CHAPTER-V

Lymphatic Filariasis in Sample Area: Biological Dimension
Epidemiology of Lymphatic Filariasis

This section describes the epidemiological picture of lymphatic filariasis (LF) in 12 sample villages. It is based on the data obtained by a house-to-house Census. The results of house-to-house survey with clinical examination of 5,357 individuals are shown in Table-2. The chronic condition of LF, namely lymphoedema and hydrocele are more prevalent in the study population. The lymphoedema alone is recorded among 2.46 per cent and 4.51 per cent of men and women, respectively. The men recorded 4.10 per cent prevalence of hydrocele. A few people are affected by more than one form of LF. Altogether, lymphoedema of lower limb cases are detected in 3.25 per cent in males and 5.06 per cent in females; and hydrocele cases are noticed in 5.46 per cent of men. A total of 357 individuals (224 males and 133 females) of the study population (6.67%) are affected with acute ADL episodes during previous three months. During the investigation, lymphoedema of upper limb is recorded in two men and five women, and three females subjects have breast swelling. The prevalence of total disease attributable to LF among males and females is 14.79 per cent and 10.04 per cent, respectively with a significant difference between two genders (p<0.001). Lymphoedema is more prevalent in females than that of the males (p<0.001), while the prevalence of ADL episodes is more among male than among female (p<0.01). Thus, the overall disease attributable to filariasis is more prevalent in males than in females (p<0.001). The age and gender specific prevalence of chronic filarial conditions is illustrated in the Figure-1. It indicates that the prevalence of lymphoedema increases with age in both genders and is highest among the aged above 70 years of age; 14.25 per cent of males and 19.35 per cent females, aged >70 years suffer from lymphoedema. The prevalence of hydrocele increases along with age up to the age cohort of 50-59 years and slightly decreases afterwards. Hydrocele is observed in 12.06 per cent men in the age group of 50-59 years. The age specific prevalence of ADL cases during a period of three months indicates that the ADL prevalence increases with age (Figure-2).
These results indicate that the prevalence of various forms of LF are moderate to high and this disease still constitutes a major public health problem in this region of Orissa state. The results also indicate that the prevalence of chronic forms of filariasis is age dependent in both the sexes. About one-seventh of men and women of higher age groups (60+ years) have chronic debilitation forms of the disease. The prevalence of ADL is also age dependent, which is not apparent in females. The epidemiological details of ADL are examined further during a yearlong surveillance of ADL cases. Also it is noticed that women in the age group of 60+ years suffered less from ADL attacks. This could be partly due to their decreasing participation in agricultural works with increasing age. Quite often patients reported that an attack of ADL is precipitated by hard physical work (Kumaraswami, 2000). A similar observation was made earlier by Partono (1987). The age dependency of chronic forms exists, probably due to accumulation of chronic cases within the population. The present age dependent trends are similar to that of the prevalence of chronic filarial conditions in other endemic areas of India (Pani et al., 1991; Sharma et al., 1999) as well as ADL episodes (Ramaiah et al., 1996). Our study also indicates differences between genders for prevalence of various forms of LF. Hydrocele contributes to higher overall disease burden in males. The prevalence of ADL is also higher among males than females. Among other chronic forms of the disease, which are found in both the sexes, the prevalence of lymphoedema is more in females. Generally, the prevalence of hydrocele is higher than that of lymphoedema in males (Sharma et al., 1987; Pani et al., 1991). The prevalence of ADL is higher in both sexes compared to other forms of the disease. The prevalence of total disease attributable to filariasis is significantly higher in males than that of females. Pani et al. (1991) reviewed data of 17 endemic localities from India and stated that the prevalence rate of the disease is generally lower in females than in males. They also indicated that gender dependency and preponderance of clinical manifestation is primarily due to the occurrence of hydrocele in males. These observations also reflect a relatively higher exposure of males to mosquito bites and other anatomical and hormonal differences. Gender specific physiological
factors such as hormones are suspected of affecting parasite establishment in human host (Brabin, 1990).

