LYMPHATIC FILARIASIS ELIMINATION FROM INDIA: ANOTHER SUCCESS STORY IN THE OFFING

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ABSTRACT
Amongst all types of vector-borne diseases, the human lymphatic filariasis (LF) is one of the oldest and most debilitating of the neglected tropical diseases, caused by 3 species of filarial parasites, viz., Wuchereria bancrofti, Brugia malayi and B. timori. The infection is transmitted by mosquitoes of varied species, but most dominantly by Culex quinquefasciatus. An estimated 120 million people in 73 countries are currently infected, and an estimated 1.393 billion live in areas where filariasis is endemic. Mass drug administration (MDA) is required. Of the 73 countries where LF is currently considered endemic, 53 countries have implemented MDA, while 37 already completed five or more rounds of MDA in at least some of their endemic areas. Of the latter at least 12 countries have moved to a post MDA surveillance phase. During 2000–2011, >3.9 billion doses of medicine were delivered to a cumulative targeted population of 952 million people\(^1\), including 22 million children below 15 years of age who are also infected with the disease. The results are encouraging, though still far from being satisfactory, and it looks like the Indian promulgation to eliminate the disease from the country will possibly still need to wait for some more years, since notwithstanding mf rate is already brought down less than 1% in most endemic districts, there still remain certain hotspots exhibiting 1 mf rate. Vector control has been demonstrated to be very useful in sustaining benefits of the MDA.

Key Words: lymphatic filariasis, elimination, India, Success, story

Introduction
Lymphatic filariasis (LF) is one of the oldest and most debilitating of the neglected tropical diseases, caused by 3 species of filarial parasites, viz., Wuchereria bancrofti, Brugia malayi and B. timori, and transmitted by mosquitoes. An estimated 120 million people in 73 countries are currently infected, and an estimated 1.393 billion live in areas where filariasis is endemic. and mass drug administration (MDA) is required. Of the 73 countries where LF is currently considered endemic, 53 countries have implemented MDA, while 37 already completed five or more rounds of MDA in at least some of their endemic areas. Of the latter at least 12 countries have moved to
a post MDA surveillance phase. During 2000–2011, >3.9 billion doses of medicine were delivered to a cumulative targeted population of 952 million people\(^1\), including 22 million children below 15 years of age who are also infected with the disease\(^2\).

**National Intervention Programme**

National Filaria Control Programme (NFCP) was launched in the country in 1955 with the objective of delimiting the problem and to undertake control measures in endemic reas. The manifold increase in filariasis during last four decades reflects failure of filariasis control programs\(^3\). About 64% of global population who are at risk of LF infection are living in southeast Asia region. It is estimated that 554.2 million people are at risk of LF infection in 243 districts across 20 states and union territories in India\(^4\). Currently there may be up to 31 million microfilaraemics, 23 million cases of symptomatic filariasis, and about 473 million individuals potentially at risk of infection in the country. Lymphatic filariasis (LF) is a major impediment to socioeconomic development (estimated loss $1 billion per year) and is responsible for immense psychosocial suffering among the affected\(^5\). National Health Policy 2002 aims at elimination of transmission and prevention of disability due to LF by the year 2015. Considerable progress has been made in diagnosis and treatment of filariasis in the last decade and new strategy for filariasis elimination aims at transmission control through mass drug administration (MDA) and at disease control through individual patient management. Annual single-dose co-administration of two drugs (ivermectin+ diethylcarbamazine (DEC) or albendazole) reduces blood microfilariae by 99% for a full year while a single dose of one drug (ivermectin or DEC) administered annually can result in 90% reduction. Field studies confirm that such reduction of microfilarial loads and prevalence can interrupt transmission\(^6\). The 50th World Health Assembly recently called on member states of World Health Organisation (WHO) to identify the global elimination of lymphatic filariasis as a public health problem\(^7\,^8\). MDA-2012 round started in November 2012. Out of 20 endemic states/UTs, MDA was to be observed in 17 except Goa, Puducherry and Daman & Diu as these were found to be fit for Transmission Assessment Survey (TAS). Transmission Assessment Survey conducted in Goa Puducherry & 1 district of Tamil Nadu and these districts passed for MDA stoppage\(^9\).

