Impact of Migrating Populations on the Re-emergence of Lymphatic Filariasis in areas under control: A Multi-centric study in Kerala

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Abstract:

Context: As one of the most prevalent neglected tropical diseases (NTDs), Lymphatic Filariasis (LF) is a significant burden on the healthcare system. Efforts to entirely eliminate LF are profoundly impaired by the migration of people from endemic areas to regions that have eliminated or achieved control of the disease.

Aims: To evaluate the impact of the migrant population on the prevalence of LF in Kerala, India and present the results to motivate appropriate health services or institutions to adopt control programs to eliminate transmission of this disease.

Settings and Design: A community-based multicentric cross-sectional study was conducted from September 2018 to February 2019. The participants were residents of both urban and rural areas where mass drug administration (MDA) was discontinued, residents of coastal regions of Kerala with an ongoing MDA program, and migrants in Kerala, India.

Methods and Material: The finger-prick method was utilized to obtain blood smears between 9 pm and 11.30 pm, after which thick smears were prepared and stained using the Giemsa staining procedure. Investigators examine the slides under the microscope for microfilaria.

Statistical analysis used: SPSS statistical software (version 23.0, SPSS Inc.) is used to analyze the data.

Results: The study included 3809 participants, of whom 11 (0.31%) tested positive for LF. The prevalence of the disease in coastal and endemic populations was 1.01%. In the migrant population, the prevalence of LF was 3.08%. No subjects from areas cleared by the TAS tested positive for LF.

Conclusions: The study confirmed an increased prevalence of LF among the migrant population in Kerala. Despite the lack of conclusive evidence to confirm that migrants pose a definite threat in active transmission in LF foci, the risk of introducing this infection to non-MDA areas is significant.

Key Messages: The reoccurrence of LF in Kerala, caused primarily by the high influx of migrants from endemic areas, will make it impossible to eliminate this tropical disease by 2020.

It is worth considering implementing MDA among the migrant population.

Introduction:

Neglected tropical diseases (NTDs) encompass a wide range of communicable diseases that are common in tropical countries [1]. They can affect the majority of a population, leading to a significant burden on the healthcare system [2,3]. The most affected are populations with low socioeconomic status, inadequate sanitation and frequent contact with livestock and infectious vectors. Lymphatic filariasis (LF), a vector-borne NTD, is one of the oldest and most significant causes of permanent disability in tropicalcountries [4,5]. World Health Organization (WHO) recognized LF as one of the most debilitating NTD and identified it as an eradicable condition [6]. Currently, 886 million people in 52 countries worldwide are at risk of LF. Of these, 63% (1.34 billion people) reside in Southeast Asia, and 30% reside in Sub-Saharan Africa, while the remainder are dispersed among other areas in tropical regions. India alone accounts for 40% of the disease burden in the Southeast Asian region [7,8]. In 2012, the WHO's roadmap reconfirmed the year 2020 as the target date to achieve the goal of eliminating NTDs [9]. The National Filaria Control Program (NFCP), initiated by the Government of India, supports the goals set by the WHO, but in many parts of India, anti-filarial measures and treatment facilities are deficient.

A single prophylactic dose of diethylcarbamazine (DEC) by mass drug administration (MDA) annually for five years interrupts transmission of the disease [10]. As per the guidelines released by the WHO in 2011, the districts that accomplish five cycles of MDA covering more than 65% of their population are subject to a transmission assessment survey (TAS) [9]. The WHO implemented the TAS as a standard methodology for surveillance to assess whether the series of MDAs in a region reduced the prevalence of microfilariae infection to such a low level that, even if mosquitoes are present, the infection cannot be transmitted in that community [8]. In Kerala, LF is endemic in approximately 11 out of 14 districts; however, the government has restricted the MDA program to very few districts, as the

prevalence of the disease in the native population has been found to be below the critical level of the TAS [11]. Because the prevalence of LF in an area dictates the control strategies, we must consider the many compounding factors that affect it. One such significant contributor to the prevalence is the migration of individuals from highly endemic areas into areas of acquired control of the disease. According to the guidelines, this is in conflict with the strategy of withdrawing MDA. Reluctance to adapt control strategies based on changes in the transmission dynamics can result in re-emergence, outbreaks, and, consequently, a need to reinstate MDA in areas that were previously cleared according to the TAS. Thus, the findings of this study are significant.

Migration is a natural phenomenon that promotes cultural exchange and diversity. According to the data of the Kerala Migration Survey, in 2018, the migrant population was estimated at 3.4 million[12]. Among the large migrant population are LF-infected individuals. Additionally, the extremely high rates of emigration from India could lead to cross-border transmission of LF, thereby highlighting its international importance. We performed our research in the southern part of India, in the state of Kerala, which has a substantial rate of migration from other endemic states in India. We hope the results of this study have reasonable generalization to other states as well as other countries based on migration trends in India. These results are also expected to bring attention to other NTDs in the future that could prompt further research in the same field.

