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Comparative Epidemiological Studies on Lymphatic Filariasis among the Population of a Rural and an Urban Area of West Bengal, India

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Abstract

Background: Situation of lymphatic filariasis is worse in many third world developing countries like India. But information is scanty from many areas. Present study focused on a comparative filarial epidemiology in rural and urban areas of West Bengal, India.

Methods: Examination of 20 µL night blood samples by finger prick and clinical examination for filarial diseases of 3144 urban and 2690 rural people was done by random selection.

Results: In both the area Wuchereria bancrofti was identified as the causative parasite of filariasis. In the urban area, overall microfilaria rate, mean microfilarial density, disease rate and endemicity rate were assessed as 3.24%, 6.31, 5.47% and 8.72% respectively; whereas in the rural area, those were assessed as 1.23%, 4.61, 1.38% and 2.60% respectively. In both areas males were more affected than the females by the filarial problems.

Conclusion: The urban study area is more endemic for bancroftian filariasis than the rural one. Urban areas are already under the threat of the disease and it is spreading towards the rural areas.

Keywords: Lymphatic filariasis; Epidemiology; Rural; Urban

Introduction

Lymphatic Filariasis was recognized in India in ancient times, as Sushruta in 6th century B.C. reported human filariasis in 'Sushruta Samhita' [1]. The disease is one of the leading causes of disability worldwide and it is most severe in the third world countries. Presently, at least 1307 million people in 83 countries/territories including 553.7 million in India are at risk of acquiring filarial infection [2]. Filarial etiologies like lymphoedema are common socio-economic problems in both developed and developing countries, which needs cohesive and concerted approach of management [3].

Information regarding filarial epidemiology from different areas of West Bengal, India, is available [4-14], but a large part of the state is untouched by the workers, specially the rural areas like Murshidabad district of West Bengal, India. So a study was carried out to collect epidemiological information such as microfilaria rate (MR), Mean Microfilarial Density (MMD), filarial disease rate (DR), filarial endemicity rate (ER) etc. in an urban and a rural area of West Bengal, India, with a comparative view.

Materials and Methods

The present study was conducted in the urban areas and rural areas of West Bengal, India during the year 2009-2011 (two year). For urban area 8 localities were selected in Kolkata (around 22.62°N & 88.42°E) namely Dum Dum, Park Circus, Topsia, Jadavpur, Kathgola, Ballyganj, South Sealdah and Nawpara. For rural area another 8 localities were selected in Tenya *gram-panchayet* of Murshidabad district (around 23.84°N & 88.18°E) namely Baidyapur, Powa, Ghosh para, Subhendupur, Pallyshree, Sahapur, Kulu pukur and Gouri nagar. In several areas, Mass Drug Administration (MDA) programme were progressing sporadically and mostly MDA uncovered localities were targeted in the present study.

The urban study area in Kolkata has very dense population with about four-fifth Hindus and rests are minority community like Muslims, Christians etc. whereas the rural study area in Tenya of Murshidabad has very low density population with about two-third Hindus and others are Muslims, mostly of labours and farmers community. In the urban study area domestic animals and vegetations are rare and there is very little open space but the rural study area is very rich in domestic animals (including cow, goat, ship, pig, dog, poultry birds etc.) and vegetations (including herbs, shrubs and different verities of tree) with plenty of open space. In the city area more than 80% of the housing is of reinforced cement concrete structure, others are poorly mentioned slums (where about one-third of the city's population lives) with poorly maintained sanitary facilities. At Tenya, most of the human habitations are hutment without or with very little windows and ventilations. Modern sanitary facilities like drains, septic tanks etc. are scanty in this area.

Blood samples (20 µL) were collected by finger prick between 1900 to 2300 hours following the method of Gubler et al. [15] from the peoples selected by random sampling [16] covering nearly 10-15% of the population of the selected study areas. Thick blood smears on the slides were prepared on the spot, dried in air and then brought to the laboratory. All the slides were dehaemoglobinized by keeping in

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distilled water and stained with Leishman's stain. Then the slides were examined under microscope for the presence of microfilariae, if any. Filarial parasites (microfilariae) were identified [17], counted and noted against each microfilaremic persons. Each subject was also clinically examined by a physician for the signs of filariasis and asked about their symptoms. Age, sex, clinical history and socio-economic status of each subject were noted. The total surveyed population was divided into different age groups, such as ≤ 10 years, 11-20 years, 21-30 years, 31-40 years and so on - as followed by many earlier epidemiologists [8-13,18].

