

Human rabies: a descriptive observation of 21 children in Kinshasa, the Democratic Republic of Congo

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Objectives: Human rabies has recently emerged as a significant public health threat in Kinshasa, Democratic Republic of Congo (DRC). However, there is little epidemiological information on human rabies especially in children.

Methods: We performed at Pediatrics Department of General Reference hospital of Kinshasa between December 2008 and July 2009, a retrospective study to assess the incidence and to describe their clinical aspects and outcome.

Results: A total of 21 cases were observed, rather three cases per month. There were 12 boys (57.1%) and 9 girls (42.9%). Biting animal was found to be dog in all cases (100%). The dog was not immunized in all of cases. On admission, all patients (100%) showed furious rabies manifestations. Only two (9.5%) had their wounds treated and received an anti-rabies vaccine (ARV) after the bite incident. Two (9.5%) patients received rabies immunoglobulin (RIG). The case-fatality rate was 100%.

Conclusions: The disease emerges as a new major public health problem because of a lack of knowledge regarding rabies risk, the poor management of dog bites. Preventative vaccination for rabies should be recommended in the population of Kinshasa, area at high risk to contract rabies, particularly in children.

Keywords: Outbreak, Human rabies, Children, Kinshasa, The Democratic Republic of Congo, Africa

Highlighted

- Rabies has emerged as a significant public health in Kinshasa, Democratic Republic of Congo.
- This study describes the clinical profile and management of 21 children.
- Patients showed furious rabies manifestations and high prevalence of stray dog bites.
- A minority of children had received an anti-rabies vaccine after the bite incident.
- It shows that the human rabies management systems in Kinshasa were unprepared.

Introduction

Rabies is an acute encephalitis illness caused by rabies virus. Rabies virus is the prototype species of the genus *Lyssavirus* in the family of *Rhabdoviridae*.^{1,2}

Human rabies still remains a major public health in the world. According to global estimations, 60 000 deaths occur each year in the world, among which 24 000 deaths in Africa in the world (95% CI: 6900–45 900) per year in Africa.^{1,2} Children are victims of up to 50% of these mortalities. Urbanization is the major cause of spread of rabies in Africa.^{1–3}

In the Democratic Republic of Congo (DRC), the first case of human rabies was reported in 1923.⁴ Rabies was declared enzootic disease by the authorities in 1950. However, there is anecdotal information on human rabies.

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In 2009, physicians in Kinshasa, the largest city of the DRC, noted numerous cases of human rabies among children, which progressed rapidly to death. The first case of human rabies in Kinshasa was detected in May 2009 in Department of Pediatrics of the University Hospital of Kinshasa (unpublished data) and since then, the spread of human rabies in Kinshasa has been relentless.

Therefore, we performed at Pediatrics Department of General Reference hospital of Kinshasa a retrospective study to assess the incidence and to describe the clinical aspects and outcome of children suffering from rabies.

Materials and Methods

Ethical consideration

This investigation was undertaken in response to the presentation of acutely ill patients to our institution with the intent of determining the infectious agent responsible for the outbreak. Ethics or IRB approval was not requested for this outbreak investigation. The permission to use data was approved by local authorities of Hôpital Provincial Général de Référence de Kinshasa.

Study design and population

Children with human rabies reported to the Hôpital Général de Référence de Kinshasa between December 2008 and July 2009 were included in the study. This hospital is a secondary level hospital and referral health institution located in Western part of the DRC. Kinshasa is the largest city and the capital of DRC (population: 10 000 000) located at the western part of DRC with a population density of 534 per square kilometer.

Patient demographic and clinical characteristics were analyzed descriptively. The following clinical information were recorded and analyzed: (1) age and gender; (2) clinical features; (3) the location of the bite; and (4) the origin of the bite. Different lag times include three latency periods: (1) the time of incubation; (2) the time from the first symptoms and the reference to our institution; and (3) the time from consultation in our institution to death.