Subjects and Methods: This was a community-based, multicentric, cross-sectional study conducted between September 2017 and February 2019 that included natives of Kerala and the migrant population. The study population was randomly selected from residents of rural and urban areas cleared by the TASs, where MDA was discontinued, residents of coastal areas of Kerala where MDA programmes are still ongoing and the migrant population of Kerala. The migrant population included labourers from the northern states of India, including West Bengal, Bihar, Assam, Uttar Pradesh, Jharkhand and Odisha, who were employed in various sectors, such as construction, waste management, gardening, and cleaning. A total of 22 rural and urban areas, two coastal regions, and three migrant settlements were selected for the study.

In addition to the migrant population, for the purpose of this study, a large native population was included to evaluate the re-emergence of the disease. All participants were older than 18 years. Excluded from the study were subjects who did not provide consent and those who spoke native languages for which translators were unavailable.

Initially, the investigators primed the population during house-to-house visits, utilizing the opportunity to provide health education regarding LF and to obtain permission from the subjects for blood collection in the early evening. At the house-to-house visits, data on age, sex, and occupation were collected with a premade form. The finger-prick method was utilized to obtain blood smears between 9 pm and 11.30 pm, after which thick smears were prepared and stained using the Giemsa staining procedure. Investigators examined the slides under the microscope for microfilaria. Specialists in the Department of Microbiology and the Department of Pathology in a tertiary hospital in South India reconfirmed the positive samples. As the study was conducted at night, some data were unavailable due to a lack of coordination from the residents. Patients who were found positive for LF received the best available standard of care.

The study protocol was approved by the Institutional Ethical Committee. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Each study participant provided written informed consent.

The data collected from 3809 individuals were entered into an Excel spreadsheet. SPSS statistical software (version 23.0, SPSS Inc.) was used to analyze the data. Qualitative variables were expressed as numbers (percentages), and quantitative variables were expressed as means (standard deviations). Associations were analyzed using the chi-square test. Variables with a p-value of <0.05 were considered significant.

Results: A total of 3809 participants were screened. The mean (SD) age of the participants in the study was 36.99 (18.18) years. The mean age of the urban and rural population of Kerala, which included 1371 males and 1817 females, was 35.56 (18.75) years. The mean age of the coastal population of central Kerala, which included 257 males and 137 females, was 34.84 (15.29) years. However, the mean age of the migrant population was 31.68 (10.96) years; the migrant population included 160 males and 67 females. The demographic details of the study population are presented in Table 1.

Area	Sex		Total
	Female	Male	
Rural	1817 (56.99%)	1371 (43.01%)	3188 (100%)
Costal	137 (34.77%)	257 (65.23%)	394 (100%)
Migrants	67 (29.51%)	160 (70.48%)	227 (100%)
Total	1954 (51.30%)	1855 (48.70%)	3809 (100%)

Table 1. Summary of demographic details

Of the 3809 participants evaluated, a total of 11 participants (0.31%) were positive for LF. Of these 11 patients, four (36%) patients were from the coastal belt of central Kerala, and the remaining seven (64%) patients were migrants. None of the patients from the rural and urban areas were positive for LF (Fig 1). The incidence of LF in the rural and urban, coastal, and migrant populations varied significantly, with a p-value of 0.0001 (Table 2). The prevalence of LF among the coastal population was 1.01% and among the migrant population was 3.08%. Of the seven LF cases in the migrant population, the majority (57.14%) of patients were natives of Bihar while others were from Odisha (28.57%) and Uttar Pradesh (14.28%) (Fig 2).

MF	Area	Total	P-value (chi-square test)		
	Rural	Costal	Migrants		
Negative	3188	390	220	3798	0.0001
Positive	0	4	7	11	
Total	3188	394	227	3809	-

Table 2. Incidence of LF among population

Discussion: This cross-sectional study was conducted to check for the re-emergence of LF in Kerala in view of the influx of migrants from the northern parts of India, where LF is prevalent. The total prevalence was 0.31%, and the specific population prevalence was 3.0% among migrants and 1.01% among the coastal population in central Kerala. None of the participants from the rural and urban populations in our study were positive for LF. This study showed that there is a significant difference in the prevalence of LF in different populations within Kerala state. The coastal belt of Kerala is endemic for LF and is under active surveillance. Even so, new positive cases may arise, thereby justifying the need for the continuation of surveillance.

