

Wellington da Silva Mendes^{1†}

Antônio Augusto Moura da Silva^{II}

Romerito Fonseca Neiva^{III}

Nicolle Matos Costa^{III}

Maressa Soares de Assis^{III}

Priscila Maria Oliveira Vidigal^{III}

Maria dos Remédios Freitas Carvalho Branco^I

Maria da Graça Lírio Leite^{IV}

Jakeline Maria Trinta Rios^{IV}

José Orlando Sousa Martins^{IV}

Salim Jorge Waquin Neto^{IV}

An outbreak of bat-transmitted human rabies in a village in the Brazilian Amazon

Surto de raiva humana transmitida por morcegos em povoado da Amazônia brasileira

ABSTRACT

During 45 days without electrical power, 57 individuals (8.7% of the population) from the village of Antônio Dino (municipality of Turiaçu, Northeastern Brazil) were attacked by bats and 16 died from human rabies. The aim of the study was to analyze the factors associated with bat attacks and the development of human rabies. Of the 46 individuals, who suffered bat attacks, 36 (78.3%) were under 17 years of age. The risk factors associated with bat attacks were age under 17 years, having observed bats inside the bedroom and having been without electrical power in the house. Age under 17 years and having been without electrical power in the house were factors associated with human rabies.

DESCRIPTORS: Rabies, epidemiology. Disease Reservoirs. Chiroptera. Disease Outbreaks. Epidemiologic Surveillance. Zoonoses.

RESUMO

Durante 45 dias sem energia elétrica, 57 indivíduos (8,3% da população) da localidade Antônio Dino, município de Turiaçu, MA, foram atacados por morcegos e 16 morreram de raiva humana. O objetivo deste estudo foi analisar os fatores associados aos ataques por morcegos e ao desenvolvimento de raiva humana. Dos 46 indivíduos que sofreram ataque por morcegos, 36 (78,3%) tinham menos de 17 anos de idade. Os fatores de risco associados a ataques por morcegos foram idade inferior a 17 anos, ter observado morcego dentro do quarto e haver ficado sem energia elétrica no domicílio. Idade inferior a 17 anos e ter ficado sem energia elétrica no domicílio foram fatores associados à raiva humana.

DESCRIPTORIOS: Raiva, epidemiologia. Reservatórios de Doenças. Quirópteros. Surtos de Doenças. Vigilância Epidemiológica. Zoonoses.

^I Departamento de Patologia. Universidade Federal do Maranhão (UFMA). São Luís, MA, Brasil

^{II} Departamento de Saúde Pública. UFMA. São Luís, MA, Brasil

^{III} Curso de graduação em Medicina. UFMA. São Luís, MA, Brasil

^{IV} Secretaria Estadual de Saúde. São Luís, MA, Brasil

[†] In memoriam

Correspondence:

Antônio Augusto Moura da Silva
Departamento de Saúde Pública
Universidade Federal do Maranhão
R. Barão de Itapary, 155 – Centro
65020-070 São Luís, MA, Brasil
E-mail: aasilva@ufma.br

INTRODUCTION

Human rabies (HR) is a serious neurological disease with almost 100% lethality. In 1983, the member countries of the Pan American Health Organization agreed to eliminate dog-transmitted HR from the main Latin American cities by 2005.⁴ To achieve this goal, the Regional Program for the Elimination of Rabies Transmitted by Dogs in Latin America was launched. The program produced significant results. By 2003, the number of cases had decreased by more than 90%. However, from 2004, a new predominant mode of HR transmission began to emerge in Latin America, when more than half of the 87 notified cases of HR were transmitted by vampire bats.⁵ Since then, vampire bats have been the main vector of HR in Latin America.¹

The objective of this study was to analyze factors associated with bat attacks and human rabies in an outbreak of bat-transmitted human rabies.

METHODS

The village of Antônio Dino has 685 inhabitants and is 320 km away from the capital of the state of Maranhão, in the Northeast of Brazil. It is located in the municipality of Turiaçu, in a well-preserved area of the Amazon forest. The population, which has low purchasing power and no fixed source of income, survives by growing cassava and rice. There are no health care services available in the village, and the residents travel 32 km, when they need medical care. In September, 2005, the transformer that distributed power to the village failed, leaving 223 (87.1%) of 256 homes without electricity. In due course, bats attacked 57 (8.3%) residents, of which 16 (28.1%) developed HR and died.

In 13 cases, antigenic typing of the virus with a panel of monoclonal antibodies was carried out at the Pasteur Institute in São Paulo and variant three of the rabies virus was identified. This variant is usually isolated from samples taken from the bat species *Desmodus rotundus*. In three other cases, confirmation was made by means of clinical and epidemiological criteria. Interventions to curb the epidemic were put in place, during which 73 bat captures were made, yielding a total of 263 animals, of which 251 (95%) belonged to the species *Desmodus rotundus*. The bats were not tested for antibodies against rabies virus.

