Malaria and the nomadic tribes of Southern Iran

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RÉSUMÉ.

Un des principaux problèmes que rencontre l'éradication du paludisme dans le sud de l'Iran est le mouvement des tribus. La principale source d'infection des nomades se rencontre dans leurs quartiers d'hiver au voisinage des agglomérations.

Les méthodes habituelles de lutte antipaludique se sont révélées inefficaces dans ce cas particulier et une série d'essais sur le terrain de différents insecticides à diverses doses a été exécutée. Ces études ont montré que les pulvérisations sont inefficaces par suite des difficultés opérationnelles et de la perte du produit lors du démontage des tentes. La surveillance et le traitement des cas de paludisme présentent aussi des difficultés. L'administration régulière de médicaments prophylactiques est mal acceptée. Les résultats de l'administration de sel médicamenté furent satisfaisants mais la protection des nourrissons, allaités au sein, ne fut pas possible et le coût per capita *fut plus élevé que dans les autres modes d'opération. En 1968 le Malathion fut introduit dans les opérations de pulvérisation et l'éradication du paludisme fut exécuté dans le sud de l'Iran suivant un système spécifique dans lequel furent utilisées des méthodes auxiliaires, en particulier la détection active des cas, l'administration de masse de médicaments, le traitement des cas positifs et la désinsectisation des tentes. Les résultats furent satisfaisants.*

ABSTRACT.

One of the main problems of malaria eradication in the south of Iran is tribal movement. The main source for contracting the disease among nomads is in winter quarters in the vicinity of villages. The usual anti-malarial activities have failed in these areas, and thus a series of field trials with different insecticides and dosages were conducted. These surveys showed that spraying is ineffective because of the difficulty of operation and because the insecticide is dusted down as the tents are dismantled. There were also difficulties in carrying out surveillance and treatment of cases. The regular administration of preventive drugs was not welcomed. The results of administration of drugs in the form of medicated salt were satisfactory, but the protection of breast feeders was not possible and the cost per capita was more than with other measures. In 1968, Malathion was introduced into spraying operations and eradication was conducted in the South under a specific system in which all the auxiliary methods were used with special attention to active case detection, mass-drug administration, treatment of positive cases, and spraying of tents. The results were satisfactory.

INTRODUCTION.

Among various types of population movement, nomadism has a special place in Iran and is dispersed throughout almost all parts of the country. In spite of increasing urbanization, the nomadic way of life is far from coming to an end. The great annual migrations from summer quarters to winter quarters and vice-versa, covering long distances and passing through many villages and towns, leave marks on social and health conditions in the areas involved. For example, these migrations play an important role in maintaining the transmission of malaria (Ghashghai, Bakhtiari, Khamsi-Basseri and Lor tribes) (1).

In the southern part of Iran, nomadic migration is the most important form of population movement, the

pattern of which is regular and stable. The commencement of migration and its duration may change from year to year depending on meteorological features, the condition of pastures, government politics and other factors. Migration creates problems in most aspects of the social and economic life of this region.

BACKGROUND INFORMATION.

The special characteristics of nomadic life, annual migration within the malarious area during the malaria season, and prevailing environmental and social factors, have an effect on the epidemiology of the disease and its control. Epidemiological investigation carried out all over the country during previous years has shown that in most parts of the country tribal movements usually do not affect the intensity of malaria transmission, especially in areas with a short transmission season (three to four months). In these areas, migration starts before the commencement of the transmission season and camping sites in summer quarters are selected mainly in hilly and mountainous areas which are not favorable for the transmission of malaria (Shahsavan tribe, East Azerbaijan). If transmission of malaria does occur, it is limited to only a few sporadic cases. This observation was confirmed in the course of the Malaria Eradication Program, which commenced in 1957 in Iran and covers all malarious areas of the country.