The present part of the results illustrates the epidemiology of acute filariasis, i.e. episodic ADL. The prevalence and episodic ADL due to bancroftian filariasis are addressed. LF is associated with a remarkably wide range of clinical signs, symptoms and sequels, which are influenced by a variety of factors related to host and parasite. In LF, acute clinical manifestations are characterised by recurrent attacks of fever associated with inflammation of the lymphoedema and or lymph vessels, termed as adenolymphangitis or ADL (Kumaraswami, 2000). The importance of acute clinical manifestation in natural progression of the disease, particularly chronic disease development has long been recognized by filarialogists (Turner, 1959; Edeson and Wilson, 1964; Raghavan, 1969). Though the need of systematic epidemiological studies on acute lymphatic filariasis or ADL is recognised, a few studies are available from different endemic countries like Ghana (Gyapong et al., 1996; Gasarasi et al., 2000) India (Ramaiah et al., 1996 and Alexander et al., 1999). The knowledge on epidemiology of acute disease is essential to understand the natural history and progression of the disease (WHO, 1992) and also this information is useful to estimate the burden of the disease. The results are based on longitudinal prospective fortnightly surveillance of 1329 population living in two villages.

**Incidence and Distribution of Acute Episodes**

The data obtained from one-year fortnightly surveillance of ADL episodes reveal that the total number of fortnightly rounds completed during one year of study is 25 and 113 episodes are recorded among 72 patients (Table-3). The annual incidence per 1000 population is 91.97 and 77.64 among men and women respectively and the overall incidence is 85.03 per 1000 total population. A total of 72 individuals (52 males and 20 females) out of total 1329 study population (5.42%) are affected. The age of the affected individuals varies between 7 years and 75 years with mean age of $36.23 \pm 16.46$ (SD) in case of males and $45.30 \pm 12.15$ (SD) in case of females with a significance difference between two sexes ($p< 0.05$). Out of 113 episodes among 52 males and 20 females, 63 episodes are
found among males and 50 episodes are found among females. The mean number
of episode per patient is $1.21 \pm 0.57$ (SD) in males and $2.50 \pm 1.67$ (SD) in females. The mean duration of episodes is $3.95 \pm 2.05$ (SD) in males and $3.90 \pm 1.79$ (SD) in females (Table-3). The t-test indicates that the mean difference of number of episodes among males and females is significant and the difference between mean duration of episodes among males and females is not significant. Among the total 72 patients suffering from acute episodes, 10, 30, 24 and 8 individuals belong to age groups of 7-20, 21-40, 41-60 and 61-75 years respectively. The number of patient is more in the age groups of 21-40 years. The total number of episodes are 16, 40, 42, 15 among the 7-20, 21-40, 41-60, 61-75 years age groups respectively. The number of episodes is more in the age group of 41-60 years (Table-4). The association of LF pathology and epidemiology of ADL is shown in Table-5. The distribution of ADL episodes by age groups (with 10 years interval) and sex is shown in Figure-3. This illustration indicates a steady raise in the incidence of episodes along with age among both males and females, except in the age group of 51-60 years (Figure-3). Among the total 72 patients who suffered in ADL attacks, 53 (73.6%) have overt chronic symptoms. Out of patients 72, 31 have hydrocele, 19 have lymphoedema and 3 have both hydrocele and lymphoedema. Of the total 113 episodes, 47 (41.59%) episodes are associated with lymphoedema, 38 (33.63%) with hydrocele, 4 (3.54%) with both lymphoedema and hydrocele and 24 episodes (21.24%) in individuals without any chronic manifestation. The mean number of episode is $1.23 \pm 0.679$ (SD), $2.47 \pm 1.71$ (SD) and $1.33 \pm 0.58$ (SD) among the patients with hydrocele, lymphoedema and both hydrocele and lymphoedema respectively. It is noticed that the mean number of episodes per patients is remarkably higher in lymphoedema patients and this variation is significant statistically ($p<0.001$). The mean duration of episode is $4.56 \pm 2.34$ (SD), $3.74 \pm 1.76$ (SD) and $3.67 \pm 1.15$ (SD) in patients with hydrocele, lymphoedema and both lymphoedema and hydrocele respectively. These differences are not significant. It is found that the information on acute form of LF, particularly on adenolymphangitis (ADL), is sporadic from a few endemic regions. The present longitudinal on prospective surveillance shows the annual incidence of ADL episodes in this rural Eastern
Indian community to be 85.03 per 1000 population. Similarly a south Indian rural community, which is endemic for bancroftian filariasis records the annual incidence of 96.3 per 1000 population (Ramaiah et al., 1996). The incidence rates are available from a few endemic countries such as Ghana 96 per 1000 population (Gyapong et al., 1996) and Tanzania 33 per 1000 population) Gasarasi et al., 2000). The proportion of people affected with ADL episodes in our study (5.4%) is similar to other bancroftian filarial endemic community from south India (5.3%). The age-wise distribution indicates that males recorded higher incidence in all age groups except in the age groups of 41-50 years and above 60 years of age. This incidence follows the pattern with the prevalence of microfilarial and chronic disease (Brabin, 1990). The variation could be due to differences in prevalence of chronic disease and differential susceptibility to ADL episodes for individuals with lymphoedema and hydrocele. The mean age of affected individuals varies between males and females. The lower mean age of male patients might be due to occurrence of hydrocele even at lower age groups among males.

