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A Cutaneous Leishmaniasis Control Trial Using Pyrethroid-Impregnated Bednets in Villages near Aleppo, Syria

by

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ABSTRACT

An intervention field trial promoting the use of pyrethroid-impregnated bednets by the local inhabitants of four villages, 20 kms northeast of Aleppo City in the Aleppo Governorate, Syria, began in mid-1994. Its aim was to examine the efficacy of such bednets in controlling anthroponotic cutaneous leishmaniasis. Two villages were selected randomly as intervention villages and two others as control villages. All the 4 578 inhabitants of the 508 households in the villages were recruited for the study.

During May and June 1994, a pre-intervention house-to-house survey was conducted in the four villages to make a census and collect socio-economic and epidemiological baseline data. Pyrethroid-preimpregnated bednets were distributed to the households in the intervention villages, and non-impregnated bednets in the control villages. The number of bednets provided to each household was proportionate to the number of its members. In June 1995 and early May 1996, extra bednets were distributed to the households in both the intervention and control areas to substitute for lost or torn bednets and to ensure a sufficient supply to each household. Moreover, the bednets distributed previously in the intervention area were re-impregnated with pyrethroid. Health education messages were disseminated to ensure the population's compliance with the proper use of bednets. A leishmanin test was carried out on schoolchildren in all schools of the four villages during June 1995 to estimate the percentage of previous cases. Furthermore, an epidemiological survey took place every six months, in December of one year and June of the following year to evaluate the impact of intervention on incidence of cutaneous leishmaniasis in the first and second post intervention years. However during the third post-intervention year (from July 1996 to June 1997) this procedure was was carried out monthly. Entomological surveys using the sticky paper technique were carried out in ten randomly selected households in the intervention villages every two weeks from May to November of 1994 and 1995 to assess the impact of insecticide-impregnated bednets on the density of *Phlebotomus. sergenti,* the vector of anthroponotic cutaneous leishmaniasis. Similar surveys were conducted in ten households in the control villages as well.

The study was not able to detect a significant impact on the reduction in density of the vector *P. sergenti* in the intervention area compared with the control area. However the results showed a sharp consistent reduction in cutaneous leishmaniasis incidence as a result of the use of pyrethroid-impregnated bednets in the intervention villages from 5.1% in the pre-intervention year to 1.2% in the third post-intervention year. The reduction was greater in the first year post-intervention period in households who had not washed the bednets during the previous transmission period. In the control area cutaneous leishmaniasis incidence doubled in the first post-intervention year from

2.4% (52/2182) to 4.6% (96/2102). In the second year, cutaneous leishmaniasis incidence regained its pre-intervention level of 2.3% (45/1985). It increased sharply in the following year (third post-intervention year) to reach 6.1% (118/1929). More studies are needed on a larger scale in different settings to confirm the impact. A comparison between the highly positive results of this study based on the use of pyrethroïd-impregnated bednets and those obtained from the use of residual insecticide house spraying should help determine the most effective strategy in foci of anthroponotic cutaneous leishmaniasis

Keywords: Cutaneous leishmaniasis, *Leishmania tropica*, *Phlebotomus sergenti*, bednet, pyrethroid, control, Aleppo, Syria

INTRODUCTION

Cutaneous leishmaniasis is endemic in most of the countries of the Eastern Mediterranean region: Syria, Lebanon, Israel, the Palestinian Self-Ruled Territories. Jordan and Iraq (Laison and Shaw, 1987). The whole area is characterized as part of the classical Oriental Sore region which extends further to the east to include Iran, Afghanistan, Pakistan and northwestern India (Ashford, 1986). The disease has been prevalent in this area for hundreds of years and has acquired the names of the towns where it has been common, such as Aleppo, Baghdad, and Delhi. The lesion has been described as long lasting, usually taking a year to heal (*Hebt a Sinne*, translated by Russell and Russell, 1794, as "botch" of a year).

It is believed that antimalarial insecticide spraying during the 1950's contributed to a considerable decline in leishmaniasis incidence in Syria as a whole, particularly in Aleppo (WHO, 1991). During the years that followed, only a few cases were noticed in some villages near Aleppo (Abdou *et al.*, 1976, Zein El-Din, 1970). It has been documented that *Leishmania tropica* is the causative parasite for the disease in Aleppo (Rioux and Pratlong, unpublished observations). This is confirmed by clinical observations that untreated lesions do not heal in less than a year and recidivans cases are common. It is believed that the disease is transmitted by *P. sergenti* (WHO, 1990; Jalouk, 1993). Although cutaneous leishmaniasis is not a fatal infection, it is well known for its negative impact on public health and the economy due the high cost and length of treatment, not to mention the psychological trauma in children and young people brought on by facial disfigurement from post-healing scars.

