

Management of a sleeping sickness epidemic in Southern Sudan

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Abstract

An epidemic of human African trypanosomiasis, also called sleeping sickness, was identified in Tambura County, Southern Sudan in 1997. Implementation of a sleeping sickness control program by international non-governmental organizations (NGOs) in Tambura County resulted in a three-fold decrease in the incidence of sleeping sickness between 1997-1999. The sustainability of these interventions once the NGOs withdraw is questioned. A hypothetical community based intervention to mitigate the epidemic is proposed which supports control and surveillance activities at the village level using the community health worker as the main focus. This paper describes how this epidemic was initially managed and provides an alternative management strategy.

Key words: sleeping sickness, African trypanosomiasis, southern Sudan, community solutions

Background

Sleeping sickness or Human African trypanosomiasis (HAT) has a long history in southern Sudan. Re-emergence of the disease in Tambura County followed the cessation of surveillance and control activities by the National Trypanosomiasis Control Program in 1990. After International Medical Corps (IMC) observed a progressive increase in passively detected cases, a population based prevalence survey documented epidemic levels of trypanosomiasis in 1997. Sleeping sickness in southern Sudan is caused by the parasite *Trypanosoma brucei gambiense*, transmitted through the bite of the tsetse fly. Initially, the parasite is confined to the haemolymphatic system, (Stage I), but as the disease progresses the parasite invades the central nervous system (Stage II). The infection progresses over a number of years and is invariably fatal if left untreated.

The primary method used to control sleeping sickness is serological screening of the population using the Card Agglutination Trypanosomiasis Test (CATT), followed by treatment of parasitologically confirmed infections. Because humans constitute the only epidemiologically significant reservoir of *Trypanosoma brucei gambiense*, this control strategy lowers the disease incidence by reducing the reservoir. This process of active case detection (ACD) of cases is supplemented by passive case detection (PCD) at hospitals and primary health care (PHC) centers. In conjunction with the screening program, vector control is used to limit the tsetse fly density at targeted sites.

Control of Sleeping Sickness Epidemic in Tambura County

An emergency program to manage the epidemic of sleeping sickness in Tambura County was implemented in October 1997 by IMC (International Medical Corps), CARE and Medical Emergency Relief International (MERLIN) with funding from the Office of United States Foreign Disaster Assistance (OFDA).

The objectives of this program are listed here:

1. Identify 100 percent of the population infected with the parasite *T. b. gambiense* via population screening in the areas of Tambura County at risk for the disease.
2. Determine disease stage in all infected persons.
3. Provide appropriate treatment and medical follow-up for all infected persons.
4. Implement focused vector control.
5. Train local personnel in the above activities.
6. Integrate these activities into the primary health care system.

As sleeping sickness is a chronic disease with a long latency period and the epidemic in Tambura County covered a large geographical area with up to 60,000 people at risk, emergency control of the epidemic could not be achieved in weeks or months. Rather it was estimated that these activities would be conducted over an 18month period.

A trained mobile survey team began mass population screening in Ezo II in October 1997, the epicenter of the sleeping sickness epidemic. Villagers were first registered; blood was then taken for testing with CATT. Seropositive people then underwent parasitological examination. Confirmed cases of

trypanosomiasis were referred to the nearest center for staging and treatment. CATT positive but parasite negative cases were recalled monthly for repeat parasitological examination. A standardized hand held registration card was implemented to allow easy identification of individual sleeping sickness status.

Ongoing prevalence surveys were conducted by a second mobile team to prioritize the next areas for mass population screening. They also aimed to educate and mobilize local health and civil authorities in trypanosomiasis treatment and control. Of the 45 villages in Tambura County, 33 judged to be at highest risk of trypanosomiasis were surveyed. Villages with a prevalence of 2 percent or greater were identified and prioritized for mass population screening by disease prevalence as well as geographical location and logistical constraints; such as high rainfall, the road conditions and security.