**Frequency and Duration of Acute Episodes**

As 113 episodes are recorded among 72 patients, majority patients (52, i.e.72.2%) experienced acute episode only once in the year, followed by 12.5 per cent of patients with two episodes, 6.9 per cent of patients with 3 episodes, 4.2 per cent of patients with 4 episodes, and 1.4 per cent of patients each with 5, 7, 8 episodes. So the number of episode in a year varies from 1 to 8 (Figure-4). Among the individual with multiple episodes, majority (16 out 20) are with chronic filarial symptoms (p<0.001). The multivariate analysis indicates that the total numbers of episodes per year per affected individuals vary significantly with sex (p<0.001) and pathology groups (p< 0.001), but there is no influence of age (Table-6). In the multivariate analysis of variance, only sex is identified as significant predictor to the number of episodes per affected individual (p<0.001). Thus, in the study population majority of affected individuals have only one episode per year and only 27.8 per cent of affected individuals have experienced more than once. Data show that these multiple episodes are more common in patients with chronic disease. The more number of episodes per year is
significantly higher among Lymphcedema patients than even hydrocele patients. The etiological reason for this variation is not clear in the literature. As the frequency of ADL episodes influences the progression of chronic pathology (WHO, 1992), the pathological changes may be more rapid in lymphoedema patients than in hydrocele patients. Repeated episodes of ADL have significance in the progression of the disease. A study from south India has reported a direct relationship between the number of acute attacks and the grade of Lymphoedema (Pani et al., 1995). It is also known that the frequency of these attacks is generally higher in bancroftian filariasis as compared to brugian filariasis (Pani et al., 1990, 1995). It is evident from the literature that recurrent acute attacks are also considered to be a rich factor for the development of lymphoedema/elephantiasis (Webster, 1993; Monstestruc et al., 1960; Pani et al., 1990; Das et al., 1994). It is interesting to note that there is significant variation in the frequency of ADL episodes with seasons of the year (p< 0.001). The average number of episodes per month during summer (March to June), rainy (July to October) and winter (November to February) is 11.00, 10.75 and 6.50 respectively. Some of the earlier studies (Ravindranathan et al., 1980; Rao et al., 1982) report higher frequency of episode in rainy season. In Tanzania, the higher incidence of ADL episodes during rainy season is related to increased transmission by infective mosquito bites (Gasarasi et al., 2000). It is consistent with the hypothesis that ADL episodes may be associated with allergic responses to massive parasite antigen release (Kar et al., 1993; Addiss et al., 1994).