In the mid-1980's the increasing number of anthroponotic and zoonotic cutaneous leishmaniasis cases in the traditional foci and their spread to new foci in Syria has been of concern to the Health Authorities (Ashford *et al.*, 1993; Tayeh *et al.*, 1997). All northwestern governorates including Edlib, Lattakia, Tartus, Hama, Aleppo as well as rural Damascus in the southwest, had a high percentage of reported cases during 1993. (Map 1) In subsequent years, the disease spread to the Al-Hasakeh and Deir al Zour Governorates in the east (Jalouk and Tayeh, 1996). This led to an increase of activities carried out by the Ministry of Health to control the disease. Treatment of cases in health centres and specialised hospitals with pentavalent antimonials, Sodium Stibogluconate (Pentostam®) and Meglumine Antimoniate (Glucantime®) has intensified. Dry ice and liquid-nitrogen have also been used recently in several health centres in Aleppo and Damascus to treat chronic forms of leishmaniasis lesions, mainly lupoid. Active case detections have been confined to schoolchildren in the Aleppo Governorate. Applications of Deltamethrin (K-Othrine®)house spraying began in the endemic areas in 1991 according to the guidelines of the World Health Organization (WHO).

However, residual insecticide house spraying did not produce the desired effects in many countries including Syria. Curtis (1994) mentioned several common reasons such as cuts in public spending, reservations among the people about the effects of spraying, denial of access to spray personnel,

low community participation, lack of trained manpower and inadequate logistics support, managerial problems, corruption and mismanagement of the expensive insecticide product including its diversion to the black market for agricultural purposes. Last but not least, the resistance of some vector populations to certain insecticides has been also an important setback.

Alternative sustainable technology usable by the people themselves is necessary for the control of vector-borne diseases. Pyrethroid insecticide-impregnated bednets trials financed by WHO and other agencies to investigate the effects on malaria mortality and morbidity have been carried out in several African and Asian countries. In West Africa, a 60% reduction in mortality and 45% in morbidity from malaria was shown in children from 1 to 4 years of age as a result of sleeping under impregnated bednets (Alonso *et al.*, 1993). Other studies in West African countries found a similar impact on mortality (Jaenson *et al.*, 1994), on reduction in malariometric indices such as parasitaemia levels (D'Alessandro *et al.*, 1995), and a reduction in the number of premature births (D'Alessandro *et al.*, 1996). In East Africa, it was found that introducing insecticide bednets led to a 74-78% reduction in the weekly rate of reinfection with the malaria parasite in the Zanzibar population (Stich *et al.*, 1994). A 65% reduction of malaria incidence during a two-year period in China was shown by Dapeng *et al.* (1994). Another study in Thailand found that the use of bednets by pregnant women reduced malaria and anaemia during pregnancy (Dolan *et al.*, 1993). A study on the use of insecticide-impregnated bednets among Afghan refugees showed a significant impact on reducing malaria incidence (Rowland *et al.*, 1996).

The success of these trials in controlling malaria through the use of a.simple technology has encouraged researchers to utilize the same technique to control non-zoonotic cutaneous leishmaniasis. Several controlled trials supported by WHO are underway in Asian and African countries including Afghanistan, Bangladesh, Iran, Nepal, Sudan and Syria. The trial in the Aleppo Governorate is one of the studies conducted under this programme.

The main advantages of pyrethroid-impregnated bednets are their low cost, safety, easy use, long lasting effects when not washed, sustainability and acceptability by the people. However, the main reservations are discomfort in warm climates, loss of efficacy if frequent washing and need of appropriate timing for entering under them. The cost-effectiveness of bednets in preventing mortality and morbidity from malaria has been demonstrated by Picard *et al.* (1993).

This paper describes a control intervention trial to prevent anthroponotic cutaneous leishmaniasis (ACL) through the use of pyrethroid-impregnated bednets in four villages northeast of Aleppo City in Syria.

