FILARIASIS AND DIAGNOSTIC TOOLS: REVIEW OF LITERATURE

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ABSTRACT

Filariasis is one of the causes of morbidity and long-term disability. In the past, diagnostic tools for diagnosing filarial infestation were limited to clinical diagnosis and detection of microfilariae in blood smears. There have been significant advances in diagnostic tools in recent years. It is obvious that the thoughtful use of these new tools are helpful in combating against filariasis.

Key words: Filariasis, diagnosis

INTRODUCTION

Lymphatic filariasis is one of the leading causes of permanent and long-term disability in the world. WHO estimates there are a billion people at risk in about 80 countries. Over 120 million have already been affected by it, and over 40 million of these are seriously incapacitated and disfigured by the disease. One third of the people infected with the disease live in India, one third are in Africa and the rest are in South Asia, the Western Pacific and parts of Central and South America. The disease, transmitted from person-to-person by mosquitoes. Infection can lead to elephantiasis or lymphoedema of arms, legs, breasts, genitals, or a number of other signs and symptoms.¹⁻³ Diagnosis of filariasis is important for programme managers for situation analyses, for monitoring and evaluation of intervention measures; and for physicians in case detection and treatment/management.⁴

SAGA OF FILARIASIS: A BURDEN ON SOCIETY

Human infection with Wuchereria bancrofti causes a disabling parasitic disease known as lymphatic filariasis, which is a major public health and socio-economic problem in many parts of the world.⁵ Ninety percent of lymphatic filariasis is caused by Wuchereria bancrofti, and most of the remainder by Brugia malayi. For W. bancrofti, humans are the exclusive host, the major vectors for W. bancrofti are culicine mosquitoes in most urban and semi urban areas, anopheles in the more rural areas of Africa and Aedes species in...
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many of the endemic Pacific islands. For the brugian parasites, Mansonia species serve as the major vector, but in some areas anopheline mosquitoes are responsible for transmitting the infection. Brugian parasites are confined to areas of eastern and southern Asia especially India, Malaysia, Indonesia, the Philippines and China. 

Lymphoedema significantly affects physical, psychological and social functioning in affected individuals. Morbidity control, in addition to control of physical disability, should target the psychosocial consequences.

Onchocerciasis is a common, chronic, multisystemic disease caused by the nematode *Onchocerca volvulus*. The disease characteristically includes dermatologic, lymphatic, ophthalmologic, and systemic manifestations. It is transmitted to humans by a bite from the intermediate host, the black fly (*Simulium damnosum*). Onchocerciasis (river blindness) is a blinding parasitic disease that threatens the health of approximately 120 million people worldwide. While 99% of the population at-risk for infection from onchocerciasis live in Africa, some 500,000 people in the Americas are also threatened by infection. A relatively recent arrival to the western hemisphere, onchocerciasis was brought to the New World through the slave trade and spread through migration. The centuries since its arrival have seen advances in diagnosing, mapping and treating the disease.

Loa loa is the filarial nematode species that causes *Loa loa* filariasis. It is commonly known as the "eye worm". Its geographic distribution includes Africa and India. The filarial parasite *L. loa* causes a chronic infection in humans that has two very characteristic clinical features: Calabar swellings (localized angioedema found predominantly on the extremities) and subconjunctival migration of the adult parasites ("eyeworm").

Human subcutaneous dirofilariasis (HSD) is a zoonotic filariasis caused by infection with several species of worms belonging to the genus *Dirofilaria*; most documented cases are attributed to *Dirofilaria repens*. Dirofilarias are natural parasites of a great variety of animals and, with the exception of *D. immitis*, live in the subcutaneous tissue of their hosts, produce circulating microfilariae, and are transmitted by mosquitoes. *D. repens* is identified by the presence of external longitudinal cuticular ridges and transverse striation, there are other Dirofilaria, which shows these morphology. Exact identification of species may be possible only after studying the fully matured worm. However, *D. immitis* can be differentiated from *D. repens* by the absence of longitudinal ridges and transverse striation. Subcutaneous migration of the worm may result in local swellings with changing localization (creeping eruption). In addition, rare cases of organ manifestation have been reported, affecting the lung, male genitals, female breast, or the eye.

