


# All What You Need To Know About the Lymphatic Filariasis

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**Abstract**
Parasitic diseases are rare in the world but have gained importance with the rise in refugees, leading to millions affected individuals in the region. Symptoms from diseases like lymphoedema may appear years later in migrants and tourists. Specific parasites like *W. bancrofti* and *T. b. rhodesiense* are found in Uganda, with cases clustering in certain areas. In a study of 1000 people, around 15 showed significant symptoms of lymphatic filariasis (LF), often overlooked in Latin America. LF mainly occurs in low Andean areas and is transmitted by mosquitoes, with chronic conditions like elephantiasis being serious health concerns. Treatment for LF includes surgery, especially for hydrocele, which can improve health outcomes. Acute symptoms arise from dying adult worms, while chronic symptoms develop over years, with some patients seeking traditional remedies. Diagnosis can be done through blood tests and imaging. The Global Programme to Eliminate Lymphatic Filariasis (GPELF) aims to eradicate LF through mass treatment and research on effective antifilarial drugs. Despite successes in some countries, LF continues to pose public health challenges, affecting millions with economic impacts. Ongoing research into vaccines and treatments is crucial for better management and control of LF.

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## 1. Introduction

Parasitic diseases are rarely encountered in Europe but have recently gained importance with the influx of refugees. An estimated 8 million people from endemic areas live in Europe [1]. After entry, migrants and tourists may present years later with lymphoedema due to filariasis. W. *bancrofti* is endemic to Kampala, whereas T.b. rhodesiense is endemic to a narrow belt along the Lake Victoria valley. The distribution of cases is non–exponential indicating an aggregation of cases [2]. The Born approximation used in the radiology literature to model lung nodule distributions reflects an underlying unimodal distribution. The Trent focus for human (filarial) lymphoedema predictions estimates the number of people currently affected and at risk of clinical disease [3]. The movement of a total of 1000 people would have similar estimates of 15 symptomatic people with nodule loads ≥100/cm2. Starting with a 100-Hz transient, the Born approximation predicts attenuation coefficients of 1.1/cm (diffuse) and 5.8/cm (212o, 2-MHz tone burst) at 0.5 MHz. More sophisticated generalisation of the 1-D Born model may provide a method for estimating nodule size distributions. Rudimentary models of aggregation may help to explain the observed focus of infection, the association of non-uniform distribution with speed of progression, and targeting of intensive parasite killing by nodulectomy [4]. The comprehensive school always had about 450 boys and men aged 11–20. Annual blood surveys in a 1% sample began in 1972 and in the whole school in 1978. Initial screening, and a later 2-year randomised trial of DEC relative to placebo, concerned only those with microfilariae. The mean annual change in microfilarial load, in a minimum of 10 fields, recorded in random Survey screens, was −14,900 para/site/y for those on DEC, and +6700 para/site/y for those on Vit. C ($p < 0.00005$). Equivalent results for the trial screens were −12,900 and −7900 (ns) [5].

## 2. Epidemiology

Lymphatic filariasis (LF) is a neglected tropical disease that is caused by infections with filarial nematodes – *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori*. It is often considered as a forgotten disease in Latin America, as transmission has been interrupted in all countries except for Guyana, Haiti, the Dominican Republic, and Brazil and morbidity of filaria has been overshadowed by a continuous higher burden of Malaria and Dengue [6]. It is believed that W. *bancrofti* was brought into South America during the slave trade period. Back then, LF was described for the first time in 1869 in two Afro-Brazilian slaves living in Recife, Brazil. Thereafter, the disease spread widely across the tropics and subtropics, involving rural and urban areas [7]. In Ecuador, no official data has been published on the prevalence of LF. Guyana, Suriname, and Venezuela have interruption of transmission status in the Americas. In the 90s, cases of LF were reported in Argentina and Brazil. LF is transmitted by *Anopheles quadrimaculatus*, *Aedes aegypti*, *Culex quinquefasciatus*, and recently *Anopheles* punctimaculae [8,9]. In Latin America, the estimated number of cases of LF dropped from 298,000 in 1985 to 12 (zero from 1991) cases in 2017, and additional 0 autochthonous cases were confirmed in Brazil in 2019. Lymphatic filariasis is a mosquito-transmitted filarial parasitic infection. The most affected population is low Andean indigenous groups. The causal agents are *Wuchereria bancrofti*, a filarial nematode found in the Asia-Pacific region, parts of Africa, and the Americas, including Brazil; additional agents include *Brugia malayi* and *Brugia timori* [10]. The disease is considered one of the most dreaded and disabling in the world. Post-infection lymphatic obstruction causes chronic manifestations, with tropical swelling of the lower limbs being the most common. The infection cycle starts when a mosquito ingests microfilariae, which develop into infective larvae that infect humans (or other hosts) via bites. After entering the human host, the larvae molt into adult parasites that colonize and reside on the lymphatic and, subsequently, deepen into the patient's body, moving to the lymphatic network [11] (ElShewy, 2024). There are two relatively independent commercial templates as an approach to study the dynamic processes of infection, drug treatment, and transmission control. The models incorporate both the intrinsic biology of the parasite and vector, including dispersal, and the somatic dynamics of the host. A new formulation is proposed that mechanistically simulates the effects of bacterial endosymbionts on parasite fecundity and worm survival. This model was used to analyze infection dynamics in large communities with the chaotic community removal with a drug campaign [12]. Surprisingly, this model indicates that the final load of parasitic forms in human hosts is too low to explain the typical observed load of lymph adult parasites after long exposures. The pharmaceutical companies that make antiparasitic drugs and produce other types of drugs have suffered fines for related reasons. The World Health Organization has been promoting the elimination of LF as a public health problem by 2030. In the case of Ecuador, during the period 2001-2019, there were 16 notifications of filariasis, without specifying the species or symptoms, although no cases of local transmission were reported [13].

### 2.1. Global Distribution

Parasitic diseases are rarely encountered in Europe. In the era of worldwide migration, knowledge of such diseases has gained importance [4]. Parasitic diseases lead to significant socioeconomic and psychosocial damage, with consequences far exceeding the medical aspects of these diseases. While clinical aspects of these diseases are relatively well-known, the imaging features are not. For the majority of parasitic diseases, ultrasound plays a crucial role in diagnosis. This review aims at describing the clinical and imaging features along with current treatment strategies, mainly for filariasis [14].

Nematodes (roundworms) are an abundant phylum of parasites and cause a wide spectrum of pathogenic infections since humans, as definitive hosts, play important ecological roles. In 2017, Schistosomiasis alone affected over 160 million people with 700 million people at risk [15]. Filariasis is caused by thread-like (filaria) parasitic nematodes (roundworms) and affects 150 million people worldwide. Dracunculiasis was the first parasitic disease completely eradicated in 2015, and with ongoing mass drug administration (MDA), most control programs will also eliminate filariasis in the coming years. Only three species of nematodes infect humans and cause lymphatic filariasis (LFI), affecting approximately 60 million patients globally [16]. LFI caused by *Wuchereria bancrofti* mainly afflicts patients in tropical regions of India, Southeast Asia, Latin America, and sub-Saharan Africa. Another filarial pathogen is *Brugia malayi* and is mainly found in China, India, Malaysia, Indonesia and the Philippines. Differing from other filarial species, Mansonella species do not have any significant abnormalities in the lymphatic vessels or lymph organ [17]. Transmitted by a mosquito vector, particularly anopheline and culicine genera females, filarial microfilariae are taken up with a blood meal and then subsequently released into the skin. Subsequently, these microfilariae invade local lymphatic vessels and develop there into mature adult worms after approximately nine months. After copulation, infective larvae (L3) are produced, pass through lymphatic vessels and subsequently circulate in peripheral blood [18]. These larvae are aggressively expelled by blood-feeding mosquitoes, restarting the life cycle. The long adult worms' life-time, up to seven years for W. *bancrofti*, is due to successful strategies of immune evasion, such as the development of a sheath that hinders attacks from lymphatic leukocytes. Filarial disease is significantly influenced and determined by the extent, as well as the continuity, of exposure to infective mosquito bites [19]. With recurring mosquito bites, the lymphatic vessels are recolonized first with a low quantity of adult worms (the relationship between worm load and disease is likely non-linear), but the obstruction is amplified by syndromic co-factors that trigger it or exacerbate it over time (e.g., lower-limb injury). Assisted with the injury, limited range of motion, neurologic conditions, comorbidities, and aging, the lymphatic pathogens further enhance a vicious, positive loop [20]. There is now robust evidence to recommend Lymphatic Filariasis (LF) patients diagnosed with hydrocele undergo surgery, particularly hydrocelectomy. As well as markedly enhancing the traditional benefits associated with hydrocelectomy (improved mental health, psychosocial conditions and economic productivity), onchoceling hydrocelectomies permit detailed epidemiological data to be gathered [6]. This data is profoundly valuable for ongoing and potential transmission assessment surveys. Their potential for informing post-Transmission Assessment Survey (TAS) interventions capable of hastening (and thus, financially and

logistically simplifying) the arrival of post-validation surveillance periods substantially expands the tradition rationale for surgical intervention in LF patients. Method Invocation an essential service to be considered in an integrated, global LF elimination strategy [21]. The traditional storey submission, vesiculectomy (VE), may be contributing to the knowledge and understanding of the current distribution and spread of Lymphatic Filariasis in another region of Northern Nigeria. Using the VE procedure on the data analysis and medical management of Hydrocele Filariasis cases seen in both the consulting surgical unit and the Background: In The Documented 34-year plunge medical school's LB Shitu surgical unit Tor, Bungudu and priyan improvement in Burura HCFS, 37 out of 48 cases (77.1%) [22].

