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Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

Healthcare-associated Transmission of Lassa Fever, Sierra Leone, November 2019–January 2020

Gebrekrstos Negash Gebru[1]*, Joseph S. Bangura[2], Leonard Hakizimana[1], Kofi Mensah Nyarko[1,5], Adel Elduma[1], Tushar Singh[3], Alden Henderson[4]

1 African Field Epidemiology Network, Field Epidemiology Training Program, Sierra Leone

2 Tonkolili District Health Management Team, Ministry of Health and Sanitation, Sierra Leone

3 Sierra Leone Country Office of U.S. Centers for Disease Control and Prevention, Sierra Leone

4 U.S. Centers for Disease Control and Prevention, USA

5 University of Environment and Sustainable Development, Ghana

*Corresponding author email: ggebru@afenet.net

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Abstract

On 20 Nov 2019 the Tonkolili District Health Office was notified that a physician working in the district hospital was diagnosed with Lassa Fever (LF). The Tonkolili District had its last LF case in 2012. An investigation was performed to determine mode of transmission, magnitude and scope of this outbreak. Clinical information, exposure history, and blood samples were collected. Active case search and Infection Prevention and Control (IPC) assessment were conducted in the hospital and community. Three of five people with symptoms compatible with LF were polymerase chain reaction positive. The primary case, a pregnant woman from the community, was admitted with severe bleeding and operated by two surgeons and anesthetist. The same medical staff operated on another woman later that day. Three of the five cases died. The hospital assessment revealed non-adherence to IPC procedures. The primary case's residence had unhygienic conditions and inappropriate food storage. Low index of suspicion for LF and non-compliance to IPC procedures contributed to the associated healthcare workers' infection spread. Health workers were sensitized to LF and trained on IPC. Education of the community in high-risk areas about LF recognition, transmission and ways to decrease rodent populations in and around their homes is recommended.

Keywords: Lassa fever, investigation, outbreak, Tonkolili, Sierra Leone, healthcare

Introduction

Lassa fever is a viral hemorrhagic disease which begins as a flu-like illness, including fever, cough, sore throat, and joint, back, and chest pain. These symptoms resemble malaria, typhoid, dengue, yellow fever, and other viral hemorrhagic fevers, making clinical diagnosis difficult. The disease has an incubation period of 6–21 days.[1]

Lassa fever is endemic to West Africa, with more than 150 confirmed cases reported yearly in Sierra Leone.[2] The disease was first identified in Sierra Leone in 1970 during an outbreak in a hospital in an Eastern Province. At that time, the highest infection rate of Lassa fever in the world was in the Eastern Province.[3] The multimammate rats, mostly found in the West, Central, and East Africa, are the natural hosts of the Lassa fever virus.[2] Transmission from rodent to human can occur through inhalation of aerosols or by direct contact with rodent fluids such as urine, saliva, and feces, or indirectly through touching objects, food, or surfaces contaminated with rodent fluids.[1,4,5] Consumption of rodents has also been reported as a possible risk factor for Lassa fever transmission.[6,7] Secondary human-to-human transmission occurs through exposure to human bodily fluids in households or healthcare settings.[8,9] Poor infection prevention practices such as hand hygiene, use of personal

protective equipment, and environmental cleaning are contributing factors in the transmission of Lassa fever among health care workers.[9]

The last confirmed case of Lassa fever in the Tonkolili District in the Northern Province of Sierra Leone was reported in 2012.[5] On 20 Nov 2019, the Tonkolili District Medical Officer alerted the district surveillance team that an expatriate surgeon working in a Tonkolili District Hospital tested positive for Lassa fever after being evacuated to his home country in Europe. The surgeon had fever, headache, and malaise before he was evacuated. On 21 Nov 2019, trainees from the Sierra Leone Field Epidemiology Training Program began their investigation of this event to identify sources of infection, the scope of the outbreak, assess Infection Prevention and Control (IPC) practices of the hospital, and improve the awareness of the community and health care workers to detect patients with Lassa fever and prevent further transmission. The findings may improve early detection of Lassa fever as well as improve case management, and ultimately reduce Lassa fever case fatality in Sierra Leone and other similar settings.

Methods

Study Area

The Lassa fever outbreak occurred in a hospital in the Tonkolili District in Sierra Leone. The district had a population of 530,000 in 2015.[6] There are 106 healthcare facilities consisting of three hospitals and 103 primary healthcare units feeding into the hospitals. The district is a mining area predominantly covered by forests and jungles and rodents are commonly found and eaten.

