

SHORT COMMUNICATION

Tick-borne relapsing fever in Mvumi Hospital, Tanzania: a retrospective study of laboratory data between 1997 and 2002

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Tick-borne relapsing fever (TBRF) is endemic in Tanzania and one of the most important vector-borne diseases according to recent research. However, the disease is so neglected that it does not even feature in the Ministry of Health Standard Treatment Guidelines. The national Health Management Information System does not have a separate category for this disease and so it is difficult to ascertain the magnitude of the disease. Another problem is that diagnosis requires microscopy, which is present in very few front-line health units.

TBRF is an important differential diagnosis of fever in children and studies of series of patients have shown that a high proportion of patients with TBRF are under 5 years old children. Barclay and Coulter (1990) examined numbers of TBRF cases treated at Mvumi Hospital from October 1985 to September 1986 and found 88% were under 5 and 36% under 1 year old. Overall mortality for children was 1.6% for under <5years and 2.3% for those under 1 year. For children admitted with TBRF the case fatality rate was 8.4%.

Jongen *et al.* (1997) published a case control study of 257 women with TBRF treated at Ndala Hospital in Tabora region between 1985 and 1995. The case fatality rate was 1.5% in pregnant women and 1.7% in non-pregnant women. Melkert (1988) reported a case fatality rate (CFR) of 3.7% in pregnant women with TBRF seen at Sengerema Hospital in Mwanza region and a report from Rwamagana Hospital in Rwanda gave an even higher CFR of 8.5% (Goubau and Munyangayo, 1983). Differences in severity of maternal infection in different geographical locations possibly suggest variations in pathogenicity between the different strains or differences in time from infection to treatment (A. Talbert, unpublished data).

Jongen *et al.* (1997) found that TBRF had a profound effect on pregnancy outcome with perinatal mortality of 436 per 1,000 births. It is not known how many women in Tanzania lose their babies due to TBRF and this clearly merits further studies.

TBRF is a disease transmitted by the saliva or coxal fluid of soft ticks of the *Ornithodoros* genus infected with spirochaetes of the genus *Borrelia*. In East Africa the main organism is *Borrelia duttonii* but in other parts of Africa *Borrelia crocidurae* is responsible for TBRF and in Ethiopia lice transmit a closely related spirochaete, *Borrelia recurrentis* which causes the epidemic disease of louse-borne relapsing fever.

Diagnosis is routinely made on the presence of spirochaetes on examination of Giemsa or Field stained thick blood films. Other techniques include dark field microscopy and acridine orange fluorescence and Quantitative Buffy Coat techniques.

The study reported in here was carried out at Mvumi Hospital in Dodoma, central Tanzania. Mvumi Hospital is a voluntary agency hospital, run by the Anglican Diocese of Central Tanganyika. It is situated 40 kilometres south east of Dodoma and serves a rural population of roughly 220,000 mostly from the south and eastern parts of Dodoma Rural District but also from neighbouring Mpwapwa and Iringa Rural districts. The average annual number of outpatients during the study period was 22,986 and inpatients were 6,839. The purpose of this study was to collate data on blood slide positive cases of *B. duttonii* and examine trends over the period between January 1997 and December 2002. TBRF has been the subject of research at Mvumi Hospital in Dodoma Region since the 1960s and the laboratory staffs are experienced in looking for and reporting spirochaetes

Table 1: Number of positive blood slides for *Borrelia* parasite at Mvumi Hospital in 1997-2002

Year	Number of positive slides for <i>Borrelia</i>
1997	96
1998	232
1999	236
2000	331
2001	376
2002	433
Total	1704

on thick blood films. Laboratory data for *B. duttonii* infection was reviewed from laboratory register at the Mvumi Hospital. These data comprised cases that were examined microscopically for *Borrelia* infection.

Data from the Hospital laboratory showed a marked increase in numbers of *Borrelia* positive blood slides from 1997-2002 (Table 1).

Graphical representation of monthly TBRF statistics showed wide variation with a preponderance of cases in the first 6 months of the year (Figure 1). Further analysis of numbers of positive cases in 2002 showed an overall *Borrelia* prevalence of 3.4% of patients presenting to the hospital with fever.

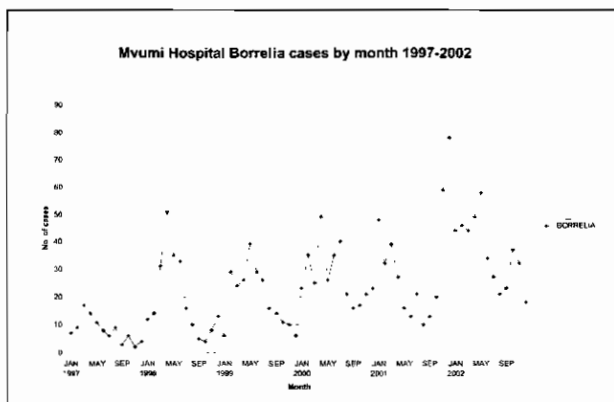


Figure 1: Monthly number of *Borrelia* cases at Mvumi Hospital in 1997-2002

The trend observed during the study period was that of increasing numbers of cases. Possible reasons for such an observation were not clear. However, the increase can probably be due to increase in awareness among the community members to seek treatment for the disease and or an increased need for laboratory diagnosis for the fever-associated diseases. The number of outpatients did not increase over this period.