### 2.2. High-Risk Regions

Lymphatic filariasis (LF) is an infection most commonly caused by the nematodes *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori*. LF is endemic in tropical and subtropical regions which puts up more than one billion people at risk of infection. Of eight filariases identified, three are zoonoses, animal diseases that affect humans who are infected as accidental hosts to the disease [23]. The zoonoses include: zoonotic *Brugia* (or Malayan filariasis) which makes humans prone to B. *malayi* and B. pahangi and spread by Mansonia mosquitoes. *Bancrofti*an or endemic *Brugia*n filariasis that occurs in human disease in Africa, the South Pacific and in untwinned regions is affected by *Anopheles*, Aedes, and Culex mosquitoes. *Loa loa* or loaisis is a disease of humans and primates spread by Chrysoconops and Tabanus tabanids [24]. By 2007, 83 countries had reported the presence of LF. Nigeria is one of the most endemic countries, with more than 40 million affected people. The Northern area of Nigeria is characterized by feeding cows with the capacity to plow and fertilize fields. The cows which plow the fields are slaughtered in the presence of people and the carcasses thrown open for vultures [6]. This practice puts people in the LF-endemic North Western part of the country at high risk of infection. Other places that are considered the most affected are those with history to livestock. Such short-lived stories often result in a masking of the real problem and often leave the scheduled site uninfected except for close supervision [16] Hussaini *et al*., 2020).

## 3. Pathophysiology

Lymphatic filariasis is a major global-health problem, caused by three species of mosquito transmitted nematode worms. Out of these *Wucherearia bancrofti* is the most prevalent nematode worm in tropical and subtropical regions [25]. Infection with these worms can involve in thickening of the walls of lymphatic channels, blockage of lymph flow via an assortment of worms or viably as a consequence of swelling of the nodes. The disorders lymphostasis, lymphedema, elephantiasis nervosa, and filariasis are interchangeable with the clinical condition named as lymphatic filariasis (LF). It is thought to affect over 120 million humans with an initial risk for over 1.34 billion in 83 countries, accounting for 40% of the global HIV condition, causing 36 billion as an annual source damage to its confrontation. Microfilaria is the circulating kind of filarial worm that spends its time in the blood or in the lymphatic and surrounding tissues [6].

Adult worms are only transmitted from person to person by the female mosquito *Anopheles* sp. They release microfilaria in the night in order to get ready for sucking of blood. This is help the microfilaria to move out of the locations where they are present to be expected to be reached by their host and attacked by the defenders [26]. These develop further inside the mosquito into more infective larval stages, after they are transmitted back to a new life, through the bite of the mosquito. These eventually mate and the female thereafter develops inside the human, this is an exotic place for them to mature but it is of use as mosquitoes only land on living beings. When a dead person is bitten by mosquitoes, they immediately leave that host and find live sites. At maturity, the female produces microfilaria in large amounts [27].

### 3.1. Life Cycle of Filarial Worms

Three species of filarial worms cause lymphatic filariasis (LF): *Wuchereria bancrofti*, *Brugia malayi*, and B. *timori*. LF infects approximately 60 million patients worldwide, with about 19.4% living in the West Pacific Region and 35.3% in the South-East Asia Region [11]. The first two species mentioned above affect India. Among these three species, W. *bancrofti* is responsible for approximately 90% of infections. B. *malayi* is a variant of *bancrofti*an filariasis, more prevalent in East Asia [4]. LF caused by W. *bancrofti* occurs in more than 80 tropical and subtropical countries, with Indonesia and India accounting for the majority of the global disease burden.

Malaria is another major disease in the tropics and the coexistence of these two diseases is well-documented. There is considerable overlap in endemic areas between filariasis and malaria, with Aedes, *Anopheles* and Culex being common vectors for these diseases [28]. Thus research into the association between these two diseases and their vectors was widespread in the past. However, little research has concerned the ecological characteristics of the coexistence of malaria, filariasis, and their potential vectors [29]. Although engaging in vector control activities targeting one of the two diseases may have ancillary benefit to the other, consideration of the implications their control in the broader ecological context is essential for avoiding negative outcomes. For example, bed-nets create selection pressure for outdoor biting and resting mosquito behaviors, which in theory could facilitate greater transmission of filariasis. In Sumba, Indonesia, where both diseases coexist and both mosquito species play a role in their transmission, their population dynamics and dispersal need to be studied. The results will help design better, more ecologically solid, vector control strategies [30].

### 3.2. Immune Response

Lymphatic filariasis (LF) is a tropical infectious disease caused by the filarial nematodes *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*. The nematode larval stages L3, released by the mosquito, enter the host, migrate to the lymphatic vessels, and develop into adult worms causing lymphatic obstruction. Some of these worms produce many microfilariae (Mf) which circulate in the blood. When mosquitoes feed on an infected individual, they pick up Mf leading to the transmission of the infection [11]. The disease manifests into various clinical conditions, termed as lymphedema (considered as chronic and acute), hydrocele, and elephantiasis of male and female external genitalia. The disease is immunologically complex with a variety of immune responses. Since transmission is dependent on lifelong carriage of worms, continuing the immune responses

which may kill worms and/or reduce the energy available for reproduction can interrupt parasite transmission [31]. The parasite utilizes mechanisms which suppress protective responses to establish infection. Understanding the immune response will lead to drug development strategies which can reduce the persistence of worms and hence the chronic infection seen in some sectors of the community. The host-parasite relationship also influences the immune response [32]. The parasite can modulate host immunity in many ways to ensure its survival. Immune modulation resulting in the suppression of the host defense mechanism against the parasite has mainly been studied with protozoan, helminthic and nematode parasites. Immune responses to nematode parasites are mixed, leading to the concomitant production of various cytokines and other factors which do not provide unequivocal information as to their protective role against parasites [33]. Nevertheless, epidemiological data seem to suggest that acquired specific immunity does develop to these parasites permitting partial restriction of reinfection in areas of endemicity with the same parasite species as well as restricting the infection rate. In the last decade there has been a substantial increase in the development of immunological methods which, in principle, allow the host response to infection to be studied, either in infections with protozoan, helminthic or arthropod parasites. A wide range of techniques has been applied to studies of immunity to parasites, and many as yet untested methods are possible [34]. Immune responses to parasite antigens by infected hosts can be quantitatively analysed by the following methods; testing serum antibody levels for the presence or absence of specific high-titre IgG, typically against purified antigens or antigenic preparations, and the kinetics of infection-induced or boosting antibody responses, measuring the avidity of the antibody response as an indirect measure of V region mutation, measuring various classes of delayed hypersensitivity responses, measuring the proliferation of T cells isolated from infected hosts to parasite antigen in vitro. These techniques have been utilized to examine the development of immune responses in animal models for a wide range of parasitic infections as well as in natural infections [35].

## 4. Clinical Manifestations

Lymphatic filariasis (LF) is one of the most debilitating neglected tropical diseases in the world. Clinical manifestations can manifest as asymptomatic host status, acute episodes, and chronic conditions. The main cases at a chronic condition are elephantiasis, lymphedema, and hydrocele [36].

Person with lymphatic filariasis for several years, can appear swelling from enlargement infected lymph nodes or enlargement of the accumulation of lymph liquids that have been disrupted by obstruction by the worms in the lymphatic vessels. People with lymphatic filariasis clinically can be divided into several categories including Asymptomatic (subclinical) carriers (10%), Acute filariasis phase (20%), and Chronic Filariasis (70%) [37]. Chronic patients have an incubation period of about 10-20 years before showing visible symptoms. Nearly 1/5 of the world's cases are in Indonesia. Indonesia has a national program of Filariasis control called 2T drugs but has not been able to reduce the number of cases nowadays. Filariasis can render a person unable to move and engage in productive work. This disease tends to make infected people stigmatized plus a variety of other reasons that exacerbate the severe condition until his/her life is very difficult [38].

There was a 35 years old male patient diagnosed with 4 years right upper limb swelling limb lymphedema who had previously been known to live in an LF endemic area. The existence of lymphedema was so giant and severe, making it difficult for the patient to work and be stigmatized. Multiple examinations have been carried out to tackle the disease [39]. The main action done in this case is this surgery. Surgical treatment was performed using liposuction and dermo-lipectomy procedures in the right arm and thorax to reduce the diameter of the lymphedema. The result of this procedure obtained good retraction and the patient was able to use external pressure therapy, so the patient's activity increased and was able to work again [40].

### 4.1. Acute Symptoms

Acute disease is caused by the spontaneous or drug-induced death of adult filariae. The acute phase (AF), also known as "febrile filariasis," is characterized by repeated attacks with filarial fever associated with chills as well as complications, such as acute lymphadenopathy (ADL), myalgia, and, rarely, complications from lymphatic vessels. There reoffending is described as a "fever attack occurring once, twice, or five times as a rule in a year." In a milder course, symptoms may resolve within a few days, and in a more severe course, remission occurs after about one or maximum two weeks [11]. Moreover, the painful palpable lymph nodes on the anterior side of the neck but also inguinal are characteristic. Tropical pulmonary eosinophilia with eosinophilia and, more rarely, patients affected by nocturnal wheezing belong to acute symptoms. "Microfilariae can be trapped in the lungs (between 2% and 15% of affected individuals) thus inducing an immune response and granuloma with local eosinophilia and meanwhile loss of microfilariae into alveoli and bronchioles. The finding of ingurgitation lines in the presence of retrograde lymphangitis in the lungs can be misinterpreted as miliary tuberculosis and should be known because of the complete different therapy." Enteritis or colitis are often signs of bacterial superinfections in diseased LFs [41].