Available data were subjected to statistical analyses using standard normal deviate 'Z' test (to compare the rates) and student's 't' test (to compare the averages) [16]. Statistical analyses were performed using the computer software Statplus 2007 and MS Excel 2003.

Results

In the urban study area 3144 people (1706 male and 1438 female) were brought into the study and overall MR, MMD, DR and ER were assessed as 3.24%, 6.31, 5.47% and 8.72% respectively. Overall MR, DR and ER was higher in the age group of 31-40 years (5.50%, 8.87% and 14.37% respectively) than the other age groups and MMD were higher in the age group of 11-20 years (7.43) than the other age groups (Table 1).

In the rural study area 2690 people (1431 male and 1259 female) were brought into the study and overall MR, MMD, DR and ER were assessed as 1.23%, 4.61, 1.38% and 2.60% respectively. Overall, MR and ER were higher in the age group of 21-30 years (2.25% and 4.10% respectively) than the other age groups, MMD were higher the age group of 11-20 years (6.00) than the other age groups, filarial DR were higher in the age group of 31-40 years (2.03%) than the other age groups (Table 2).

In both the study areas, generally, all the parameters were higher

Age group (Years)	Number of persons examined									Disease rate			Endemicity rate		
	M	F	T	M	F	O	M	F	O	M	F	O	M	F	O
≤ 10	204	110	314	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
11-20	306	282	588	3.27	1.42	2.38	7.80	6.50	7.43	3.92	2.13	3.06	7.19	3.55	5.44
21-30	336	264	600	4.76	5.30	5.00	7.25	6.14	6.73	5.36	3.79	4.67	10.12	9.09	9.67
31-40	352	302	654	6.82	3.97	5.50	6.92	5.17	6.33	11.93	5.30	8.87	18.75	9.27	14.37
41-50	262	232	494	3.05	3.45	3.24	5.25	5.50	5.38	9.16	4.74	7.09	12.21	8.19	10.32
51-60	202	184	386	1.98	1.09	1.55	4.50	3.00	4.00	9.90	4.89	7.51	11.88	5.98	9.07
61-70	24	48	72	0.0	0.0	0.0	-	-	-	8.33	4.17	5.56	8.33	4.17	5.56
≥ 71	20	16	36	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
Total*/Overall	1706*	1438*	3144*	3.63	2.78	3.24	6.77	5.60	6.31	6.92	3.76	5.47	10.55	6.54	8.72

M=male, F=female, T=total, O=overall

Table 1: Microfilaria rate, Mean microfilarial density, Disease rate and Endemicity rate according to sex and age group among the urban populations of Kolkata, West Bengal, India.

Age group (Years)	Number of persons examined									Disease rate			Endemicity rate		
	M	F	T	M	F	O	M	F	O	M	F	O	M	F	O
≤ 10	195	175	370	0.0	0.0	0.0	-	-	-	0.51	0.0	0.27	0.51	0.0	0.27
11-20	217	207	424	1.84	0.97	1.42	6.25	5.50	6.00	1.38	0.48	0.94	3.23	1.45	2.36
21-30	275	213	488	2.55	1.88	2.25	4.29	4.75	4.45	1.45	2.35	1.84	4.00	4.23	4.10
31-40	283	258	541	1.77	2.33	2.03	4.80	4.50	4.64	2.47	1.55	2.03	4.24	3.88	4.07
41-50	204	189	393	0.98	1.06	1.02	3.50	3.50	3.50	1.96	1.59	1.78	2.94	2.65	2.80
51-60	150	136	286	0.67	0.0	0.35	2.00	-	2.00	2.00	1.47	1.75	2.67	1.47	2.10
61-70	76	58	134	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
≥ 71	31	23	54	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0
Total*/ Overall	1431*	1259*	2690*	1.33	1.11	1.23	4.63	4.57	4.61	1.54	1.19	1.38	2.87	2.30	2.60

M=male, F=female, T=total, O=overall

Table 2: Microfilaria rate, Mean microfilarial density, Disease rate and Endemicity rate according to sex and age group among the rural populations of Tenya, West Bengal, India.

