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Controlling human Oesophagostomiasis in Northern Ghana

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-Chapter 8-

Annual mass treatment with albendazole might eliminate human oesophagostomiasis from the endemic focus in northern Ghana

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Abstract

As a follow up to the study of Ziem *et al.* published in chapter 6, efforts to control human oesophagostomiasis and hookworm infections in northern Ghana were pursued, and the results evaluated in collaboration with the Lymphatic Filariasis Elimination Program (LFEP). This phase of evaluation of the impact of mass treatment was no longer limited to a small-scale research setting. Evaluation was done both in the context of an operationally viable national control programme and as a continuation of the Oesophagostomum Intervention Research Project (OIRP) described elsewhere in this issue. The methods of evaluation included classical stool examination with Kato thick smears, stool culture and ultrasound examination of the colon wall.

The results showed that yearly population-based albendazole-ivermectin treatment in 11 villages scattered over north eastern Ghana, with a treatment coverage of 70-75% resulted in a reduction of *Oesophagostomum* -prevalence from about 20% before intervention to less than 1% after two years of mass treatment. Simultaneously, hookworm prevalence went down from 70% to approximately 15%. The data, however, cannot be readily compared with those published in chapter 6 because of the relatively crude diagnostic (single stool cultures) screening system that had to be used for evaluation of the large-scale control programme.

In the research area of the OIRP interruption of mass treatment resulted in a rising hookworm-prevalence. The *Oesophagostomum*-prevalence on the other hand, continued to go down. Transmission of human oesophagostomiasis appears interruptible and small numbers of persistent cases of *Oesophagostomum* infection were shown insufficient to serve as a nucleus of renewed spread of the infection.

The data suggest that both the infection with and the pathology due to human oesophagostomiasis can be eliminated and that elimination is likely to be achieved through operationally feasible albendazole-ivermectin treatment as used by the Global Alliance for the Elimination of Lymphatic Filariasis (GAELF).

Introduction

Human oesophagostomiasis caused by infections with *Oesophagostomum bifurcum*, has been shown to be abundantly present in parts of northern Ghana and Togo. The local people recognise the characteristic symptoms locally described as "Dapaong Tumours" (Gigase *et al*., 1987; Haaf & van Soest, 1964). Although mild in its presentation in the majority of cases, the infection can result in severe clinical disease and pathological nodular lesions. Nodular lesions can be visualized by ultrasound in over 50% of the inhabitants in heavily infected villages (Ziem *et al*., 2005a; Storey *et al*., 2001c).

The Ghana health service recognized the infection as a serious, though local health problem and measures to prevent and/or control both the morbidity caused by the parasite and the parasite itself were considered necessary (Polderman *et al*., 1999). The *Oesophagostomum* Intervention Research Project (OIRP) carefully analysed the possibilities to control human oesophagostomiasis through regular mass treatments with albendazole. The impact of treatment on the frequency of ultrasound-visible pathology at the population level one year after two rounds of mass treatment has been reported in chapter 6 (Ziem *et al*., 2006, in press). The impact of repeated albendazole mass treatment on the prevalence and intensity of *O. bifurcum* and hookworm after two years and four rounds of mass treatment has been reported in chapter 6 (Ziem *et al.* TMIH, 2006, in press). Both papers report on carefully conducted studies performed under well-controlled conditions, and the studies showed that:

1. *Oesophagostomum* infection was strongly associated with hookworm infection, both at the individual and at the village level. Practically all *Oesophagostomum* infected subjects were infected with hookworm as well.
2. The frequency of *Oesophagostomum* infection and ultrasound-visible nodular pathology rapidly decreased after treatment.
3. The prevalence of *Oesophagostomum* infection and morbidity remained low following intervention and transmission seems to have stopped in the intervention area. The results suggest that effective control and possibly elimination of human infection in the area are achievable goals.
4. The prevalence and intensity of hookworm infection are greatly reduced but transmission is not interrupted.

In the present brief communication, the impact of the population-based mass treatment as practised by the Global Alliance for the Elimination of Lymphatic Filariasis and the operational feasibility of the treatment on human oesophagostomiasis is being reported. The results were compared with those obtained during and after the control-oriented research efforts in the intervention area of the OIRP. After the successful reduction of prevalence and *Oesophagostomum*-related pathology in the intervention area of the OIRP, mass treatments were stopped. In October 2004, 18 months, and 2 rainy- (transmission) seasons after the last treatment, the individuals shown to be uninfected in September 2003 were re-examined to check whether new transmission had given rise to new infections.

Methods

Evaluation of the impact of treatment was done in two different settings: as part of the Lymphatic Filariasis Elimination Programme (LFEP), and within the Oesophagostomum Intervention Research Project (OIRP). The methodology of monitoring was different. In the LFEP-based evaluation the stool culture procedure used by Yelifari et al (2005) was followed: stool samples were collected from 100 subjects (25 boys, 25 girls, 25 adult men and 25 adult women, randomly chosen from the village population, as described by Yelifari et al, 2005)) and analysed on the basis of single coprocultures. In October 2004, this procedure was used to establish the prevalence of infection in 11 "sentinel villages" which were also examined between 1995 and 1998 by Yelifari and coworkers. The villages were the same but the subjects examined were not. The inhabitants of the 11 sentinel villages had been subjected to LFEP's standard albendazole-ivermectin treatment twice: in April 2003 and April 2004. None of these villages were included in the OIRP studies.