Currently only: molecular methods (antigen or DNA detection or PCR) ultrasound for the lymph nodes how advanced techniques, and standard X-ray in peripheral areas (detection of inhomogeneous well-circumscribed pneumonia better visible on the right side as "the platform of azygos" in tropical pulmonary eosinophilia need to be considered and how these methods link to acute symptoms). The detection of acute symptoms could be possible by professional examination [4].

### 4.2. Chronic Symptoms

JG, 35 years old male came to the clinic with complaints of swelling, pain, jaundice, fever, and urticaria in the right inferior extremity since the last 5 days. There were diseases similar to the patient but experienced in other countries or regions [42]. Patients experienced mild pain in the hip joint accompanied by muscle weakness as a symptom of filariasis. However, the treatment given by public health efforts to drink mass medicine did not show significant changes. Patients seek help from traditional practices or non-health, such as dukuns, tend to look for supernatural causes and tend to treat with traditional medicines before medical treatment [37]. After obtaining a medical diagnosis, the majority of chronic filariasis with sequelae of lymphatic obstruction becomes

clear / evaluated scientifically or medically, 10-15 years after infection. Initial symptoms are either acute or subacute. Physical examination found edema type 1. In danger, it can be caused by biological, physical, or psychological factors or combinations that can potentially endanger entities or the environment [36]. There are 3 symptoms of danger based on the level of consciousness. Responsive up to help in needs. Temperature, pulse rates, respiratory rates, blood pressure, mucous membranes, diaphoresis, and laorose/oligo urine. Location intestine and hypothermia, loss of control system blood sugar. Treatment is an act to restore health (health care facility level). It is suggested to him to take the medicine provided by puskesmas because it is a health effort and should be taken continuously [43].

Filariasis is an infection caused by nematodes with *Wuchereria bancrofti* in the majority and *Brugia timori* and *bancrofti* microfilariae in very small proportions. An infection generally arises in the first 5-15 years of life, and it may take many years before symptoms develop. Infection with these parasites occurs after transmission by culex spp. And *Anopheles* mosquitoes with infected microfilaria in their saliva [44]. The microfilariae of the parent worm are located in the bloodstream and may be found in almost all tissues. Diagnosis of filariasis can be made by finding microfilaria in peripheral blood. There are 3 species of *Wuchereria bancrofti*, *Brugia malayi* and b. *Timori*. Of these 3 types, all have different characteristics related to the type of mosquito vectors and microfilaria. Symptoms in acute diseases such as lymphadenitis inguinalis, and lymphangitis are itching, pain, and swelling in the lymph nodes. Lymphangitis is manifested by red streaks [45]. Filariasis with lymphatic obstruction developments is chronic filariasis. Here there is a fee of solid edema, fibrosis, edematous fibrosis, tegumental thickening, and hyperpigmented plaque. The skin can be hypertrophic, verrucose, and fibrotic, with the formation of thickened, pebbled, and additionally fibrous and edematous folds on the surface. Edematous and fibrotic changes in the chronic fibrotic stage mostly occur subcutaneously [46]. More severe dermatolymphangioadenitis (DLA) causes compression of lymphatic channels and vessels, leading to the movement of interstitial fluid easily squeezed by subcutaneous connective tissue. This condition is thought to cause the entry of F members into the circulatory system. Except for elephantiasis, it can also cause cellulitis. The cell content of the circulatory system is increased, so that the composition of tissue fluid is not only water but also has a more cellular content, such as particulate skin pigments [47]. Because circulation slows down, straight-up structures are more petechiae and/or hyperpigmented. Cracks, ulcerations, secondary bacterial infections, and gangrene eventually occur in fisher horn lesions. Varicosities of the lymphatic channels that originally occurred due to lymphatic dilatation can also spread to natural lymphatic bifurcations caused by valves' blocking and retrograde flow. Consulting a primary health care doctor with the complaint of s foggy of gibbons durmiente (numb fogs), the patient experienced a phantom-like sensation. This situation is considered frightening, so it is good to obtain an explanation so first aid can be given [48]. Further, the patient has been suffering from illness for several years and to relieve the complaint, the patient binds the waist cords. It prompts the consideration, consult a health care professional to find a solution or ask the local community workers to provide information about the illness. Swelling in the right hand is an allergic reaction in the form of urticaria (skin rash with reddish color similar to kelambu) [49]. By knowing the previous treatment, suspected symptoms of filariasis either during treatment or caused by the treatment with DEC. Promptly consult health care providers or medical professionals for further examination or cancel the treatment and take blood thoroughly. Chronic filariasis most often experienced in Java. However, the patient may feel asserted due to several infectious diseases caused by bacteria. Large lymphatic vessels that drain the hind limbs have the C-shaped flow direction (cranio-cordial) to the outside. In the popliteal area, there are two main lymphatic vessels, the superficial and the deep [50]. While in mammals, deep lymphatic vessels in the popliteal and inguinal muscle regions are less common and sometimes do not exist. The narrowing of lymphatic vessels may be caused by parasitic infections due to filariasis *Wuchereria bancrofti*. A treatment for such cases can be administered without surgery by using drugs that are proven effective in killing the microfilaria [51]. Pharmacological therapy can be given in various combinations such as DEC 6mg, doxycycline 100mg, and amoxicillin 500mg. As for a prevention, it should be the maintaining the local situation with the environment. Lingering incurable filariasis infection left untreated by health services is most dangerous.-regexp of clinical fit to invest a parasitic disease by finding laboratories to patients with symptoms of fever, chills, hand lymphatic swelling, muscle aches and pains [52]. Prov and declare down as a first step to prevent the spread of pathogens elsewhere. Pro nearly for being infected shingle, it may become more cautious towards being affected.alertView for early signs and symptoms of the disease. Encourage individuals to be alert, work in groups, quickly get medical treatment, and do not panic. Word worth groups mentioning are not usually in the same state of partnership though most of the conditions are marked by being in the same state. In the case of symptoms occurring partnership, infected individuals should consult a health worker for assessment and further treatment respectively [53].

## 5. Diagnosis

The diagnosis of the disease can be done clinically in majority of cases. At times, demonstration of microfilaria in peripheral blood can help to establish the diagnosis. In some studies, it was performed in which on each of first 30 days of the antifilarial medication drive volunteers were spaced out in the school during school hours where one of us immediately collected the nocturnally circulating blood from four of them in plane vacutainers between 9 and 12 in night hours using disposable syringes [54]. The blood was filtered under light of battery operated emergency lamps within 1 hour. The cord was then observed in day light under magnifying plain glasses. Thereafter volunteer was directly inducted in the bed net assisted blood film collection driven by experienced health worker [55]. The volunteers served as clear light attractant source for mosquito that produce the microfilaria and help in the blood film collection from the volunteers. However during the study given in mechanized set up, the nocturnally circulating microfilaria was detected in day light from the cord of filtering rig itself [56]. Modern drug treatment for lymphatic filariasis is based on repeated mass drug administration (MDA) of albendazole combined with diethylcarbamazine or ivermectin. MDA is not recommended in areas co-endemic for LF and loiasis because of concern over severe reactions [57].

### 5.1. Clinical Diagnosis

Lymphatic filariasis (LF) is a mosquito-transmitted parasitic disease caused mainly by the parasitic form of the nematodes *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*. It is an important public health problem in tropical and subtropical countries of the world. The problem is huge because the World Health Organisation (WHO) estimated that 1.13 billion individuals lived in filariasis endemic areas in 1994 [11]. It has been estimated that approximately 120 million individuals are infected with these parasites, with over 40 million disfigured and incapacitated by the disease in Africa, the Americas, Western Pacific, South-East Asia and Eastern Mediterranean regions. This highlights the fact that filariasis is a global threat to public health [36].

Since the clinical spectrum of detection is wide, a number of different diagnostic tools, such as clinical, imaging, and ancillary diagnostic tests, may be appropriate according to the clinical setting. CLINICAL DIAGNOSIS: The clinical study is important for the diagnosis of lymphatic filariasis. Acute filarial lymphoedema is an acute inflammatory episode that causes long-term progressive damage to the lymphatic vessels and is a significant contributor to chronic morbidity. The staging of lymphoedema is classified as mild, moderate and severe based on the width of the limb at clinic. Microfilaraemia is usually diagnosed by microscopic examination of peripheral blood samples that are collected at night when microfilariae (mf) are present in peripheral blood. Three known techniques are mostly used to detect microfilariae: the membraneslide method, thick smear method and circulating antigen detection test [58, 59].

This is an unusual case of 62-year-old right hand dominant female, who first presented with acute skin infection and secondary lymphangitis with swelling of the right hand and arm. Despite oral and intravenous antibiotic therapy, the skin infection and swelling progressed over 6 months. Clinical and radiological investigations of the right upper limb showed numerous infected palpable inguinal nodes, axillary nodes and epitrochlear nodes [55]. Marked soft tissue oedema, fibrosis, and marked increase in subcutaneous volume were present in the latter part of the right upper limb from the shoulder downwards. On the basis of these findings, a diagnosis of lymphatic filariasis was made, and detailed infections disease workup excluded human immunodeficiency virus infection, tuberculosis, intracellular parasites, leukemia, and any other specific infection. There was a history of travel to an area where *Wuchereria bancrofti* is endemic [60].