Age group (Years)	Adeno-lymphangitis (%)		Lymphoedema (%)		Elephantiasis (%)		Chyluria (%)		Epididymo-orchitis (%)	Hydrocele (%)
	M	F	M	F	M	F	M	F	M	M
≤ 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11-20	1.31	1.42	0.65	0.71	0.0	0.0	0.0	0.0	0.0	1.96
21-30	1.19	3.03	0.60	0.76	0.60	0.0	0.0	0.0	0.60	2.38
31-40	3.98	3.31	1.14	1.99	0.0	0.0	0.57	0.0	0.57	5.68
41-50	3.05	3.02	0.76	0.86	0.0	0.86	0.76	0.0	0.0	4.58
51-60	2.97	1.63	0.99	2.17	1.98	1.09	0.0	0.0	0.0	3.96
61-70	0.0	2.08	0.0	2.08	8.33	0.0	0.0	0.0	0.0	0.0
≥ 71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Overall	2.11	2.29	0.70	1.18	0.47	0.28	0.23	0.0	0.23	3.17
	2.19		0.92		0.38		0.13			

M=male, F=female

Table 3: Sex and age group wise distribution of percent of different filarial diseases among human population of the urban study area.

Age group (Years)	Adeno-lymphangitis (%)		Lymphoedema (%)		Elephantiasis (%)		Chyluria (%)		Epididymo-orchitis (%)	Hydrocele (%)
	M	F	M	F	M	F	M	F	M	M
≤ 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.51
11-20	0.46	0.48	0.46	0.0	0.0	0.0	0.0	0.0	0.0	0.46
21-30	0.73	1.88	0.0	0.47	0.0	0.0	0.0	0.0	0.0	0.73
31-40	0.71	1.16	0.71	0.39	0.0	0.0	0.0	0.0	0.35	0.71
41-50	0.98	0.53	0.0	1.06	0.49	0.0	0.0	0.0	0.0	0.49
51-60	0.0	0.74	0.67	0.0	0.0	0.74	0.67	0.0	0.0	0.67
61-70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
≥ 71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Overall	0.49	0.79	0.28	0.32	0.07	0.08	0.07	0.0	0.07	0.56
	0.63		0.30		0.07		0.04			

M=male, F=female

Table 4: Sex and age group wise distribution of percent of different filarial diseases among human population of the rural study area.

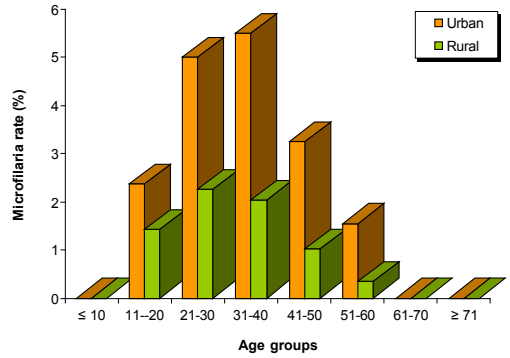

Figure 1: Comparison of microfilaria rate of urban and rural study area among different age group population.

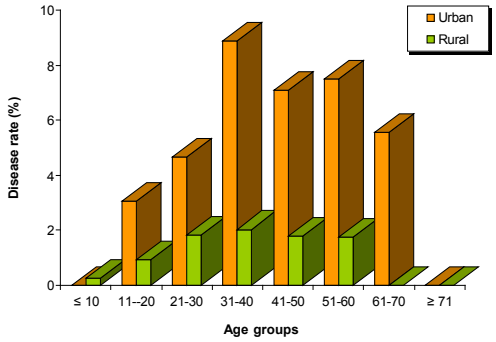

Figure 2: Comparison of disease rate of urban and rural study area among different age group population.

in males than the females but not in all age groups (Tables 1 and 2). The filarial parasite (microfilariae) obtained in the blood was different stages of *Wuchereria bancrofti*, in both the area.

In both the areas, 6 different filarial etiologies were encountered during the study. In the urban area, out of 3144 persons 172 (118 male and 54 female) were found with filarial diseases, of which most prevalent symptom was hydrocele (3.17%). Adeno-lymphangitis is higher in the age group of 31-40 years in both males (3.98%) and females (3.31%). Lymphoedema is higher in the age group of 31-40 years in males (1.14%) and in the age group of 51-60 years in females (2.17%). Elephantiasis is higher in the age group of 61-70 in males (8.33%) and in the age group of 51-60 years in females (1.09%). Chyluria is higher in the age group of 41-50 in males (0.76%) but no chyluric females were found. Epididymo-orchitis and hydrocele is higher in the age group of 21-30 and 31-40 years respectively (0.60% and 5.68% respectively) (Table 3).

