

Control and prevention techniques of dreadful “Ebola” virus

Abstract

Although there is a bunch of disease and disorders are there, Ebola is one of the leading diseases in the world map causing numerous affected beings per year. The viral modification with time and wide spreading boundaries are causing more red alters. So the review is focused on the life cycle of the virus, its spread detection technique and new age strategy for drug development to under the control the condition in nutshell.

Keywords: ebola, virus, infection, scenario, nutshell, fluorogenic probes, diarrhea, abdominal pain

Volume 9 Issue 1 - 2020

Priyanka Bose,¹ Amit K Harit²

¹Department of chemistry, Banaras Hindu University, India

²Department of Chemistry, Korea University, Seoul, Korea

Correspondence: Priyanka Bose, Department of chemistry, Banaras Hindu University, Banaras, India, Email meow.bose@gmail.com

Received: September 17, 2019 | **Published:** January 08, 2020

Introduction

In recent years of span in between 2014-2018 Ebola viral disease has spread as epidemic but the emergence of the disease first occurred in 1976 near the Ebola River, Democratic Republic of Congo. After that the virus has emerged periodically and affected several African countries. Among the reported cases of viral infection around 61% of the cases are fatal by nature.¹ Among the family of viruses Filoviruses is the family under which Ebola virus genera comes that contains the genus Cuevavirus. The six species under the Ebolavirus are well known as follows, Zaire ebolaviruses (Ebola virus (EBOV)), Sudan ebolavirus (Sudan virus), Bundibugyo ebolaviruses (Bundibugyo virus), Tai Forest ebolaviruses (Tai Forest virus), Reston ebolavirus (Reston virus (RESTV)) and the most notorious specie Bombali ebolaviruses (Bombali virus). Major filoviruses cause hemorrhagic fever in humans, with high rate of fatality case and Ebola viral disease is a disease which has set of symptoms like severe headache, fever, muscle pain, fatigue along with diarrhea, nausea, abdominal pain and unexpected hemorrhage (Figure 1).²⁻⁴

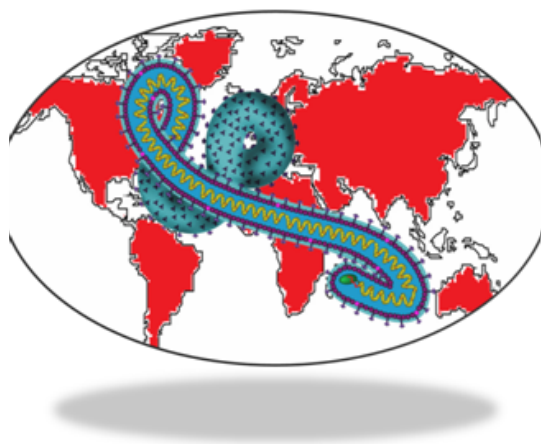


Figure 1 Graphical abstract

Host and disease spread

There is some conception about the reserved host source for the spread of Ebola to be African fruit bats which is still a research field to explore but some evidence reveals that recent, Bombali virus has been found in samples of bats collected in Sierra Leone. Major spread occurs via the use of contaminated needles and syringes causing transmission and amplification of the disease. In 1989, there was a true fact revealed the Reston ebolavirus found in research monkeys imported from the Philippines that the virus can transmit through droplets in the but no such viral transmission is possible in humans. During the period of 2014-2015 Ebola outbreaks in West Africa, majority of transmission events were between family members and due to direct contact with the dead bodies who died from viral disease was proved to be one of the most dangerous process.⁵⁻¹²