The cases were classified in the following four age groups: infants (1 month to 1 year), toddlers (>1 year to 5 years), younger children (>5 years to 10 years), and older children (>10 years to 14 years).

Diagnosis of rabies

The diagnosis of rabies was based upon an animal bite history and clinical examination. Clinical examination and complete neurological examination were systematically practiced by a pediatrician.

Data management and statistical analysis

The data from each patient were entered anonymous into a Microsoft Excel. Data were analyzed by descriptive statistics such as frequency distribution and percentages.

Results

Over a period of about 7 months, 21 children were classified as clinical human rabies-compatible cases and were included in the study. The estimated hospital incidence was three cases per month. There were 12 boys (57.1%) and 9 girls (42.9%). Table 1 shows a peak incidence in the group of older children (47.1%). All the children were from Kinshasa City. Details of demographic characteristics are presented in Table 1.

Biting animals were found to be dog in all the cases (100%). Exposure in 19 patients (90.5%) was by stray dogs. Legs in 14 patients (66.7%), arms in 5 patients (23.8%), and back in 2 patients (9.5%) were the most frequently reported location of the bites. All the dogs were not immunized.

Period of incubation was less than 60 days in 18 patients (85.5%).

Table 2 shows the clinical findings of children at the time of presentation to our institution. Fever, pain, and paresthesia were the three most prodromal symptoms. The two most common neurological signs were agitation (100%) and confusion (38.1%). Signs of autonomic nervous system dysfunction included 19 cases of hydrophobia (90.5%), 11 cases of hypersalivation (52.4%), and 11 cases of digestive disorders (52.4%). On admission, all the patients (100%)

Table 1 Demographic characteristics in a series of 21 children with rabies

Parameter	Number of patients, n (%)
Median age, years (range)	
Males	12 (57.1)
Distribution by age*	
Infants (1 month to 1 year)	0 (0)
Toddlers (>1 year to 5 years)	3 (14.1)
Younger children (>5 years to 10 years)	8 (38.1)
Older children (>10 years to 14 years)	10 (47.1)
Animal origin of the bite (n = 21)	
Dog	21 (100)
The time between the bite incident and the appearance of symptoms	
≤30 days	9 (42.9)
>30 days	12 (57.1)

showed furious rabies manifestations. No case of paralytic rabies was noted.

Following the WHO recommendations, only 2 out of 21 patients (9.5%) had their wounds treated and received an anti-rabies vaccine (ARV) after the bite incident. Two (9.5%) patients received rabies immunoglobulin (RIG). Others unknown treatments were given in 9 patients (42.8%). However, the interval between bite incident and this preventive treatment, the number of doses are not specified by the parents.

The case-fatality rate was 100%. Interval between bite incident and death was less than 60 days in 12 patients (57.1%) and more than 60 days in 3 patients (14.3%). The duration was not specified for six patients (28.6%). Other details are presented in Table 3.

Conventional reverse transcriptase polymerase chain reaction for detection of the rabies virus genome in saliva, corneal swabs, and ante- and post-mortem cerebrospinal fluid was not performed for technical reasons.

Discussion

The present study is the first attempt to describe the clinical aspects of human rabies in the pediatric population in Central Africa. At the onset of the rabies outbreak in 2009, the human rabies management systems in Kinshasa were unprepared.⁵

This study recorded approximately three cases of human rabies per month in children during the study period. This outbreak is one of an increasing number involving children in Central Africa. The city of

Kinshasa was not known to be a human rabies endemic area. Before April 2009, rabies was not a notifiable disease in this city. In the first three months of 2009, the Republic of Angola suffered a severe outbreak of rabies and has claimed the lives of at least 93 children in Luanda, the capital of Angola. Angola is a country in south-central Africa bordered by the DRC to the north and the east. After the outbreak in this country, some cases of human rabies were reported in DRC. The movement of dogs and the jackals found between Angola and DRC are probably contributed to the spread of the virus in western part of DRC.⁶