Study Design, Sample Collection, and Analysis

A descriptive cross-sectional study was designed to investigate the Lassa fever outbreak in the Tonkolili District, Sierra Leone. A suspected case was a person residing in the Tonkolili District who presented with a fever above 38 °C and did not respond to appropriate antimalarial and antibiotic treatment within 72 hours between 1 Nov 2019 and 31 Jan 2020. A probable case was any suspected case with epidemiological links to a confirmed Lassa fever case, or any patient in which clinicians suspected Lassa fever. A confirmed case was any suspected or probable case confirmed positive for Lassa fever IgM by enzyme-linked immunosorbent assay (ELISA) or by real-time polymerase chain reaction (RT-PCR). A contact was anyone who had physical contact, including handshaking, eating together, sleeping together, providing medical care, or having contact with body fluids of a confirmed or probable case from two weeks before symptoms onset to eight weeks after symptom onset.

Additional cases were searched for in the hospital and the cases' community. For cases in the hospital, medical records were obtained for patients admitted between 1 Nov 2019 and 31 Jan 2020 with fever above 38 °C who did not respond to appropriate antimalarial and antibiotic treatment within 72 hours. Clinicians and nurses were also interviewed to identify suspected cases. For cases in the community, cases' houses were visited and all household members were interviewed. In addition, key informants in the village (i.e., village and religious leaders) and community health workers were interviewed.

All contacts of the probable or confirmed cases were interviewed using a semi-structured questionnaire with closed and open-ended questions. The questionnaire collected demographic, clinical, and risk factors data. Blood samples were collected from all suspected or probable cases and the samples were sent for confirmatory testing, IgM ELISA test and PCR, at the Viral Hemorrhagic Fever Reference Laboratory in Kenema District.

Infection Prevention and Control Assessments in the Hospital

Compliance with IPC measures were assessed at the Tonkolili health facility by observing protocols and practices for sterilization and decontamination of the surgical equipment and medical supplies used to operate on the primary case of this outbreak. A standard IPC assessment checklist was used to observe the availability of hand washing points with running water and soap, and use of personal protective equipment (PPE) such as gowns, gloves, facemasks, and face shields. The medical staff were also interviewed to determine if they followed proper handwashing practices, and use of gowns, gloves, face masks, and face shields. However, the IPC self-reported practices were assessed among healthcare workers who were involved in the management and care of the two probable cases. The general environment was observed for hygiene including environmental cleaning inside and outside of the hospital's operating room.

Environmental Assessment at the Cases' Residence

The house of the primary case was assessed and inspected for hygienic conditions and rodent infestation. Storage collection, and disposal of trash and garbage were also observed.

Data Analysis

The demographic, clinical, and exposure data was described for each case-patient identified during the

investigation. A pictorial diagram was used to summarize the clinical and epidemiological history of each case-patient, i.e., the history from date of exposure to date of death.

Consent and Institutional Review Board Approval

To ensure confidentiality, the interviews were conducted in a private and quiet place within the health facility and no personal information was disclosed to other parties except to the investigators. Administrative approval was obtained from the Ministry of Health and Sanitation for the investigation. Before the interviews started, a verbal informed consent was obtained from the case-patients or their families. However, ethical approval was not applicable to the investigation because it is part of a routine epidemic prone disease notification and case investigation.

Results

The Lassa fever outbreak investigation team identified two probable and three confirmed cases; two were from the community and three were medical staff working in the hospital one of which was an expatriate surgeon. Three died (case fatality ratio: 60%). Three cases were women. Two women from the community were pregnant. All of the five cases developed fever, three of them developed malaise, three developed vomiting, and two of them had bleeding.

Cases' Presentations

Case patient 1 (C1)

A 30-year-old pregnant woman, at gestational age of 38 weeks, probable case, started developing acute febrile illness symptoms on 30 Oct 2019. She was treated at a maternal and child health post on 3 Nov 2019 for fever, abdominal pain, vomiting, loss of appetite and vaginal bleeding. She was referred to a hospital in the Tonkolili District on the same day. The patient had surgery on 4 Nov 2019 for pregnancy-related complications and died on the same day due to heavy bleeding. The baby also died. No blood sample was taken from this patient as there was no suspicion of Lassa fever.

Case patient 2 (C2)

A 38-year-old male surgeon performed the caesarean section on C1 and did a manual evacuation on C5 later that day. The surgeon developed fever, headache, and malaise on 10 Nov 2019. He was treated for typhoid, malaria, and influenza, but his symptoms persisted. He was evacuated to the Netherlands on 19 Nov 2019 where he tested positive for Lassa fever. He died on 24 Nov 2019.

Case patient 3 (C3)

A 33-year-old female medical doctor, assisted in the operation of C1 and C5. She developed symptoms mainly fever, abdominal pain, vomiting and headache on 11 Nov 2019 and tested positive for Lassa fever on 21 Nov 2019. She was evacuated to the Netherlands on 23 Nov 2019. She was treated and recovered on 6 Dec 2019 in the Netherlands.