In the OIRP study area, on the other hand, the subjects examined one year earlier were revisited and asked to submit a stool sample once again to establish whether or not *Oesophagostomum* transmission was going on after interruption of the albendazole treatments. These samples were analysed using single 25 mg Kato smear and double coprocultures, as described earlier (Ziem et al, 2006). In 2004, the presence of ultrasound-visible pathological *Oesophagostomum*-specific lesions was established as described elsewhere (Ziem *et al*., 2005a). The inhabitants of the

OIRP study area had been treated four times: thrice by the Oesophagsotomum-project (October 2001, April 2002, October 2002) and once by LFEP (April 2003).

Results and Discussion

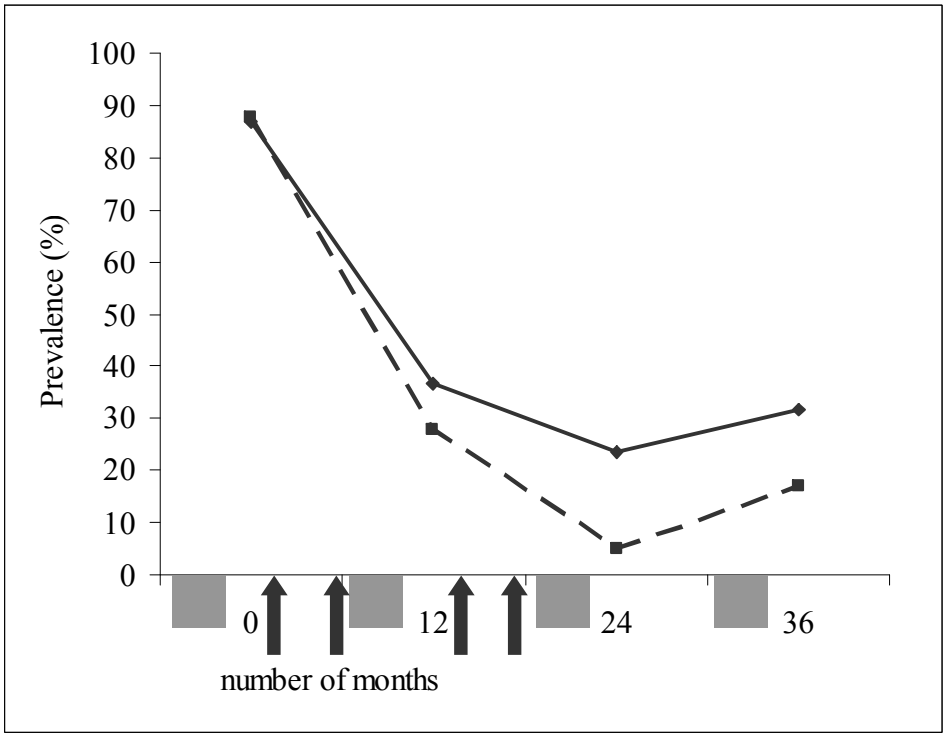
The results presented in table 8.1 show that the prevalence of *Oesophagostomum* infections in the LFEP-treated sentinel villages was greatly reduced, compared to the earlier survey 7-9 years ago. Only incidental cases were seen in villages, which were previously highly infested. The hookworm-infection rates went down considerably as well.

Table 8.1 Prevalence of infection of hookworm and *O. bifurcum* infection in 1995 and in 2004 after two rounds of LF-treatment had been carried out in Sentinel villages in northern Ghana

Village	Prevalence of infection in 1995			Prevalence of infection in 2004		
	n	Hookworm	*O. bifurcum*	n	Hookworm	*O. bifurcum*
Kakasiogo	94	47.9	3.2	77	1.3	0.0
Kologo-Akas	100	75.0	17.0	97	23.7	0.0
Karimenga	90	98.9	17.8	59	13.6	1.7
Kulbia-Gyenga	84	84.5	34.5	77	14.3	1.3
Namolgo	98	6.1	0.0	92	17.4	0.0
Sayoo	98	45.9	1.0	59	6.8	0.0
Tambalug	100	44.0	49.0	121	21.5	0.8
Kpemale	76	85.0	16.0	76	43.4	0.0
Mimima	90	91.0	14.0	24	4.2	0.0
Tatara	60	94.0	58.0	131	5.3	0.0
Timpeila	88	96.0	30.0	57	1.8	1.8
Total	**978**	**69.8**	**21.9**	**870**	**13.9**	**0.5**

In OIRP's intervention area follow-up of the status of infection after interruption of mass treatments was done in two different ways: with universally used Kato smears and with coproculture. The Kato results reflect infection with either hookworm or *Oesophagostomum*; the coproculture results give species-specific infection rates. Since infection with hookworm is always more common than that with *O. bifurcum*, the Kato-based egg counts really reflect hookworm infections. Figure 8. 1 shows that the infection rates increased again, after interruption of treatment. The

Fig 8.1 Prevalence of infections at baseline (September 2001, month 0 on time scale) and after four rounds of mass treatment September 2004, month 36 on time scale).