### 5.2. Laboratory Diagnosis

The definitive laboratory diagnosis of lymphatic filariasis (LF) is based on demonstration of a microfilaria in blood. This requires that blood samples be collected between 9pm and 12am because of the nocturnal periodicity of the parasite. Infection with LF typically produces a high density of circulating microfilariae, so identification of microfilariae is usually straightforward with thick and thin blood smears that are stained with Giemsa or hematoxylin [11]. Filariasis should usually be suspected in individuals with signs and symptoms of infection who have elevated WEC counts or microfilaremia in populations where helminth infections are common [57]. Microfilaremia is primarily a feature of *Wuchereria bancrofti* and *Brugia malayi* infections, whereas microscopy of a skin snip should be used to detect infection with *Onchocerca volvulus* and *Loa loa*. Night blood examination is done with blood sample, collected between 9 pm to 12 am, excellent slide preparation is necessary. Film should be well stained, as the acid-fast property of microfilaria fades with time, and examined under low power to moderate power objective. Moving microfilaria may be identified by its typical undulation motion. Night blood examination is also known as a filtration method of blood collection [61].

### 5.3. Imaging Techniques

Lymphatic filariasis is a chronic parasitic disease spread by mosquitoes. Approximately 1.2 billion people in 81 countries are at risk, including 120 million people who are infected with the parasitic worms. Infection can result from microfilariae permanently displacing lymphatic structures or from acute inflammation due to exposure to different life stages of the parasite [60]. Over time, progressive accumulation of lymphatic fluid and particles can cause a variety of symptoms or complications, such as skin damage, poor lymphatic return, or protein-losing conditions. The most notable symptom would be swelling of the limbs or other body parts besides the trunk. Cases in which this process involves the dominant arm have not been well described, as most published cases were of lower limb involvement [62]. The described MR imaging findings, including thick-walled, enhancing, infiltrative mass-like tissue with only partial encasement of vasculature, were found to be most consistent with the mechanisms of collateral lymphangiomatosis resulting from the progressive accumulation of lymphatic debris. Foci of low signal intensity within the T2 hyperintense lymphatic channels were also seen, possibly indicating active nests of live adult worms [63]. On native T1-weighted and post-contrast images, a thick-walled, enhancing, infiltrative soft tissue mass is seen. However, complete encasement of the brachial vessels is not appreciated and the mass also expands beyond the confines of the lymphatics. Both mechanisms are thought to play a role in lymphatic filariasis disease. For discrete forms of damage, lymphatic structures cannot be displaced by the parasites; instead, structures are removed entirely due to parasite infection or as a form of inflammation response. Plugging of the lymphatics with a variety of materials, including adult worms, dead microfilia, RBCs, proteins, and other cellular debris, results in obstruction of lymphatic flow [64]. In response to the obstruction, surrounding lymphatics dilate and cause the pressure to increase, which damages the endothelium and causes rupture. The progression of lymphatic damage is thought to be best seen in the Lymphatic Filariasis - Post-treatment image set, showing the patients before and after treatment. The serpentine lymphatics appear relatively normal in the initial studies. Over time, increased collateral lymphatic generations replace segmental regions of the abnormal dilated lymphatics. Following treatment, these collateral vessels eventually revert to normal lymphatics [6].

## 6. Treatment Options

The antifilarial therapeutic outcomes unequivocally boost the assumptions of drug discovery for *bancrofti*an filariasis, which, in the past, have been mostly dependent on empirical approaches through the study of traditional medicine and serendipitous findings for all infectious diseases in general [65]. What is now desirable is that acute impetus be given to an intense, multidisciplinary research on *bancrofti*an filariasis with the aim of developing safe, effective and

relatively non-toxic antifilarial agents. One of the main issues that arose in evaluating the efficacy of therapies for *bancrofti*an filariasis was the differences in outcome measures of treatment used in different trials [66]. Of these we identified the following key outcome measures: microfilaricidal effect, clearance of antigenaemia, macrofilaricidal effect, and prevention of clinical effects or complications of filariasis. DEC, ALB, and IVM are the most important antifilarial agents that have been currently made available for therapy of *bancrofti*an filariasis [67].

This trial was conducted to develop a co-administration regimen of drugs already in use for other indications that would be safe and tolerable in adults and children, and as effective as the MB regimen or a single-dose therapy in clearing circulating *Wuchereria bancrofti* microfilariae. The triple-drug therapy regimen of a single dose of ivermectin (IVM: 200mcg/kg), a double dose of diethylcarbamazine citrate (DECl: 6 mg/kg), and a standard dose of albendazole (ALB: 400 mg) was found to be safe, and were as effective as the comparator regimens in clearing microfilaremia, with a faster onset and more sustained response than comparable combinations of two MDA drugs in research trial settings [68].

### 6.1. Pharmacological Treatments

The Global Programme to Eliminate Lymphatic Filariasis (GPELF), initiated in 1997 with the goal of global elimination by 2020, currently has a goal of elimination of LF as a public health problem, in part by employing mass treatment of all eligible individuals in LF endemic areas with antifilarial medications [68]. Elimination is defined as driving prevalence below a threshold, originally 1 percent, and later changed to < 0.1 percent for infection, using a unit of measurement based on monitoring of microfilaremia in sentinel and spot-check sites. Common regimens involve diethylcarbamazine (DEC), albendazole (ALB), and ivermectin (IVM) either used alone or in combination with each other. These drugs impact in improving microfilaremia, antigenemia, and hydrocele, making them acceptable for use in the management of *Bancrofti*an filariasis [69].

Ivermectin inhibits the normal bonding of neurotransmitters at neuromuscular junctions, subsequently causing death of parasite. Ivermectin affects the worm more during nocturnal cycles when microfilariae are in circulation. DEC is actually more potent on the adult worms compared to Ivermectin and thus is more effective in killing mf in lymphatic filariasis [70]. It mobilizes microfilariae from peripheral blood, enhances their destruction in spleen and liver, and off extends life of adult worms. DEC accelerates the reduction in antigenemia and hydrocele size. DEC also reduces leg lymph flow in *Bancrofti*an filariasis, so it is expected that DEC may be effective when LF hydroceles are around the groin or pelvis. Albendazole is an orally administrable benzimidazole carbamate, or it is also known as an anthelminthic drug [71]. In parasites, the mechanism of action of ALB is preventing the polymerization of B-tubulin, which causes a decline in glucose uptake and leads to disruption of microtubules functionality. Triple-drug treatment, Ivermectin, DEC and Albendazole pills for 2 weeks, allows for integrating a less extensive, more implementable program within existing health structures in order to achieve the goal of global LF elimination [72].

### 6.2. Surgical Interventions

There are several surgical interventions designed to alleviate or correct some of the symptoms of lymphatic filariasis, also known as elephantiasis, including hydrocelectomies, wide excision of tissue, and penile bloodstream reconstruction [6]. Although worm reduction treatment can prevent progression and is an important intervention for preventing swelling from developing in people with subclinical infection, in people who already have genital manifestations of LF, especially hydrocele, mass drug administration alone is usually not enough to treat their condition. Surgical interventions are indicated for superficial and non-reversible conditions such as end-stage chronic lymphedema of the legs and/or genitalia [73]. In this context, the guidelines recommend the surgical approach for the treatment of the hydrocele form in areas where appropriate facilities exist. However, there are medical interventions that are still taking the first steps. Four hundred forty-one patients were screened for genetically solved penile malformations. Seventy-three patients had PD hormone, had seriously inappropriate, undesirable or deadly behaviors related to their disease, and did not comply with treatment or follow-up [74]. Penile bloodstream reconstruction was performed in 73 different cases. At least 12 months with at least one follow-up file after surgical intervention were included in the study. Postoperatively, more than one-third of the subjects had satisfactory intercourse with their female partners, whereas preoperatively it was only 6.85%. Penile venous flow also significantly improved after Penile Bloodstream Reconstruction [75].

Physical rehabilitation for lymphatic filariasis includes water technology for provisional relief, manual lymph drainage for massage to revive the lymph, self-care and basic hygiene, compression bandages, and materials therapy. Despite a widespread global distribution, lymphatic filariasis remains a relatively low profile geodermal and parasitological infection [76]. Infection results from lymphatic injury due to persistent tissue inflammation caused by the filarial worm. Lymphatic damage progresses over time, paving the way for an adhesive process within the connective tissue of the cutis, which promotes derma fibrosis. The only visible sign of the chronic phase of the disease is the edematous collection of the limbs caused by the blindness of the cutaneal and then subcutaneous blood [77].

## 7. Prevention Strategies

All 81 Filaria Endemic Countries are Recommended to Consume Table Salt Fortified with Filaricidal Albendazole or Ivermectin Alone. Because Large-scale Prophylaxis with this Approach has Never Been Tried Before, an International Efficacy Trial is Urged Using Historical Data on Lymphatic Filariasis in Thailand [78].

Elephantiasis is Generally Accepted to be a Pattern Resulting from Obstruction of Lymphatic Vessels Due to Chronic Manifestations of Lymphatic Filariasis. Traditionally, Debridements to Clear Obstructed Vessels, Antibiotics, Surgical Interventions and Other Clinical Procedures Have been the Main Treatments [79]. The Global Program to Eliminate Lymphatic Filariasis has Introduced a New Eclectic Approach, in the Complementary Packaging of Pill-form Diethylcarbamazine and Albendazole or Ivermectin for Treatment During Mass Drug Administration Campaigns. The High Rate of Compliance to these Control Campaigns Contrast with the Lack of Long-Standing Compliance for Other Management Strategies Subsequently, Simultaneous Conduct of these Control Campaigns Caused a Considerable Falls in Prevalence, but Benefits were Short-Lived and

Unanticipated High Levels of Infection Resumed within a Few Years. It was Indefinite Whether this was the Result of: High Level Resistance to the Filaricidal Drugs by Parasites, Insufficient Courses of Treatment, Poor Drug Distribution or Some other Cause [80]. With Persistence of high Levels of Infection, New Research and Control Initiatives were Done. Lymphatic Filariasis is a Mosquito-transmitted Parasitic Infection and this Mode of Transmission has been Utilized Worldwide for Invasions Attempts by Insects that Carry Pathogens Killer Strains of Bacteria to Millets that Attack Weed Species Preferred by Birds [81].