A convenience sample of 148 individuals (21.6%) of the village population was selected from the most affected areas. They were enrolled and divided into two groups: group 1— comprised of 102 individuals, who were not attacked by bats; and group 2—made up of 46 (80.7%) of the 57 individuals attacked by bats, including 16 who developed HR and died. In the cases of death, disease was diagnosed by interview with a member of the family and review of medical notes.

To identify factors associated with bat attacks, the following variables were analyzed: sex, age (under 17, ≥ 17 years), type of dwelling, availability of electricity in the domicile, availability of public lighting in the street, having been without electricity during the power failure, frequent sightings of bats inside the dwelling during the power outage and adopting popular practices for preventing bat attacks (i.e. sleeping with the light on or with a wick lamp lit in the room).

To identify factors associated with developing HR, the following variables were analyzed: sex, age (under 17, ≥ 17 years), having been without electricity during the power failure and not having received the antirabies serum and vaccine after the bat attack.

Odds ratios were estimated by multiple logistic regression. The variables yielding a p value of less than 0.20 in univariate analysis were submitted to multivariate analysis.

The study was approved by the Research Review Board at the hospital of the *Universidade Federal do Maranhão* and followed the Declaration of Helsinki principles.

RESULTS

Twenty five (54.3%) out of 46 individuals attacked by bats were males and 36 (78.3%) were under 17 years of age. Attacks took place on the lower limbs in 30 cases (65.2%), on the face in 11 (23.9%), on the torso in four (8.7%) and on the upper limbs in one. Fifteen (41.7%) out of 36 children (<12 years old) who were attacked developed HR, while only one (10%) of the adults (≥ 17 years old) who were attacked became ill. Antirabies serum and vaccine were administered to only ten (21.7%) out of 46 individuals attacked. No one, who received serum and vaccine, developed HR.

Ten (62.5%) out of 16 cases of HR were females and 15 (93.8%) were under 17 years of age. All were attacked by bats during the 45 days of power failure. The incubation period varied from 16 to 39 days for 15 of the cases. In one patient, the incubation period was estimated at 120 days. Deaths occurred between two and nine days after the onset of symptoms. The most common symptoms were headache (12 cases, 75%) and fever (11 cases, 68.8%). The most common neurologic complaints were paraparesis (14 cases, 87.5%), aggressiveness and/or agitation (six cases, 37.5%), mental confusion (four cases, 25%) and tetraparesis (three cases, 18.8%). Seven (50%) out of 14 patients who initially developed paraparesis evolved to paraplegia. Hydrophobia and/or sialorrhea were present in ten cases (62.5%). In univariate analysis, the risk factors for being attacked by bats were being under 17 years of age, frequent sightings of bats inside the dwelling

Table. Multivariate analysis of the risk factors for being attacked by bats and for developing human rabies. Turiaçu, Northeastern Brazil, 2006.

Variable	Odds ratio (95% CI)	p
For bat attack		
Having been without electricity during the power failure	84.28 (9.59;740.42)	< 0.001
Being under 17 years of age	14.30 (5.03;40.61)	< 0.001
Frequent sightings of bats inside the dwelling during the power outage	5.64 (2.00;15.93)	0.001
For developing human rabies		
Being under 17 years of age	23.08 (2.96;180.00)	0.003

and having been without electricity during the power failure. In multivariate analysis, the risk factors for bats attacks were the same as in univariate analysis.

In univariate analysis, being under 17 years of age and having been without electricity during the power failure were risk factors for developing HR. In multivariate analysis, being under 17 years of age continued to be a risk factor for HR (Table). Although the variable having been without electricity during the power failure was highly significant in the univariate analysis ($p < 0.001$), it could not be evaluated in the multivariate analysis because it predicted HR perfectly and was automatically dropped from the model.

DISCUSSION

Antônio Dino features all the main characteristics associated with outbreaks of bat-transmitted HR: it is a small village in the rural Brazilian Amazon; the dwellings are vulnerable; there are very few farm animals present, making humans an important source of food for vampire bats; and access to health care facilities is difficult, causing administration of post-exposure prophylaxis to be low.^{2,3}

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However, the strong statistically significant association between the power failure and attack by vampire bats, which was found in both univariate and multivariate analysis, suggests that the power failure was the main factor associated with this outbreak of bat attacks that in turn led to the HR outbreak. The bats attack their victims to feed, while people sleep. The residents are accustomed to bat attacks and usually fail to seek medical aid; consequently, the antirabies serum and vaccine are usually not administered.^{2,5} More than 90% of the attacks were to the extremities of the limbs or to the face, areas usually exposed during sleep. There was a statistically significant association between being under 17 years of age and both bat attacks and the development of HR, possibly because young people tend to uncover their extremities while sleeping.

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