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Ebola Disease in Africa

Rihab Muhammad Dafallah*

Department of Microbiology, University of Gezira-Sudan, Wad Madani, Sudan

Abstract

Ebola virus appeared first in Africa in the village near the Ebola River in Zaire (new democratic Congo), then the virus spreads to many countries in Africa as an ongoing Ebola virus outbreak (endemic disease). Ebola virus, Sudan virus, and Bundibugyo virus cause severe Ebola Virus Disease (EVD), a life-threatening outbreak in humans the scientists previously knew the virus as a potential bioweapons agent. The EBOV spreads far in Asia, Europe, and America due to human movement and travelers.

Keywords: Filo virus • Africa • Ebola viruses • Endemic disease

Introduction

Ebola Virus Disease (EVD) is a viral disease known formerly as hemorrhagic fever [1-3]. The Ebola Virus causes a serious and contagious disease, which is an often-fatal infection if untreated; it is characterized by fever with gastrointestinal signs and multiple organ dysfunction syndrome [4-6]. Ebola viruses affect mammalian species, from humans to wild and domestic animals. The hunters (bushmeat) are exposed to EBOV in its natural environment with the contaminated animal and their products, the virus is transmitted to humans from wild animals and spreads in the population through person-to-person transmission [7,8].

The largest unprecedented and unexpected outbreak in history was in western Africa around 2013 and early 2016, which spread from Guinea to other countries in Western Africa, leading to 28,652 patients and 11,325 deaths [9,10]. The second largest outbreak about 3,418 infections and 2240 deaths was on 28 January 2020 [11] while the last outbreak of EBOV in Africa (Sudan EVD) was reported on 20 September and on 6 October 2022, in Uganda 44 confirmed cases, 10 confirmed deaths, and 20 probable deaths of EVD have been identified [12]. Due to awareness of this outbreak and the response of WHO such as a health screening of each traveler and health care provider, no cases have been reported outside of Uganda.

History of the disease

The first outbreak of Ebolavirus Disease (EVD) in 1976 in the democratic republic of Congo (old Zaire) around the Ebola River from which the disease takes its name and also appeared in south Sudan [2,3,13].

The causative agent

Ebolavirus belongs to the family Filoviridae under the order Mononegavirales which includes three genera Cuevavirus - Marburgvirus – Ebolavirus [14,15]. The genus of Ebolavirus has six species that have been identified Zaire, Bundibugyo, Sudan, Taï Forest, Reston, and Bombali. Filoviruses are enveloped RNA viruses, which are non-segmented negative strands [14,15].

Intermediate hosts

Most researchers due to Epidemiological surveys suggested that fruit bats are natural Ebola virus hosts due to the widespread antibodies against EBOV in the fruit bats. Chimpanzees, gorillas, monkeys, forest antelope, or porcupines in the rainforest are thought to be EBOV carriers [7,8].

Geographical distribution

The initial outbreak appeared in Zaire (Democratic Republic of the Congo), the Republic of the Congo - Gabon, and Guinea as an endemic disease [8-11]. The movements of the people played an important role in distributing the virus in other countries in Africa as an epidemic disease in Mali, Nigeria, and Senegal [16]. During the period between 2013 -2016, there are many outbreaks from Guinea to Liberia and Sierra Leone. Migration and traveling enhance the spread of the virus as a pandemic disease in Asia, Italy, the United Kingdom, and the United States [16]. The outbreaks in humans caused by the Sudan virus have been reported in Sudan and Uganda [2].

Transmission to human

The virus spreads in two ways horizontal and vertical transmission, first the horizontal transmission we found that the human population catches the disease through direct contact with the infected wild animals' (blood, secretions, organs, or other bodily fluids) [17]. Then humans could help in spreading the virus from person to person *via* direct contact through broken skin or mucous membranes with blood or body fluids of a person who is sick with or has died from Ebola and also contaminated objects with body fluids from sick or died person [18]. Second vertical transmission, the breast milk from pregnant who recover from acute infection may carry the virus [19] or in pregnancy-related fluids and tissues [20].

Symptoms:

The incubation period is from 2 to 21 days. The infected person could not spread the infection until shows symptoms [21,22].

