and life cycle
 - Clinical features
 - Diagnosis and treatment

Lymphatic filariasis (Elephantiasis)



Lymphatic Filariasis: Introduction

- Lymphatic filariasis, also known as elephantiasis, is a chronic mosquito-borne infection targeting the lymphatics, caused by filarial nematodes.
- Epidemiology: 120 million patients infected worldwide as of 2019
- Geographic distribution:
 - Tropical and subtropical climates (West & Central Africa, South America)
 - Lymphatic filariasis has a 10:1 predilection for men over women.

Lymphatic Filariasis: Etiology- Filarial nematodes

• Nematodes (roundworms) are long, thin, unsegmented, tube-like worms. Adult worms form separate sexes, with the males usually being smaller than the females.

• Causative species:

- *Wuchereria bancrofti* (responsible for most cases of lymphatic filariasis worldwide)
- Brugia malayi



Lymphatic Filariasis: Etiology- Filarial nematodes- Stages of Life

• Microfilariae:

- Produced by adult nematodes
- Found in the peripheral blood of the human host
- Microfilariae have nocturnal periodicity (10 p.m. to 2 a.m.).

• Larvae:

- Microfilariae that lose their sheaths
- Microfilariae mature into larvae inside the mosquito: L1 (1st stage) larvae to L3 (3rd stage) larvae
- Maturity reached in 6–9 months



Lymphatic Filariasis: Etiology- Nematodes Stages of Life

• Adults:

- Mature from L3 larvae in the regional lymphatics
- Wuchereria worms:
 - Adult female: 80–100 mm in length
 - Adult male: about 40 mm
- Brugia worms:
 - Adult female: 43–55 mm in length
 - Adult male: 13–23 mm in length



Lymphatic Filariasis: Etiology- W. bancrofti Life Cycle

- 1. An infected mosquito introduces L3 larvae into the skin of the human host.
- 2. L3 larvae migrate to the lymph nodes and regional lymphatics and mature into adults, which have a predilection for inguinal lymph nodes.
- 3. Adult worms undergo sexual reproduction, with females birthing microfilariae that migrate actively through lymph and blood.
- 4. A mosquito ingests the microfilariae during a blood meal \rightarrow Within the mosquito, the microfilariae develop into L1 larvae.
- 5. L1 larvae subsequently develop into L2 then L3 infective larvae

Lymphatic Filariasis: Etiology- W. bancrofti Life Cycle



Lymphatic Filariasis: Mode of Infection

- Mode of transmission: female mosquito bite.
- *W. bancrofti* is transmitted by many different mosquito species, depending on geographical distribution. Among them are:
- Aedes spp.
- Anopheles spp.
- *Culex* spp.
- Mansonia spp.



Lymphatic Filariasis: Disease process

- Pathological lesions occur in the lymphatic system, due to the presence of adult worms (living or dead), but not due to microfilariae.
- Symptoms may take 9 months up to 1 year to manifest after the initial infection.
- Children or individuals in endemic areas often remain **asymptomatic** (subclinical infection), while others show **acute** and/or **chronic** signs and symptoms.

Lymphatic Filariasis: Disease process- Acute phase

• Acute infection: Filarial antigens trigger increased cytokines and immunoglobulins (IgE and IgG4).



Lymphatic Filariasis: Disease process- Acute phase Clinical Features

A. Filarial fever: Typically, low-grade fever (self-limiting). May have myalgias, +/– Lymphadenopathy.

- B. Acute adenolymphangitis (ADL):
 - Fever and lymphadenopathy
 - Lymphangitis (inflammation spread distally to the lymph node), with lymphatic vessels in the leg(s) becoming warm, enlarged, red, and tender
 - Commonly seen in inguinal lymph nodes but can also affect the genitalia (epididymitis in males)
 - Lasts a few days then resolves, but recurs periodically
- C. Tropical pulmonary eosinophilia (TPE): Immune reaction to microfilariae trapped in the lungs results in Restrictive lung disease, which can progress to interstitial pulmonary fibrosis

Lymphatic Filariasis: Disease process-Chronic phase

- Chronic and repeated infections lead to: Granuloma formation, and Fibrosis of lymphatic vessels and the surrounding connective tissue
- Effects:
 - Contractile dysfunction and lymphatic occlusion, causing lymphedema
 - Susceptibility of the human host to bacterial and fungal infections, which further contribute to tissue damage



Lymphatic Filariasis: Disease process- Acute phase Clinical Features

A.Lymphedema:

- Chronic swelling of the limb from chronic inflammation of the lymphatic vessels
- Graded based on the extent and progression of the symptoms: From Grade 0: subclinical to Grade III: nonpitting oedema with skin thickening and overgrowths, non-reversible (elephantiasis)





Lymphatic Filariasis: Disease process- Acute phase Clinical Features

- B. Chronic Hydrocele: the accumulation of fluid in the scrotal sac. It can impact their fertility, and mobility.
- C. Renal involvement: Chyluria (milky urine):
 - Normally, lymphatic vessels have no communication with the urinary tract.
 - In filariasis, fluid with intestinal lymph leak into the urine intermittently. Leads to protein loss.



Lymphatic Filariasis: Diagnosis

- A.Peripheral blood smear: blood smear obtained at night (with Giemsa stain): detection of microfilariae
- B. Circulating filarial antigen (*W. bancrofti*): detects antigens of adult filarial worms. May be positive even in those without microfilariae
- C. Anti-filarial antibody tests: elevated levels of anti-filarial IgG4 in the blood. Used mostly for travellers (who are not from endemic areas)
- D.Imaging (Ultrasonography): Reveals adult worms moving in lymphatic vessels.

