Lassa Fever: Epidemiology, Disease Course, and Medical Management

An overview of the epidemiology, disease progression, and medical management of Lassa Fever, a viral hemorrhagic fever endemic in regions of West Africa.

Colleen S. Kraft, MD, Emory University

Epidemiological Status of Lassa Fever

- Geographical Distribution

  Lassa Fever is endemic to West Africa, primarily found in countries such as Nigeria, Sierra Leone, Liberia, and Guinea.

- Incidence Rates

  The annual incidence of Lassa Fever is estimated to be around 100,000-300,000 cases, with a mortality rate of approximately 1%.

- Seasonal Trends

  Lassa Fever cases typically increase during the dry season (November to May) due to the increased rodent population and human-rodent contact.

- High-Risk Populations

  Healthcare workers, family members of infected individuals, and those living in rural areas with poor sanitation are at the highest risk of contracting Lassa Fever.

- Surveillance and Reporting

  The World Health Organization (WHO) and national health authorities are actively conducting surveillance and reporting on Lassa Fever cases to monitor the epidemiological trends.

Lassa Fever Disease Course

Initial Exposure

Person contracts Lassa Fever virus, typically through contact with infected rodents or their bodily fluids.

Early Symptoms

Fever, headache, muscle pain, sore throat, and cough begin to manifest within 1-3 weeks of exposure.

Disease Progression

Symptoms may worsen, including nausea, vomiting, diarrhea, and abdominal pain. Inflammation of the skin, eyes, and mucous membranes may occur.

Potential Complications

In severe cases, the virus can affect the central nervous system, leading to tremors, encephalitis, or seizures. Bleeding and organ failure may also develop.

Recovery or Death

With proper medical treatment, most patients recover within 1-4 weeks. However, the disease can be fatal in 1% to 15% of cases, especially if left untreated.

“Recognizing and managing Lassa Fever symptoms is crucial, as early detection can significantly improve patient outcomes and prevent the spread of this potentially deadly disease.”

WORLD HEALTH ORGANIZATION

Lassa Virus locations

The virus was first discovered in 1969 in the town of Lassa, Nigeria, where it was isolated from the blood of a missionary nurse. Since then, Lassa virus has been found to be endemic in several West African countries, including Nigeria, Liberia, Sierra Leone, and Guinea.

Lassa Fever Diagnostic Techniques

Reverse Transcription-Polymerase Chain Reaction (RT-PCR)

Detects the presence of Lassa virus RNA in patient samples, such as blood or bodily fluids, and is considered the gold standard for Lassa fever diagnosis.

Enzyme-Linked Immunosorbent Assay (ELISA)

Identifies Lassa virus-specific antibodies in patient serum, providing evidence of current or recent Lassa fever infection.

Rapid Diagnostic Tests (RDTs)

Provide a quick, point-of-care method to screen for Lassa virus antigens in patient samples, offering a faster alternative to laboratory-based techniques.

Virus Isolation

Involves culturing the Lassa virus from patient samples, such as blood or tissue, in a specialized laboratory setting.

These diagnostic techniques play a crucial role in the early detection and management of Lassa fever, enabling prompt treatment and disease containment efforts.

Lassa Fever Surveillance and Reporting

International Surveillance	National-Level Surveillance
The World Health Organization (WHO) coordinates the Global Alert and Response Network (GOARN) to monitor and respond to public health emergencies, including Lassa Fever outbreaks globally.	The Nigeria Centre for Disease Control (NCDC) operates the national Lassa Fever surveillance system, which includes case reporting, contact tracing, and laboratory confirmation at designated treatment centers.
The Centers for Disease Control and Prevention (CDC) in the United States collaborates with international partners to provide technical assistance and support for Lassa Fever surveillance and outbreak response.	The Federal Ministry of Health in Nigeria has established the Lassa Fever Emergency Operations Center (LFEOC) to coordinate the national response to Lassa Fever outbreaks.

*World Health Organization, Centers for Disease Control and Prevention, Nigeria Centre for Disease Control, Federal Ministry of Health of Nigeria

Lassa Fever Treatment and Management

Prompt recognition of Lassa Fever symptoms, such as fever, headache, and sore throat, and immediate testing of suspected cases to confirm the diagnosis.

Providing fluids, electrolyte management, and pain relief to maintain the patient's vital functions and manage symptoms until the illness resolves.

Administration of the antiviral drug ribavirin, which has been shown to reduce the severity and mortality of Lassa Fever when given early in the course of the disease.

Placing the patient in isolation to prevent the spread of the virus to healthcare workers and other contacts, and using appropriate personal protective equipment (PPE) to minimize the risk of transmission.