Case patient 4 (C4)

A 35-year-old male nurse, administered anaesthesia to case patients C1 and C5. He developed fever and malaise on 16 Nov 2019. A blood sample tested positive for Lassa fever on 22 Nov 2019. He was treated for Lassa fever and recovered on 23 Dec 2019.

Case patient 5 (C5)

A 33-year-old pregnant woman, at gestational age of 19 weeks, went to the hospital on 4 Nov 2019 and was operated on the same day. On 16 Nov 2019 she developed symptoms suggestive of Lass fever including fever, vomiting, and bleeding gums. She died on 19 Nov 2019 before Lassa fever was suspected. The same surgeons and anaesthetist operated on her on 4 Nov 2019 which was on the same day and in the same operating room as the first case (Figure 1).

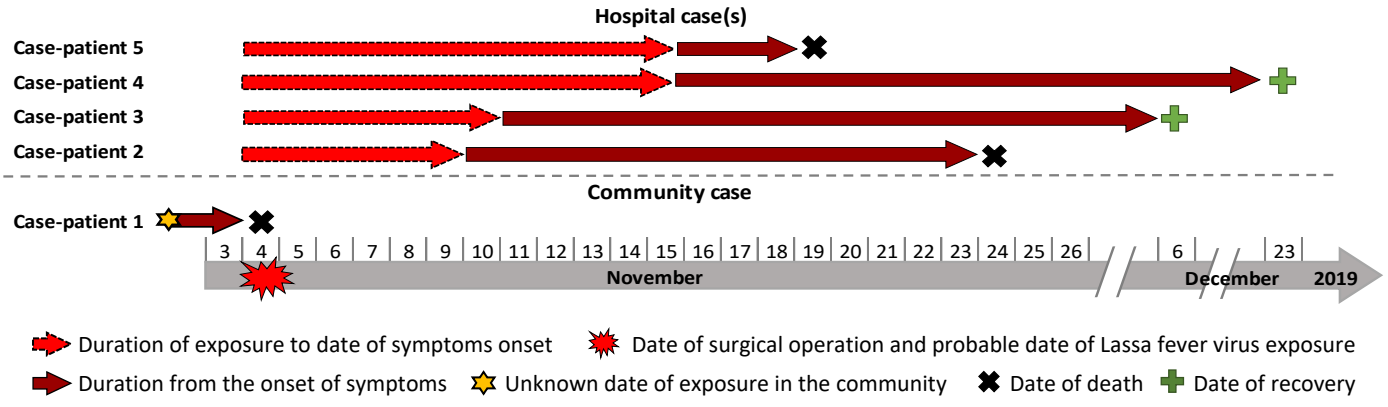

Figure 1. Transmission of Lassa fever infection in a Hospital, Tonkolili District, November 2019

C1 introduced Lassa fever to the hospital which resulted in transmission of Lassa fever virus to the medical staff, C2, C3, and C4, during her surgery. C5 entered the hospital and was operated in the same surgery room by the same medical staff as C1. C2, C3, and C4 had positive laboratory tests for Lassa fever. C1, C2, and C5 died, but C3, and C4 recovered. There was no evidence of epidemiological linkage between C1 and C5 in the community which strongly implies C5 was probably exposed in the hospital during operation.

Active Case Search

No additional cases were found in the affected hospital, in nearby health facilities, and in the communities of the case patients C1 and C5.

Contact Tracing Findings

Totally 276 contacts were identified from the probable and confirmed cases, 72 of the contacts were identified in Sierra Leone, and approximately 200 were identified in other countries. Forty-one of the 72 contacts in Sierra Leone were health care worker contacts at the Tonkolili hospital and two at the health post where C1 was treated initially. There were 24 contacts in the case-patients' community. Of the 204 contacts identified outside of Sierra Leone, 171 were in the Netherlands, 20 in the United Kingdom, 5 in Germany, 5 in Denmark, 3 in USA and from other countries. The international contacts were those who interacted with C2 and C3 during evacuation or during treatment in the Netherlands. The average number of contacts per case in this investigation was 56 (276/5). No contacts developed Lassa fever symptoms after 21 days since the onset date of the last case.

Environmental Assessment

Household waste was not properly stored and scattered all around C1's house, giving an opportunity for rodents to breed. Rodent droppings were also observed in C1's house, a mud house with a mud floor adjacent to a garbage dump. The house had an unprotected toilet facility used by many people. The general surrounding environment and food storage was untidy, and trash was scattered around the houses in the community.

Infection Prevention and Control Assessment

The investigation team found the availability of PPEs such as coveralls, face shields, gloves, and aprons. There were also running water, soap, handwash stations, and chlorine. The medical staff who were involved in the caesarian operation of two probable cases self-reported to have used gloves and face masks and followed hand washing protocols before and after operation. However, the assessment at the hospital revealed non-adherence to IPC procedures and some equipment such as autoclaves needed to maintain sterility were not available. The medical staff who participated in the operation of the pregnant women and who were interviewed during the assessment also reiterated that proper decontamination and sterilization of the surgical equipment was not done between the surgery of the two pregnant women. In addition to this, the investigation team also observed blood contaminated gloves scattered, blood spillover on the floor and other blood contaminated surgical equipment in the operating room which implies possible cross-contamination.