As not all rabies patients die at hospital and other patients may have been referred to other hospitals, and some rabies cases may have been missed as the diagnostic was based on clinical symptoms, the number of rabies cases is certainly much higher. Social and cultural constraints such as ignorance, poverty, habits, and practices can contribute to under-reporting.⁷ In addition, detection by reverse transcriptase polymerase chain reaction and the Immunohistochemical Test developed by CDC were not performed because the required equipment was not available in DRC during the period of outbreak.^{5,8} A diagnosis of rabies can be established clinically and is the official standard for human cases in limited-resources area.^{9,10}

The male preponderance noted in this series was comparable with previous studies.¹¹⁻¹⁷ This can be the result of more mobility of boys in Congolese society.

Table 2 Clinical features of 21 children with rabies at admission

Clinical expression	Frequency (n)	Percent (%)
Prodromal symptom		
Fever	15	71.4
pain	11	52.4
Paresthesia at the bite site	10	47.6
Central nervous system		
Agitation	21	100
Hallucinations	15	71.4
Confusions	8	38.1
Autonomic nervous system dysfunction		
Hydrophobia	19	90.5
Nausea	11	52.4
Hypersalivation	11	52.4

Table 3 Mortality

Parameter	Number of patients, n (%)
Death	21 (100)
The time between the bite incident and death	
<30 days	6 (28.6)
31-60 days	6 (28.6)
>60 days	3 (14.3)
unknown	6 (28.6)
The time between admission in our institution and death	
<24 hours	10 (47.6)
25-48 hours	7 (33.3)
>48 hours	4 (19.0)

The largest percentage of our study group patients (47.1%) was older children. This can be the result of more mobility in this group of children. This group of age was found to be more exposed in Ivory Coast,¹¹ in Uganda,¹⁸ and in Senegal.¹⁹

Africa Rabies Expert Bureau (AfroREB) members documented 146 known human rabies cases in all represented countries combined for 2008 with an incidence of 0.07 cases per 100 000 people in 34 countries in Africa.²⁰ However, it is estimated to be actually between 2.00 and 3.60. In addition, AfroREB members agreed that the real numbers of rabies deaths were probably 100–160 times higher than reported.

All the children were bitten by dogs in our report. Dogs have the main role in the transmission of the disease to humans as found in developing countries.^{9,10,12,21–24}

Exposure in 19 cases (90.5%) was by stray dogs; similar to the situation reported in Ivory Coast.¹¹ Stray dog population has been identified as the cause of the rapid spread of the disease in Kinshasa. Some reasons can be mentioned for this high prevalence of stray dog bites which were lack of domestic dog, sheepdog collaring, lack of fencing, and physical bordering of the houses. Unfortunately, due to poverty, dogs are forced to look for food in the streets of Kinshasa.

All offending animals had disappeared or were killed by the population. This rate was low to those reported in Ivory Coast in which the dogs were found alive in 74.9%.¹¹

Despite this, stray dog control programs have been impossible to implement due to the lack of any appropriate veterinary services, a high population density and unhygienic environment in Kinshasa. Conditions are ripe for the spread of rabies in the city. All the cases involved bites by stray dogs whose vaccine status was unknown. This situation is similar to those reported in other developing countries.^{11,14,25,26}

No patient had received a pre-exposure prophylactic vaccination. This prevention is not used anywhere in the DRC. Our result is similar to those reported in developing countries.^{9,11} Pre-exposure prophylaxis with rabies vaccine has been recently recommended by WHO for children living in highly endemic regions.²⁷

This study shows that most children suffering from rabies did not receive proper first aid, rabies vaccination, or passive immunization post-exposure.²⁸ In our cohort, only 9.5% ($n=21$) had their wounds treated and received an ARV after the bite. Two (9.5%) patients received RIG. For these two patients, The RIG was purchased from a private circuit and was paid approximately US\$150 per bottle. However, the dose and site of injection are unknown. Others

unknown treatments were given in nine (42.8%) cases. No patient received appropriate post-exposure prophylaxis. In our midst, probably most of health professionals did not know the precise indication for the rabies vaccine and rabies immunoglobulin.⁵ In addition, most of families are poor and because a free health-care facility is not available in DRC, these preventive treatments are not affordable to many of the patients. This situation contributes to the low rate reported in our study. This result was reported by other authors in developing countries.^{12–14,23,25}