**CONVENTIONAL APPROACH TO DIAGNOSIS**

Diagnosis of bancroftian filariasis relied until recently almost exclusively on the detection and identification of microfilariae in night blood specimens. The reason for this is that, in most geographical areas, *W. bancrofti* microfilariae have a natural periodicity, with highest intensity in the peripheral blood at night and few or none during the day. The other alternative test is a DEC provocation test, where the suspected patient is given a single oral dose of 50–100 mg of diethylcarbamazine, followed by a blood sample 30–45 minutes later: this procedure can "flush out" microfilaria into the
peripheral blood during day time and has a sensitivity that is almost comparable to that of night blood surveys.\(^{19-20}\)

![Image of adult worm in tissue](image)

**Figure 1.** Dirofilaria repens adult worm in tissue, comprising of thick multi-layered cuticle.

The demonstration of microfilaria in the peripheral blood, urine or in body fluids like hydrocoele fluid remains a useful and specific test for the diagnosis of a current filarial infection. However, the thick blood smear technique normally employed to detect microfilaria is insensitive and as both *W. bancrofti* and *B. malayi* microfilaria peak in the peripheral circulation at night, a nocturnal specimen is normally needed for diagnosis to increase the chance of detecting the infection. Larvae or adult filaria parasite sections are sometimes encountered during histological examination of pathological specimens. Filaria parasites encountered in tissue sections have been identified as *Brugia*, *Wuchereria* or, rarely, *Dirofilaria*.\(^{21}\)

Venous blood drawn at night and filtered through millepore membrane filters, enables an easy detection of microfilaria and quantifies the load of infection. They are usually observed in the early stages of the disease before clinical manifestations develop. Once lypoedema develops microfilaria are generally absent in the peripheral blood.\(^{22}\)

Ultrasonography has helped to locate and visualise the movements of living adult filarial worms of *W. bancrofti* in the scrotal lymphatics of asymptomatic males with microfilaraemia. The constant thrashing movement of the adult worms in their ‘nests’ in the scrotal lymphatics is described as the ‘filaria dance sign’.\(^{23}\)

**NEW ERA OF DIAGNOSIS**

Enzyme-linked immunosorbent assays (ELISA) using soluble extracts of *B. malayi* microfilaria, infective larva or adult worms can be used for diagnosis. However, positive readings were obtained in 93-100% of subjects living in endemic areas, those with microfilaraemia as well as those with clinical evidence of filariasis.\(^{24}\) Antigen testing is now recognized as the method of choice for detection of *W. bancrofti* infections. Unlike tests that detect microfilariae, antigen tests can be performed with blood collected during the day or night. However, existing enzyme-linked immunosorbent assay (ELISA) tests
for filarial antigenemia are difficult to perform in the field, and this has limited their use in endemic countries.²⁵

A need has been felt for the development of rapid, specific, sensitive and reproducible diagnostic methods for field application for the detection of infection (microfilaremia or adult parasites) both in humans and in vector mosquitoes. A rapid day blood immuno-chromatographic card test (ICT) for detection of infection, developed elsewhere has been found highly specific and more sensitive in India also in comparison with the night blood smear examination. Although it is costlier, it has the advantage of on the spot day blood detection of parasite carriers in large numbers (compared to the night blood smear examination).⁴ The other newer diagnostics include Og/C antigen assay in human whole blood and sera⁴ and DNA probes for infection detection in vector/mosquito.⁴ Real-time PCR of skin snip samples is significantly more sensitive than microscopic examination for the detection of *Onchocerca volvulus* microfilaraemia. The molecular assays required smaller amounts of blood and tissue than conventional methods and could be performed by laboratory personnel without specialized parasitology training. Although not quite ready for widespread use in areas of endemicity, the successful performance of these molecular assays is an important step forward in making accurate filarial diagnostic tools more accessible to clinical parasitology programs that serve internationally mobile populations.³⁰

**CONCLUSION**

The specific laboratory diagnosis of filariasis depends either on the demonstration of circulating microfilaria in the peripheral blood or various stages of the parasite in tissue sections. Concentration techniques, can detect the parasite in those with very low microfilaria counts. A rapid day blood immuno-chromatographic card test can assist in confirming a clinical suspicion of filaria infection. The development and use of specific monoclonal antibodies for the detection of circulating antigens in the enzyme-linked immunosorbert assay will probably increase the specificity of the assay.

**REFERENCES**