Fever

Fatigue

Muscle pain

Headache

Sore throat

This is followed by:

Vomiting

Diarrhea

Rash

Symptoms of impaired kidney and liver function

In some cases, both internal and external bleeding (for example, oozing from the gums, or blood in the stools).

***Address for Correspondence:** Rihab Muhammad Dafallah, Department of Microbiology, University of Gezira-Sudan, Wad Madani, Sudan, E-mail: jczintgraff@gmail.com*

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Laboratory findings include low white blood cell and platelet counts and elevated liver enzymes.

Pathogenesis

In humans, the invasion of the EBOV occurs through the skin, mucous membrane, or parentally, then the virus moves to the lymph nodes and continues to spread to other organs and infect many different cells including monocytes, macrophages, dendritic cells, endothelial cells, fibroblasts, hepatocytes, adrenal cortical cells, and epithelial cells [23,24]. The incubation period is between 6-10 days, depending on the side of infection, which means the migration of the virus from the portal towards the target organ or localized region (lymph nodes and subsequently the liver, spleen, and adrenal gland) [25]. The EBOV necrosis in hepatocellular and adrenal leads to clotting factor regulation that results in subsequent coagulopathy while in adrenal is associated with hypotension and reduced steroid production [26,27]. The vascular leakage due to the release of pro-inflammatory cytokines that reduced clotting leads to multiorgan failure and shock [28].

Diagnosis

It can be hard to differentiate Ebola disease from other infectious disease such as meningitis, malaria, typhoid fever.

Direct method

Isolation of the virus: Isolation of Filovirus (EBOV) needs biocontainment facilities capable of handling dangerous human viruses in special laboratories. MA-104 cells or Vero are suitable cells for the Filoviruses.

Electron microscope: Filovirus particles can detect their distinctive morphology by electron microscope in tissues or blood.

Experimental host: Infected pigs are detected by immunohistochemistry, with rabbit polyclonal antibody targeting the Ebola virus VP40 protein.

Indirect method

Polymerase Chain Reaction (PCR): Quantitative RT-PCR (qRT-PCR), and reverse transcriptase polymerase chain reaction (RT-PCR).

Enzyme-Linked Immunosorbent Assays (ELISA): In humans, IgM and IgG ELISAs may be used for the patient's serum.

Antigen-capture detection test: This method uses a probe of antigenic region peptide bounded with enzyme and put it into the patient's serum to detect specific antibodies against EBOV.

Neutralization test: Neutralization test means if the antibodies are specific to antigens the attachment to cell culture will not happen (no free antigens).

Direct and indirect methods are possible diagnostic methods to detect EBOV disease in humans or animals. The WHO determined some methods for rapid diagnosis such as IgM and IgG ELISAs and qRT-PCR - RT-PCR [29].

Morbidity and mortality

EVD is characterized by a high case–fatality rate, we found that ZEBOV and SEBOV strains are confirmed for their virulence and their fatality rate of about (53 -90%) in humans [30]. Reston (REBOV) shows low pathogenicity or is non-pathogenic in humans. The incidence of REBOV infection has been found in Asia (China, the Philippines) [31].

Cleaning and disinfection

Survival: Filoviruses are comparatively stable in room temperature and liquid media. The virus may also continue infectious for a period after drying and on fomites if found susceptible species and the concentration of the virus is suitable for portal initial infection [32]. The EBOV is survived on refrigeration and freezing which prolongs the survival of Ebolaviruses on meat [32-34]. The peace way from EBOV is cooking at 100°C [35].

Disinfection: World Health Organization (WHO) recommends that the sensitivity of EDS to ordinary disinfectants such as Calcium hypochlorite (bleach powder) [36,37] is diluted at 1:100 to disinfect (gloves, boots, and equipment such as (thermometers and spills) while the dilution is at 1:10 to disinfect (urine, feces) [38]. UV light [34,39] and Gamma irradiation [40,41] succeeded in inactivated Filoviruses. Boiling heat for 20 minutes is an alternative way due to unavailable autoclaving in the endemic area [38]. The process of human burial should be in minimal handling [42].

