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RELAPSING FEVER, A DISAPPEARING CAUSE OF FEVER AND MATERNAL DEATH IN SENGEREMA, TANZANIA, EAST AFRICA

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ABSTRACT

***Objective*: To study the incidence of tick borne relapsing fever (TBRF) during the last 50 years, once like malaria an endemic disease in Sengerema, Tanzania.**
***Design*: By analyzing the annual reports, focusing on the number of admissions, maternal deaths, blood smears of patients with fever for Borrelia.**
***Setting*: Sengerema district, Tanzania.**
***Subject*: Admissions in Sengerema Hospital due to TBRF.**
***Main Outcome Measures*: From 1960 to 2010, we analyzed the incidence of TBRF.**
***Result*: Forty annual admissions in the sixties/seventies, 200 in the eighties (range from 37 in 1964 to 455 in 1988), dropping to 30 in the nineties. For the last nine years no *Borrelia spirochetes* were found in blood smears at the laboratory anymore and no admissions for TBRF were registered. The number of maternal deaths due to relapsing fever decreased simultaneously; the last one recorded was in 2002.**
***Conclusion*: During the last century, we have witnessed the disappearing of tick borne relapsing fever in Sengerema. Increase of gold mining, improved local economy, housing and standards of living after the nineties resulted in an almost complete eradication of the incidence of TBRF.**

INTRODUCTION

During the first half of the 20th century, relapsing fever was a disease of major worldwide importance, affecting 50 million people and associated with death rates of 10-40% (1,2). During the 1930's, approximately one third of the population in Africa was devastated by an epidemic attributed to relapsing fever. Relapsing fever is a recurrent febrile infection caused by various *Borrelia spirochetes* transmitted either by lice (epidemic relapsing fever) or ticks (endemic relapsing fever, caused by Borrelia Duttoni). Clinically, these spirochetes all produce an undulating febrile disease in humans, with signs and symptoms often indistinguishable from those of malaria (3,4) .

The disease affects especially under fives and men and women in the age group 15 to 30 years (5). It takes a very serious course among children and pregnant women and is responsible for quite a number of abortions, preterm deliveries, and maternal and child deaths (6,7). The common clinical features are fever (95%), headache (75%), muscle-and joint pain (60%), and on examination splenomegaly (60%), haepatomegaly (40%). It is one of the most severe febrile diseases, predictable in its behaviour and complicated by several organ and system disorders.

Diagnosis in most disease-endemic areas relies on demonstrating the spirochete in Giemsa-stained blood films. Spirochetes can be simple, if roughly, quantified (3). Tick borne relapsing fevers may be endemic or sporadic. The vector is the soft tick, genus Ornithodoros, prevalent in sub-Saharan Africa and Eurasia (8). These ticks live in traditional houses and mainly feed nocturnally. The disease is transmitted either by saliva during tick feeding or in coxal fluid, excreted during feeding. The ticks feed for a short time only, and return to the earth floor or walls of the house harboring the causative organisms in the

cracks of the walls inside the houses (2). They still cause major health problems in Central Tanzania, where this disease is a substantial cause of maternal and child deaths. Although present in some European countries, Central Asia, the Middle East and the Americas, tick borne relapsing fever is rare. It is often associated with camping out in rural locations in close proximity to animal reservoirs of the spirochete and their associated Ornithodoros tick vectors (2).

We assessed the importance of relapsing fever as cause of fever and mortality during the last 50 years in Sengerema district, Tanzania, with focus on maternal mortality.

MATERIALS AND METHODS

In the absence of community-based data, the use of hospital-based information may provide insight on disease trends. In Sengerema designated district Hospital information was obtained on yearly numbers of births and inpatient admissions and death for relapsing fever for the years 1960-2010. Sengerema Hospital was founded in 1959 by the Dutch congregations of the brothers of Mercy and the sisters of Charity. The hospital is localised 10km south of the southern shores of Lake Victoria and about 30 km west from Mwanza. In 1976 Sengerema Hospital became Designated District Hospital; from this date on the treatment has been free of charge.

The hospital is providing curative and preventive health services to a population of inhabitants, mainly Wasukuma.

Sengerema Hospital has a good standard laboratory. In 1964, a training-school for laboratory auxiliaries was started. Several laboratory workers from other hospitals have worked for short periods to learn new techniques like bacteriology, culture and sensitivity.

The annual reports of Sengerema Hospital of the last 50 years were analysed, since the start of the hospital in 1959, using the International Classification of Diseases (ICD) of the World Health Organization. Reporting of diseases was included since 1962. All diagnoses of patients admitted in Sengerema Hospital (IPD) or seen at the outpatient department (OPD) were registered and case fatality rates were recorded as well by medical officers during their weekly administration.

RESULTS

Annual reports were collected and grouped with intervals of ten years selected. We focused on two infectious diseases, tick borne relapsing fever and malaria. Most annual reports gave laboratory results concerning blood slides with investigations for malaria and/or relapsing fever, using Giemsa- or Leishman-stain. The total number of blood slides, number of admissions (Figure 1), diagnosis of Borrelia/malaria and mortality, focusing on relapsing fever and malaria as febrile diseases and indirect causes of maternal mortality with diagnoses based on blood smears, were analysed. Most patients came from Sengerema town (39%), 24% came from within ten miles and 30% from over 10 miles, but inside the district.

