Vector control in lymphatic filariasis elimination programme

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Lymphatic filariasis (LF), which is transmitted by mosquitoes, and caused by parasitic worms, *Wuchereria bancrofti*, *Brugia malayi* and *B. timori*, affects an estimated 120 million people throughout the tropical and subtropical countries. The International Task Force for Disease Eradication has identified it as one of the six major tropical diseases considered as potentially eradicable[1]. The World Health Assembly adopted a resolution supporting the Global Programme to Eliminate Lymphatic Filariasis (GPELF) and a twenty-year elimination programme is now under way[2]. The strategy includes controlling both transmission through community-wide (mass) chemotherapy and the disease itself via individual patient management[3]. The disease is also viewed as a filarial syndrome[4].

Under the LF elimination programme, annually on a particular day, the anti-filarial drug, diethylcarbamazine (DEC) is distributed to all inhabitants of filariasis endemic areas, excluding pregnant women and children below two years of age. Though this drug has limited effect on infective stage larvae or on the adult worm, it clears microfilariae (mf) from the circulation of the affected individuals in the community, thereby preventing the mosquito from transmitting the infection[5]. However, the mass drug administration (MDA) of DEC is beset with several difficulties because of toxic reactions in human beings; in many patients even after the full regimen of treatment has been given, some mf do persist[6,7] and mass administration of the drug through medicated salt has been successful in clearing mf only for some time and that too only in isolated communities[8].

The effectiveness of LF elimination depends upon the consumption of the drug by the affected population. Implementation of MDA led to diverse problems in some communities (urban areas, remote areas, migrant populations, minority groups), with high rates of non-compliance having caused low treatment coverage[9]. The success of the programme needs to be evaluated at a minimum interval of three or four years. Evaluation of LF elimination programme mainly to check transmission could be carried out through detection of mf by night-blood smear examination or using PCR techniques of night-blood samples. In many parts, the programme is run based on morbidity data. In the absence of baseline mf prevalence data, it will be difficult to evaluate the MDA programme.

The community fear of side reaction of the drug and absentees on the drug distribution day resulted in reduction in consumption of the drug by people in different areas[10]. Under the MDA programme, the various precautions needed to be undertaken include drug procurement only from standard companies that follow good manufacturing practices, prompt management of side effects by the medical officers and drug distributors to build up the confidence of the people, and exclusion of drug administering to extremely old and seriously ill people[11,12].

With only chemotherapy under annual single dose of MDA, the parasitic load in the community could be reduced up to a certain degree/level in the population depending upon the percentage of coverage on distribution of drugs and consumption of the drugs by the community[13]. Under these circumstances, the potential individuals harbouring mf in their blood stream are sufficient to transmit the disease to other individuals.

Studies on drastic reduction of *Culex quinquefasciatus* population by adopting the environmental sanitation measures have been reported elsewhere[14,15]. Integrated vector control management programme has yielded the desired result (i.e. prevention of LF transmission in urban areas) in a time-bound period at Puducherry[16].

Integrated vector control study carried out by the Vector Control Research Centre (VCRC), Puducherry during 1981–85 has demonstrated that total interruption of transmission is possible if there is a drastic improvement in sanitation leading to low emergence of vector mosquitoes and when intensified vector control is combined with efficient administration of drug to all mf carriers after detecting them[17,18]. A single campaign of mass treatment for bancroftian filariasis with DEC in Makunduchi, a town in Zanzibar, United Republic of Tanzania, combined with elimination of mosquito breeding in pit latrines with polystyrene beads and followed by a progressive decline over a 5-year period in the mf rate from 49 to 3%, visualized the impact of vector control[19,20].

In Zanzibar town, treatment of 3844 wet pit latrines and cesspits with polystyrene beads lead to reduction of 65% adult mosquito population in houses[20]. Applying polystyrene-bead layers in pits which form a major component of vector population of *Cx. quinquefasciatus*, helped in considerable reduction in man–vector contact in the process of LF elimination by MDA[21]. Urban mosquito control in Cochin, Kerala, where a systematic approach on vector control has been emphasized[22], the outcome of diminishing focus on LF resulted due to the continuous efforts of several years of programme on both vector control and chemotherapy by the National Filaria Control Unit and the City Corporation[23]. That vector control is appropriate in different environments has been highlighted in the control of vector-borne diseases of South East Asian countries[24]. Inclusion of entomology components in the control of filariasis and the monitoring of LF elimination programme has been warranted in Pacific programmes[25]. Studies on vector control complements MDA against bancroftian filariasis at Tirukoilur, Tamil Nadu that the gains of MDA were sustained only with the integration of vector control measures and also advocate the incorporation of vector control in the GPELF as it can potentially decrease the time required for LF elimination[26]. In spite of the decrease in cumulative mf load using chemotherapy, effective reduction in transmission parameters need not result, if vector density in the community remains high[27].

Although integration of vector control with MDA did not appear to be cost-effective[28], achievement through the implementation of various types of vector control methods on longer duration were beneficial to the community[29]. It has been proved that the involvement of vector control component as such may not be cost-effective in the initial stage of the implementation; however the same measures proved to be cost-effective during

the longer period in the permanent improvement on the reduction on the breeding sources of the principal vector *Cx. quinquefasciatus*[5,30].

The community currently spending millions of rupees on the purchase of personal protective measures in the form of mosquito coils or vapourising mats or liquids to prevent mosquito bites during night hours, could be drastically reduced by providing a strong IVM programme by any organized sector with involvement of intersectoral collaboration and active participation of the people. Thereby the money spent by the people on personal protective measures could also be saved further. It has been reported in Puducherry that an estimate of average monthly expenditure on personal protection measures were US$ 1.3 and 0.17 in urban and rural areas respectively[31].

There is a danger that MDA campaigns may fail to maintain adequate treatment coverage to achieve LF elimination. Hence, additional measures to suppress transmission might be needed to ensure the success of the GPELF[32]. The need for vector control component in *Anopheles*-transmitted filariasis has been emphasized with potential benefits[33]. Vector control has successfully eliminated LF when implemented alone or with MDA. Challenges towards LF elimination include uncertainty in the exact level and duration of microfilarial suppression required for elimination, migration of infected individuals and consistent non-participation of some infected individuals in MDA. Though vector control has proven highly effective in preventing disease transmission, it is not being used to its full potential. Hence within the past two decades many important vector-borne diseases have re-emerged or spread to new areas[34].

Integration of vector control with MDA can address potential benefits of vector control such as: (a) the ability to suppress filariasis transmission without identifying all individual foci of infection; (b) reduction in risk of reestablishment of transmission from imported mf-positive individuals, and (c) decreases the risk of dengue or malaria transmission where *Aedes* or *Anopheles* are also found to be vectors of LF.

In India also, the desired result of the LF programme is uncertain even after a continuous effort of MDA in the endemic regions. At this juncture, ignoring the importance of vector control will ultimately lead to failure instead of successful elimination of LF. Based on several studies in the past, along with MDA vector control has to be integrated towards the LF elimination not only in India, but also many parts of the globe.

Sustainability of transmission suppression of LF could be achieved only through integration of different strategies of vector control along with MDA. The time has come to incorporate vector control to play a key role in the prevention of disease transmission with full satisfaction of community not only to protect them from vector bites but also their appreciable participation would be helpful towards the successful elimination of the non-fatal disease. To win the confidence of the people regarding their participation in both MDA and vector control, delivering required Information Education and Communication is a prerequisite for the success of the GPELF.

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