Persistence of Lymphatic Filarial Infection in the Paediatric Population of Rural Community, after Six Rounds of Annual Mass Drug Administrations

by I. P. Sunish, A. Munirathinam, M. Kalimuthu, V. Ashok Kumar, and B. K. Tyagi

Centre for Research in Medical Entomology (ICMR), No. 4 Sarojini Street, Chinna Chokkikulam, Madurai - 625 002, Tamil Nadu state, India

Correspondence: Dr. B. K. Tyagi, Scientist “G” & The Director in-Charge, Centre for Research in Medical Entomology (ICMR), No. 4 Sarojini Street, Chinna Chokkikulam, Madurai - 625 002, Tamil Nadu state, India. E-mail <crmeicmr@icmr.org.in>; <bk_tyagi@sify.com>.

Present address: I. P. Sunish, Regional Medical Research Centre (ICMR), Field Unit, Perka village, Car Nicobar -744 301, Andaman & Nicobar islands, India.

Summary

Under the Global Programme to Eliminate Lymphatic Filariasis (LF), mass drug administration (MDA) is being implemented in Tamil Nadu, south India, by the State health machinery. The impact of six annual rounds of MDA using diethylcarbamazine (DEC) with and without albendazole (ALB) on filarial infection (microfilaraemia prevalence—MFP; antigenaemia prevalence—AGP) in paediatric population of 2–9 years was determined in two revenue blocks, with a population of 321 000. After each MDA, 300–400 children were screened for filarial infection. After six MDAs, an overall MFP reduction of 84.67% and 57.95% was observed in DEC\textsuperscript{+}ALB and DEC alone arms, respectively. Corresponding AGP reductions were 72.88\% (p < 0.001) and 41.51\% (p = 0.023). Observation of microfilaraemic children after six MDAs (0.32\% in DEC\textsuperscript{+}ALB; 0.75\% in DEC alone), necessitates the need for supplementary control strategies (viz., vector control), in order to achieve the goal of LF elimination.

Key words: lymphatic filariasis, paediatric, mass drug administration, Tirukoilur, south India

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Lymphatic filariasis (LF) has been targeted for elimination as a public health problem by the World Health Organization [1]. The key strategy of the Global Programme to Eliminate LF (GPELF) is by annual mass drug administration (MDA) to all individuals at risk of infection with a single dose of diethylcarbamazine (DEC) combined with albendazole (ALB) for at least 4–5 years [2]. Mass treatment with DEC+ALB has shown to have significant impact on Wuchereria bancrofti infection and also an additional long-term beneficial effect of reducing intestinal helminth infection [3, 4]. LF infection is acquired first in childhood in several instances, even though the clinical manifestations start appearing much later. Direct observation on the incidence of LF infection has been reported in very young children [5, 6]. We have earlier documented the effect of DEC+ALB on filarial infection after one to three
<table>
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<tr>
<th>Observation period</th>
<th>2–5 years</th>
<th>6–9 years</th>
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<tr>
<td></td>
<td>Tirukoilur (DEC+ALB)</td>
<td>Mugaiyur (DEC alone)</td>
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<tr>
<td></td>
<td>Number screened</td>
<td>MFP (95% CI)</td>
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<tr>
<td>Pre-treatment (March 2001)</td>
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<tr>
<td>Post-MDA I (March 2002)</td>
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<tr>
<td>Post-MDA II (March 2003)</td>
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<td>Post-MDA III (March 2004)</td>
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<tr>
<td>Post-MDA IV (September 2005)</td>
<td>185</td>
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<tr>
<td>2.5 years Post-MDA IV (April 2007)</td>
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<td>Post-MDA V (January 2009)</td>
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<tr>
<td>Post-MDA VI (February 2010)</td>
<td>181</td>
<td>0.00</td>
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MFP, microfilaraemia prevalence; AGP, antigenaemia prevalence.
MDAs [4, 7, 8]. In the present communication, the impact of six rounds of MDA on the filarial infection in paediatric population (2–9 years) was analysed.

