Study of the Impact of Deltamethrin Impregnated Mosquito Nets on Malaria Incidence at a Military Station

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Abstract

Deltamethrin impregnated mosquito nets have been successfully used all over the world to combat malaria. To study the efficacy of these mosquito nets in the service conditions of Armed Forces, a field trial of Deltamethrin impregnated mosquito nets was carried out at Military Stations 'A' (trial station) and B (control station) between July 96 to June 99. July 96-June 97 was the pre-trial year during which base line data was collected for malaria incidence. Three rounds of Deltamethrin impregnation of the mosquito nets were done in the trial station for the actual trial duration (July 97-June 99) in lieu of residual spraying. Antimalaria measures including residual spray were continued as usual in the control station. The intervention led to a significant decline in slide positivity rate and malaria incidence in the trial station. Malaria cases declined by 87% in the trial station whereas the control station noticed an increase by 75% at the end of the trial.

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Key Words : Deltamethrin impregnated mosquito nets; Malaria control

Introduction

Deltamethrin impregnated mosquito net(s) (DIMN) is a newer weapon in the hands of the public health officials for control of malaria. It effectively combines the personal protective effect of a conventional mosquito net and the residual effects of Deltamethrin, a synthetic pyrethroid. Use of DIMN causes a decline in the mosquito density, biting density and longevity of the mosquitoes [1]. Unlike a conventional mosquito net, even a torn DIMN provides significant protection [2]. Protective rate of female mosquitoes biting through DIMN was found to be 5-6 times that of a conventional mosquito net [3]. Use of DIMN for malaria control is cost effective. In the Gambian national impregnated bed net program, net cost effectiveness ratio per death averted and discounted life years gained were found to be US$ 471 and US$ 31.5 respectively [4]. This study was carried out at Military Station(s) (MS) 'A' and 'B' both located in South India, as a part of multicentric randomized controlled trial organized by Indian Army. The original study included a lot of parameters e.g. effect of DIMN on malaria, mosquito density, effect on flies, bug bed and other insect nuisance (subjective feeling among the users) and incidence of allergic or other side effects among the users. Since inclusion of all parameters in this article would have exceeded the limits laid down as per authors guidelines, only one major aspect of the study i.e. effect on malaria is proposed to be published in this study which, intends to present our experience at these stations and not the overall result of the trial.

Material and Methods

The study was conducted between July 1996 to June 99 at MS 'A' (trial station) and 'B' (control station). Both of these stations are adjacent to each other and are alike in topography and climatic conditions etc. The initial one year (July 96-June 97) was termed as pretrial year during which the base line data for malaria incidence was recorded for the trial station (TS) and the control station (CS). During July 97- June 99 actual intervention was introduced.

In the TS, residual spraying was replaced by three rounds of Deltamethrin impregnation of the mosquito nets, conducted in July 97, March and November 98. Routine antimalarial measures like anti-larval operations and space sprays were continued as usual. In the CS, all the antimalaria activities, including residual spray were continued undisturbed. Impregnation of the mosquito nets was done as per the guidelines given in Malaria Action Plan-95 [5]. Mosquito nets of the troops residing in MS 'A' were included in the study. Families were excluded from the study since it was difficult to ensure the usage of mosquito nets as well as their reporting sick at the respective military hospital (s) (MH). Regular data was collected for malaria cases from MH(s) located at 'A' and 'B'. Fever cases with a positive peripheral smear for malarial parasite were diagnosed as malaria. Epidemiological investigations were carried out for all the cases and cases were classified as local or imported. Data analysis was done using SPSS package and epidemiological information program of CDC Atlanta, with the help of statistician at National Institute of Nutrition, Hyderabad. Trends were analyzed for slide positivity rate (SPR), malaria among troops before and after the intervention in TS and CS. These cases were further analyzed after segregating them into local and imported cases. Comparison was also made for malaria cases for the corresponding years in both stations.

Results

Malarial parameters in both stations are summarized in

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Tables 1 and 2 respectively. It can be seen that in TS, annual parasite incidence (API) declined from 0.57 to 0.06 and SPR from 0.57 to 0.06 at the end of the trial. Both these observations were statistically significant. In CS both these parameters have shown a wide fluctuation. Among the troops in TS, a statistically significant decline in API from 0.70 to 0.09 was observed, while in CS no such trend was seen. Decline in API among families was also noticed in both stations but it was not found to be statistically significant.