Temporary treatment centers adjacent to the primary health care (PHC) center were established in each payam to treat patients with Stage I sleeping sickness. A 10-day course of Pentamidine was used. Tambura Hospital's bed capacity of 50 was expanded to 125. All patients with Stage II disease were admitted to Tambura Hospital and treated with a 22-day melarsoprol regimen. Following treatment, all Stage II patients had their cerebrospinal fluid (CSF) re-examined to ensure that disease markers had decreased. A patient recall system was developed and implemented to follow-up all treated cases as well as CATT-positive parasite negative individuals.

Training of hospital, PHC, laboratory and mobile survey team personnel was conducted on an ongoing basis. Samples of all slides examined were sent to an independent laboratory in Nairobi for quality control of laboratory procedures.

Vector control was implemented through the placement of pyramidal tsetse fly traps manufactured in the village. These were placed at sites of high human-fly contact. Vector control personnel were trained in vector recognition and trap maintenance.

To evaluate the effectiveness of the emergency control program an independent impact study was conducted in late November 1998 by the Centers for Disease Control and Prevention (CDC). From the data collected during the mass population screening of Ezo Centre and Ezo II villages in November and December 1997 an estimate of the annual incidence was calculated at 13.5% (pers. com. Dr A Moore). Results from the impact study indicate that the seroincidence had decreased to 4.8%, representing a reduction of nearly three-fold in trypanosomiasis transmission.

Difficulties

Operating in a politically unstable region exposed the program and its personnel to numerous difficulties that hindered the efficacy of its implementation. Security was a continual concern with large number of Sudanese People's Liberation Army (SPLA) troops in the county. Access to villages was denied on regular occasions and a member of the Sudan Relief and Rehabilitation Association (SRRA) had to accompany the mobile teams at all times. The hospital microscope used for diagnosing and staging sleeping sickness was stolen, and although eventually recovered at the border market in the Central African Republic, its theft indicated that elements of the population had no concept of the importance of the program being undertaken. The original population numbers sourced from the SRRA were found to be grossly inaccurate. Only 7,031 people were screened in Ezo payam instead of the expected 20,000. Estimation of the population in the other five payams was subsequently reduced to 40,000 from the original 60,000.

Follow-up of treated sleeping sickness patients was also problematic. Patients require a lumbar puncture as part of the examination but will often not present for review when they feel well to avoid this much disliked procedure. Surveillance of treated cases was centered at Tambura Hospital and access for most patients was difficult. Most villages were more than an hour walk from the hospital and with very few vehicles in the county transport was unreliable.

Control of a sleeping sickness epidemic is expensive. A proportionately higher percentage of Stage II cases were identified than would otherwise have existed if the disease was at endemic levels. When active case detection was incorporated into the strategy, many more asymptomatic cases were identified. Funding for the program was difficult to procure. National monetary support was non-existent while the international donor community were hesitant to allocate their budget to programs that are perceived to have a high cost / beneficiary ratio.

Comparative Programs

The role of vector control in the management of Tambura's epidemic was peripheral to the identification and treatment of cases. In other countries, vector control is the mainstay of eliminating trypanosomiasis. In Zimbabwe, where sleeping sickness caused by *Trypanosoma brucei rhodesiense* is endemic, control of the tsetse fly population was seen as the basis to limiting sleeping sickness in the human population. Fake cows impregnated with kairomones were introduced in the mid 1980s (Ferriman 2001). The flies, drawn to the fake cattle, came in contact with the insecticides and died. Since the introduction of this novel control method, the cases of nagana, a disease equivalent to sleeping sickness in cattle, have plummeted. Another important consequence of these fake cows is that they have superseded the use of DDT pesticides to control the fly.

On the Tanzanian island of Zanzibar, the tsetse fly was successfully eradicated through the Sterile Insect Technique (SIT). Eight million male tsetse flies rendered sterile by exposure to gamma radiation from cobalt-60 were released on the island (Bhalla 2002). Female tsetse fly only mate once and therefore no offspring are produced if their mate is sterile. Some experts are cautious with regard to the technique's mass application. John McDermott quoted in the Lancet believes the efficacy of SIT alone is questionable and must be supplemented by aerial spraying particularly in areas where the infestation cannot be isolated.