Detection techniques

Among the detection techniques majorly four types of detection techniques are being focused those are (a) cell culture assay, (b) antibody detection assay, (c) protein antigen detection technique and (d) RT-PCR technique. In cell culture assay techniques to confirm the presence of virus the viral isolation in cell culture, typically using Vero E6 African Green monkey kidney cells are being carried out. The propagated virus is visualized by electron microscopy directly or indirectly visualized by immuno fluorescence microscopy within 1 to 5 days of inoculation. Due to the requirement of bio safety level 4 containment, the technique is typically restricted to research and public health laboratories. Next in antibody detection, ELISA is the basis of it. In 1995 outbreak first IgM and IgG ELISAs were employed by the CDC during with persistence of IgG and the final time point tested was day 117. In recent studies during the 2014-2015 epidemics the onset of IgM and IgG was between 6 and 11 days and 9 and 11 days after the viral symptom onset respectively. Further the study revealed that the IgM antibody responses are variable, with the onset of detection from 2 to 11 days but the IgG responses are detectable in the second week of illness and persist for years which is useful tool for population-level more studies and detection. However, in Protein Antigen Detection, the viral protein antigens circulating in blood provides a dependable

method for diagnosing as the viral proteins accumulate to detectable ranges within a few days of disease onset. The method provide the viral antigen in serum easily diagnosable as early as the first day of symptoms and the antigen is present nearly in all affected patients by day 3 of the onset.

First time in 2000, RT-PCR or Real-time PCR assays utilizing fluorogenic probes were developed to detect Ebola from the serum samples. Piles of report from the span of 2014 onwards have revealed higher mortality in patients with $>10^7$ RNA copies/ml blood at the time of diagnosis.^{13–21}

Current treatment and future prospect

During the 2018 eastern Democratic Republic of the Congo outbreak, four investigational treatments were initially available among them the two antiviral still in use are, mAb114 and REGN-EB3, for patients with confirmed Ebola. There is currently no antiviral drug recommended by the U.S. Food and Drug Administration (FDA). However, multiple antiviral drugs are being developed and tested. The maintenance therapy for the treatment is to provide fluids and electrolytes via infusion intravenously. Support with oxygen therapy to maintain oxygen status. Different drugs in combination are used to support blood pressure, reduce vomiting and diarrhea and to manage fever and pain.

As there is no approved therapy so to find potential therapeutic targets, a vast research area is engaged. Though there more than 14 protein in the pipeline for the protein based drug development but in a 2019 report a new gene has been identified which is, GNPTAB, that encodes α and β subunits of N-acetylglucosamine-1-phosphate transferase. The Ebola infection is impaired in a cell line of GNPTAB knockout. Impaired infection correlates with loss of the expression of cathepsin B, essential for the virus entry. The gene activity is dependent upon proteolytic cleavage by the SKI-1/S1P protease. Inhibition of the protease using a small-molecule PF-429242 directly inhibits the virus entry and infection. So this fact can be exploited as a strategy for host-targeted therapy.²²

Another versatile approach has been reported in 2019 reports that Dettol Antiseptic Liquid can be used for inactivating Ebola virus (Makona C07 variant) within an organic load in suspension was evaluated per ASTM E1052-11. Authors claimed a steady decline with rapidity and substantial inactivation of EBOV/Mak by DAL which suggests the use of this hygiene product is helpful to prevent the spread of Ebola virus.

Conclusion

The review enclosed major perspectives under research for Ebola viral infections and its remedies. Focus on the disease is important as with time the viral modification occurring and developing more virulent strain for human race and whenever the viral is affecting its outbreak is occurring over a huge mass population. The span of the virus has spreaded from Asia, Africa to America, Europe. More concern should be focused over the research field for more caution and maintenance therapy.

Acknowledgments

None.

Conflicts of interest

The author declares that there are no conflicts of interest.

Funding

None.