After 2014, the Mosquitoes were Removed from a Village in the North-Eastern Brazilian State of Bahia and after 2016 from a South-Eastern Region within Rio de Janeiro State [82]. The High Degree of Success in Reducing Mosquito Populations from these Pest Control Initiatives Prompted a Discussion as to whether Similar Approaches could be Adapted and Used in Attempts to Control Infection Transmitted by Mosquitoes. Wildlife of Yap Islands, Trinidad, Myanmar, and The Philippines Contain a Bacterial Endosymbiont, *Wolbachia pipientis*. for Example, the Primary Vector of Dengue, *Aedes aegypti*, Loses its Natural *Wolbachia* through the Elimination of which can Block Reproduction. This is Due to the Incompatibility of Matings between Wild Type Uninfected Mosquitoes with those that have Recently been Given Exogenous *Wolbachia* Infections. An Outgrowth of this Field Application has been the Development of Several Proprietary Strains or Releases of *Wolbachia*, Inoculations of these into *Aedes* to be Bred in Factories and then the Release of Large Numbers of Sterile or Semi-sterile Males at the Target Location. Successful Application of this Technology has been Documented for Lake Charles, California and RJ Jaildo with the Outcome of Such Measures be Followed Closely to Assess whether Possible to Transfer this Approach for New Initiatives Control of Lymphatic Filariasis [83].

### 7.1. Vector Control

Lymphatic filariasis (LF) elimination programs have been implemented widely across various regions, and one of the most effective approaches to achieve success has been the annual mass drug administration (MDA). This strategy aims to significantly interrupt transmission of the disease by utilizing a combination therapy of different medications to ensure greater efficacy and more comprehensive coverage [84]. Most of the programs are in countries where *Wuchereria bancrofti* is prevalent, and in such areas An. gambiae, An. funestus, An. *merus and Culex* spp. are primary vectors of LF and filarial transmission is amphizoinic appearing similar to other diseases transmitted by the same mosquitoes. Treatments with anti-filarial combination drugs are known to reduce the infectivity of humans to mosquitoes, but maybe less so when only 4 or 5 of the full six doses are given [85]. As a result, there has been growing recognition of the potential role of including vector control activities for controlling LF. More than half of the countries requiring MDA for LF have now incorporated vector control as a supplement to MDA and the occurrence of insecticidal treated nets (ITN), long lasting ITN (LLIN) and indoor residual spraying (IRS) on malaria have provided the infrastructure for implementing vector control [86]. Enormous progress has been made in reducing the global burden of LF, mainly through sustained annual MDA campaigns, and in 2000 it was estimated that 120 million people in 81 countries were affected, with 1.34 billion people at risk [6]. In 2015, with the phasing out of LF programs in 14 countries in the African region, the Global Programme achieved 98% geographical area coverage and 72% of implementation units (IU) worldwide, nearly all of the countries providing data and having an average programmatic coverage of 66%, and the number of new cases reported fell by more than two-thirds over a 7-year reporting period [87]. It is estimated that transmission of LF has stopped in 16 of the requirement 20 countries, and has had in the restricted expansion in activities to improve the MDA impact, more focus on pre- and post- MDA transmission assessment surveys (TAS) sampling, staff incentives and training, in addition to routine programmatic activities like national bednet campaigns. On Zanzibar, the GPELF has successfully stopped LF MDA and disease specific surveillance evaluation surveys found no evidence of active transmission [66].

### 7.2. Mass Drug Administration

The Global Programme to Eliminate Lymphatic Filariasis recommended that five annual rounds of Mass Drug Administration should be delivered to a minimum of 65% of the total population in order to contribute to the elimination of filariasis as a public health problem [88]. The initial levels of MDA coverage in American Samoa in 2000–2001 accounted for 60.0% and 66.3% of the population. The American Samoa experience demonstrates that the levels of MDA coverage achieved in the five years following introduction of MDA are not a good predictor of future MDA coverage. MDA is an integral part of the Global Programme to Eliminate Lymphatic Filariasis. The programme began operating in the year 2000, with the broader goal of global elimination of lymphatic filariasis as a public health problem by the year 2020 [89]. The programme is based on five strategic components. (a) Stop the geographical spread of infection: to provide treatment through MDA to all eligible persons living in areas with lymphatic filariasis. (b) Interrupt transmission: to provide treatment through MDA to all eligible persons in identified transmission foci. (c) Alleviate the suffering and prevent disability: to provide necessary surgical and related interventions in places where such services are limited. (d) Strengthen and expand morbidity control: to implement activities for the prevention of acute episodes of the disease. (e) Rehabilitate persons affected by lymphatic filariasis [90].

## 8. Public Health Impact

Lymphatic filariasis (LF) induces severe and sustained morbidity, yet the extensive and underestimated morbidity suffered by around 40 million people with this disease has been overlooked. Despite the rapid expansion of the Global Programme to Eliminate Lymphatic Filariasis, attention and resources have largely been focussed on the twin goals of interrupting transmission and administering preventive therapy [36]. The feasibility, benefits and broader implications of programs to manage lymphedema and hydrocele have been little studied. An analysis draws on research in Sri Lanka to consider two key impediments for better supported patients: the invisibility of the disease, and the shame and stigma encountered by those deformed by it [46]. Sufferers are far from passive victims, utilizing a wide range of coping mechanisms, and some are able to transform their social and economic conditions through often heroic efforts. Training in simple clinical measures used for self-care, coupled with

basic advice on foot care might prevent the secondary bacterial infections that exacerbate and speed morbid change in the limb, and greatly reduce the disability and exclusion these patients experience [91].

Lymphatic filariasis (also known as elephantiasis) is a mosquito-borne parasitic disease caused by infection with *Wuchereria bancrofti* in South Asia and Africa, and *Brugia malayi* or B. *timori* in the Pacific Islands and South-east Asia [11]. It results in two main clinical conditions, filarial lymphedema and hydrocele. Common filarie areas also have a high incidence of acute filarial febrile episodes that include lymphadenitis, funiculitis, or cellulitis to the extent that over 60% of males in some hyperendemic areas end up with hydrocele. Lymphedema is an insidious chronic disorder, and almost invariably progressive [6]. It is characterized by painful, disfiguring and often massive accumulations of lymphatic fluid, most often in lower extremities. Chronic lymphedema profoundly impacts the physical, emotional and economic health of persons who have the disease. Patients typically become socially stigmatized, are unable to work productively and become ostracized by their families and communities [5]. It was from the spectre of these changes that mothers and grandmothers of boys affected by elephantiasis reported their deepest fears. The isolation, the rejection, the persecution they received from their community when a son, grandson or husband was affected: fear was centered—as well as justifiably so, since it became a daily occurrence—on what the boys would have to face in the future on a social scale [92].

### 8.1. Socioeconomic Consequences

Lymphatic Filariasis (LF) caused by filarial parasites remains one of the World's most prevalent tropical diseases affecting 120 million people worldwide with 1.2 billion considered to be at high risk in the affected countries. LF causes disability and chronic subclinical pathology affecting the individual and their family [93]. LF primarily affects the poorest in society with 85% of the disease burden experienced in Africa and Southeast Asia. Such increased mortality occurs probably due to divorce, withdrawal of family support and inability to perform hard work after suffering from filarial hydrocele. The Bhuyians are one of the ancient classified tribes (Caste) (Scheduled Tribe) of India and like other tribes, has its own socio-cultural and religious behaviour, practice and belief on various aspects of life [94]. Based on understandings the scent of medicines each and every Bhuyian have got individual or group specific indigenous knowledge to treat various illnesses. Filarial infection is found since the last few decades on the population studied and it is common to have hydrocele among the older age men [5]. The relationship of hydrocele with marriage and sexuality is very vital among the tribal of Orissa state, India for the development of informational privacy of the disease. The Bhuyians do not prefer to marry a girl/boy with the history of hydrocele. Thus, a socio-economical observation highlighted the demand to discuss the analysis of marriage, sex, negotiation chance and conjugal life related with filarial hydrocele as seen among Bhuyian population. As well as it changes the concept of beauty on leg. Earlier before treatment, a lot of such patients could not walk properly and have large and severely deformed of legs; people expressed some comments like a deer, elephant. After treating with a span of 2-6 months, swelling and deformity of leg have been reduce and start walking comfortably, thus the comment has been changed taking mother legs. Lymphedema patient felt more comfort after they begun to concentrate on the effect of treated with drugs and going for dressing long. Now she has 2 more sarees. Before treatment, amalife feel hot and after treatment, fresh & hygienic. Reduced all smell buy applying talcum powder [46, 95].