The standard treatment for Stage II *T. b. gambiense* disease recommended by the World Health Organization (WHO) is melarsoprol. Alternative medications to those used in the Tambura County epidemic, have been employed to treat sleeping sickness in other countries. Two other therapeutic agents, enflornithine and nifurtimox, have been used in various regimens since 1981 for the treatment of stage II sleeping sickness and melarsoprol-refractory disease. Results from numerous centers indicate cure rates of over 60% can be achieved with these alternative medications (Van Nieuwenhove, 1992). In Congo, Democratic Republic of Congo and Cote d'Ivoire, a clinical trial using enflornithine undertaken by Pepin et al compared a 7-day intravenous course with the standard 14-day course (cost \$700) (Van Nieuwenhove, 2000). The authors concluded that the 7-day regimen could not be recommended, while the cost and complexity of a 14-day course for standard treatment is prohibitive. Although hailed as the answer to the sleeping sickness treatment conundrum, both these drugs do have serious side effects, their availability is not guaranteed and in the case of enflornithine is more costly than melarsoprol.

Alternative Management Strategy

The implementation of any program for the control of an infectious disease epidemic is normally performed on an emergency basis with a rapid response being of the utmost importance to prevent further morbidity and mortality. For *T. b. gambiense* sleeping sickness the situation is somewhat unusual due to the disease's long latency and chronic nature. Although the management strategy for the Tambura epidemic described was effective, resulting in a three-fold decrease in the incidence of the disease, it was heavily reliant on expatriate staff and expertise outside each community. The sustainability of the program once international assistance and supervision was withdrawn is difficult to estimate, as there are so many extraneous influences to support its failure.

To implement a trypanosomiasis control program that is effective as well as sustainable, community involvement must be paramount in the strategy. This is not a new concept in sleeping sickness control as - in 1941 an administrative circular on rural health said, "the local population must be shown the importance of the work and led to participate willingly and directly in its own defence" (WHO 2001). The following discussion describes a community approach to manage the sleeping sickness epidemic in Tambura County supported by a regional system.

Community Strategy

Community Dialogue

Community dialogue combined with a participatory rural appraisal as the first step, would allow the project team to identify the local belief system that is applied to sleeping sickness and facilitate self-development. Zande, the predominant tribe in Tambura County, have a strong belief in witchcraft and the supernatural. In a community that has a literacy of less than 50 percent, it is unlikely that the scientific tenants of trypanosomiasis are widely understood and accepted. Alternative, perhaps magical, explanations are more likely to apply to individuals with sleeping sickness symptoms or who die from the disease. For example, in Congo considerable emphasis is placed on the supernatural and projects involving innovations succeed when they are accepted, that is, adapted to local beliefs and mentalities

(Leygues 1989). Attitudes, knowledge and the ensuing health practices must be comprehended for each village. From this understanding, individual interventions can be designed and targeted with community cooperation to ensure that vector control, mass screening, treatment, and surveillance are optimized and self-sustainable in each village.

Community health workers

Community health workers (CHW) specifically trained in sleeping sickness will implement mass screening and surveillance in all villages. CHW will collect blood samples on filter paper, to be examined by the CATT at the established laboratories. This method of testing with filter paper samples gives a false negative rate of 5.8%, and test specificity of 100.0% (Noireau 1991). The presence of special sleeping sickness CHW will ensure that sentinels are permanently present in each community and health education with respect to sleeping sickness is ongoing. CHW will be supervised by their respective primary health care center reinforcing the educational process.

Passive case detection

Passive case detection will be undertaken by CHW and at the PHC center.

Screening

Screening of all new arrivals (returnees, refugees or transient visitors) to the village by CHW will ensure that new infection is not introduced. Movement of people is an important factor in trypanosomiasis epidemiology and can increase incidence and undermine control efforts (pers. com. Moore).