Control of the disease

Treatment: There is no treatment than supportive care such as fluids to treat hydration *via* intravenous or oral, blood products [43], and immune and drug therapies are evaluated treatments to improve survival from specific symptoms [44].

Prevention: Prevent transmission of EBV in different ways

Wildlife to human transmission: Humans should be kept away from fruit bats and other carriers' areas, and fruit trees should be removed. Appropriate clothes are very important for tourists during direct contact with wild animals and animal products (blood meat) must be cooked well before use.

Human-to-human transmission: Avoid community engagement during the outbreak of the EBV, and avoid direct contact with patients and their body fluids, the persons who take care of patients in the hospital or at home should wear personal protective equipment.

Outbreak containment measures: people who may be in direct contact with patients or have been returned from endemic areas as tourists should be separated in a special place or home for monitoring health for about 21 days. Frequently hand washing with soap and water is recommended by WHO.

Sexual transmission: The infected male should be kept themselves away from their wife for about 12 months after the appearance of symptoms or to chick semen two times to confirm a negative result.

Transmission from pregnancy-related fluids and tissue: Survivors pregnant women keep the EBV after recovery in fluids and breast milk.

Vaccination: Eleven different EBOV Ebolavirus vaccines are under investigation. The European Medicines Agency [45], and United States Food, and Drug Administration [46] subsequently licensed the Ervebo vaccine in November and December 2019 and prequalified by WHO. Then most of the endemic areas in Africa approved the vaccine (the Democratic Republic of the Congo, Ghana, Guinea, Rwanda, Burundi, Central African Republic, Uganda, and Zambia), and the vaccine is safe and protective against the species Zaire EBOV. The European Medicines Agency has licensed the new Zabdeno vaccine delivery in two doses. Mvabea vaccine is licensed for individuals 1 year and older.

References

1. Siegert, R., Hsin-Lu Shu, W. Slenczka and D. Peters, et al. "On the etiology of an unknown human infection originating from monkeys." *Dtsch Med Wochenschr* (1967): 2341-2343.
2. Bowen, E. T. W., G. S. Platt, G. Lloyd and A. Baskerville, et al. "Viral haemorrhagic fever in southern Sudan and northern zaire. Preliminary studies on the aetiological agent." *Lancet* (1977): 571-573.
3. Johnson, K. M., P. A. Webb, J. V. Lange and F. A. Murphy, et al. "Isolation and partial characterisation of a new virus causing acute haemorrhagic fever in Zaire." *Lancet* (1977): 569-571.
4. Formenty, Pierre, Christophe Hatz, Bernard Le Guenno and Agnés Stoll, et al. "Human infection due to Ebola virus, subtype Cote d'Ivoire: Clinical and biologic presentation." *J Infect Dis* 179 (1999): S48-S53.
5. Okware, S. I., F. G. Omaswa, S. Zaramba and A. Opio, et al. "An outbreak of Ebola in Uganda." *Trop Med Int Health* 7 (2002): 1068-1075.
6. Maganga, Gaël D., Jimmy Kapetshi, Nicolas Berthet and Benoît Kebela Ilunga, et al. "Ebola virus disease in the Democratic Republic of Congo." *N Engl J Med* 371 (2014): 2083-2091.
7. Kuhn, Jens. "Filoviruses: A compendium of 40 years of epidemiological, clinical, and laboratory studies." (2008).
8. Barry, Ahmadou, Steve Ahuka-Mundeke, Yahaya Ali Ahmed and Yokouide Allarangar, et al. "Outbreak of Ebola virus disease in the Democratic Republic of the Congo, April–May, 2018: An epidemiological study." *The Lancet* 392 (2018): 213-221.
9. Wenham, Clare."What we have learnt about the world health organization from the Ebola outbreak." *Philos Trans R Soc Lond Biol Sci* 372 (2017): 20160307.
10. Chippaux, Jean-Philippe. "Outbreaks of Ebola virus disease in Africa: The

beginnings of a tragic saga." *J Venom Anim Toxins Incl Trop Dis* 20 (2014): 02-14.