In this study, the incubation period of human rabies was more than 30 days in 57.1% of cases. This is a typical picture of rabies in humans. The average incubation period is around 1–3 months, but may range from less than 7–6 years. This period was found to be similar to those described.^{9,10,29}

The signs and symptoms reported in this study were found to be similar to those described elsewhere.^{12,30} The rabies virus is highly neurotropic and it uses evasive strategies to successfully evade the host immune system.³¹

Diagnosis was challenging, with multiple missed diagnoses and transfers from ward to ward before the final diagnosis of rabies in our institution. Failure in diagnosing imported cases in our midst is most likely related to the lack of medical familiarity with even the typical clinical features of the disease.⁵ This situation is similar to those described in developing countries.¹⁷

All the patients developed furious rabies in this report. No case of paralytic rabies was noted. This is similar to those found in Ivory Coast²³ and in Senegal.¹⁷ However, it is possible that all the paralytic cases have been missed and some cases are unusual manifestations.³²

The fatality rate of this disease is 100%. Furious rabies is characterized by a rapid decline in neurological functions which occurred in 100% of our patients. After the emergence of clinical symptoms in both humans and animals, this disease is not curable.^{1,9,10,13,25,30}

Mortality rates for rabies have changed in developed countries since the advent of rabies immunoglobulin and vaccine. However, in the DRC, the access to this preventative treatment is limited due to its expensive cost and unavailability in Congolese health institutions.

In the DRC, for post-exposure prophylaxis, intramuscular regimens is considered and the five dose regimen is the only available vaccine. The five-dose regimen is administered on days 0, 3, 7, 14, and 28 into the deltoid muscle. RIG and vaccine (RIG+vaccine) were indicated but performed only in 10% of the patients. The major reason for this is resource deficiency. Most of the parents of our patients are poor and because a free health care facility is not available, (RIG+vaccine) are not

affordable to many of the patients. An additional factor is the unavailability and their high cost in Democratic Republic of Congo. One vial for the five-dose regimen costs US\$60. Other vaccines or economical intradermal vaccine regimens are not recommended or used locally. This low rate is similar to that reported in developing countries with inadequate public health resources.^{2,9,10,12}

Conventional reverse transcriptase polymerase chain reaction for detection of the rabies virus genome in saliva, corneal swabs, and ante- and post-mortem cerebrospinal fluid was not performed. Therefore, there is no laboratory confirmation of disease or virus characterization. This is similar to those reported in previous studies in developing countries.^{14,33}

Conclusions

Human rabies remains important yet neglected diseases in DRC. The disease emerges as a new major public health problem during this outbreak. Unfortunately, many challenges remain in DRC such as the not well-trained staff and the lack of national standard guidelines for management of dog bites in pediatric patients. Pre-exposure vaccination for rabies should be recommended in the population of Kinshasa, an area at high risk to contract rabies, particularly in children. However, rabies control and elimination require a comprehensive 'One Health' approach, including community education and awareness, proper use of modern vaccines for post-exposure and pre-exposure prophylaxis, and dog mass vaccination and developing good animal bite centers is the way to go especially in a huge country like the DRC with logistical difficulties.^{34,35}

Disclaimer Statements

Contributors DIIM, MJLE, JMN, HLB, AKM, BMD, and MNA performed statistical analysis, data interpretation, and wrote the paper. DIIM, MNE, JPMB, MLA, MBE, and MNA analyzed the data and revised the manuscript. DIIM, MJLE, MBE, MLA, and MNA conceived and designed this study and revised the manuscript. All authors read and approved the final manuscript.

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