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Containing a Lassa fever epidemic in a resource-limited setting: outbreak description and lessons learned from Abakaliki, Nigeria (January–March 2012)

Nnennaya A. Ajayi [a], Chinedu G. Nwigwe [b], Ben N. Azuogu [c], Benson N. Onyire [d], Elizabeth U. Nwonwu [c], Lawrence U. Ogbonnaya [c], Francis I. Onwe [e], Tobin Ekaete [f], Stephan Günther [g], Kingsley N. Ukwaja [a,*]

[a] Department of Internal Medicine, Federal Teaching Hospital Abakaliki, Ebonyi State, Nigeria
[b] Department of Surgery, Federal Teaching Hospital Abakaliki, Ebonyi State, Nigeria
[c] Department of Community Medicine, Federal Teaching Hospital Abakaliki, Ebonyi State, Nigeria
[d] Department of Pediatrics, Federal Teaching Hospital Abakaliki, Ebonyi State, Nigeria
[e] Epidemiology Unit, Ministry of Health, Ebonyi State, Nigeria
[f] Institute of Lassa Fever Research and Control, Irrua Specialist Teaching Hospital, Edo State, Nigeria
[g] Department of Virology, Bernhard-Nocht-Institute for Tropical Medicine, Hamburg, Germany

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SUMMARY

Objectives: Despite the epidemic nature of Lassa fever (LF), details of outbreaks and response strategies have not been well documented in resource-poor settings. We describe the course of a LF outbreak in Ebonyi State, Nigeria, during January to March 2012.
Methods: We analyzed clinical, epidemiological, and laboratory data from surveillance records and hospital statistics during the outbreak. Fisher's exact tests were used to compare proportions and *t*-tests to compare differences in means.
Results: The outbreak response consisted of effective coordination, laboratory testing, active surveillance, community mobilization, contact and suspected case evaluation, and case management. Twenty LF cases (10 confirmed and 10 suspected) were recorded during the outbreak. Nosocomial transmission to six health workers occurred through the index case. Only 1/110 contacts had an asymptomatic infection. Overall, there was high case fatality rate among all cases (6/20; 30%). Patients who received ribavirin were less likely to die than those who did not ($p = 0.003$). The mean delay to presentation for patients who died was 11 ± 3.5 days, while for those who survived was 6 ± 2.6 days ($p < 0.001$).
Conclusions: The response strategies contained the epidemic. Challenges to control efforts included poor local laboratory capacity, inadequate/poor quality of protective materials, fear among health workers, and inadequate emergency preparedness.

1. Introduction

Lassa fever (LF) is caused by a single-stranded RNA virus of the family *Arenaviridae*. It is endemic in Guinea, Sierra Leone, Liberia, and parts of Nigeria, and also in other countries in the West African sub-region.[1] It is also a zoonotic disease, whose animal reservoir is a rat of the genus *Mastomys* (the 'multimammate' rat). People become infected through direct exposure to the excreta of infected rats, or by transmission from person to person via body fluids.[1] Lassa infection is asymptomatic in about 80% of cases, but causes an acute illness in the rest. Fever and general weakness are followed by headache, chest pain, vomiting, diarrhea, cough, pleural effusion, bleeding from orifices, and in the late stages sometimes disorientation and coma.[2] Deafness occurs in 25% of cases. In fatal cases, it kills rapidly – usually within 14 days. The overall case fatality rate is around 1%, rising to 15% of hospitalized cases.[1]

Worldwide, an estimated two million persons are affected every year, resulting in 5000 to 10 000 deaths.[3] It is estimated that 300 000 to 500 000 cases of LF occur annually across West Africa.[4] LF is endemic in West Africa and high rates of seroprevalence have been reported in Nigeria, Sierra Leone, Guinea, and Liberia.[5–8] In Nigeria, the seroprevalence of LF is about 21%.[8] It is an epidemic-prone disease dreaded by health workers and the community. The threat of LF as an epidemic-prone disease in Nigeria is indicated by an alert threshold of a

* Corresponding author. Tel.: +234 08036243196.
E-mail addresses: ukwajakingsley@yahoo.co.uk, ukwaja.kingsley@gmail.com (K.N. Ukwaja).

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single suspected case and an epidemic threshold of a single confirmed case, by the Nigeria Federal Ministry of Health.[9] Since the identification of the virus in 1969, some outbreaks of the disease have been reported in various parts of Nigeria including Ekpoma, Aboh-Mbaise, Onitsha, Jos, and Lafia,[7,10,11] and more recently in Ebonyi, Taraba, Nasarawa, Yobe, Rivers, Ondo, and Edo states.[12–14]

Despite the epidemic nature of LF in Nigeria and other African countries, the details of outbreaks and subsequent responses to contain it have not been well documented in these places, and it is difficult to learn from these experiences to improve the management of future outbreaks. Available Nigerian reports have focused mainly on a nosocomial outbreak that occurred almost two decades ago,[7] or more recently on laboratory diagnosis of blood samples of suspected cases sent to a national reference laboratory.[12,13] Thus limited information exists regarding the containment and management of cases and suspects during outbreak situations.