Identifying and monitoring individuals who have been in contact with the infected patient to detect and manage any secondary cases of Lassa Fever.

Educating the local community about Lassa Fever, its transmission, and preventive measures to reduce the risk of future outbreaks.

Lassa Fever Preventive Measures

- Proper food storage

  Store food in rodent-proof containers and keep food preparation areas clean to prevent contamination by rodents.

- Effective rodent control

  Implement measures to reduce rodent populations, such as sealing entry points, using traps, and properly disposing of garbage.

- Personal protective equipment

  Wear personal protective equipment, such as gloves, masks, and protective clothing, when handling suspected cases or potentially contaminated materials.

- Safe burial practices

  Ensure safe and dignified burial practices for those who have died from Lassa Fever to prevent further transmission.

- Early detection and reporting

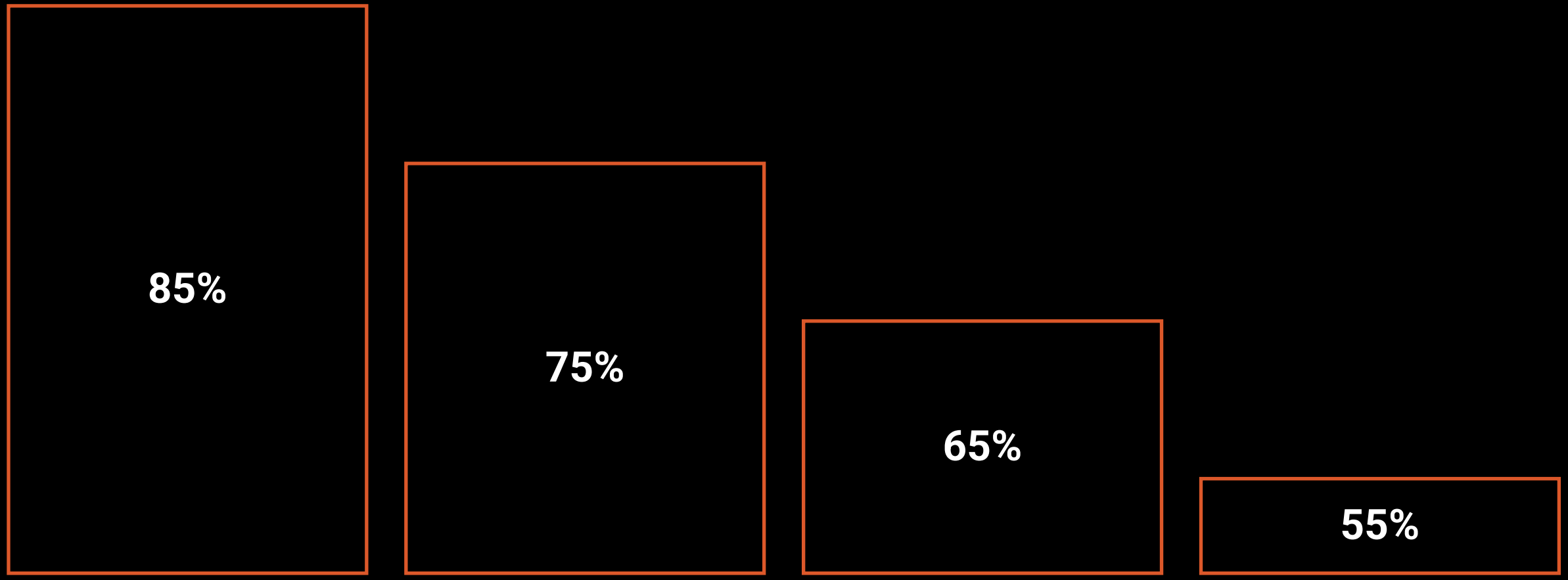
  Promptly report any suspected cases of Lassa Fever to health authorities to enable early intervention and containment.

- Community education

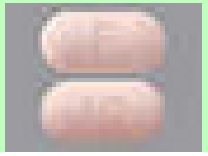
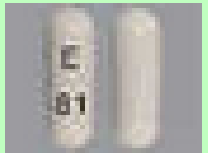
  Educate communities on the symptoms, transmission, and prevention of Lassa Fever to raise awareness and promote preventive behaviors.

Lassa Fever Vaccine Development

Percentage of Completion for Various Lassa Fever Vaccine Candidates



Treatment: Ribavirin oral capsules

IMAGE	MCK ITEM #	NDC	HIST	DESCRIPTION	EST. NET PRICE
	1376094	65862020768	HST	RIBAVIRIN TAB 200MG AURO 168	$94.77
	3400140	65862029084	HST	RIBAVIRIN CAPS 200MG AURO 84@	$103.20

Below are the costs for the Ribavirin 200mg capsules which is available via 84 and 168 count. At Emory Healthcare, if the capsules today, it will be delivered tomorrow.