Treatment

Treatment of all Stage I disease at the PHC centers will ensure that any infected individual is not removed from their community and can still contribute to the household economy.

Census & Data base

Performing a census by household and headman at the beginning of the project will provide an exact population figure for each village from which a sleeping sickness database can be constructed at both the village and county level.

Recall system

Follow-up of patients will be conducted by the PHC centers through the CHW in each village. All screened individuals will have a sleeping sickness registration card indicating results of screening, treatment and follow-up dates. Any hand held record associated with health in Africa is treasured. Hence the registration card will be an effective accessible information system.

Fly traps & clearing

Targeted trapping of tsetse flies at water sources in or near villages with a high prevalence of sleeping sickness will decrease the fly population and thereby decrease sleeping sickness transmission. The pyramidal traps of blue and black fabric can be made locally. The tasks of water collection and clothes washing falls to women, they are therefore well placed to be integral in the monitoring of the tsetse traps. Training women from each village to be trap monitors will support the sustainability of this intervention. Monitors will then report to their respective PHC center.

Installation of village water pumps

In Tambura County, water for drinking is collected from the streams and small rivers adjacent to the village while washing and bathing is also conducted at these sites. These areas are synonymous with the tsetse fly habitat. By installing hand operated water pumps in the villages the necessity to collect water from the tsetse infested sites would be removed and transmission of sleeping sickness curtailed.

County Strategy

Coordination of control and surveillance activities at the county level will ensure that there is no duplication of effort and the program impact is maximized. The structure at county level will include international expert technicians, local technicians (lab, nurse, doctor, medical assistants), community health workers, village members, trap monitors, and SRRA representatives.

Training

Training of hospital, PHC workers, CHW and laboratory staff will be implemented with a continuing education program.

Treatment Centers

These will be established at each PHC for Stage I disease and at Tambura Hospital for Stage II treatment.

Standard treatment protocols

Protocols will be established in accordance with WHO guidelines. Melarsoprol-refractory disease will be treated with enflornithine.

Laboratory services

Laboratory services will be established at Tambura and Ezo to allow wide coverage of the population and ease of access.

Census and sleeping sickness data

Census and sleeping sickness data generated from each village and PHC will be collated centrally to identify prevalence levels, treatment trends and ensure that the whole at risk population is screened. This information will also act as an early warning system for any further outbreak of disease.

Mapping

Cases of trypanosomiasis are distributed in changing geographical outbreak areas that can be visualized over time and space (Lucas, 2001). By applying the tools of cartography and spatial analysis to the epidemic in Tambura, using a Global Positioning Systems (GPS) and appropriate GIS software a specific map will be developed that will illustrate the epidemiological status of any one area. This will permit more effective planning of surveillance and control strategies specific to each site. This process will be linked to the World Health Organization trypanosomiasis data analysis program to ensure expert support for all ongoing activities.

Sterile fly release

The release of sterile male flies into well-circumscribed endemic foci, as discussed elsewhere in this paper, would decrease the ability of the tsetse to reproduce and over time eradicate the fly in that particular area. This strategy in conjunction with the continued trapping of flies at strategic sites would rapidly decrease the vector and thereby decrease transmission of sleeping sickness.

Educational Materials

Educational Materials will be created by the local technicians to ensure applicability to the Tambura environment and then distributed through the PHC and CHW network.

Evaluation

Evaluation of the management strategy will be ongoing through review of screening and treatment statistics, trap data, village focus groups and an impact study at each village of known previously seronegative individuals one year from their original screening date.

Conclusion

Management of a sleeping sickness epidemic requires an integrated approach. Because of the disease's long latency period and chronic nature there is no quick fix solution. Tambura County like so many other sub-Saharan regions is isolated with a poorly supported health infrastructure. Building the capacity of the community to manage their problem, their sleeping sickness epidemic, empowers and creates ownership for the intervention ensuring its sustainability.

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