### 8.2. Burden of Disease

Lymphatic filariasis (LF) is an infection with filarial worms spread by mosquitoes that affects individuals and communities in many tropical and sub-tropical regions of the world. The consequences of the infection can range from apparently healthy individuals with no visible signs of infection or disease, to individuals with complex pathology of the lymphatic system leading to a variety of symptoms and chronic disabilities [19]. Within the human host, the worms reside in the lymphatics where adult *Brugia* or *Wuchereria* worms produce living progeny called microfilariae (mf). The pathological conditions of lymphatic filariasis are related to the body's inflammatory reaction to the presence of dead or living worms in the lymphatic vessels causing an overall host immune response. The natural course of lymphatic filariasis is mainly characterized for the lymphatic dysfunction; onchocerciasis can cause skin lesions and leading transparency, and *Loa loa* produces a severe encephalopathy [96]. Pregnant women and children aged below five years are currently excluded from treatment with LF MDA in order to minimize the risk of adverse events to them. Borders of endemic regions have changed over time and have a greater uncertainty of representativeness for regional outcomes in models at the time they were first drawn. The results showed an increase of support costs with the increasing of Geographic Units [97]. The extreme value represented by the support to Geographic Unit 0 may be explained by the fact that the capital Recife, one of the major cities of the LF endemic region, was included in this unit. The number of support is proportional to the size of the population; the largest number of dreams of polyuria/snakes, drawing Tablets received by a single health unit in a given scenario is 3,000,000. The second greatest number of adverse eve... would be afraid to approach the "health agents" for fear of receiving "an injection" [7]. The GPELF has been shown to be cost-effective in South-Sulawesi state. Such hypertrophy inhibits lymph flow increasing the risk of acute dermatolinfangioadenites (ADLs). Lymphedema primarily presents as a change in the size of the different parts of the limb that are related to the underlying lymphatic architecture, and on the presentation of pads of fatty tissue called adipose tissue. NF may be preceded by extended ADLs (average of 8 ADLs per year in the first year and half of an NF case). AC and PT are reduced versions of the LF I and LF E lymphedema grading. The hindrance to the flow causes the progressive enlargement of the vessels leading to dilation of the walls. By the end-of-year 2017, around US$ 4 million dollars were lost, equivalent to the cost of 54 Grid Sticker Notebooks [45].

## 9. Current Research Trends

Lymphatic Filariasis (LF) is a vector-borne disease caused by filarial parasites transmitted through mosquitoes. It is a very complex parasite, as a hermaphroditic worm, it expresses an event-dependent immune survival strategy in its interactions with its human host. After the mosquito bite, the infective third-stage larvae need to develop from L3 to adult worms, to

be able to release and protect its microfilariae from the defences of the host [6]. To deal with the worm fitness or immune system attack, adult worms can die by themselves or being killed by the immune effectors. This may lead to an inflammatory reaction where a large release of mf may be observed. In such situation, larvae survival and establishment of the next generation are favoured [98]. Some environmental, accident-like sources of bouts of filarial-specific nonspecific immune activation, unproductive for parasite clearance, or even triggered by filarial molecules, such as *Wolbachia* bacteria; or the worm-derived ES-62, a phosphorylcholine containing molecule acquisite directly from the biofilminar surface of the parasite [99]. This type of inflammation may also contribute to morbidities caused by filarial infection. There has been several intervention strategies implemented since the mid-1999, in particular Mass Drug Administration for Preventiver Chemotherapy in addition to other strategies [100]. Successfully implemented in the Regions of the Americas, 2004, was the application of Transmission Assessment Survey to a classifiable methodology for impact assessment of MDA in terms of interrupting the transmission [101]. This both as a better way to implement MDA in non-endemic areas, by defining clear stopping rules, and as an estimation of the level of resources, in terms of time period and drug administration coverage expected, that would be necessary to achieve interruption of the transmission also in other endemic areas. Unfortunately, nowadays only 8 out of 73 known endemic countries of Lymphatic Filariasis have already stopped MDA and have started its POST-MDA surveillance [36].

### 9.1. Vaccine Development

Vaccination, the development of a vaccine based on an antigen of an infectious agent, has contributed to the prevention of many infectious diseases, from live vaccines such as measles to the recent Human Papillomavirus (HPV) vaccine. Especially in the case of neglected tropical diseases (NTDs) with no prophylactic vaccine, research on vaccine development has been active [102]. This computational approach facilitates the selection of the most promising candidates for development as vaccine targets based on examination of the proteins exposed on the surface of the pathogen. Comprehensive analysis was performed to identify immunogenic candidate proteins by developing and characterizing the putative proteome of W. *bancrofti* by subtractive proteomics analysis [103]. Similar proteome database construction was performed for B. *malayi* and the proteomes of several bacterial pathogens, such as *Wolbachia* endosymbionts present in filarial parasites. It is crucial for pathogenicity that parasites, which are mostly intracellular pathogens, survive in the host. As part of this, they are armed with various virulence factors that continuously attack host tissues, ultimately causing pathological changes [104]. By screening the expressed proteomes of the pathogen, proteins that are crucial to the survival and pathogenicity of the pathogen and exposed and involved in virulence, interaction, and other antigenic factors with the host (which can be used as vaccine targets) are identified. Redundant analyses have all revealed the same protein, which has great predictive power for ultimately choosing the best vaccine candidate [105] (Zhu *et al*.2025). A protein called 'Kunitz type inhibitor domain-containing protein' (VDM15541) has emerged as the most promising among the potential vaccine candidates. VDM15541 is a secreted protein present in the extracellular region that has the potential to be highly antigenic. It contains motifs present only in the subset of pathogen proteins that interact with the host. The first interaction between the infecting pathogen and the host's immune system is the binding of the surface proteins of the two organisms (pathogen-host). Filarial parasites are multicellular and long-lived pathogens and have evolved complex mechanisms to evade the host immune system [104]. Multi-epitope vaccine is a vaccine consisting of several epitopes of antigenic protein molecules that are predicted to be efficient immunogens using in silico analysis. The most interesting features are that it can contain multiple antigenic domains/pathogens or multiple B and T cell epitopes, and less or no side effects are expected compared to traditional types of vaccines. The advent of high-throughput methods using processes in vaccination research has greatly expanded the spectrum of potential targets, allowing the identification and characterization of vaccine targets that have the potential to be highly successful [106].

### 9.2. Novel Therapeutics

Recent Advances in *Bancrofti*an Filariasis Management About lymphatic filariasis (LF), a MEDLINE search was carried out for articles published in the last five years. Study quality was evaluated using the epidemiology guidelines of the Center for Diseases Control and Prevention [107]. In addition, in-depth interviews were conducted in May and June 2005 with 23 physicians specializing in LF, with a detailed questionnaire prepared and pre-tested that mainly focused on key areas of controversy and gaps identified in the literature. Lymphatic filariasis is a major public health problem in the tropics and warmer regions of the developing countries and is caused by three closely related nematode parasites: *Wuchereria bancrofti*, *Brugia malayi*, and B. *timori* [108]. The burden of lymphatic filariasis, especially due to W. *bancrofti*, is highest in the Asian region, and affects an estimated 120 million people. The adult worms lodge in the lymphatic vessels and lymph nodes for years or even decades, resulting in an array of inflammatory reactions such as vasculitis, but more commonly as lymphatic endothelial cell proliferation and fibrosis, eventually leading to lymphatic obstruction. A majority of the infected patients will progress to develop chronic clinical manifestations, lymphatic filariasis, and suffer physical disability such as elephantiasis, hydrocoele, or chylothorax [109]. Acute disease is usually self-limiting and eventually manifests as inguinal lymphadenitis. Lymphatic filariasis is currently predominantly controlled by single-dose, once yearly mass chemotherapy using diethylcarbamazine with or without added albendazole; the goal is to globally eliminate the disease as a public health problem by 2020 [66].

## 10. Global Initiatives

Global, National, and Individual Initiatives to Eliminate Lymphatic Filariasis Lymphatic filariasis (LF) is a vector-borne parasitic disease caused by the parasite *Wuchereria bancrofti*, and to a lesser extent by *Brugia malayi* and *Brugia timori* [110]. The primary goal of the Global Programme to Eliminate Lymphatic Filariasis (GPELF) is to interrupt transmission throughout the world. Operational guidelines have been developed to support national filariasis elimination programmes in their preparation, implementation and follow-up processes. A significant portion of these guidelines consists of basic recommendations from the perspectives of

pharmacology and hygiene [36]. Nevertheless, these guidelines recognise that because of centuries of trade, warfare and cooperative policies, people have moved throughout Asia, Africa and the Pacific especially. In many parts of the world, such mixing of people of different ethnic groups together with a hilly or mountainous terrain have resulted in populations of people being geographically disparate, e.g. hilly and mountain areas having various plains on their borders. Such a situation makes the prospect of LF-freedom in such areas extremely complex [111]. In implementing the GPELF, operational 'worldwide' guidelines are provided, as a complement to national ones. They pertain specifically to guidelines wherein national programmes should offer assistance to neighbouring countries that are either implementing programmes themselves or are already LF-free. Such guidelines recognise that worldwide, and between countries, there is a responsibility to prevent the reintroduction of LF [112]. Moreover, such guidelines acknowledge that in several parts of the world, people have already been working with their neighbours through other regional initiatives. Such guidelines hopefully provide the foundation for their expansion to include LF [36].

### 10.1. WHO Strategies

Lymphatic filariasis is both a cause of human morbidity and a problem of public health importance in many countries. Effective control will require the involvement of all relevant sectors within government and will require the collaboration of a number of international organizations [6]. Factors that may explain why previous large-scale attempts at lymphatic filariasis (LF) control have not always been successful are reviewed, and the options available to national programmes are outlined. A global initiative from the World Health Organization to foment prevention and control of LF is introduced, and the ways in which WHO can provide support to national programmes involved in LF control activities are outlined [110]. The question of how to measure impact on the prevalence of LF is addressed. A set of minimum programme procedures, which national LF programmes are asked to systematically follow and report on, is proposed and discussed. Finally, continuing research needs concerning the laboratory and operational research aspects of LF control are addressed, and the intention of WHO to continue to take a lead in the overall efforts to control lymphatic filariasis is expressed [113].