MATERIALS AND METHODS

The study area

In April 1994 before the start of the intervention, four villages were identified as highly endemic with active cases ranging from 3.3% in Tal Shaeer to 1.2% in Halisa. The four villages are located 20-25 kms northeast of Aleppo, as seen in the sketch-map of the area. (Map 2) Halisa and Tal Shaeer are two small villages with about 700 people each, while Kafar Sagheer and Sheikh Najjar have a population of about 2000 each.

The area was very fertile until recently and well known among the people of Aleppo for its agricultural production. However, the expansion of cement, glass, stone masonry and other manufacturing industries from Aleppo to the Free-Zone area nearby resulted in a decline in agricultural production as pollution increased and farm labour migrated to the factories for alternate forms of work, e.g. as watchmen. Furthermore, the location of the weekly Aleppo Sunday Market on the main road between Kafar Sagheer and Sheikh Najjar and a scattering of government and private poultries in the area along with the presence of large borrow-pits for the solid waste from Aleppo City added to the environmental problems.

Compounds and houses usually consist of an entrance leading to a courtyard. There are rooms and other facilities on the sides of the courtyards. Most houses consist of one or more bedrooms, a living room, a small kitchen and a toilet. Each room has its own separate doors and windows opening onto the courtyard or corridor leading to the courtyard. Living rooms serve as bedrooms at night for children and older members of the family. People also eat in the living room in the winter. Grain, conserved foodstuffs such as jam and cheese, dried vegetable, and other food items are stored in the small kitchen. The toilet is usually located far from the major rooms. Although stables and shelters for the animals, mostly sheep, goats and sometimes cattle are usually built at the furthest end in the same compound opposite the living area, sometimes households keep their animals outside the compound but near enough to be watched closely.

The inhabitants perform various activities in the courtyards in the daytime during summer. They also watch television and sleep in the courtyards on summer nights when it is very hot. Some grow plants in the courtyards and others have kitchen-gardens. The farms are usually not very far from the villages. Agricultural products include grain, olives, grapes, and vegetables. The households generally have more mattresses than the number of members to accommodate visitors who stay overnight after late night festivals or other occasions such as weddings, religious rituals, or just visits.

Electricity is supplied to all four villages on a continuous basis through the main network. Hence, it is not unusual to find various household electrical appliances such as washing machines, refrigerators, radios, televisions, fans. Water supply is also generally continuous through government projects though some households have underground reservoirs and/or elevated

reservoirs which are filled with water bought from vendors. Some have their own boreholes and deisel pumps which serve their domestic and agricultural needs. There are no sewage networks in any of the four villages covered by the study but some compounds have septic tanks or pits-latrines. Unfortunately, waste water is not directed towards the pits latrines but flows onto the streets or courtyards forming small puddles in the clay soil which last for long periods and attract insects.

There is at least one mosque in each village but shops selling food and other small items can only be found in the two larger villages, Kaffer Sagheer and Sheikh Najjar. Each village has a school from grades one to six. Young people, especially males, who wish to continue their secondary education travel to secondary schools in the larger villages nearby. Halisa and Tal Shaeer with a small population have elementary schools with 160 and 161 students respectively. Kaffar Sagheer and Sheikh Najjar with a larger population have combined elementary and preparatory schools with 450 and 400 students respectively. The schools have a two-shift system, from 7:00 a.m. to noon, and the other from noon to 5:00 p.m.

None of the four villages have public health clinics. Patients from Halisa and Tal Shaeer frequent the health centre or private doctors in nearby Faifeen village or travel to Aleppo in case of emergency. A new popular private transportation system provides easy access to Aleppo by mini-bus. The inhabitants prefer to travel to Aleppo for treatment as they can have a good choice of clinics there. Early in 1995, some private medical doctors from Aleppo opened two clinics in Kaffer Sagheer.

The study population

The total population of the four villages was chosen for the study, viz., 4,578 people in 508 households, all of them Muslims. The people are basically subsistence farmers though a few depend upon livestock. Many of the men work as manual labourers or watchmen in nearby factories to earn cash, but farming as a source of agricultural production continues. Work in cement, glass, and masonry swing factories poses some degree of physical risk particularly for those using explosives for masonry excavations. The main activities of the women consist of household duties. They also work on the farms during spring and summer. The women and children seldom leave the village except to go for treatment in health clinics in Aleppo or to visit relatives. They invariably return to their village before nightfall.

Sleeping patterns