

THE EFFECT OF MASS-CHEMOTHERAPY IN THE CONTROL OF BILHARZIASIS IN IRAN*

Arfaa, F.**, Sahba, G.H.**

and Farahmandian, I.**

ABSTRACT

With the success achieved in the interruption of the transmission of bilharziasis by snail control in most endemic areas of Iran, mass-chemotherapy has been used extensively for reducing the number of cases in various villages.

Niridazol was chosen for this purpose after a screening of several drugs.

Eight thousand eight hundred seventy-four cases in 259 localities were treated from 1966 to the present time. The side-effects encountered were generally mild.

This extensive mass-treatment has resulted in a reduction of the prevalence of infection below 10% in the majority of villages in all foci. The overall reduction in the positivity rate was 92.2% in 100 villages where transmission had been stopped and 64.4% in 14 villages where transmission had not been stopped.

The results of follow-up examinations revealed that only 3 and 2.1% of treated cases, respectively, were still passing viable eggs 3 and 6 months after therapy.

The success achieved in this area, in spite of vast programs of irrigation development, is proof that with the schistosomicidal drugs now avail-

* This study was supported in part by the funds of the School of Public Health and Institute of Public Health Research, University of Teheran, and in part by the Public Health Research Project of the Ministry of Health and the Plan Organization.

** Dezfoul Research Station, School of Public Health and Institute of Public Health Research, University of Teheran, P.O. Box 1310, Teheran, Iran.

able, mass-treatment should be considered an effective method for the control of bilharziasis.

INTRODUCTION

The peculiar epidemiological features of urinary bilharziasis in Khuzestan, southwestern Iran, together with the success achieved in the interruption of transmission, accomplished through the destruction of snails by chemicals (mollusciciding) and by mechanical elimination and modification of snail habitats, encouraged the Project Staff to use mass-chemotherapy as a method of controlling bilharziasis in this country.

MATERIAL AND METHODS

Trials on the effect of mass-chemotherapy in the control of bilharziasis in Iran were begun with thioxanthon (Lucanthon Hydrochloride) and antimony compounds in 1964.

After the introduction of a Niridazol compound and the encouraging results obtained from this drug, this method of control was extended to all infested foci.

The use of Hycanthon was begun recently and preliminary trials have proven its high efficacy in the mass-treatment of bilharziasis.

The first criterion necessary for starting mass-chemotherapy in a village is the presence of evidence that transmission has been interrupted in this village. This includes (1) a total absence of snail intermediate-hosts in the habitats near the village and (2) a minimum age of not less than 3 years for infected children.

However, in some areas where snail destruction could not be achieved, mass-chemotherapy was undertaken without satisfactory interruption of transmission in order to evaluate the effect of this method alone on the control of infection.

In every trial, after preparing a scotch map of the villages, numbering the dwelling and taking a census of population, and prior to the administration of the drug, a mobile team consisting of a physician and two technicians was sent to each village. They examined most of the inhabitants in order to detect positive cases and to establish the prevalence of infection.

All infected cases were examined by a physician and patients with severe clinical manifestations such as fever, T.B. and heart trouble, as well as pregnant women, were excluded from treatment.

A follow-up examination of treated cases was undertaken 3-6 months after treatment and the prevalence of infection was re-established one year after therapy. All new cases found during this survey were treated.

The results of trials with different schistosomicidal drugs, their dosage, methods of administration, cure rates and side-effects have been published in several papers (Arfaa *et al.*, 1966^a 1966^b, 1967^a, 1967^b, 1970^a, 1970^b and 1972).

The results obtained with Niridazol compound, which has been used extensively in the treatment of about 9,000 infected cases by the administration of a daily dose of 30 mg/kg body weight for 4 consecutive days, and which has dramatically reduced the rate of infection in most villages, will be discussed here.

RESULTS

The cure rates observed and the type of side-effects encountered with drugs of antimony and thioxanthon compounds are shown in Table 1.

Niridazol has been used for the treatment of 8,874 cases in 259 villages and localities. The results of mass-treatment with Niridazol in various foci of infection (Arfaa *et al.*, 1967) are summarized in Table 2. Cases referred by physicians and treated at the Bilharziasis Station are not included in this table.