Two revenue blocks of Tirukoilur taluk (in Tamil Nadu, south India), viz., Tirukoilur and Mugaiyur, with 204 villages and a population of 321,000 (including ~100 thousand children), were selected for the study. All eligible individuals were targeted for antifilarial drug consumption. Tirukoilur block was assigned for DEC + ALB, whereas Mugaiyur block with DEC alone. The MDA programmes were implemented by the Tamil Nadu Public Health Department for six rounds during the years 2001–10. The drug compliance in both the arms during all the MDAs was comparable. During MDA 2010, the compliance in DEC + ALB and DEC alone arms were 84.62% and 81.22%, respectively. The status of microfilaraemia and antigenaemia was assessed before the first MDA and 1 year after each MDA. During each survey, fingerprick blood samples (20 μl for microfilaraemia and 100 μl for antigenaemia [7]) were collected between 21.00 and 24.00 h, from 300–400 children (2–9 years), with prior consent. The impact of MDA on filarial infection was analysed using statistical software SPSS ver.10.0.

The pre-treatment microfilaraemia prevalence (MFP) in 2–9 years were 2.07% and 1.78% in DEC+ALB and DEC alone arms, respectively, whereas the corresponding antigenaemia prevalence (AGP) were 12.76% and 12.72%. These were comparable (p > 0.05). After each MDA, a gradual decline in filarial infection was observed. The MFP in DEC+ALB arm declined below 1% after two MDAs, and reached 0.32% during post-MDA VI, demonstrating an overall cumulative reduction of 84.67% (p > 0.05). In the DEC alone arm, MFP remained at 1% level throughout, and during post-MDA VI, the MFP was 0.75% (reduction of 57.95%, p > 0.05). In 2–5 years, the MFP became nil in DEC+ALB after two MDAs, whereas in DEC alone arm, microfilaraemics were observed throughout, up to post-MDA VI (Table 1). In the higher age group of 6–9 years, children with MF were observed during most surveys in both the treatment arms. The reductions in this age group were similar (80.9%) in the two arms. AGP reduction in 2–9 years after six MDAs was 72.88% (p < 0.001) in DEC+ALB arm. The reduction in DEC alone arm was half (41.51%) than that observed in the two drug arm, but was significant (p = 0.023). At post-MDA VI, the AGP were 3.47% and 7.44% in DEC+ALB and DEC alone arms, respectively (Fig. 1). In 2–5 years, the overall AGP reduction was four times higher in DEC+ALB arm (88% as against 23% in DEC alone arm) (Table 1). After six MDAs, the values declined from 9.32% to 1.10% in DEC+ALB arm (reduction was significant, $X^2 = 10.49$; p = 0.001), whereas from 8.81% to 6.77% in DEC alone arm (p > 0.05). In 6–9 years, the AGP reduction in both the treatment arms were significant (p < 0.05).
Protecting children from LF infection and disease should be the primary goal of GPELF [9]. Prevalence of microfilaraemia [10], acute [11] and chronic [12], disease has been recorded in school-age children. Childhood MFP was 30% of adult prevalence for <10 years [13]. MFP in 2–9 years in the present study declined from 2.07% to 0.32% after six MDAs in DEC+ALB arm, and the reduction was 1.4 times higher in this arm, as compared to DEC alone arm. In Haiti, DEC+ALB combination was well tolerated, efficacious at reducing W. bancrofti infection in 5–11-year-old children [14]. The detection of circulating antigen has proven to be a much more sensitive diagnostic for bancroftian filariasis. The direct observations on the incidence of infection in very young children [5, 6, 13] emphasize the magnitude of the proportion of children acquiring their infections even before age 5. In the present study, with each MDA a gradual decline in antigenaemia was observed in both the treatment arms. However, post-MDA V showed an enhanced AGP value in DEC alone arm probably due to the absence of MDAs for 2 years in between. This trend was not observed in DEC+ALB arm, thus demonstrating a significant advantage of ALB inclusion. Combination therapy demonstrated modest, but significant reductions (72.8%) in antigenaemia during post-MDA VI when compared to DEC alone (41.5% reduction), suggestive of a macrofilaricidal effect.

Baseline infection status is an important factor influencing the outcome of LF elimination programme [15]. In the present study, the baseline infections were similar in both the arms. With similar higher drug compliance in both arms (70–80%), there were children with microfilaria (0.32–0.75%) and antigenaemia (3–7%), even after six MDAs. In DEC alone arm, AGP remained at >4% level throughout the study, and the possibility of these children as a source of infection for the vectors to transmit LF infection in the community needs to be considered. Even at <1% MFP, new infections occurred in highly endemic villages, though the epidemiological importance of the new infections was not clear [16]. Monitoring these villages need to be continued to determine whether this low level of infection is maintained further. It may be worthwhile to supplement MDA with additional control strategy, viz., cost effective vector control, to achieve LF elimination faster.

References