11. Jacob, Shevin T., Ian Crozier, William A. Fischer II and Angela Hewlett, et al. "Ebola virus disease (Primer)." *Nat Rev Dis Primers* 6 (2020).
12. World Health Organization. "Ebola disease caused by Sudan virus–Uganda" (2022).
13. Leitenberg, Milton, Raymond A. Zilinskas and Jens H. Kuhn. "The Soviet biological weapons program: A history." Harvard University Press (2012).
14. Kuhn, Jens H., Gaya K. Amarasinghe, Christopher F. Basler and Sina Bavari, et al. "ICTV virus taxonomy profile: Filoviridae." *J Gen Virol* 100 (2019): 911.
15. Kuhn, Jens H., Takuya Adachi, Neill KJ Adhikari and Jose R. Arribas, et al. "New filovirus disease classification and nomenclature." *Nat Rev Microbiol* 17 (2019): 261-263.
16. Pigott, David M., Aniruddha Deshpande, Ian Letourneau and Chloe Morozoff, et al. "Local, national, and regional viral haemorrhagic fever pandemic potential in Africa: A multistage analysis." *Lancet* 390 (2017): 2662-2672.
17. Dowell, Scott F., Rose Mukunu, Thomas G. Ksiazek and Ali S. Khan, et al. "Transmission of Ebola hemorrhagic fever: A study of risk factors in family members, Kikwit, Democratic Republic of the Congo, 1995." *J Infect Dis* 179 (1999): S87-S91.
18. Bausch, Daniel G., Jonathan S. Towner, Scott F. Dowell and Felix Kaducu, et al. "Assessment of the risk of Ebola virus transmission from bodily fluids and fomites." *J Infect Dis* 196 (2007): S142-S147.
19. Fallah, Mosoka P., Laura A. Skrip, Bernice T. Dahn and Tolbert G. Nyenswah, et al. "Pregnancy outcomes in liberian women who conceived after recovery from Ebola virus disease." *Lancet Glob Health* 4 (2016): e678-e679.
20. Haddad, Lisa B., John Horton, Bruce S. Ribner and Denise J. Jamieson, et al. "Ebola infection in pregnancy: A global perspective and lessons learned." *Clin Obstet Gynecol* 61 (2018): 186.
21. Glynn, Judith R., Hilary Bower, Sembia Johnson and Catherine F. Houlihan, et al. "Asymptomatic infection and unrecognised Ebola virus disease in Ebola-affected households in Sierra Leone: A cross-sectional study using a new non-invasive assay for antibodies to Ebola virus." *Lancet Infect Dis* 17 (2017): 645-653.
22. Xu, Zhe, Bo Jin, Guangju Teng and Yihui Rong, et al. "Epidemiologic characteristics, clinical manifestations, and risk factors of 139 patients with Ebola virus disease in western Sierra Leone." *Am J Infect Control* 44 (2016): 1285-1290.
23. Gupta, Manisha, Siddhartha Mahanty, Rafi Ahmed and Pierre E. Rollin, et al. "Monocyte-derived human macrophages and peripheral blood mononuclear cells infected with Ebola virus secrete MIP-1α and TNF-α and inhibit poly-IC-induced IFN-α *in vitro*." *Virol* 284 (2001): 20-25.
24. Wahl-Jensen, Victoria, Sabine Kurz, Friedericke Feldmann and Lukas K. Buehler, et al. "Ebola virion attachment and entry into human macrophages profoundly effects early cellular gene expression." *PLOS Negl Trop Dis* 5 (2011): e1359.
25. Siragam, Vinayakumar, Gary Wong and Xiang-Guo Qiu. "Animal models for filovirus infections." *Zool Res* 39 (2018): 15.
26. Geisbert, Thomas W., Howard A. Young, Peter B. Jahrling and Kelly J. Davis, et al. "Mechanisms underlying coagulation abnormalities in ebola hemorrhagic fever: Overexpression of tissue factor in primate monocytes/macrophages is a key event." *J Infect Dis* 188 (2003): 1618-1629.
27. Wilson, Andrew J., Daniel S. Martin, Victoria Maddox and Simon Rattenbury, et al. "Thromboelastography in the management of coagulopathy associated with Ebola virus disease." *Clin Infect Dis* 62 (2016): 610-612.