Discussion

A Lassa fever outbreak occurred in a hospital in the Tonkolili District, Sierra Leone in November 2019. Five people had Lassa fever, all had symptoms compatible with Lassa fever and three were laboratory confirmed. Lassa fever was reported after an expatriate surgeon, who was working at a hospital in the Tonkolili District, was evacuated to his home country. He had a positive test for Lassa fever. Based on the investigation findings, a pregnant woman, who was operated on by the surgeon, was the most likely source of this outbreak. Healthcare-associated transmission likely occurred due to poor IPC practices, including inadequate cleaning of the operating room between patients resulting in four additional cases. Presence of rodent droppings and garbage near the index case's house and no travel 21 days prior to onset of illness suggests that she may have been infected with Lassa fever virus at her residence.

The two pregnant women were not suspected and not tested for Lassa fever infection before they died. The surgeon was suspected and tested for Lassa fever only after he was evacuated to the Netherlands. This indicates that staff had low suspicion for Lassa fever. Detection, diagnosis, and management of Lassa fever remain major challenges among health care workers in developing countries, including Sierra Leone.

Lassa fever among pregnant women is usually fatal. A study conducted in Sierra Leone reported that 50% died due to Lassa fever.[7] In this study, C1 and C5 were both pregnant women who died from Lassa fever. Poor outcomes among pregnant women infected with Lassa fever virus are mainly due to the immunological changes during pregnancy, or the affinity of the virus to the highly vascularized placenta.[7] Delayed medical treatment may worsen the patient's prognosis. In addition, overlapping clinical symptoms such as abdominal pain, headache, and vaginal bleeding among pregnant women can cloud the diagnosis of Lassa fever.[8,9]

Lassa fever transmission occurs in healthcare settings where healthcare workers provide clinical care for patients.[10,11] In this outbreak, the healthcare workers might have been infected from C1's blood and other body fluids or a contaminated environment. C1 most likely contracted the Lassa fever virus at her home. However, in this study, no rodent trapping or investigation was conducted on rats in the primary case's house to identify the source of this outbreak.

Effective IPC measures are essential in healthcare settings to reduce the risk of disease transmission, including Lassa fever. Most healthcare-associated infections, including viral hemorrhagic fever, are attributed to poor IPC measures.[12] This healthcare-associated infection transmission implies poor adherence of healthcare workers to standard and transmission-based precautions. This poor compliance might have exposed the healthcare workers to this Lassa fever infection which finally led to death of two more people in this investigation. However, contact time for each of the cases was not collected during the investigation which limits this study from determining the infectious period of the cases.

Conclusion

A Lassa fever outbreak occurred in the Tonkolili District, Sierra Leone in November 2019. Five people has Lassa fever, and three were laboratory confirmed. Case-patient 1 was probably infected with Lassa fever before coming to the hospital. A low index of suspicion for Lassa fever and poor IPC practices contributed to the spread of Lassa fever to the operating medical team and to another patient in the hospital.

Public Health Action and Recommendations

The investigation team sensitized community members on Lassa fever prevention and control measures, including ways to decrease rodent populations in and around their homes. It is essential to strengthen community mobilization and report any suspected cases of Lassa fever to health facilities. Additionally, personal hygiene and environmental conditions for the community need to be improved to reduce reservoirs.

On-the-job training was conducted on Lassa fever case definition for health workers in the Tonkolili District to improve early case detection. In addition, the team provided guidance for case identification, particularly for the integrated disease surveillance and response focal points in different hospitals. Health authorities should ensure that health care workers in hospitals and healthcare facilities where Lassa fever was previously reported and also in surrounding areas must understand the transmission routes, clinical manifestations, management and protective measures for Lassa fever.

Health care workers were sensitized about IPC compliance and decontaminated of the operating room and wards. All febrile patients admitted for healthcare services should be assumed to be infected with bloodborne infectious agents and standard and transmission-based IPC precautions should be adhered to. Adherence to IPC practices is required in all healthcare facilities. Areas such as operating rooms are considered especially high-risk. IPC measures including training of healthcare workers on IPC practices and procedures, as well as ensuring an adequate supply of IPC supplies, such as PPE, are essential for preventing and controlling healthcare-associated infections. Periodic IPC assessments should be conducted in healthcare facilities to prevent healthcare-associated infections, including Lassa fever.

Disclaimer

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

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Conflict of Interest

The authors declare no conflict of interest. No copyrighted materials were used in developing this article.

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