We report on the investigation and management of the LF outbreak that occurred from January 1 to March 25, 2012 in Ebonyi State, Nigeria. Our specific objectives were: to describe the socio-demographic characteristics, clinical characteristics, and the management outcome of the cases seen, to describe the outbreak response, and to attempt to draw lessons for future outbreaks.

2. Methods

2.1. Study area and population

Ebonyi State is located in the southeastern geopolitical zone of Nigeria. It has 13 local government areas and an estimated population of 2.5 million people.[15] About 80% of the population are subsistence farmers and a similar proportion resides in rural areas.[15] The patients studied were managed at the Federal Teaching Hospital, Abakaliki (FETHA), Ebonyi State, in southeastern Nigeria. The hospital services the urban and semi-urban agrarian communities in Ebonyi State. It is the only tertiary referral center serving an estimated three million population in the southeastern region of Nigeria and receives referrals from neighboring states including Cross River and Akwa Ibom.

2.2. Data sources and methods

We retrospectively analyzed surveillance data, hospital records, and the outbreak response activities. Additional information about the affected LF patients was collected from the individual clinical records. We collected data on the onset of the outbreak and the management of individual patients. For suspected and confirmed LF cases, we collected data on their socio-demographic and clinical characteristics (age, sex, residence, occupation, most likely source of exposure, clinical presentation, and laboratory data), as well as the final outcome of their management. Additional information related to timing of events was also collected.

2.3. Diagnosis

All patients/contacts with features suggestive of LF (alert cases) were evaluated clinically and were classified using the World Health Organization (WHO)/Integrated Disease Surveillance and Response (IDSR) guidelines as suspected cases[16] (Table 1). Confirmation was based on a positive test using Lassa virus-specific reverse-transcriptase PCR (RT-PCR), or epidemiologically (Table 1).[16] Laboratory confirmation was performed at the Institute of Lassa Fever Research and Control, Irrua Specialist Teaching Hospital, Edo State, Nigeria. The Lassa virus-specific RT-PCR was performed as described previously.[17]

2.4. Data analysis

The data analysis was conducted using Epi Info. Continuous variables were summarized using means ± standard deviations and medians, and categorical variables were summarized as proportions. Categorical group comparisons were made using Fisher's exact tests, and continuous variables were compared using the *t*-tests for differences in means.

3. Results

3.1. Outbreak detection

On January 9, 2012, the FETHA notified the Ebonyi State and Federal Ministry of Health (MoH) of a laboratory confirmed LF case. The individual was a 25-year-old university graduate

Table 1
Definitions used in the study

Variable	Definition
Lassa fever diagnosis[a]	
Alert case	Unexplained fever for 5 days or more not responding to antimalarial/antibiotics (for malaria, typhoid fever) from the community or hospital Action to be taken: invite the Lassa fever technical committee to review the case
Suspected case[a]	Illness with gradual onset with one or more of the following: malaise, fever, headache, sore throat, cough, nausea, vomiting, diarrhea, myalgia, chest pain, hearing loss, bleeding tendency, and a history of contact with excreta of rodents or with a suspected case of Lassa fever. And has received standard treatment for fever (above) without response Action to be taken: declare 'suspected' case, send for laboratory confirmation, and may start Lassa fever treatment
Laboratory confirmed case	A suspected case that is laboratory confirmed (positive IgM antibody, PCR, or virus isolation) Action to be taken: for Lassa fever treatment
Epidemiologically confirmed case	A suspected case that is epidemiologically linked to a laboratory confirmed case (for example, contacts of a laboratory confirmed case, with signs and symptoms consistent with Lassa fever, whose confirmatory laboratory results were either unavailable or tested negative) Action to be taken: for Lassa fever treatment
Final outcome	
Dead	Confirmed/suspected cases who died from Lassa fever and/or its complications
Survived	Confirmed/suspected cases who recovered from Lassa fever following treatment
Contact[a]	
Contact	Someone who slept in the same household as the case within 1 month, or had direct contact with the case (dead or alive), or touched his/her linens or body fluids

[a] Definitions based on: Centers for Disease Control and Prevention and World Health Organization. Technical guidelines for integrated disease surveillance and response in the African region. Atlanta, GA: CDC; 2010, p. 1–416.[16]