28. Hensley, Lisa E., Howard A. Young, Peter B. Jahrling and Thomas W. Geisbert, et al. "Proinflammatory response during Ebola virus infection of primate models: Possible involvement of the tumor necrosis factor receptor superfamily." *Immunol Lett* 80 (2002): 169-179.
29. World Health Organization. Urgently Needed: Rapid, Sensitive, Safe, and Simple Ebola Diagnostic Tests.
30. De La Vega, Marc-Antoine, Grazia Caleo and Jonathan Audet, et al. "Ebola viral load at diagnosis associates with patient outcome and outbreak evolution." *J Clin Invest* 125 (2015): 4421-4428.
31. Peñas, Johnette A., Mary Elizabeth Miranda, Vikki Carr de Los Reyes and Ma Nemia L. Sucaldito, et al. "Risk assessment of Ebola Reston virus in humans in the Philippines." *Western Pac Surveill Response J*: WPSAR 10 (2019): 1-8.
32. Piercy, T. J., S. J. Smither, J. A. Steward and L. Eastaugh, et al. "The survival of filoviruses in liquids, on solid substrates and in a dynamic aerosol." *J Appl Microbiol* 109 (2010): 1531-1539.
33. Bausch, Daniel G. "Ebola virus as a foodborne pathogen? Cause for consideration, but not panic." *J Infect Dis* 204 (2011): 179-181.
34. ETW Bowen, DIH Simpson, WF Bright and I. Zlotnik, et al. "Vervet monkey disease: Studies on some physical and chemical properties of the causative agent." *Br J Exp Pathol* 50 (1969): 400.
35. European Food Safety Authority (EFSA). "An update on the risk of transmission of Ebola virus (EBOV) *via* the food chain–Part 2." *EFSA J* 13 (2015): 4042.
36. Schou, Søren and Axel Kornerup Hansen. "Marburg and Ebola virus infections in laboratory non-human primates: A literature review." *Comp Med* 50 (2000): 108-123.
37. Peters, Clarence J., P. B. Jahrling, Thomas G. Ksiazek and E. D. Johnson, et al. "Filovirus contamination of cell cultures." *Dev Biol Stand* 76 (1992): 267-274.
38. World Health Organization (WHO) Division of Emerging and Other Communicable Diseases - Surveillance and Control, Centers for Disease Control and Prevention (CDC): National Center for Infectious Diseases Division of Viral and Rickettsial Diseases Special Pathogens Branch. Infection Control for Viral Hemorrhagic Fevers in the African Health Care Setting. World Health Organization. Updated 1998. Accessed July 8 (2021).
39. Sagripanti, Jose-Luis and C. David Lytle. "Sensitivity to ultraviolet radiation of lassa, vaccinia, and Ebola viruses dried on surfaces." *Arch Virol* 156 (2011): 489-494.
40. Elliott, Luanne H., Joseph B. McCormick and Karl M. Johnson. "Inactivation of lassa, Marburg, and Ebola viruses by gamma irradiation." *J Clin Microbiol* 16 (1982): 704-708.
41. Lupton, Harold W. "Inactivation of Ebola virus with 60Co irradiation." *J Infect Dis* 143 (1981): 291-291.
42. Centers for Disease Control and Prevention CDC. "Update: Management of patients with suspected viral hemorrhagic fever--United States." *MMWR Morb Mortal Wkly Rep* 44 (1995): 475-479.
43. Lamontagne, Francois, Robert A. Fowler, Neill K. Adhikari and Srinivas Murthy, et al. "Evidence-based guidelines for supportive care of patients with Ebola virus disease." *Lancet* 391 (2018): 700-708.
44. Gaudinski, Martin R., Emily E. Coates, Laura Novik and Alicia Widge, et al. "Safety, tolerability, pharmacokinetics, and immunogenicity of the therapeutic monoclonal antibody mAb114 targeting Ebola virus glycoprotein (VRC 608): An open-label phase 1 study." *Lancet* 393 (2019): 889-898.
45. European Commission. Vaccine against Ebola: Commission grants first-ever market authorization.
46. US Food and Drug Administration. First FDA-approved vaccine for the prevention of Ebola virus disease, marking a critical milestone in public health preparedness and response.

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