The "filarial dance sign"

an irregular worm movement pattern—may be detected on Doppler

Lymphatic Filariasis: Treatment

- A. Filariasis without co-infection:
- Diethylcarbamazine (DEC): 1st-line therapy, Single dose
- Doxycycline in addition to DEC → For nonpregnant adults and children > 8 years of age
- B. Surgical treatment:
- Skin debulking and lymphovenous anastomosis for drainage improvement
- Surgical excision of hydrocele



- Which stage of the Lymphatic Filariasis parasite primarily causes damage to the lymphatic system?
- A. Egg
- B. Larvae
- C. Adult worm
- D. Microfilariae

Correct Answer: C. Adult worm



What is the primary vector for the transmission of Lymphatic Filariasis?

- A. Tick
- B. Mosquitoes
- C. Fleas
- D. Flies

Correct Answer: B

Toxoplasmosis



Toxoplasmosis

- Toxoplasmosis is an infectious disease caused by the obligate intracellular parasite Toxoplasma gondii.
- **Epidemiology:** Found worldwide, but more common in tropical regions
- **Pathogen:** Toxoplasma gondii, an obligate intracellular, single-celled protozoan.

Toxoplasmosis: Etiology- T. gondii Life Cycle

- 1. Cats are the definitive hosts for *T. gondii*. The parasite completes its sexual reproduction only in cats, shedding oocysts in their faeces.
- 2. Once expelled into the environment, the oocysts sporulate (mature) and become infectious.
- 3. Humans, and various animals become infected by ingesting mature occysts from contaminated sources, leading to infection.
 - This can occur through consuming contaminated food, water, or soil, or handling cat litter without proper hygiene.

Toxoplasmosis: Etiology- T. gondii Life cycle

4. Once ingested, the oocysts transform into tachyzoites, which are:Obligate intracellular fast-replicating form, Crescent-shaped form with a central nucleus.

tachyzoites \rightarrow multiply rapidly in GI cells \rightarrow rupture cells

- 4. Tachyzoites are transported in the lymphatics and disseminate in the bloodstream to: Skeletal muscle, Myocardium, Brain, and Eyes
 - localize in neural and muscle tissues \rightarrow develop into tissue cysts
 - Immune system generally controls the replication of tachyzoites.



Toxoplasmosis: Etiology- T. gondii Life cycle

- 7. The tachyzoites forms a thick wall around itself converting into bradyzoites (tissue cyst)
 - Resistant to digestive enzymes
 - Bradyzoites develop cysts and remain dormant → can remain dormant for years
 - Killed by freezing and normal cooking temperatures
- 8. Cat consumes an infected intermediate host's tissue that harbour tissue cysts \rightarrow organism undergoes sexual cycle \rightarrow cycle continues





Toxoplasmosis: Etiology- T. gondii Life Cycle



Toxoplasmosis: Mode of Transmission

- Oral route:
 - Ingestion of oocysts passed cat faeces
 - Ingestion of infected raw or insufficiently cooked meat (tissue cyst form) (most common)
 - Unpasteurized milk (especially goat milk)
- Blood transfusion or organ transplantation
- Vertical transmission (Transplacental transmission)

Toxoplasmosis: Clinical Presentation

- Immunocompetent host:
 - Mainly asymptomatic (~ 90% of patients)
 - Symptomatic (< 10% of patients): Mononucleosis-like symptoms with bilateral cervical adenopathy.
- Immunosuppressed patients (e.g., patients with AIDS):
 - Symptoms of encephalitis in cerebral toxoplasmosis
 - Visual impairments and pain in ocular toxoplasmosis

Toxoplasmosis: Clinical Presentation

- Fetus, newborn, or infant \rightarrow Congenital toxoplasmosis:
- First trimester:
 - Increased risk of premature birth and spontaneous abortion
 - Classic triad of toxoplasmosis
 - Chorioretinitis (a form of posterior uveitis)
 - Diffuse intracranial calcifications
 - Hydrocephalus
- Second or third trimester: subclinical or mild toxoplasmosis

Toxoplasmosis: Clinical Presentation

- Sequelae of congenital toxoplasmosis
 - Epilepsy
 - Intellectual disability
 - Visual disabilities (chorioretinitis)
 - Sensorineural hearing loss

Toxoplasmosis: Diagnosis

• Serology

- IgM antibody test: positive within first week of acute infection
- IgG antibody test: positive 2 weeks following infection and remains positive for life

• PCR

- Detects parasite DNA
- Amniotic fluid for suspected intrauterine disease

Additional diagnostics

- CT/MRI of the brain for suspected cerebral toxoplasmosis
- Brain imaging may be performed if CNS or congenital toxoplasmosis is suspected.

Toxoplasmosis: Treatment

- Immunocompetent patients do not usually require treatment.
- Indications include immunosuppression, pregnancy, and severe infection (e.g., active ocular toxoplasmosis).

Toxoplasmosis: Prevention

- General advice:
 - Wash hands after handling raw meat or cat litter.
 - Thoroughly cook meat.
- Pregnant patients:
 - Avoid cats.
 - Do not clean litter boxes (if unavoidable, wear gloves).



The resistant form of Toxoplasma gondii that contaminates soil and water is:

- A. Trophozoite
- B. Merozoite
- C. Oocyst
- D. Sporozoite
- E. Schizont

Correct Answer: C) Oocyst

Thank you