**Vectors**

Bancroftian filariasis, transmitted in India by the ubiquitous principal vector, *Culex quinquefasciatus*, predominantly prevail in the continental Asia. In Indian mainland where the periodicity of LF infection is nocturnal, 98% of LF parasite is transmitted by *Cx. quinquefasciatus* in urban areas\(^10\). The goal of the GPELF is to eliminate lymphatic filariasis as a public-health problem by 2020, and in India by 2015. In India MDA with DEC was launched as a pilot project in
13 districts of seven states in the year 1996\textsuperscript{11}. There have been several views on the use of Albendazole (Alb) for MDA towards the elimination of LF\textsuperscript{12-14}.

**The Trikoilur study**

Under the GPELF, in Tamil Nadu three rounds of MDA with DEC have been completed by March 2000. From the fourth round of MDA (March 2001), albendazole was co-administered with DEC in some districts. Under the WHO/TDR project, the Centre for Research in Medical Entomology, Madurai had carried out technical evaluation of the impact of MDAs on filarial infection variables both in the community and in vector population in two revenue blocks of Tirucoilur and Mugaiyur in Villupuram district, Tamil Nadu State, India with a total human population of 3,21,000 were covered by the project.

Three rounds of annual mass drug administration, with diethylcarbamazine and ivermectin, were complemented by vector control (mainly using polystyrene beads) in villages of Tirucoilur, south India, during 1995–99. Subsequently, drug administration is being carried out with diethylcarbamazine and albendazole or diethylcarbamazine alone. The CRME evaluated the impact of mass drug administration used alone or in conjunction with vector control from 1995 to 2005, using vector transmission indices. Annual single dose of DEC was administered in Mugaiyur block during March 2001, 2002, 2003, September 2004, December 2007, June 2009 and February 2010; while albendazole (ALB) was co-administered with DEC in Tirucoilur block. The MDAs during the years 2005, 2006 and 2008 could not be implemented due to administrative reasons at the State Heath Department.

Evaluation was carried out to determine the impact of MDAs on filarial infection variables, viz, microfilaraemia, antigenaemia, entomological indices, and also on soil transmitted helminth infection in children.

**Vector control as an adjunct to MDA for lymphatic filariasis elimination**

Vector density greatly decreased in villages where vector control was used as an adjunct to mass drug administration and almost no infective mosquitoes were found in the small numbers still remaining. Considerable numbers of filarial larvae (including L3 stages) were found in the mosquitoes caught in the villages receiving MDA alone. We observed that the prevalence and intensities of microfilaraemia decreased sharply (in the survey during 1997) in villages receiving both MDA alone and MDA with vector control (88% to 92%), after two MDAs using DEC + IVR (carried out in 1995 and 1996). In the subsequent survey in 1999 (without any MDAs in between) the microfilarial prevalence and intensities resurged in villages receiving MDA alone but did not do so in villages receiving MDA with vector control. The gains of mass drug administration were sustained only with the integration of vector control measures. We advocate the incorporation of
vector control in the Global Programme to Eliminate Lymphatic Filariasis as it can potentially decrease the time required for eliminating lymphatic filariasis.

**Impact of MDA under filariasis elimination campaign on entomological and parasitological aspects of filariasis and intestinal worm burden**

After each MDA there was a gradual decline in microfilaraemia prevalence in the DEC+ALB arm demonstrating this combination of 2-drug treatment to have a better edge over DEC alone arm. One year post MDA VI, found the microfilaraemia prevalence (MFP) in the two arms to be 0.73% and 0.78% in DEC+ALB and DEC alone arm respectively (Figure 1).