Little is known of the transmission dynamics of TBRF in Tanzania. However, recent advances in *B. duttonii* research include the first successful *in vitro* cultivation from 5 patient isolates from Mvumi Hospital in 1999 by Cutler *et al.* (1999). Fukunaga *et al.* (2002) reported detection of *B. duttonii* in ticks using a nested PCR of flagellin gene and the same group has more recently identified *B. duttonii* and a postulated new species from blood of humans around the Mvumi area (Kisizza *et al.*, 2003). These achievements have opened the way for sensitive estimates of *Borrelia* prevalence in host and vectors enabling further studies of TBRF transmission dynamics.

There have been efforts to control TBRF in Dodoma in the recent years. Insecticides that have been found to be active against ticks include lambda-cyhalothrin, permethrin and deltamethrin. Insecticide

treated mosquito nets have also been found to protect against tick bites (Talbert *et al.*, 1998). Some householders have used the deltamethrin, supplied in net treatment kits, diluted with water, to sprinkle on the floor and walls (Kisizza *et al.*, 2004). Preliminary research has shown that using pyrethroid insecticides either for indoor residual spray or on mosquito nets is effective in reducing TBRF cases. Furthermore, improving house standards and using a mixture of lime and sands has also been useful in Dodoma district (Kisizza *et al.*, 2004).

Few longitudinal studies have been done looking at numbers of ticks in houses. An intervention study of interior residual spraying showed marked fluctuation in tick numbers in the control village. Factors affecting the tick densities need further investigation but ticks are present all year round.

Prevalence studies on *Borrelia* infection in ticks by Fukunaga *et al.* (2002) found very high infection rates in ticks from Mvumi: 45% in one series of 120 ticks from 8 households. The risk of being bitten by an infectious tick is high for residents of tick-infested houses. There is no data on how infection rates vary over time. More work is needed on the natural history of tick *Borrelia* infection.

Incidence and prevalence studies of *B. duttonii* infection have been carried out on humans in Dodoma Rural District. One series by Mushi (1996) in Makang'wa village found slide positivity rates of *Borrelia* in 3.2% of adults (12/380), 2% of schoolchildren (2/100), 3% of children under 5 years old (3/100) and 7.5% of pregnant women (3/40). Recent PCR studies by Kisizza *et al.* (2003) have found that 4% of healthy afebrile children (13/307) and 11% of febrile children (6/54) in a sample from Muungano village were positive for *Borrelia*.

Many people in the Mvumi area sleep on the floor on cowhides making them easy targets for the nocturnal ticks living in earth floors. Less than 10% sleep on beds, a measure advocated by Walton (1964) to reduce tick numbers. Whilst this intervention worked in Kenya, observations in the Mvumi area show that ticks are capable of climbing walls and thus probably bed legs, as is borne out by comments of the local people. When the ticks are very active in the hot dry months of October and November many people sleep outside their houses, which may limit contacts with ticks, which are rarely found outside the houses.

Regarding symptomatic disease, children and pregnant women are the most severely affected groups due to low immunity. Old people rarely present with signs of TBRF yet their houses are often heavily infested indicating high levels of immunity. There is anecdotal evidence of strain specific immunity from infection after travel to different areas. Recent molecular techniques could help to clarify these issues. Serology studies are complicated by the *Borrelia*'s marked ability for antigenic variation. The expression

of different membrane proteins is a mechanism for evading host immune responses, leading to the relapsing character of the disease if untreated.

Kitchen (1972) investigated the effect of climate on TBRF incidence from cases diagnosed at Mvumi Hospital from December 1969 to November 1971. He found very wide fluctuation in incidence from month to month but concluded that climate does not seem to be a major factor in the changes in incidence of the disease. This is probably the reason why a seasonal pattern could not be observed in our study covering six years. The microclimate inside the houses may be a more important predictor, since the ticks live indoors and this has not been studied in the Mvumi area yet.

It is obvious that it is premature to speculate on reasons for trends in TBRF disease whilst so much basic research on tick and human behaviour and *Borrelia* transmission is still needed. This disease is ready for a re-appraisal of much of the earlier work done in East Africa in the 1950's using modern laboratory techniques.

The final question is "How frequent is TBRF in other regions of Tanzania?" Laboratory data from other health institutions would be useful because TBRF-specific data is missing from national Health Management Information System. Laboratory staffs need to be alert to the possibility of spirochetes being present and not just malaria parasites on thick blood films. Further training would enable them to be confident of the diagnosis. Clinicians should be aware of TBRF as a differential diagnosis of children and pregnant women with fever and should be up to-date with management of the disease.

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