Malaria incidence amongst the troops is summarized in Table 3. In TS, malaria cases declined from 8 to 1, (a decline by 87%) whereas in CS an increase of cases from 12 to 21, (an increase by 75% over base line level) was observed. The decline in malaria cases in TS was found to be statistically significant. A progressive, statistically significant decline in the proportion of local cases from 4 (50%) to nil was observed in TS, whereas in CS local cases showed an increasing trend. Further, comparison of malaria cases among the troops was done for corresponding years. It can be observed that initially there was no significant difference between two stations, but as the trial progressed, a significant decline in malaria cases was observed in TS.

Discussion

The study amply indicates that in the trial station, use of DIMN led to decline in malaria incidence in the station as a whole and among the troops in particular. Due to a very small number of cases of malaria reported among the families, no valid conclusion can be drawn. In TS where no case was reported among the families for consecutive two years, it may be due to overall effect of DIMN upon the critical mosquito density leading to reduction of cases. Like this study, other authors have also observed a decline in malaria after the use of DIMN. Karch et al (1993), observed a decline of 50% in malaria cases after five months of use of DIMN [1]. Kirigia et al (1998) found 41% reduction in paediatric malaria admissions after DIMN use [6]. The variation in the magnitude of decline in malaria cases, in different studies may be due to differences in usage of mosquito nets, local behaviour of the mosquitoes and the people.

The results of this study though significant, should be applied with caution, due to small number of malaria cases in both the TS and CS, which precludes any valid

Table 1
Malarial parameters in the trial station

Year	Station strength			Malaria cases			Annual parasitic incidence			Slides examined			
	Troops	Families	Total	Troops	Families	Total	Troops	Families	Overall	No Ex	No positive	SPR	OR*
96-97	11300	4400	15700	08	01	09	0.70	0.22	0.57	1558	09	0.57	1.00
97-98	11213	4110	15323	03	00	03	0.26	0.00	0.19	1616	03	0.18	0.32
98-99	11100	4100	15200	01	00	01	0.09	0.00	0.06	1444	01	0.06	0.12

*X^2 of linear trends for the decline in SPR = 7.003, $p < 0.05$ (significant)

Table 2
Malarial parameters in the control station

Year	Station strength			Malaria cases			Annual parasitic incidence			Slides examined			
	Troops	Families	Total	Troops	Families	Total	Troops	Families	Overall	No Ex	No positive	SPR	OR*
96-97	11570	6723	18293	12	05	17	1.03	0.74	0.92	4515	17	0.37	1.00
97-98	11570	6993	18563	32	03	35	2.76	0.42	1.88	5185	35	0.67	2.04
98-99	13200	7882	21082	21	04	25	1.50	0.50	1.18	3850	25	0.64	1.95

*X^2 of linear trends for the SPR = 2.99, $p > 0.05$ (not significant)

Table 3
Malaria cases among troops in trial and control stations

Year	Trial Station						Control Station							
	Troops with malaria			Troops without malaria	Total	OR#	Troops with malaria			Troops without malaria	Total	OR+	*X^2	p
	Local@	Imported	Total#				Local	Imported	Total+					
96-97	4 (50%)	4 (50%)	8 (100%)	11292	11300	1.00	07 (58%)	5 (42%)	12 (100%)	11558	11570	1.00	00.71	> 0.05
97-98	1 (33%)	2 (67%)	3 (100%)	11210	11213	0.38	23 (72%)	9 (28%)	32 (100%)	11538	11570	2.67	23.17	< 0.05
98-99	0 (00%)	1 (100%)	1 (100%)	11099	11100	0.13	16 (76%)	5 (24%)	21 (100%)	13179	13200	1.53	18.36	< 0.01
% change**			-87%						+75%					

#X^2 of the linear trends for the trial station = 6.058, $p < 0.05$ (significant); + X^2 of the linear trends for the control station = 0.840, $p > 0.05$ (not significant); * X^2 when comparison is made between corresponding years of trial for total number of cases; ** Percentage changes in the malaria cases with respect to 96-97 level; + sign indicates an increase and - sign a decrease in the malaria cases; @ Chi square of linear trends for the local cases at the trial station = 4.7, $p < 0.05$ (significant)

inference when generalized. However, it can be argued that the study has shown a conclusive proof (amidst its limitations), that DIMNs are useful in the settings of Armed Forces even in the stations which have low malaria transmission. The logistics required for impregnation of mosquito nets with Deltamethrin are much less as compared to the massive efforts required for antilarval and residual sprays. With restructuring of the manpower in Station Health Organization(s), DIMN should be introduced in the Armed Forces to maintain effective malaria control.

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