References

1. <https://www.cdc.gov/vhf/ebola/history/chronology.html>
2. Burk R, Bollinger L, Johnson JC, et al. Neglected filoviruses. *FEMS Microbiol Rev*. 2016;40(4):494–519.
3. Yang XL, Chee Wah Tan, Danielle E Anderson, et al. Characterization of a filovirus (Mengla virus) from Rousettus bats in China. *Nat Microbiol*. 2019;4:390–395.
4. Miranda ME, Miranda NL. Reston ebolavirus in humans and animals in the Philippines: a review. *J Infect Dis*. 2011;204(3):S757–S760.
5. Baseler L, Chertow D, Johnson KM, et al. The Pathogenesis of Ebola Virus Disease. *Annu Rev Pathol Mech Dis*. 2017;12:387–418.
6. Goldstein T, Anthony SJ, Gbakima A, et al. The discovery of Bombali virus adds further support for bats as hosts of ebolaviruses. *Nature Microbiology*. 2018;3(10):1084–1089.
7. Amundsen S. Historical Analysis of the Ebola Virus: Prospective Implications for Primary Care Nursing Today. *Clinical Excellence for Nurse Practitioners*. 1998;2(6):343–351.
8. http://www.who.int/hrh/documents/21may2015_web_final.pdf
9. Khan A, Tshioko FK, Heymann DL, et al. The Reemergence of Ebola Hemorrhagic Fever, Democratic Republic of the Congo, 1995. *J Infect Dis*. 1999;179(1):S76–86.
10. Feldmann H, Sanchez A, Geisbert TW. Filoviridae: Marburg and Ebola viruses. 2013;923–962. In Knipe EM, Howley PM (editors). *Fields virology*. Philadelphia, PA: Lippincott Williams & Wilkins.
11. Uyeki TM, Mehta AK, Davey RT, et al. Clinical management of Ebola virus disease in the United States and Europe. *N Engl J Med*. 2016;374(7):636–646.
12. MacNeil A, Reed Z, Rollin P. Serologic cross-reactivity of human IgM and IgG antibodies to five species of Ebola virus. *PLoS Negl Trop Dis*. 2011;5:e1175.
13. Baize S, Leroy EM, Georges-Courbot MC, et al. Defective humoral responses and extensive intravascular apoptosis are associated with fatal outcomes in Ebola virus-infected patients. *Nat Med*. 1999;5(4):423–426.
14. Drosten C, Gottig S, Schilling S, et al. Rapid detection and quantification of RNA of Ebola and Marburg viruses, Lassa virus, Crimean-Congo hemorrhagic fever virus, Rift Valley fever virus, dengue virus, and yellow fever virus by real-time reverse transcription-PCR. *J Clin Microbiol*. 2002;40(7):2323–2330.
15. Crowe SJ, Maenner MJ, Kuah S, et al. Prognostic indicators for Ebola patient survival. *Emerg Infect Dis*. 2016;22(2):217–223.
16. Fitzpatrick G, Vogt F, MoiGbaba OB, et al. The contribution of Ebola viral load at admission and other patient characteristics to mortality in a Medecins Sans Frontieres Ebola case management centre, Kailahun, Sierra Leone, June–October 2014. *J Infect Dis*. 2015;212(11):1752–1758.
17. Lanini S, Portella G, Vairo F, et al. Blood kinetics of Ebola virus in survivors and nonsurvivors. *J Clin Invest*. 2015;125(12):4692–4698.
18. Li J, Duan H, Chen H, et al. Age and Ebola viral load correlate with mortality and survival time in 288 Ebola virus disease patients. *J Infect Dis*. 2015;212:34–39.
19. deLaVega M, Caleo G, Audet J, et al. Ebola viral load at diagnosis associates with patient outcome and outbreak evolution. *J Clin Invest*. 2015;125:4421–4428.

20. <https://www.cdc.gov/vhf/ebola/treatment/index.html>
21. Mike Flint, Chatterjee P, David L, et al. A genome-wide CRISPR screen identifies N-acetylglucosamine-1-phosphate transferase as a potential antiviral target for Ebola virus. *Nature Communication*. 2019;10:285.
22. Todd A Cutts, M Khalid Ijaz, Raymond W Nims, et al. Effectiveness of Dettol Antiseptic Liquid for Inactivation of Ebola Virus in Suspension. *Scientific Reports*. 2019;9:6590.