On 20 March 2023, it was announced that four further countries (Bhutan, Maldives, Republic of Korea and Timor-Leste) had eliminated lymphatic filariasis (LF) as a public health problem, reducing the number of countries requiring MDA interventions from 54 to 50 [89]. This announcement was made on the anniversary of the launch of the World Health Organization (WHO) NTD Roadmap, a 10-year commitment to deliver 20 disease-specific global targets by 2030. Eliminating LF as a public health problem was one of these targets. In this mini-review, the disease characteristics, history and pathology of LF are described. The timeline of significant global events in LF control is also outlined [108]. Attention is on the innovative strategies employed by Zambia, issues that may lead to stakeholder disengagement post elimination, and a commentary on overcoming these challenges highlighting three key lessons or areas for improvement that Zambia may consider. It is hoped that the focus on elimination-certified countries like Zambia will serve to highlight the pathway taken to success and open conversations for collaboration, with the ultimate goal of learning from their experiences [3].

### 10.2. Partnerships and Collaborations

For current public health interventions and programmes the activities at the national levels, in endemic countries, need to be backed by significant investment in strategic and coherent partnerships and collaborations at the global level [114]. Global partnership in the context of the Neglected Tropical Diseases has often been commented as one of the "success stories". The Global Programme to Eliminate Lymphatic Filariasis (GPELF) achieves large distribution in 2000. In 2002, according to GA resolution, the partnerships have set the target of providing all required MDA to LF-endemic areas by the end of 2006 [110]. By the end of 2005, the Global Alliance had raised the necessary donations of the drugs both diethylcarbamazine citrate and albendazole. On the other hand, a large number of institutions and development agencies have been active in the research and development of new diagnostics, drugs and means for vector control. The creation of a paradigmatic example of an effective partnership that makes best use of the existing expertise and capabilities was presented from the Republic of Korea [115]. As a political entity, South Korea oscillated both prestige and public health politics, since it inaugurated the Model Area Demonstration Project of the World Health Organization in 1958. It demonstrated, in 1962, the original elimination of *Wuchereria bancrofti* from the island of Koje-do as "the first case of lymphatic filariasis eliminated since the formulation of WHO's Global Programme to Eliminate Lymphatic Filariasis" of 1997. Removing *Bancrofti*an filariasis from the territory of a highly endemic, lower and middle income country, long before the semblance of the modern tools for such programs, has demonstrated that the GPELF, or similar strategic efforts carried out by WHO Regional Offices, have a lone precedent. In view of the above, the range of options to tackle more effectively various modes of implementation and activity within the larger global partnership in anticipation to the WHO resolution passed the World Health Assembly was set. In return, it is reflected the lessons for scaling up the ongoing programs whose significant impetus emerged during the Partners' Forum to the World Health Assembly in 1998. This article was set up in exactly ten years ago, than just, when the APOC program, the partnership, and the global campaign to eliminate LF were all in the beginning stages [116, 117].

## 11. Challenges in Control

Excellent progress has been made in controlling (eliminating) Lymphatic Filariasis (LF). The goal to globally eliminate LF by year 2020 [118] through collaboration of governments, public and private organizations around the globe has been announced. While some countries have already achieved progress, or eliminated their endemic of LF, LF remains a public health problem and a contributor to disability, economic and social burden of disease in Indonesia [119]. Scientific publications are crucial to share knowledge, field experiences, evaluations, and best practices in public health, all of which are important to meeting the global target to eliminate LF. The edited volume provides an overview of information concerning LF, focusing on the epidemiology, parasitology, diagnosis, the environmental context, and the control of the disease. Conditions specific to Indonesia will

be touched on wherever possible [120].

The aims of this review are to understand the historical context of LF, to become aware of the most recent and relevant literature, and to speculate on the immediate and future effects that LF will have while identifying some of the numerous research questions that exist. Limitations of the review are that emerging data is likely to change our understanding of the disease, and a limited space is available to touch only a few of the topics that could be addressed. Between 2000 and 2013 the population living in districts that require mass drug administrations as part of the Global Program to Eliminate LF increased by 83% and the population at-risk of contracting either form of the disease increased by 45%. Monitoring & evaluation of GPELF's progress is needed on high powered trials which are locally specific, and typically require RCTs. Nodes of evidence remain under-investigated – notably the understanding of the potential benefits of DEC in mass treatment outside of its anti-parasitic effects [121,122]. Parasites have not been made a public health priority or concern in their own right, while the enduring methodological dominance of a randomized controlled trial has the unwanted effect of caricaturing the complexity of health systems, policy environments and communities in which those parasites exist. Experimentation in this field is vital, but some harms through that experimentation have become avoidable. A shift in focus towards a more pragmatic and empirically based programmatic interest on NTDs may achieve a more appropriate balance of interests [123].

### 11.1. Drug Resistance

Lymphatic filariasis (LF) is targeted for elimination. Strategies include multiple rounds of mass drug administration (MDA) to end transmission and control morbidity; however, MDA might not result in 100 per cent elimination of the parasite, and low levels of persistent microfilaremia following cessation of MDA in some individuals might support a reservoir of subclinical infection with potential for parasite transmission and recrudescence to patency [124]. Longitudinal studies on the impact of MDA on *bancrofti*an filariasis estimated that the low endemicity site might reach the target of microfilaria (Mf) prevalence of <1 per cent after 24 years of MDA. In addition, assessment of peripheral blood samples for Mf, while providing surveillance data on effectiveness of MDA, found evidence of persistent microfilaremia in a few individuals with a history of MDA [125]. These observations suggest that despite MDA, the global efforts to eliminate LF might not interrupt transmission completely. Finally, family members of asymptomatic microfilaremic individuals are a higher risk of being microfilaremic compared with family members of amicrofilaremic individuals [126].

While this might be explained initially by common exposure in the village, there is evidence elsewhere of a genetic predisposition to LF infection. Currently, a comprehensive project focuses on LF in Tanga Region, northern Tanzania where between 2004 and 2011, eight rounds of mass treatment with a combination of albandazole, ivermectin, and maloprim have been provided in a cluster randomised, double-blind trial in ten treatment and ten control wards [127].. At baseline and during annual rounds of treatment, specific surveys were conducted for markers of infection and for morbidity. Run-out surveys were completed in 2012, 15 months after the last round of treatment, and additional surveys are planned for subsequent years. It is also necessary to confirm parasite elimination following transmission interruption, which is assessed qualitatively at present by presence or absence of Mf [128]. A thorough evaluation of survey methods is required to identify cost-effective surveillance strategies beyond the current WHO recommendations. Novel methods are also required for diagnosing cryptic Mf or other viable parasites and for monitoring susceptibility for resurgence following treatment cessation [129].

### 11.2. Healthcare Access

Lymphatic filariasis (LF) is characterized as ollyarashedonari in the local language, mainly affecting the poor, who work on agricultural fields [95]. Consequences of chronic patients with LF can cause severe socio-economic effects, both the patients and their caregivers developing a negative attitude with associated serious financial problems because of highly increased treatment cost. An epidemiological study observing 3,266 individuals above 20 years old with filariasis in a big village reflects these healthcare issues [5]. Suffering from any morbidity is the main problem of healthcare access, but the situation is still worse for those who are poor even when economic development took place in their area. As a result, geographic access to healthcare is easy for the patients who are financially better-off, while the financially poor remain without any treatment. This review of a rural village clearly supports of such condition where 70% of all comprised affect people consider the service charge as a 'big'. One more important issue is that 85.7% chronic patients are spending money from their family or by borrowing [130]. It will take a few days off to arrive at the specialized facilities. That's about 28 KM, and in many cases, they are spending more than 75 BDT per outing. on the other hand, the first one must know the exact cause of chronic swelling or the side effect of SPP contributing to nearly 72% being ignorant of the reason. Concerned people cite evil spirits and cold nature (51.4%) as a common explanation. Elf acts as a big constraint. For instance a huge portion of 38.3% is not known about the available healthcare facility and government subsidy. Rather 07.1% patients benefiting those who know and have experience [131]. With the increase in educational level corresponding to treatment seeking as well as the effective increased. The causality of such sorts for a patient and his/her family is the "poverty resulting from expensive treatment of SPP. Among all healthcare issued, 45% chronic patients stated that we feel bad for being unqualified. The negligible percent of patients treated by medical practitioners is only 09.8% which can be as high as 90%. An overview of a rural block supports the SPP cases is developing continuously [132].

## 12. Future Directions

Lymphatic filariasis (LF) is a leading cause of permanent and long-term disability worldwide. This preventable disease is prevalent in 73 countries and territories in the tropics and sub-tropics. It is estimated that 856 million people are at risk of the disease, with 120 million already affected and 44 million displaying clinical manifestations. Globally, it is one of the most significant and devastating causes of disability [133]. In India LF is caused by W. *bancrofti* and transmitted by a vector mosquito *Culex quinquefasciatus* which is the most commonly distributed mosquito throughout the country [118]. Depending on the habitat and behavior of vector,

microfilariae of W. *bancrofti* exhibit different periodicity, that is nocturnally subperiodic, nocturnally periodic or diurnally sub periodic. There are much less known subperiodic form in India. In States like Kerala and Tamil Nadu there is mixed assemblage of both nocturnally periodic and subperiodic LF (W. *bancrofti*) since vectors, like An. subpictus, malayensis and varius are capable of transmitting both forms of the parasite. Similarly An.culicifacies another important vector in other parts of the country is also susceptible to both forms. Efforts to control the disease began as far back as 1955 with basic health measures, which limited moderate success in some areas. Subsequent to landmark Resolution adopted by WHA on 19th May 1997 calling for the elimination of this disease as a global public health problem by 2020, with broad based inter-Country collaboration, rapid action emerged that generated a great deal of dynamism and enthusiasm in the global community. As a result a Global Programme to Eliminate LF (GPELF) envisaged, providing renewed optimism for eradication of the disease. Subsequently the Government of India also underwent renewal of efforts and commitment to eliminate this disease and participated in the programme along with global community [134].