In the south of the country, i.e. the southern slopes of the Zagros chain and along the Persian Gulf and the Oman Sea littoral, malaria is conserved at village level, and the nomadic population, by camping around villages, offers shelters and victims for the vectors (Ghashgai tribe). In this area, the Malaria Eradication Program has had several setbacks as a result of operational and technical problems which have developed during the operation. The main operational failures in the south of the country were due to the movement of tribes and extensive utilization of temporary dwellings such as tents and summer huts.

In the winter quarters of the South, the duration of the transmission season is long, extending over about nine months. The development of resistance to chlorinated hydrocarbon insecticides in the main vector *Anopheles stephensi* and exophilic and exophagic tendencies in *A. superpictus*, *A. fluviatilis* and *A. dthali*, the vectors in the hilly areas of the Zagros slopes, have made the South a problem area for malaria eradication.

In summer quarters, however, the period of the transmission season lasts only three to four months and the vector activity of *A. superpictus* and *A. sacharovi* starts from July. Both vector species are susceptible to DDT in these areas and malaria is under control.

The tribes usually leave the winter quarters before the transmission season has begun (March-April) and most of the migratory route is not yet in the transmission season; thus they escape infection. In July the conditions for transmission are quite suitable in the summer quarters and they remain so along the way to winter quarters. Even in the winter quarters transmission is very active for quite some time. As a result, the tribes are liable to contract the disease in summer quarters or on their way back to winter quarters. Owing to the malaria campaign in these areas during recent years, the risk of transmission in winter quarters has become very low, but active foci still exist.

The disease is usually transmitted from the inhabitants of stable villages to tribal people who have camped close by, or from infected tribal people to other villagers. Rarely, a sort of inter-tribal malaria transmission is established when the camping site is favorable for the building up of a critical density of vectors.

MALARIA ERADICATION AND NOMADISM.

Difficulties and obstacles created by nomadism in the implementation of various malaria eradication activities such as geographical reconnaissance, spraying operations, surveillance and drug administration were extensively studied by the School of Public Health and Institute of Public Health Research in cooperation with the Malaria Eradication Organization, Iran, since the beginning of malaria eradication in this country.

Several field trials were conducted among various sects of the Gashgai and Khamseh tribes in the Kazeroun and Fasa areas of southern Iran, and the results of these studies are summarized in the following paragraphs:

Residual insecticide spraying and impregnation.

For these trials, various formulations of DDT, Dieldrin and HCH were used at different concentrations or dosages for the impregnation or spraying of tents (2). The effects, also measured on different tent materials, were evaluated by chemical estimate of insecticide residues, bio-assay tests and entomological observations. The most important results are given below:

1. DDT solution in kerosene sprayed at a dose of 2 g DDT/m^2 has shown a biological residual effect of six weeks in the case of non-movable tents, with more than 50 % kill in bio-assay tests, and a much shorter period in the case of movable tents.

2. DDT water dispersable powder (w.d.p.) sprayed at a dose of 4 g technical DDT/m^2 remained effective for four weeks in non-movable tents and for two to three weeks in movable tents. The effect in the latter was prolonged to four to five weeks if gum arabic or asphodalus were added to the formulation.

3. Dieldrin solution in kerosene sprayed at a dose of 1 g Dieldrin/m² has shown a residual effect of two to three weeks in the case of both movable and non-movable tents.

4. Dieldrin w.d.p. sprayed at a dose of 1 g technical Dieldrin/m² or Dieldrin Nova Sol sprayed at a dose of 0,5 g technical Dieldrin/m² remained biologically effective for six to seven weeks in the case of non-movable tents (60 % kill in bio-assay tests, 90 % kill in test huts after 24 hours).

5. Dieldrin w.d.p. used at a dose of 0.5 technical Dieldrin/m² for the impregnation of movable tents has shown an effect of about two months (70 % kill in bio-assay tests).

6. HCH 50 % w.d.p. sprayed at a dose of 1.0 g gamma-isomer/m² or HCH resin 25 % at a dose of 1.0 gamma-isomer/m² have shown biological effect for about two to three weeks in the case of non-movable tents (25-35 % kill in bio-assay tests).

