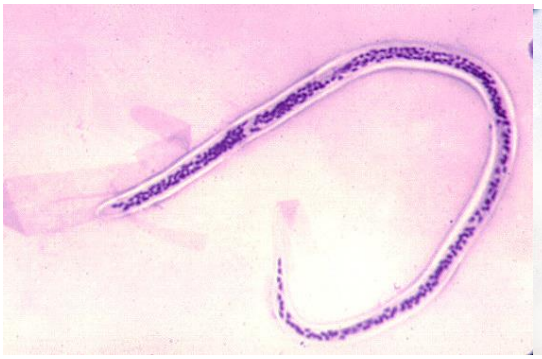
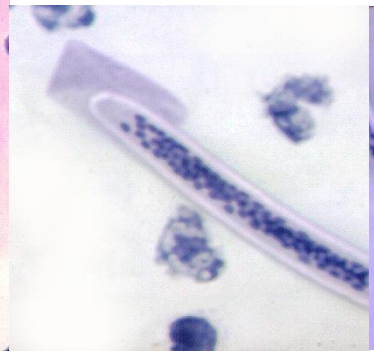
Wuchereria bancrofti Filariasis

Organism:

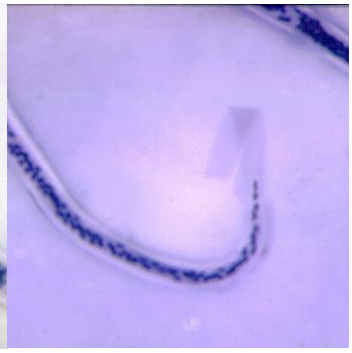
Infections are transmitted to humans by the bites of obligate blood-sucking arthropods that had become infected through ingesting larvae (microfilariae) contained in a blood meal obtained from a mammalian host. The filarial nematodes are a group of arthropod-borne worms that reside in the subcutaneous tissues, deep connective tissues, lymphatic system, or body cavities of humans. Some adult filarial worms can survive in the human host for many years, causing a number of chronic and debilitating symptoms, including inflammatory reactions.



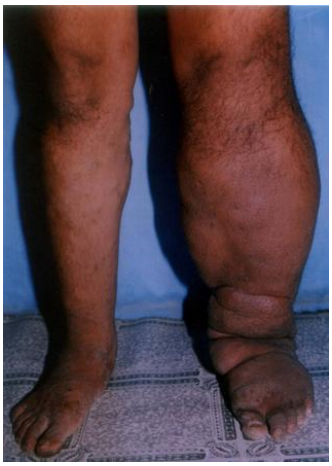
Wuchereria bancrofti microfilaria

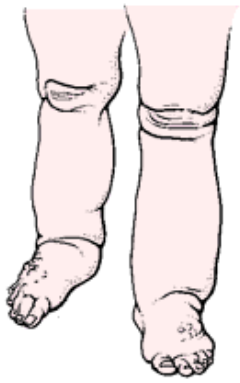


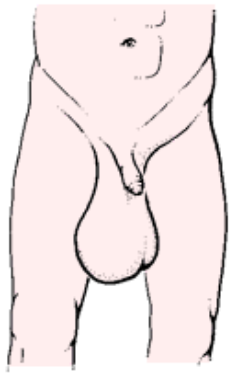
W. bancrofti head

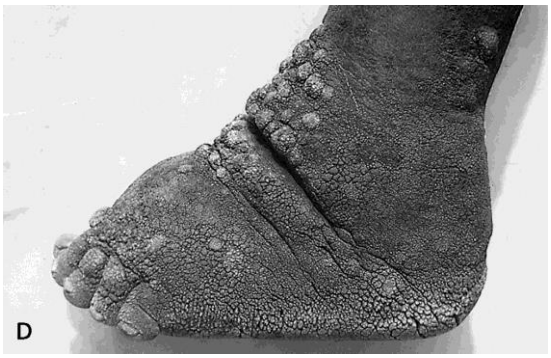


W. bancrofti tail









Various images of elephantiasis

Life Cycle:

The female worms produce large numbers of larvae called microfilariae, which are highly motile, thread-like prelarvae that in some species maintain the egg membrane as a sheath; these are called sheathed forms, while those that rupture the egg membrane are called unsheathed forms. Once released by the female worm, microfilariae can be detected in the peripheral blood or cutaneous tissues, depending on the species. The microfilariae, which may survive for 1 to 2 years, are not infective for other vertebrate hosts, nor do they undergo any further development in the vertebrate host. The infections are transmitted to humans by the bites of obligate blood-sucking arthropods that had become infected through ingesting larvae (microfilariae) contained in a blood meal obtained from a mammalian host. The asymptomatic incubation period can be from 6 months to 3 years; therefore, the chances of eliciting a relevant patient history are rare, at best.

Each parasite has a complex life cycle, and human infections are not readily established unless there is intense and prolonged exposure to infective larvae. After exposure, it may take years before significant pathological changes in the human host are evident. In the adult stages, human filarial parasites inhabit the lymphatic system, subcutaneous tissues, or deep connective tissues. The adult females produce microfilariae, i.e., prelarvae that may retain the egg membrane (sheathed microfilariae) or may lose it (unsheathed microfilariae). Once released by the female worm, microfilariae, which are highly motile and threadlike, can be detected in the peripheral blood or cutaneous tissues, depending on the species. The microfilariae, which may survive for 1 to 2 years, are not infective for other vertebrate hosts, nor do they undergo any further development in the vertebrate host.

Humans and mosquitoes are necessary to complete the life cycle of *W. bancrofti*. The intermediate host, a mosquito, acquires the infection by ingestion of microfilariae in the blood meal. The major vectors are culicine mosquitoes in

urban and semi-urban areas, while anophelines are involved in the rural areas of Africa, and Aedes is found in the Pacific islands. An individual within an endemic area is exposed to approximately 50-300 infectious larvae each year. Within hours after their arrival in the mosquito stomach, the microfilariae lose their sheaths. The larvae then penetrate the wall of the gut, migrate to the thoracic muscles, and develop into infective (filariform) larvae over a period of 7 to 21 days. The larvae migrate to the labella (distal end of the proboscis) of the mosquito and enter the skin of the definitive host through the puncture wound when a blood meal is taken. The infective larvae enter the peripheral lymphatic system and migrate to lymph vessels distal to the lymph nodes, where they grow to mature female and male adults and mate. Thousands of developing embryos can be found within the uteri of the female. Microfilariae are released from the gravid female and can be detected in the peripheral circulation in 8 to 12 months postinfection; however, filariasis without microfilaremia is not uncommon.

Acquired:
Infection in humans is acquired through the bite of infected mosquitoes.

Epidemiology:
W. bancrofti infections are widely distributed throughout the tropical and subtropical regions of Africa, Asia, Central and South America, the Caribbean islands, and the Pacific Islands. It infects an estimated 115 million individuals; however, based on diagnostic test limitations, the actual number may be twice as great. *Anopheles* and *Culex* mosquitoes are night-biting vectors for the nocturnally periodic *W. bancrofti*, while the subperiodic strain is transmitted by day-biting *Aedes* mosquitoes. In areas of endemicity, exposure begins early in childhood, with microfilaria rates increasing with age, although the infection may not be clinically apparent.

Clinical Features:
Early symptoms of filariasis include high fevers (filarial or elephantoid fever), lymphangitis, and lymphadenitis. Filarial fever usually begins with a high fever and chills that last 1 to 5 days before spontaneously subsiding, and in many cases, patients with filarial fevers do not have a microfilaremia. The lymphangitis will extend in a distal direction from the affected nodes where the filarial worms reside. Lymphadenitis and lymphangitis develop in the lower extremities more commonly than in the upper. In addition to limbs, there can be genital (almost exclusively a feature of *W. bancrofti* infection) and breast involvement. The lymph nodes most often affected are the epitrochlears and femorals. The nodes are firm, discrete, and tender and tend to remain enlarged, while the lymph vessel is indurated and inflamed. The overlying skin is tense, erythematous, and hot, and the surrounding area is edematous. Occasionally, abscesses form at the lymph node or along the lymphatic system and may take 2 to 3 months to heal.