![Microfilaraemia prevalence changes with MDAs](image)

Fig. 1. Microfilaraemia prevalence changes with MDAs

The overall cumulative percentage MFP reductions in the two treatment arms were 86% and 82% in DEC+ALB and DEC alone arms respectively. The trend for the geometric mean intensity (Mf) also was similar. The cumulative decline in antigenaemia prevalence in the two-drug treatment strategy (DEC+ALB) was two times higher than that of DEC alone arm even after 6 MDAs (Figure 2). The overall reduction was 75% and 38% in DEC+ALB and DEC alone arms respectively. In children of 2-5 years the overall reduction of AGP was 4 times higher in DEC+ALB arm (88% as against 23% in DEC alone arm).

The impact of DEC+ALB and DEC on the prevalence and intensity of soil transmitted helminth, viz; Ascaris, hookworm and Trichuris, the stool samples from the school children of 9 and 10 year old in the 18 index villages was determined. Ascaris was the predominant species in both the arms with 53-55% of the student harbouring it; and the Trichuris were in less percentage (5-7%). DEC with albendazole co-administration demonstrated an impact on all 3 helminths, while DEC alone showed effect on only Ascaris. With 7 rounds of MDA (during the span of 10 years) the overall STH prevalence reductions were 79% and 10% in DEC+ALB and DEC alone arms respectively; while the egg intensity reductions were 98% and 47% respectively.
Entomological indices showed declining trend with each MDA in both the treatment arms, with higher advantage (reductions) in 2-drug arm. During one year post MDA V, the Per Man Hour density (PMHD) was lower in both the treatment arms (14.01 and 10.82 in DEC+ALB and DEC alone arms respectively). The parity rates were similar in both the arms.

The transmission intensity index and other indices were low in DEC+ALB arm. In DEC alone arm the infection and infectivity rates were 5.76% and 0.66% during Pre MDA I, which declined to 0.85% and 0.20% respectively. Entomological indices (TII) values showed 97% and 83% reductions in DEC+ALB and DEC alone arms respectively during one year post MDA V (Figure 4).
The seventh annual MDA programme using DEC, and DEC plus albendazole was carried out in February 2010. The drug compliance during MDA VII was 84.62% in DEC+ALB arm, while in DEC alone arm it was 81.22%. The adverse reactions were negligible (1.5% & 2.0%). The overall cumulative percentage reductions in microfilaraemia one year after MDA VI in the two treatment arms were 86% and 82% in DEC+ALB and DEC alone arms respectively. The prevalence of antigenaemia (AGP) in 2-25 years was 18.87% in the baseline (March 2001) in DEC+ALB arm, which declined gradually, and at one year post MDA VI the AGP was 4.71%, with an overall reduction of 75% (P<0.0001). In DEC alone arm, the AGP value, which was 7.55% at one year post MDA IV increased to 10.21% during 2.5 yrs post MDA IV and later during one year post MDA VI the AGP was 9.33%. In DEC+ALB arm the percentage reductions in prevalence and egg intensities of soil transmitted helminths during MDA VII post treatment period was similar to that observed for the previous MDAs, with respect to the respective pre-treatment values; while the reductions were much lower in DEC alone arm as compared to previous MDAs. DEC with albendazole co-administration demonstrated an impact on all 3 helminths, while DEC alone showed effect on only Ascaris. After 7 rounds of MDA with ALB co-administration, the percentage positivity of STHs among the school students showed a marked reduction of 98% and 47% in the egg output. Entomological indices like Transmission intensity index (TII) from resting catch & Annual Transmission Potential (ATP) from landing catches were estimated to demonstrate the impact of MDAs on these parameters. During one year post MDA VI, the Per Man Hour density (PMHD) was lower in both the treatment arms (13.13 and 10.68 in DEC+ALB and DEC alone arms respectively). The parity rates were similar in both the arms. It was observed in DEC+ALB arm that the percentage reduction in TII values was highest (>95%) during post MDA V & VI; whereas in DEC alone arm the reductions were 70-80%. In landing collection, the transmission potential (TP) was nil in DEC+ALB arm during the one year post-MDA V & MDA VI. During the latter period (post MDA VI), DEC alone arm demonstrated average monthly TP value of 5.81.
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