### 12.1. Innovative Approaches

Programme progress In a itiative that has focused over the last decade on building the commitment and infrastructure to support country implementation, 20% of LF-endemic countries initiated MDA in 2000–2002. Because many countries have populations at risk of infection greater than the WHO threshold for drug intervals of four years, mapping and MDA in large (>10 million) populations may delay global progress [135]. However, there remains a reasonable expectation that there will soon be widespread initiating of MDA, and that subsequent efforts will address many (if not most) of the endemic populations at highest risk of adverse sequelae. With that process there are concerns that the details of national plans and operational strategies are well-crafted in keeping with lessons learned during the past quarter century of global filariasis control efforts [36]. Beyond the imperative to avoid wasted opportunities and mistakes of the past, such careful planning must also anticipate changes in drug availability and the evolving nature of filarial infections and their control because both parasite and underlying human populations may change over a time frame of a decade or more [110].

Mass treatment strategies consist of a single dose of diethylcarbamazine (DEC) or, within some foci, several weeks of doxycycline. The RAP has sought to develop treatment strategies that can complement (or substitute for) population-based MDA. Such complementary treatment strategies could prove [136]. The Aedes may be controlled “by the development of contaminant traps using dry ice”, and several conurbation projects may receive endectocidal treatment through the international airports of Mumbai and New Delhi. A recent initiative is the distribution of DEC-fortified salt in an attempt to upgrade the capacity of existing vector control projects [137]. Here is the first report describing the scope and findings of these seven studies, all of which were undertaken during 1973–1977 on tropical pacific islands that were then among the most intensely filariasis endemic areas of the world [83].

### 12.2. Policy Recommendations

The objective of this review article is to summarize the current status of Lymphatic Filariasis in terms of its thresholds within Global Burden of Disease database, the statistics of cases post-elimination in endemic countries, policies that have been published, researches on the socio-economical impacts and quality of life of the patients. It is anticipated that this article can provide guidelines for relevant personnel to understand the current outbreak and construct an overview of this mosquito-transmittable disease.

Elimination of Lymphatic Filariasis is defined as: (1) reduced microfilariae to a level at which transmission is no longer sustained; and (2) Management of chronic disease cases. Numerous countries where filariasis is endemic, however, have yet to reach the break points. There are also a number of scientific researches which are quite recent. These include mathematical or epidemiological models on the mosquito transmission or socio-economic pathways of filariasis, laboratory investigations, etc. Several other review articles have also been identified and the specific ongoing outbreak of filariasis is not the main focus of these former publications. The comparison of the outbreak of filariasis in Sudan during 1987-1994 and the most recent outbreaks in Africa will still be the main focus.

The following concise list of considerations is provided to oversight the current outbreaks and give the audiences or readers a brief idea to get a fast look when entering new area [36, 109].

## 13. Case Studies

A 40 years old farmer belonging to dominant caste group presented with mild fever, moderate leg edema, moderate hydrocele, painless hard inguinal adenitis, and right inguinal lymphadenopathy with tenderness. This denotes causal relationship of microfilaria with lymphatic pathology, where disease presentation will be different from presence of microfilaria alone. His history revealed that left hydrocele developed 10 years ago of soft type for which surgery was done in local private hospital. He believed that there is familial tendency of developing hydrocele. After a year of surgery, swelling developed in the right scrotum which gradually increased in size. There was no pain and he had no difficulty in doing his work. However, he had discomfort in crossing his legs. The patient was adherent to treatment and took DEC 12 mg/kg, which caused reduction in microfilaria to 0 on last day. IPE was given along with DEC. Reduction in calibre and funnel shaped lymphangiectasia of proximal lymphatics with no changes in collecting lymphatics supports possible prevention of spreading filarial disease. However, hydrocele can occur if macrofilaria/philaria induces chronic obstructions which may simultaneously injure valves in deep lymphatics. Importantly, low level microfilariae and asymptomatic filarial cases in endemic settings may not be a public health problem but surgery can be recommended to free themselves and have better life quality [138].

Four different cases were outlined (a, b, c, d) to provide the diversity exhibiting recurrent episodes of febrile lymphangitis at different frequencies. Each case had coherent episodes of adenolymphangitis fever with average frequency of 2.9 [5]. Hodgkin’s disease presenting with generalized lymphadenitis may not affect PLT obviously depends upon prevailing microfilaria intensity in blood and homeostasis of lymph. However, hepatoslenomegaly with thrombocytopenia is a rare presentation in IgD lymphoma affecting

retroperitoneal and mesenteric group of lymph nodes. Reversal of blood findings after surgery suggested that splenectomy was the cause for development of thrombocytosis. A 68 years old farmer presented with upper abdominal pain, dyspepsia, vomiting of ingested food, blackening of stool, tiredness due to weakness, blurred vision, etc. He had cervical, axillary and inguino-femoral group of lymphadenopathies bilaterally which were hard, painless and matted with tenderness. Testis was firm. It was difficult to see the underlying vessels. There was aspiration damage with blood stained aspirate. However, inconclusive aspiration requires good clinical skill, like how notoriety is lymphatic filariasis is related to 'time and space'. Temporality and level of reasoning giving the ability to inspect the nodules clearly at visual examination inherently limits health care facilities of developing countries. A common complaint in post-filarial patients where debridement may not solve problems after a long history of the disease as initiated elsewhere [139].

### 13.1. Successful Interventions

In some nations of the world, interventions have resulted in reduction of transmission and complete elimination of lymphatic filariasis as a public health concern. This has been achieved mostly by the integrated use of the oral medicines albendazole, diethylcarbamazine, and ivermectin, singly or in combination, to reduce microfilaremia [6]. In several countries 5-6 rounds of treatment were sufficient to achieve both targets and the intervention has been stopped. Concomitantly, surveillance using the available diagnostic tests–blood smears, the thick blood film for microfilaremia, and the detection of circulating antigens of *Wuchereria bancrofti* using the ICT card test, Immunochromatographic Test–have confirmed that infection and transmission has not resumed so that we can consider the disease as eliminated in those countries [112]. There have now followed two successful examples of post treatment surveillance, where stringent surveillance and rapid response to surveillance data have ensured that the post-treatment phases are being managed successfully in the face of greatly reduced resources. The best example of success is Jordan, which has succeeded in stoppage of transmission within 2 years of the launch of MDA and has already stopped treatment since 2004 [140]. With very limited resources, Jordan is now in the 5th year of the post treatment surveillance and is most likely to pass a resolution to the World Health Assembly that it has indeed done so officially by 2012. Similarly, Egypt has stopped treatment due to the observed reduction of unable effects in the first year of treatment. Post treatment surveillance has been integrated with the other vector borne diseases, Malaria and Schistosomiasis and is now being done at very reduced scale as compared to before [141].

### 13.2. Lessons Learned

A random cross-sectional survey of all available data on lymphatic filariasis in Nigeria before the launch of the MEFLON programme in April 2000, by district, was constructed followed by comparison with new mapping and rapid assessment data where available [142]. The results are variable data quality, but they appeared to confirm the presence of endemic areas up the North and Central areas of the country, the NW Centre having particularly severe disease including hydrocoeles and obvious lymphoedema, and supporting the programme's strategy of treating all 19 Northern districts first [112]. Perhaps surprisingly, while the results clearly indicate that many key data gaps remain.

Rapid community identification of a filariasis problem in a still-mapped area allowed a pilot programme providing microfilaricidal treatment to be started in 20 villages of Benue State, Nigeria. Initial prevalence of circulating antifilarial antibody at such hyperendemic sites was 22.2% in apparently healthy individuals and 38.0% in those with hydrocoeles. Direct integrants in program focus implementation and evaluation, were: (i) any man reaching 20 years had had a 10.6% chance of developing early-stage disease; and reaching 60 years had a cumulative prevalence of 11.2%, (ii) incidence data are described for the first time, once early-stage disease is apparent men had an annual risk of 1.57% of developing acute hydrocoeles; (iii) case-finding methods are strongly biased toward end-stage cases. Early-stage disease is less prevalent in endemic communities than has been reported previously from hospital-based studies. Subsequently the decision to treat all 19 Northern districts first led to intense community-based research and other observations. It is recommended that the advice was given on the basis of formal operational research [143, 144].

## 14. Conclusion

Lymphatic filariasis is caused by the parasitic worms *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori*. The disease is endemic in 83 countries worldwide and remains a public health problem in 73 of these countries. It is noteworthy that an evaluation before launching the disease estimation process in 2000 is useful to understand the characteristics of hidden filaries at the base level and to create necessary data in the future. Therefore, this study examined hidden filariases and epidemiological factors in three endemic districts in Tanga, Tanzania, in 1989. Efforts to eradicate hidden parasiterable diseases have been made in Indonesia with the participation of 27 countries and areas to eliminate hidden parasiteric diseases through the proposal of the Indonesian Ministry of Health in 1977. The disease is also called lymphatic filariasis. Lymphatic filariasis affects 90 brands, including Asian and Pacific regions, with great social, economic, and medical effects.

Case detection of asymptomatic patients has been found to be a difficulty in the control of the policy, and it is necessary to establish the analysis of epidemiological characteristics of endemic areas and the appropriate, simple, and practical diagnostic techniques for case detection of ulcer and lymphatic filariasis. This paper examines the results of a longitudinal study in Cakra Negara Puskesmas, Gili Indah Village, Jonggat District, South Lombok. On November 15th, 2000 and February 12, 2001, at the Cakra Negara Puskesmas Complications Clinic, a micro-parasite examination and specific surface serial exams were conducted at the Jonggat Puskesmas Laboratory at Klinik Cakra Negara to obtain data on lymphatic filariasis.

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