Duration of the episode varies from 1 day to 11 days and the mean duration is 3.93 days (1.94 SD). The episodes persist for 3 days (26.4%), 5 days (8.3%), 1 day (5.6%), 6 days (5.6%), 7 days (5.6%) and 11 days (1.4%) (Figure-5). The analysis of variance (ANOVA) indicates that there is no significant difference in the duration either between males and females (p>0.05), or between different pathology groups. When all the variables are considered simultaneously in multivariate analysis of variance, the individuals' pathological condition remains as a significant predictor to the mean duration of episode (p<0.05) (Table-7). The duration of the ADL episodes has greater economic implications on the individuals, their families and community. There is substantial loss of work
during these episodes leading to subsequent economic loss (Sabean et al., 1992; Ramaiah et al., 1998). In our study population, on average each episode persisted for 4 days, which is similar to the other endemic areas (Rao et al., 1982, Kimura et al., 1985; Partono, 1987; Ramaiah et al., 1996; Gasarasi et al., 2000)

**Clinical Symptoms Associated with ADL Episodes**

The various clinical symptoms reported among these acute cases are pain in arms, legs, genitals, breasts, tenderness in upper arm, legs, genitals and lymphangitis in inguinal regions, papillary and swelling of lymphatic nodes with fever or without fever, anorexia, nausea, vomiting, etc. Distribution of various clinical symptoms among these acute cases is presented in Table-8. Occurrence of fever (77.87%) and swelling of inguinal region (63.72%) are most common symptoms among acute cases. In the local language, swelling of lymphatic nodes is known as *bagi* or *pichhili*, which is commonly known as the initial symptom of filariasis among the study population. Pain and tenderness in different body parts were seen in majority of cases. Out of total 113 episodes, 10.62 per cent of episodes have experienced pain in upper arm, 73.45 per cent episodes have pain in legs and 20 per cent have pain in genitals. Only 0.88 per cent episodes (in female patients) have experienced pain in the breast. Total 8.85 per cent episodes have experienced tenderness in upper arms, 11.50 per cent have tenderness in legs and 21.24 per cent have experienced tenderness in genitals. Presence of local swelling, anorexia, nausea and vomiting are associated among majority cases. 63.72 per cent episodes have experienced anorexia, 53.98 per cent have nausea and 28.32 per cent have experienced vomiting. A total 81.42 per cent have experienced swelling of lymphatic nodes. Only 8 out of 72 acute patients (11.11%) are microfilaraemia.

Though there are similarities in the associated symptoms of ADL episodes among the various endemic communities, the etiology of the ADL is not clear. The majority of the ADL patients in this study area are amicrofilaraemia. Many studies have suggested an inverse relation between microfilaraemia and disease. However, a meta-analysis have indicated that there is no evidence of an inverse
association between microfilaraemia and disease, and there is equal chance of disease occurring in positive and negative individuals (Michael et al., 1994). A study from Ghana also concluded that there is no association between acute ADL and infection (microfilaraemia) (Gyapong, 1996). It suggests in a study from Haiti that the acute ADL may occur in the absence of current adult worm infection (Addiss et al., 1994). It is reported that these ADL episodes are induced due to various factors such as allergic reactions parasitic infection, (Evert et al., 1980; Ottensen, 1984), immunological mechanism (Piessens et al., 1980; Ottensen et al., 1982; Kar et al., 1930), toxins liberated from adult parasite (Chatterjee, 1965), repeated exposure to infective mosquito bites (Partano, 1987), etc. It is relevant to mention here that the ADL episodes are precipitated by hard physical work. Similar observations are made earlier by Partano (1987) and Ramaiah et al. (1996). Hence, the influence of physical stress on etiology should be considered along with the above-established factors. It is essential to have a clear understanding on the etiology of ADL for developing morbidity management strategies. The management of these acute ADL episodes has significance during control/elimination of lymphatic filariasis. It is clear that there are two types ADL episodes, ADL secondary to bacterial or fungal infections and ADL caused directly by the parasite infection itself (Kumaraswami, 2000). In addition, for the episodes among chronic lymphoedema cases secondary bacterial infection may be possible explanation. It is also evident from recent findings that simple foot hygiene and prevention of secondary bacterial infection lower the incidence of ADL episodes (Shenoy et al., 1995; 1998; Burri et al., 1996). Hence, simple, cost effective and user-friendly measures may be developed to minimize the burden of acute disease of LF.