The most common side-effects encountered, in order of their frequency, were: headache, abdominal pain, generalized pain, nausea, vomiting, vertigo and insomnia.

Neuro-psychiatric manifestations in the form of convulsions (epilepsy) were observed in 18 persons. In some of these cases, administration of the drug was interrupted, but most of them recovered when given chlorpromazine tablets. This drug was also used for patients suffering from nausea and vomiting.

Patients with other side-effects were treated by drugs such as belladonna tincture for abdominal pain, acetyl salicylic acid for myalgia and promethazine hydrochloride for insomnia and pruritis.

The use of mass-treatment as a method of control of bilharziasis has resulted in a reduction of the prevalence of infection in most of the villages; at present the number of villages with a prevalence of 10% or more is less than 20 in the entire endemic area in this country, and these are mostly villages where transmission has not been interrupted.

The results achieved by mass-treatment in reducing the overall prevalence of infection in villages where transmission has been stopped and in villages where it has not been stopped, are shown in Table 3. As indicated in this table, whereas the overall reduction in the positivity rate is 92.2% in 100 villages where transmission has been stopped, a reduction of only 64.4% has been achieved in 14 villages where transmission is still under way.

The results of follow-up examinations undertaken up to the end of

1969 have indicated that only 3% and 2.1% of treated cases were still passing viable eggs 3 and 6 months after treatment, respectively, while the remaining positive cases found 3 months after therapy during 1970 and 1971 were 7.3% and 10% of the total patients treated during this period.

The acceptability of this drug to the inhabitants, which was very high during previous years, has decreased slightly during the past two years because many patients treated during this period were treated previously and then became re-infected from living in areas where transmission has not been stopped.

DISCUSSION AND CONCLUSION

In spite of the success achieved in the control of many endemic diseases in most developing countries, bilharziasis is on the increase in several infested areas. This increase, which is due mainly to the extension of irrigated land to provide food for increasing populations, constitutes one of the most important public health problems in several countries.

Of various methods attempted in the control of bilharziasis in infested countries in the past, the use of mass-treatment did not succeed mainly because of the following reasons:

1. the inadequacy of safe and effective antischistosomal drugs;
2. the long duration of time needed for the completion of treatment with the old drugs;
3. the use of chemotherapy in areas where transmission had not been interrupted.

The discovery of safer and more effective drugs in recent years has resulted in great success from the use of mass-chemotherapy for the control of bilharziasis.

The results achieved by mass-chemotherapy in the control of bilharziasis in man confirms the conclusion reached by McDonald (1965) with his mathematical approach, which indicates that mass-chemotherapy gives better results in a shorter period of time than do other means of control.

In our trial, even in areas where transmission had not been completely interrupted, an overall reduction in the positivity rate of infection of 64.4% was achieved.

By continuing mass-chemotherapy in infested areas, the reduction in the prevalence and intensity of infection will certainly reduce the amount of miracidia introduced into snail-infested water, and this may result in the reduction of infected snails below the critical density (if any) to the point where no transmission can be established.

In addition, the effect of mass-chemotherapy in diminishing the intensity of infection will result in preventing and reducing the severe compli-

cations of bilharziasis, the importance of which has already been shown (Forsyth and Bradley, 1966).

It should be noted that success in the control of bilharziasis by mass-treatment in Iran has been hampered due to the extension of irrigation networks. Although it was planned to reduce the number of villages with a prevalence of infection of 10% or more to nil by the end of 1969 (Arfaa *et al.*, 1970), because of the infection of inhabitants of villages located along newly snail-infested canals, this aim has been delayed.

Another achievement during the trial with Niridazol was the administration of 30 mg/kg of the drug for 4 days only. This resulted in a reduction in the duration of treatment and thus a reduction in the cost of operation as well as in the amount of absenteeism of patients, which occurs a great deal when the duration of treatment is long.

Recently, we performed a trial giving the daily dose once in the morning instead of twice; this procedure gave the same cure rate and a similar amount of side-effects.

The reason for the slight decrease in the cure rate observed in recent years cannot be attributed to the building up of a resistance to the drug, since this decrease has been observed mainly in villages where transmission has not been stopped and thus may be due to the re-infection of patients immediately after treatment.