Whereas in the rural area, out of 2690 persons only 37 (22 male and 15 female) were found with filarial diseases, of which most prevalent symptom was adeno-lymphangitis (0.63%) closely followed by hydrocele (0.56%). Adeno-lymphangitis is higher in the age group of 41-50 years in males (0.98%) and in the age group of 21-20 years in females (1.88%). Lymphoedema is higher in the age group of 31-40 years in males (0.71%) and in the age group of 41-50 years in females (1.06%). Elephantiasis is higher in the age group of 41-50 in males (0.49%) and in the age group of 51-60 years in females (0.74%). The only chyluric patient found was a male in 51-60 age group (0.67%). Epididymo-orchitis and hydrocele is higher in the age group of 31-40 and 21-30 years respectively (0.35% and 0.73% respectively) (Table 4).

In the urban area 8.72% of the populations were filarial victims i.e. either detected as microfilaremic or with any type of filarial etiologies, whereas in the rural area it is only 2.60%. In all the age groups, prevalence of MR and DR were much higher in urban population than in rural population (Figures 1 and 2).

Discussion

First-hand information regarding filarial endemicity and its vector was gathered in the present study from rural area of Tenya of Murshidabad district, West Bengal, India and compared with those of an urban area of Kolkata. Gender wise distribution shows that, overall, MR, MMD, DR and ER were higher among males than females in both the areas (differences are statistically not significant, $p>0.05$), as also reported in some other studies [7,8,10,12,13,18,19]. This can be explained by the fact that, males were more exposed to mosquito bites than females, and this is true for both the study areas.

Age group wise distribution shows that, in both the study area MR, DR and ER were generally higher among the peoples of younger to middle age [21-40], which is somewhat similar to some other areas [12,13]. MMD was higher in very young age group [11-20], which is similar to some other areas [10], but does not match with the findings of many other areas [12,13]. In both the study area peoples of active working age groups were more affected by the filarial parasites, which may seriously affect their efficiency and economy. Moreover, higher MMD among the younger age group is indicative of intensified filarial problem in near future. In both the areas, there was a tendency of acquiring *W. bancrofti* infection as well as developing filarial diseases in childhood, as also found in some recent works [20].

Among the aetiologies, frequency of hydrocele and adeno-lymphangitis were higher than all other symptoms in both urban and rural areas under study. A steady state of transmission was indicated by the fact that, different disease symptoms were distributed unevenly in different age groups and in both genders, in both the areas.

Among the males, MR, MMD, DR and ER were much higher in urban study area in comparison to the rural study area (differences are not significant in case of MR and MMD, $p>0.05$; but significant in case of DR and ER, $p<0.05$). In females also, those parameters were higher in the urban area than rural area, but the differences are not significant ($p>0.05$). When overall population (irrespective of sex) were compared, it was found that, MR, MMD, DR and ER were higher in urban study area than the rural study area (differences are not significant in case of MR and MMD, $p>0.05$; but significant in case of DR and ER, $p<0.05$). Different aetiologies in both the sexes and almost in all the age groups were more or less higher in human population of urban area in comparison to the rural one. Presence of dense human population closely situated human habitations, favourable mosquito breeding place, gathering of too many outsiders every day etc. in the urban area of Kolkata in comparison to totally opposite picture in the rural area of Tenya, probably aided to this situation.

The present study indicates that Kolkata (the urban area) is more endemic for bancroftian filariasis than Tenya (the rural area). But the figures in the rural area are not negligible. It is assumed that microfilaria carries as well as the diseased persons among the rural population carried the infection from outside where they used to go once or twice a year as labourers for their work and stay for a considerable period.

It is apparent that though the urban area is more endemic, the rural area is also becoming potentially dangerous regarding filarial transmission day by day due to indiscriminate development. To be a part of the Global Programme to Eliminate Lymphatic Filariasis (GPELF), India has launched a MDA programme, but its proper implementation is often neglected [21,22]. From the present study it appears that management of filarial problems are not working properly in some urban areas as well as in some rural areas of West Bengal. MDA programme should be strengthened in these areas with proper implementation to achieve the goal of GPELF. During the formulation of control strategies, the rural areas should be given due importance along with the urban one keeping in mind the recommendations made by Chandra [23], Chandra and Paramanik [24], Raju et al. [25].

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