Figure 1
Admission

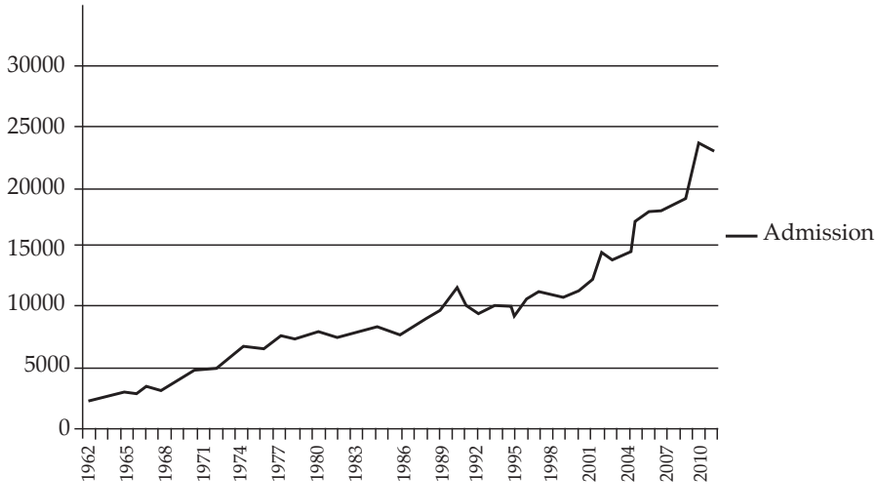
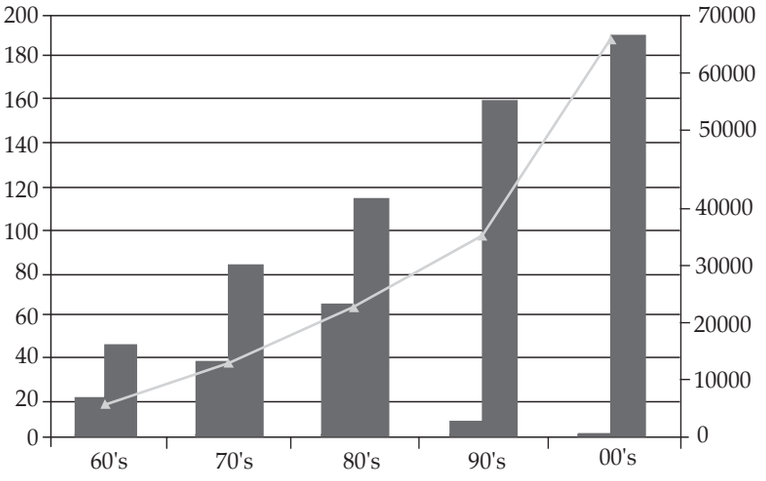


Figure 2
Maternal mortality versus total number of deaths due to relapsing fever/number of deliveries



In most annual reports basic data like number of deliveries and number of admissions were available. We retrieved 45 of the 50 annual reports with information concerning deliveries in 96%, admissions in 94%, maternal deaths in 90% and blood smears (malaria, relapsing fever) in 82% and maternal deaths were classified in 60%. Annual reports were available since 1962. The proportion of total admissions and total deaths as well as the case fatality rate for relapsing fever were calculated. The average for ten -years periods was then calculated. For analysis of maternal mortality only those with complete data were analysed.

In the early 60's yearly 7,000-12,000 blood slides were examined, with 25% positive for malaria (Falciparum) and 0.5% for tick borne relapsing fever with Borrelia Duttoni. Yearly 10-20 patients died in the hospital due to malaria and one to two patients due to relapsing fever. These figures persisted till the first half of the seventies. In the 60's no relapsing fever was mentioned as cause of the 32 classified maternal deaths. In the 70's the first maternal death with relapsing fever was reported in an annual report; this occurred in one of the nine indirect maternal deaths.

In the 80's, an increase of relapsing fever was found (maximum of 455 cases yearly). Every year 20 patients died due to malaria and seven to ten patients due to relapsing fever. In this decade most cases of relapsing fever were seen. In three of the nine indirect causes, Borrelia infection was seen as explanation for maternal mortality.

After the 90's, 20,000 blood slides were examined every year at the hospital-laboratory with a growing number of 30-40% positive for malaria parasites. Only 0.2% cases of Borrelia (RF) were seen with a few fatal cases. In the 90's, two of nine indirect maternal deaths were attributed to relapsing fever.

From 2000-2009, around 10,000 cases of malaria were treated at the outpatient department (OPD) or admitted with severe malaria (IPD). In the last seven years only one single case of relapsing fever was seen and confirmed at the laboratory. The mortality rate of tick borne relapsing fever during the last fifty years is presented in Figure 2.