The encouraging results obtained from the use of Hycanthon in mass-chemotherapy in Iran (Arfaa *et al.*, 1972) is of great importance because the short duration of treatment with this drug (a single injection) would greatly diminish the cost of operation. If further clinical assessments of this drug prove its safety, its use in the mass-chemotherapy of bilharziasis, especially in areas infested with *S. mansoni*, should be encouraged.

TABLE 1

Cure rates and severity of side-effects observed with antimony compounds and Lucanthon Hydrochloride used in preliminary trials

Type of Compound	Drug Tried	No. Patients Treated	Cure Rate Observed %	Severity of Side-effects
Antimony	Sodium antimony gluconate (Triostom)	32	58	Severe at time of administration
	Sodium antimony dimercaptosuccinate (Astiban)	208	70-100	Severe
Thioxanton	Lucanthon hydrochloride (Miracil-D)	74	39.2	Very severe

TABLE 2

Population of villages, number examined and number treated in various foci (1966-1971)

Area	Number of Villages	Population of Infested Villages	No. Examined	No. found Infected	No. Treated	Percent Treated %
Dezful	117	33,461	25,527	5,442	4,354	80.
Ahwaz	60	12,467	9,237	2,479	2,280	92.
Dasht Mishan	40	20,792	6,334	1,077	1,004	93.
Bidroweh	15	4,038	2,322	546	483	88.
Shushtar	26	5,022	3,715	671	641	95.
Khoramshahr city	1	30,000 *	6,236	152	112	74.
TOTAL	259	105,780	53,371	10,367	8,874	85.5

* Population of infested parts only .

TABLE 3
 Results of mass-treatment of bilharziasis in villages where transmission
 was interrupted by snail destruction and villages where
 snail control was not completed

	No. of Village	Mean Prevalence of Infection		Reduct. in Prevalence	Reduct. in Positivity Rate
		Before Masseche- motherapy	3-5 Years after Mass-chem.		
Villages where snail destruction was achieved	100	25.9	2.0	23.9	92.2
Villages where snail destruction was not achieved	14	38.8	13.8	25.0	64.4
TOTAL	114	27.5	4.3	23.2	84.3

REFERENCES

1. Arfaa, F., Bijan, H. and Panahandeh, A. (1966^a). Mass-treatment of urinary bilharziasis with sodium antimony dimercaptosuccinate in Iran. *J. Trop. Med. & Hyg.* 69: 12-14.
2. Arfaa, F., Farahmandian, I. and Bijan, H. (1966^b). Trial of CIBA 32644-Ba in the mass-treatment of urinary bilharziasis. *Acta Tropica*, 211-218.
3. Arfaa, F., Bijan, H. and Sadeghi, A. (1967^a). Mass-chemotherapy or urinary bilharziasis with a Nitrothiazolyl compound (Ambilhar). *Trans. Roy. Soc. Trop. Med. & Hyg.* 61, 5, 653-58.
4. Arfaa, F., Tohidi, E. and Ardalan, A. (1967^b). Treatment of urinary bilharziasis in a small focus with sodium antimony dimercaptosuccinate (Astiban). *The Am. J. Trop. Med. & Hyg.* 16 :300-303.
5. Arfaa, F., Farahmandian, I., Sahba, G.H. and Bijan, H. (1970^a). Progress towards the control of bilharziasis in Iran. *Trans. Roy. Soc. Trop. Med. & Hyg.* 64:912-917.
6. Arfaa, F., Farahmandian, I. and Soleimani, M. (1970^b). Evaluation of the effect of mass-chemotherapy with Niridazole as a method of bilharziasis control in Iran. *Trans. Roy. Soc. Trop. Med. & Hyg.* 64, 1, 130-133.
7. Arfaa, F., Sahba, G.H., Jamshidi, C.H. and Ardalan, A. (1972). Preliminary trial of the effect of Hycanthon (Etrenol) in the mass-treatment of urinary bilharziasis. *Int. J. Parasit.* 2.
8. Forsyth, D.M. and Bradley, D.J. (1966). The consequences of bilharziasis, medical and public health importance in northwest Tanzania. *Bull. Wld. Hlth. Org.* 34 :715.
9. MacDonald, G. (1965). The dynamics of helminth infections, with special reference to schistosomes. *Trans. Roy. Soc. Trop. Med & Hyg.* 56 :489-506.