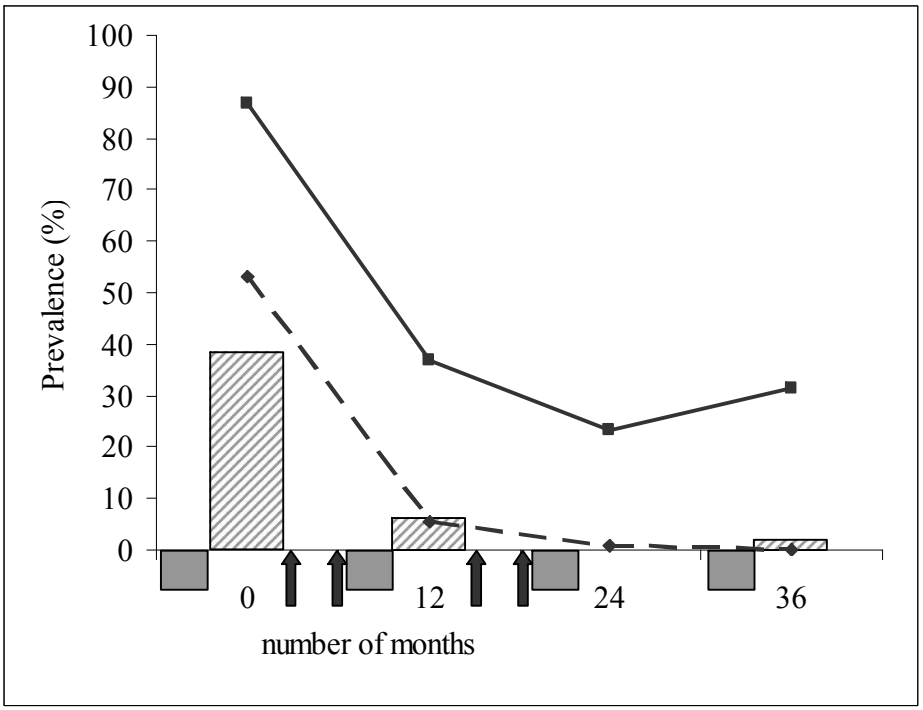


Legend
The broken line represents the prevalence of hookworm-like eggs determined by Kato
The solid line represents prevalence of hookworm infection determined by coproculture
The bars on the X-axis represent the periods of rains and transmission

Arrows on the X-axis represent times of treatment

figure also shows that overoptimistic results would be produced when analysis is based on the examination of Kato smears especially in light infections. Kato smear examination is much less sensitive than stool culture. Low rates of egg-positivity are misleading in that the remaining low grade infections appear to form a sufficiently large reservoir of infection to give rise to important re-infection as soon as intervention is interrupted.

Fig 8.2 Prevalence of *O. bifurcum* infection and nodular pathology at baseline (September 2001, month 0) and after four rounds of mass treatment (September 2004, month 36).



The broken line represents the prevalence of *O. bifurcum* infection determined by coproculture

The solid line represents the prevalence of hookworm infection determined by coproculture

The bars represent the prevalence of *O. bifurcum*-induced nodular pathology determined by abdominal ultrasonography

The bars on the X-axis represent periods of rains and transmission

The Arrows on the X-axis represent times that treatments were given

Figure 8.2 graphically represents the decline of both infection and pathology in the intervention area. It is particularly important to note that there is no return of *Oesophagostomum* infections after interruption of mass treatments. The absence of new cases is not due to sampling effects since it was the same individuals who were examined in 2003 and 2004. The absence of new cases also shows that no new infections in humans were procured from an animal reservoir. Indeed, the strain of infection found in monkeys and baboons, common hosts of *O. bifurcum* in Northern Ghana, has been demonstrated to be different from that found in man (de Gruijter et al, 2005). The rate of disappearance of ultrasound-visible lesions can not be calculated since no ultrasound examinations were done in the 2003 survey.

Conclusions

The observations presented here, provided from a collaborative study with the LFEP give further support to the existing evidence that human oesophagostomiasis can be eliminated as a public health problem and probably as a human infection in Northern Ghana, through a series of mass treatments with albendazole (with or without addition of ivermectin).

From an operational point of view it should be stressed that:

1. Careful monitoring of the *Oesophagostomum* situation during the next few years will be necessary to consolidate the successes achieved so far and to ascertain whether or not the elimination of the parasite can indeed be achieved.
2. Integration of the activities to control human oesophagostomiasis and lymphatic filariasis is shown highly effective. Intense and continued collaboration is needed to avoid gaps: to avoid leftover foci of *Oesophagostomum* transmission in places where control of filariasis is considered unnecessary. Such foci exist in Togo and the success of *Oesophagostomum* control will be undoubtedly related to albendazole coverage of the entire *Oesophagostomum*-endemic area.