Obstructed genital lymphatics may lead to hydrocele or scrotal lymphedema. Lymph varices near the scrotal surface are readily seen and may rupture. Obstruction of the retroperitoneal lymphatics may cause the renal lymphatics to rupture into the urinary tract, leading to chyluria. Chyluria is often prominent in the morning and is intermittent. Almost half of the microfilaremia patients will have renal abnormalities characterized by proteinuria and hematuria.

Acute filarial lymphangitis occurs when the adult worms die, leading to severe localized inflammation. This syndrome appears to be uncommon in untreated individuals. The dead worms may be absorbed, or they may calcify or produce abscesses. The inflammatory reaction evoked by the filarial infection is a result of host reactions to the products of the developing worm or its death. Microfilariae do not appear to be responsible for the major sequelae of lymphatic filariasis.

Clinical Specimen:
Blood: In areas of endemic infection around the world, the presumptive diagnosis of filarial infections is frequently based on clinical evidence; however, definitive diagnosis is based on the detection of microfilariae, primarily in the blood.
Serum: Except for patients not native to the area of endemicity, immunodiagnostic tests are of limited value.

Laboratory Diagnosis:
Blood: Detection and identification of microfilariae in the blood (smears and/or concentrations). Assays for the detection of circulating antigen of *W. bancrofti* rely on two diagnostic tests, an Og4C3 ELISA (Trop Bio Og4C3 Antigen test, Trop Bio) and an immunochromatographic card test (NOW ICT, Binax). The sensitivity of the Trop Bio test is close to 100%, while the specificity is about 99-100%. The ICT test has a sensitivity of 96-100% and a specificity of 95-100%. PCR assays are becoming useful diagnostic tools because they can discriminate between past and present infection, can be used to monitor therapy, and can be used to detect and differentiate multiple filarial infections

Serum: Current tests lack both sensitivity and specificity, and most people from the region of endemicity will have a positive serologic response. This response may be due to exposure to nonhuman filarial antigens from infected mosquitoes, and filarial antigens may cross-react with antibodies to other parasitic diseases.

Ultrasonography: Infection with *W. bancrofti* not only affects the structure and function of lymphatic vessels but also is associated with extralymphatic pathology and disease. Since it is now possible to detect living adult worms by

ultrasonography, a great deal of emphasis is placed on lymphatic pathology. However, the finding of renal damage in asymptomatic microfilaremic carriers has led to increased recognition of the importance of extralymphatic complications in bancroftian filariasis. Filarial pathology of the male genitalia is apparently underreported if physical examination alone is evaluated.

Organism Description:

Adult: Adult worms are minute and threadlike, have a smooth cuticle, and are found in the lymph nodes and lymphatic channels. Adult males are about 40 mm long by 0.1 mm in diameter. Adult females are 80 to 100 mm long by 0.24 to 0.30 mm in diameter.

Microfilariae: The microfilariae range from 244 to 296 µm long and actively move about in the lymph or blood. The microfilaria has a sheath, and the body nuclei do not extend to the tip of the tail

Laboratory Report:

Serology results indicated (with interpretation); microfilariae identified and reported

Treatment:

The two important drugs in the treatment of filariasis are diethylcarbamazine and ivermectin, which may be used in combination with albendazole. Treatment differs depending on the objective, interruption of transmission by microfilaria suppression or treatment of an individual patient.

Garcia, L.S. 2007. Diagnostic Medical Parasitology, 5th ed., ASM Press, Washington, D.C.

Control:

Since these helminths do not multiply within the human host, infection levels are related directly to the number of infective larvae to which humans are exposed. Individual protection involves the use of insect repellents and bed netting; however, long-term protection has been sought through vector control and the use of chemotherapy.