An overall prevalence of 18.3% was found in a study from Kuwait on filarial antigenemia among migrant workers, with more than 90% of the study subjects from the filaria endemic areas of Bihar, Andhra Pradesh, Uttar Pradesh and Tamil Nadu in India [13]. Moreover, 3.5% of cases of LF reported in Saudi Arabia were among immigrants predominantly from five Southeast Asian countries, with the majority from India [14]. A study in Ernakulam, a migrant-rich district in Kerala, by George et al. [15] reported a prevalence of 3.6% among migrants predominantly from states in northeastern India. These results demonstrate that there is a significant proportion of people LF in the northeastern and southern states. In 2017, international migration reports indicated that India was the largest country of origin, with approximately 17 million international migrants, meaning that India is responsible for preventing the cross-border transmission of LF[16]. Due to migration from endemic areas to areas that have achieved elimination/control of LF, such as the state of Kerala, progress in elimination of this disease is severely impacted. The risk of transmission by migrants is higher in Kerala than in developed countries where the environment is mosquito-free, or the transmission from human to vector is limited. Surveillance should be emphasized in vector-prevalent areas in Kerala to monitor the pattern of migration and the status of infection in migrants [17]. Mosquito eradication methods must be implemented with high intensity in areas with large migrant populations to hinder transmission.

Considering the preliminary data and guidelines set in the past, the government plans to withdraw MDA. It is worth emphasizing that guidelines are to be considered as only guidelines and should be customized based on the evolving scenario. The withdrawal of MDA under the condition of increasing migration could be compared to adding fuel to the fire. If new methods are not implemented, the re-emergence of LF and subsequent outbreaks in areas with high-vector populations can be anticipated. The necessity to manipulate the guidelines based on real-time demands is crucial. Additionally, this also prompts the need for further cross-sectional studies to assess the prevalence status. The re-evaluation of strategies, such as migrant-focused campaigns, for surveillance and eradication is necessary. Control programs involving migrant screening and continuation of MDA in specific areas with large migrant populations and with high influxes of migrants should be maintained.

Although there is no conclusive evidence yet to demonstrate that migrants pose a definite threat in the active transmission in LF foci, there is a significant risk for the introduction of the infection from non-MDA areas. Additionally, there is a risk for the resurgence of infection caused by local individuals with residual microfilaremia (MF). This is compounded by local vectors and their ability to transmit infection in non-endemic areas. Among the vectors, Aedes mosquitoes are considered to have a significantly greater ability to transmit LF than Culex or Anopheles mosquitoes [18]. There is evidence of the resurgence of infection in countries in the Pacific Ocean region, where Aedes species are the vectors, even after low levels of post-intervention LF infection [19,20]. These particular regions are known for inter-island migration. However, there is limited research to understand the role of migrants in resurgence.

The targets set by the Global Program to Eliminate Lymphatic Filariasis (GPELF) towards the 'elimination of LF as a public health problem by 2020' require the consistent assessment of these goals, which may serve as a guide in future programmatic planning [8]. Even though the prevalence rates in our study were seemingly small, the burden of the world's second most debilitating disease, along with the aim of eliminating LF by 2020, makes this study highly relevant and significant. Active surveillance and health awareness among natives of Kerala is very much appreciated, but there is a need for the continuation of programs in coastal belts, and this need may extend beyond 2020. Although this article focuses on LF, it also intends to bring attention to other NTDs with similar transmissibility.

The authors acknowledge a few limitations of this study. First, as the sample size was large, screening the samples using a molecular test was not performed; molecular testing could have a superior advantage in identifying asymptomatic carriers with very low parasitic loads, which we may have missed in this study. However, the positive outcome of this study makes it highly significant.

Conclusion: Through the collection of microbiological samples, this study identified significant findings that have the potential to emphasize the need for the customization of the WHO's 'Global Program to Eliminate LF by 2020' guidelines. It emphasizes the demand for tailoring present strategies according to significant factors, i.e., migration, to control the spread of LF. With migration, an influx of microfilaria occurs, resulting in a potential threat of the re-emergence of LF. This could possibly delay our goal of attaining elimination of LF by 2020. As migrant populations are spread throughout the state,

an active program focusing specifically on these populations should be developed. The massive inflow of migrant workers, along with their families, increases daily, as the state keeps its doors open for employment, consequentially adding to the threat of an impending outbreak. High rates of emigration from India can contribute to the cross-border transmission of LF, which should also be addressed appropriately. The results of this study have reasonable external validity in other states, as well as other countries, based on the migration trends within and outside India. Hence, these results have the potential to affect the LF control strategies in the country with the highest prevalence. This study should draw the attention of government bodies towards migrants and thus prompt the development of customized programs to eliminate this NTD once and for all.

List of Abbreviations:

LF, lymphatic filariasis; MF, microfilaremia; NTD, neglected tropical disease; MDA, Mass Drug Administration; TAS: Transmission Assessment Survey

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