These results indicate that the spraying of tribal tents with suitable insecticide formulations may be an effective measure against the local vector, but the rather short residual effect, especially in the case of movable tents, seriously reduces its value.

The movements and the scattering of nomadic populations and difficult operational conditions due to the local topography have not permitted the achievement of the required operational efficiency and precision and the frequent enough application of insecticides. Therefore, only spraying or impregnation of tents with residual insecticides cannot be considered adequate for achieving interruption of malaria transmission in this particular population group.

Use of medicated salt.

In view of the inadequate efficacy and feasibility of the use of insecticides alone, a pilot study for the application of medicated salt was developed.

On the basis of the experience gained in this pilot study, application on a larger scale was prepared for, covering about 11,000 nomadic population of the same tribe and 6,250 settled inhabitants of villages (3). The preliminary stage in 1962 served to perform geographical reconnaissance, to determine the sources of salt in the area, to study the preparation and distribution of table salt, to decide on the drug of choice (chloroquine/amodiaquine), to train agents and to provide mixing machines and other equipment.

The actual operations started in April 1973, and continued up to 1966. They consisted of the following major activities:

1. Preparation of medicated salt.

2. Monthly distribution of salt, tent to tent, among one group. In another group the distribution was six-monthly until the beginning of 1964, when it was changed to monthly distribution.

3. Checking of salt consumption and parasitological and entomological evaluation. In the course of the project, chloroquine was distributed during two-and-a-half years and amodiaquine during 18 months. This produced a significant reduction of malaria cases and the parasite rate dropped from 7.89 % in 1962 to 0.01 % in 1966 among the nomadic population and from 17.3 % in 1962 to 0.05 % in 1966 among the stable population.

The estimated cost of this program was U.S. $ 0.20-0.25 *per capita* per month. This amount excludes the cost of entomological activities.

Prior to starting these studies, it seemed that the indirect method of mass drug administration would be easier to apply, less expensive and quite effective. In practice it was observed that a parasite reservoir was maintained for some time, as this method does not produce protection for infants breast feeding. It was also seem that the program is costly and not suitable for use in Iran. The malaria incidence began to rise very soon after stopping the administration of medicated salt.

Another pilot project was carried out in Fasa, Fars Province, by the Malaria Eradication Organization, in which spraying was carried out (DDT 75 %, 2 g/m²) continually, even to the attempt to spray at every newly erected temporary dwelling, in combination with fortnightly mass drug administration in infected regions. The results of this operation in this sample problem area without *A. stephensi* were almost satisfactory. It would appear that, after finding a suitable insecticide in combination with drug administration, it may be possible to achieve the interruption of malaria transmission in areas of tribal movement.

Malaria eradication operations.

Malaria eradication operations in the South were resumed in 1968, when spraying with Malathion was introduced in the areas of *A. stephensi*. Spraying with Malathion and DDT was conducted extensively, in some regions as often as five times a year. Full surveillance was applied in the South with timely, radical treatment of positive cases, mass drug administration in regions where spraying was less effective, chemical larviciding around

the cities and towns, and the abundant distribution of Gambusia fish (4).

In this program, special attention was given to coverage among nomads; in November-December 1968, at the end of the transmission season in winter quarters, the entire tribal population received mass radical treatment using a seven-day schedule. The coverage was 94 % and the results were satisfactory. Blood smears were collected randomly during the following month and a considerable drop in the parasite rate was observed. In the following years, attempts were made to find the remaining infected foci and to apply mass drug distribution there using seven-day or eight-week schedules. Sects of tribes which were at the risk of infection in winter quarters also received preventive drugs. Moreover, during migration to summer quarters, they were given 300 mg chloroquine and 30 mg primaquine (presumptive doses for adults). In summer quarters belonging to infected areas, nomads were protected by spraying operations, surveillance and drug administration.

The positivity rate decreased from 2.85 in 1968 to 9.10 in 1972, and not a single case of *P. falciparum* infection has been reported since 1969 (5).

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