Maternal mortality: In the 440 maternal deaths specified during these 50 years, direct causes attributed to most of them (78%). Indirect causes like malaria, meningitis, HIV / Aids counted for 93 maternal deaths (21%); in 1% of the cases no cause was mentioned. Relapsing fever or Borrelia infection was an indirect cause of death in seven pregnant women, being 7 / 93 (8% of the indirect causes.

Since 2000 only one single patient was seen with a fatal case of relapsing fever in the maternity of Sengerema Hospital, confirmed in a blood smear and mentioned in the laboratory results, according to the annual report in 2002. In 2008 a clinical case of neonatal RF was mentioned, but not confirmed by the laboratory. So despite clinical focus on Borreliosis, the last nine years no Borrelia was found in blood smears.

DISCUSSION

In Sengerema district, Tanzania, Tick Borne Relapsing Fever (TBRF, Borreliosis) was once an endemic disease, but showed a downward trend in the last

few decades. Throughout the years the diagnosis relapsing fever was frequently made, since the start of the hospital in 1959. In 1983, almost 3% of all in-patients had relapsing fever. The average case fatality rate over these years was 4,6 %, which indicate that relapsing fever was a rather dangerous disease. The frequency of admissions due to relapsing fever increased between 1963 and 1983 and decreased afterwards. The proportions of deaths due to malaria, however increased, but decreased due to relapsing fever. The disappearance decrease of relapsing fever is probably related in part to changes in housing and local economy (gold mining after 1980). The increase for example in admission rates in the early 1980's corresponds to a period of acute food shortage and drop in local economy in the country. The increase of malaria was observed in most parts of Tanzania and may be associated with the development of chloroquine resistance.

Poverty-related factors such as poor housing and crowding in simple houses with grass roofs with a high tick load, increase the community risk of being exposed to ticks and getting infected with *Borrelia Duttoni*. It has been argued that improvement in housing and nutrition in Western Europe before the introduction of tuberculostatic drugs in the 1950's were primarily responsible for the decline of tuberculosis incidence in that part of the world (9). In 1986, 40 pregnant women were seen at Sengerema Hospital, who had a positive bloodslide for Borrelia. Twenty recovered without any problem, nine patients showed mild complications and 11 had severe complications with two maternal deaths (6). The results of this study were similar to those previously reported from Rwanda and Central Tanzania: a risk of 30-58 percent of interruption of pregnancy and perinatal mortality of 15 percent, case-fatality rate of 1.5% in pregnant women (10-12). There is a positive correlation between the density of the spirochaetemia and the severity of complications (3,10).

Assessment of maternal mortality in Tanzania was performed in nearby Sumve Designated District Hospital, Mwanza region, Tanzania. Most deaths were attributed to the top five worldwide causes: obstructed labor, puerperal sepsis, post-partum haemorrhage, complications of abortion, and pre-eclampsia. There were few reports of abortions and abortion-related mortality. Relapsing fever or Borrelia infection was an indirect cause of death common to the region and particularly hazardous to pregnant women and many hospital deaths were emergency admissions (12).

Patients said that they often caught the disease while visiting relatives for a funeral and staying with them for the mourning period. In this gathering of people beds are not available in a sufficient amount and it is hypothesised that ticks then take the opportunity to infect the people lying on the ground. During such gathering women sleep in the houses and men outside, which might explain the fact that about twice as many women are affected as men. The above mentioned facts might mean that certain resistance exists, not only with the increasing of age but also to specific strains of the organism. The main causes of maternal deaths were direct causes like sepsis and haemorrhage as provided by these hospital data of Sengerema Hospital over the last fifty years. This is compatible with the main causes reported for maternal death in low income countries and similar to data for other regions in Tanzania (12, 13).

Under reporting and misclassification of maternal deaths are common. Post-partum autopsy was seldom done. In Sengerema Hospital this classification is done by medical doctors. Under estimation of maternal mortality due to relapsing fever is common too. In the 80's Borrelia infections were often seen during pregnancy and it was a known risk factor for maternal mortality. We found in this hospital analysis, that relapsing fever was an important indirect cause of maternal deaths of 33% in those years. Nowadays relapsing fever is an incidental finding and other indirect causes of maternal mortality like malaria and especially HIV / Aids are the new risk factors.

The results of this study must be interpreted with care. Changes in disease frequency may be related to population changes, increased access to and use of medical facilities, increased disease recognition and variation in diagnostic pattern. It is also uncertain to what extent admission patterns truly reflect the pattern of disease in a community where most deaths may occur at home. The trends, however, observed in this study in malaria and relapsing fever admissions rates most likely reflect what was happening in the community. After the eighties, Sengerema started to expand due to mining activities in the nearby area (Geita Gold Mines, gold run) and better houses were build in Sengerema with booming local economy. So the disappearing of relapsing fever, as cause of fever and maternal death may reflect the better housing possibilities with cement houses instead of mud houses and grass-roofs. This is probably the reason why Tick Borne Relapsing Fever (TBRF) is disappearing as cause of fever and maternal death, in Sengerema district, Tanzania.

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