Treatment: Ribavirin inhaled

	1526433	42494042301		RIBAVIRIN INH SOL 6GM CAME 1=@ $ NOV+ EQUIV ! AIR FREIGHT	$6907.50
	2362945	63629214901		RIBAVIRIN INH SOL 6G BRP 1 DS Drop Ship	$12375.88
	3618493	68382039504	HST	RIBAVIRIN INH SOL 6GM ZYD 4= ! AIR FREIGHT	$73680.00

Costs for the 6gm inhalation: Item 2362945 would be a drop ship which takes 2-3 business days. Items 1526433 and 3618493 would be next day delivery if ordered before 4pm EST.

Treatment: Ribavirin intravenous

Compassionate use intravenous ribavirin can be obtained from Bausch Health; initiate requests by contacting CDC's Viral Special Pathogens Branch (770-488-7100).

Published in final edited form as:
Clin Infect Dis. 2017 September 01; 65(5): 855–859. doi:10.1093/cid/cix406.

Favipiravir and Ribavirin Treatment of Epidemiologically Linked Cases of Lassa Fever

Vanessa N. Raabe[1,a], Gerrit Kann[2,a], Bruce S. Ribner[1], Andres Morales[3], Jay B. Varkey[1], Aneesh K. Mehta[1], G. Marshall Lyon[1], Sharon Vanairsdale[4], Kelly Faber[5], Stephan Becker[6], Markus Eickmann[6], Thomas Strecker[6], Shelley Brown[7], Ketan Patel[7], Philipp De Leuw[2], Gundolf Schuettfort[2], Christoph Stephan[2], Holger Rabenau[8], John D. Klena[7], Pierre E. Rollin[7], Anita McElroy[7], Ute Ströher[7], Stuart Nichol[7], Colleen S. Kraft[1,9,a], Timo Wolf[2,a], and for the Emory Serious Communicable Diseases Unit[b]

[1]Division of Infectious Diseases, Emory University, Atlanta, Georgia

Emerging Microbes & Infections
2024, VOL. 13, 2301061 (14 pages)
https://doi.org/10.1080/22221751.2023.2301061

Monoclonal antibody therapy demonstrates increased virulence of a lineage VII strain of Lassa virus in nonhuman primates

Courtney Woolsey[a,b]*, Robert W. Cross[a,b]*, Abhishek N. Prasad [a,b], Krystle N. Agans[a,b], Viktoriya Borisevich[a,b], Daniel J. Deer[a,b], Natalie S. Dobias[a,b], Alyssa C. Fears[a,b], Mack B. Harrison[a,b], Megan L. Heinrich[c], Karla A. Fenton[a,b], Robert F. Garry[c,d], Luis M. Branco[c] and Thomas W. Geisbert[a,b]

[a]Galveston National Laboratory, University of Texas Medical Branch, Galveston, TX, USA; [b]Department of Microbiology and Immunology, University of Texas Medical Branch, Galveston, TX, USA; [c]Zalgen Labs, LLC, Frederick, MD, USA; [d]Department of Microbiology and Immunology, Tulane University School of Medicine, New Orleans, LA, USA

ABSTRACT

Lassa virus (LASV) is a World Health Organization (WHO) priority pathogen that causes high morbidity and mortality. Recently, we showed that a combination of three broadly neutralizing human monoclonal antibodies known as Arevirumab-3 (8.9F, 12.1F, 37.2D) based on the lineage IV Josiah strain protected 100% of cynomolgus macaques against heterologous challenge with lineage II and III strains of LASV when therapy was initiated beginning at day 8 after challenge. LASV strains from Benin and Togo represent a new lineage VII that are more genetically diverse from lineage IV than strains from lineages II and III. Here, we tested the ability of Arevirumab-3 to protect macaques against a LASV lineage VII Togo isolate when treatment was administered beginning 8 days after exposure. Unexpectedly, only 40% of treated animals survived challenge. In a subsequent study we showed that Arevirumab-3 protected 100% of macaques from lethal challenge when treatment was initiated 7 days after LASV Togo exposure. Based on our transcriptomics data, successful Arevirumab-3 treatment correlated with diminished neutrophil signatures and the predicted development of T cell responses. As the *in vitro* antiviral activity of Arevirumab-3 against LASV Togo was equivalent to lineage II and III strains, the reduced protection in macaques against Togo likely reflects the faster disease course of LASV Togo in macaques than other strains. This data causes concern regarding the ability of heterologous vaccines and treatments to provide cross protection against lineage VII LASV isolates.

