

Subperiodic-diurnal Circadian Rhythm of *Trypanosoma brucei* *Rhodesiense* in Peripheral Blood of Infected Humans: A Case Report from Zambia

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ABSTRACT

We present a case of a male adult patient that was diagnosed with stage-1 of *Rhodesiense* Human African Trypanosomiasis (rHAT). On the day of confirming the diagnosis, peripheral blood examination of the patient in the morning sample revealed no trypanosomes while early evening examination showed trypanosomes present. We try to offer a nature's explanation for this observation. This is important to minimise missed diagnosis of rHAT.

Keywords

Human African Trypanosomiasis (HAT), Subperiodic-diurnal Circadian Rhythm, Parasitaemia.

Introduction

Human African Trypanosomiasis (HAT) exclusively occurs on the African Continent. The infection is transmitted mainly by the bite of an infected tsetse fly belonging to the genus *Glossina spp* [1] The parasite responsible is a hemoflagellate belonging to the species *Trypanosoma brucei*. There are two subspecies of *Trypanosoma brucei*. These are *Trypanosoma brucei rhodesiense* (*Tbr*) which causes a more virulent and acute form of HAT called *Rhodesiense* HAT (rHAT) or East African HAT and is found in Eastern and Southern Africa [2]. The other subspecies is *Trypanosoma brucei gambiense* (*Tbg*) which cause a less virulent and chronic form of HAT called *Gambiense* HAT (gHAT), also called West Africa HAT or Equatorial African HAT [3]. If left untreated, HAT has virtually a fatality of 100% [1].

Laboratory diagnosis is key in the diagnosis and management of HAT cases. In almost all endemic countries, laboratory diagnosis is based on thick blood film Giemsa stained light microscopy to detect trypanosomes in peripheral blood of the patient [4].

In Zambia, rHAT is still endemic in provinces such as Northern, Muchinga, Eastern, Lusaka, Luapula and Central. The infection

is a zoonosis with reservoir host being wild animals in national game parks.

We present this case report to highlight the relevance of the Subperiodic diurnal periodicity circadian rhythm of *Tbr* in the detection of trypanosomes in peripheral blood in the light microscopy diagnosis of rHAT.

The Case

A 28years old female patient was admitted to a hospital in the northern region of Zambia on 20th January 2025. Her complaints were headache, joint pains, palpitations, and dyspnoea for some days/weeks. The patient was 21 weeks pregnant. On physical examination, there was nothing remarkable. A provisional diagnosis of rHAT was made as the patient came from a rHAT endemic area. Blood examination for trypanosomes was requested by the attending doctor. A thick blood film was made at 09:00hrs and immediately sent to the laboratory for Giemsa staining and light microscopy. The laboratory test result showed no trypanosomes present. A repeat thick blood film was made at 19:00hrs on the same and again sent to the laboratory for Giemsa staining and light microscopy by the same laboratory technician that had examined the morning sample. This time the laboratory test showed presence of trypanosomes. A diagnosis of stage-1 rHAT was made. The patient was put on a five weeks course of suramin intravenously. The patient made a full recovery and was discharged at the end of the course.

Discussion

As the world approaches 2030, the year the World Health Organisation has targeted as the elimination of gHAT (no transmission) and elimination of rHAT as a public health problem (less than 2 cases/10,000 inhabitants in endemic region) accurate laboratory diagnosis of HAT is critical [5]. For rHAT, which our patient had, and which is a zoonosis, time of the day when peripheral blood is collected from a patient and examined for trypanosomes under the microscope seems to matter. It seems therefore that even though trypanosomes may be present in peripheral blood of the infected person throughout the day, maximum density of parasitaemia occurs in the late afternoon or early evening. This means that blood examined in the morning for trypanosomes may be negative for the parasite but positive in the late afternoon or early evening blood sample. This Subperiodic-diurnal circadian rhythm of *Tbr* could be explained by the observational studies conducted in animals and the vector, tsetse fly. The Tsetse flies are primarily active during the day, specifically in the late afternoon (two hours before the day ends) and early morning (two hours after day break) [5-9]. It is during these times that the tsetse flies are likely to pick trypanosomes when they are actively seeking a blood meal. While they can bite throughout the day, their peak activity periods are when they are most likely to transmit the trypanosomes. It is suggested that for diurnally active hosts, man and reservoir vertebrate host such as wild animals, trypanosomes, in our case *Tbr*, circadian rhythm is characterised by parasitaemia throughout the day which peak in late afternoon or early evening [10]. This Subperiodic- diurnal periodicity is a biological adaptation by the trypanosomes to be present in higher numbers in peripheral blood when they are likely to be picked up the feeding tsetse fly to complete their life cycle in the tsetse fly.

Conclusion

Due to the apparent existence of Subperiodic- diurnal circadian rhythm in the appearance of *Tbr* in peripheral blood, it is essential to repeat a blood examination in the late afternoon or early evening in a patient that had a negative blood test in the morning on that day.

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