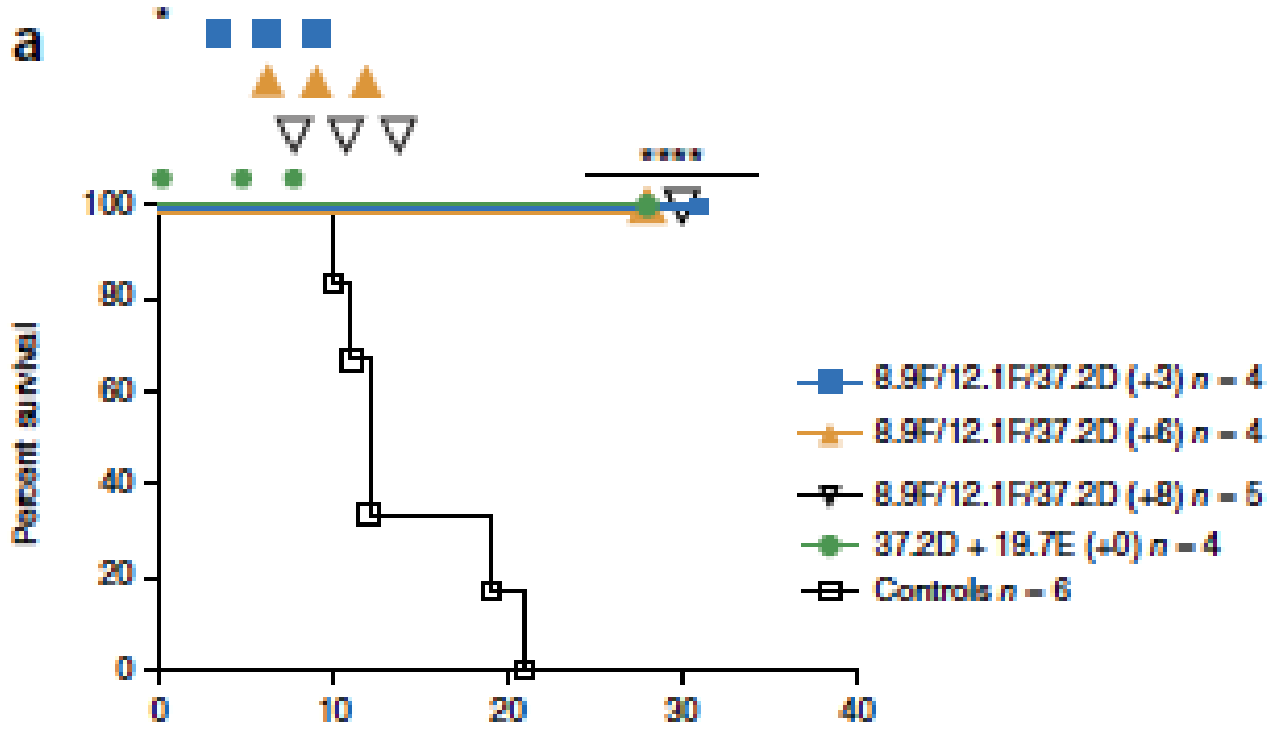
BRIEF COMMUNICATIONS

nature medicine

Human-monoclonal-antibody therapy protects nonhuman primates against advanced Lassa fever

Chad E Mire[1,2,11], Robert W Cross[1,2,11], Joan B Geisbert[1,2], Viktoriya Borisevich[1,2], Krystle N Agans[1,2], Daniel J Deer[1,2], Megan L Heinrich[3], Megan M Rowland[3], Augustine Goba[4,5], Mambu Momoh[4–6], Mathew L Boisen[3], Donald S Grant[4,5], Mohamed Fullah[4,5,10], Sheik Humarr Khan[4,5,10], Karla A Fenton[1,2], James E Robinson[7], Luis M Branco[3,11], Robert F Garry[3,8,9] & Thomas W Geisbert[1,2]

There are no approved treatments for Lassa fever, which is endemic to the same regions of West Africa that were recently devastated by Ebola. Here we show that a combination of human monoclonal antibodies that cross-react with the glycoproteins of all four clades of Lassa virus is able to rescue 100% of cynomolgus macaques when treatment is initiated at advanced stages of disease, including up to 8 d after challenge.



Conclusions

Early detection is life saving and transmission preventing in Lassa Fever

Ribavirin is the mainstay of therapeutics, although monoclonal antibodies are being developed