Ebola Virus Disease and its Complications

ABSTRACT

Now a day in African countries Ebola virus has been responsible for several deaths. In addition to being a global health concern, the virus also is considered a potential biological threat agent. Ebola viruses are incompletely understood pathogens that cause severe, often fatal, illnesses in humans and non-human primates. Ebola virus disease affects most of the human being and finally mortality rate is increases in that county. Most of the countries are on alert for the ebola virus because maximum peoples who worked on the affected area of Africa without proper test in airport or other places he doesn't enter in to the resident country. In this review we discuss ebola virus disease and how it affects the peoples worldwide.

KEYWORDS: Ebola Virus; Ebola Virus Disease (EVD); Hemorrhagic Fever; Filoviruses.

1.INTRODUCTION

Ebola is a rare but deadly virus that causes bleeding inside and outside the body. As the virus spreads through the body, it damages the immune system and body organs. Ultimately, it causes levels of blood-clotting cells to drop, finally leads to severe uncontrollable bleeding.

The disease, also known as Ebola hemorrhagic fever or Ebola virus, kills up to 90% of people who are infected. So far serious, Ebola cases have only shown up in Central and West Africa. Ebola can spread from country to country when people travel. Ebola can feel like the flu or other illnesses. Symptoms show up 2 to 21 days after infection [1-4]. Cases and deaths from EVD in Guinea, Liberia, Nigeria, and Sierra Leone as of 31 July 2014 mentioned in table1. The spread of Ebola Virus Disease (EVD) between and within the three neighbouring countries accounting for the majority of the cases noted so far Guinea, Liberia, and Sierra Leone is due to high cross- border movement and the introduction of EVD in additional neighbouring countries in the sub region might not be excluded due to the existence of similarly porous borders [5].

Table 1 EVD Cases and deaths in Guinea, Liberia, Nigeria, and Sierra Leone as of 31 July 2014

Country	Cases	Deaths	Case Fatality Rate (%)	Health care workers affected (Cases/Deaths)
Guinea	472	346	73	33/20
Liberia	360	181	50	47/28
Nigeria	1	1	100	0
Sierra Leone	574	215	37	44/33
Total	1407	743	53	124/71

2. STRUCTURE OF EBOLA VIRUS

EBOV (Ebola Virus) carries a negative-sense RNA genome in virions that are cylindrical/tubular, and contain viral envelope, matrix, and nucleocapsid components. The overall cylinders are generally approx. 80 nm in diameter, and having a virally encoded glycoprotein (GP) projecting as 7-10 nm long spikes from its lipid bilayer surface (figure 1) [6].

The Ebola has characteristic "threadlike" structure, however, a more general morphologic characteristic of filoviruses (alongside their GP-decorated viral envelope, RNA nucleocapsid, etc.) [7].

3. ETIOLOGY

The species is avirological taxon species included the genus in Ebolavirus family *Filoviridae* (members known as Filovirus) [8], order *Mononegavirales* [9]. The Zaire ebolavirus species is also the type species (reference or example species) for *ebolavirus*. Its natural reservoir is bats, particularly fruit bats.

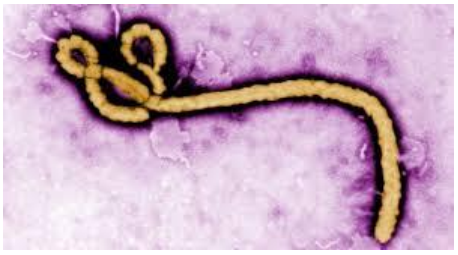

Figure 1 Structure of Ebola virus (Transmission electron micrograph)

The EBOV genome is approximately 19,000 base pairs long. It encodes 7 structural proteins: nucleoprotein (NP), polymerasecofactor (VP35), (VP40), GP, transcription activator (VP30), VP24, and RNA polymerase (L) (figure 2) [10]. It is difficult to study due to the virulent nature of the virus.

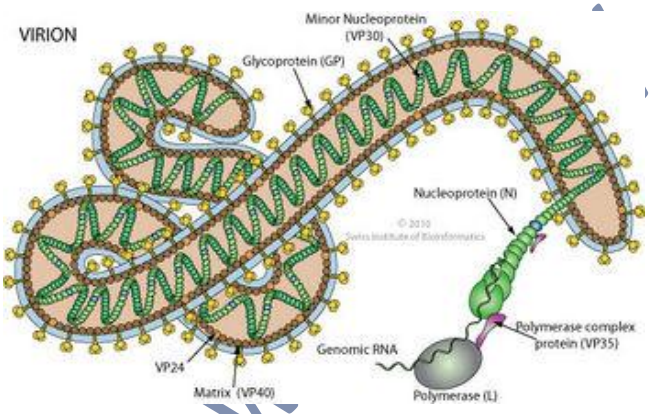

Figure 2 Virion structure of Ebola virus

4. SPREAD

Ebola spreads to people by contact with the skin or body fluids of an infected animal, like a monkey, chimp, or fruit bat. After that it moves from one person to another person by the same way. Persons who care for a sick person or bury someone who has died from the disease often get it. Ebola also spread by touching contaminated needles or surfaces. Ebola cannot spread through air, water and food, handling the meat from infected animals, coming into contact with the infected person's blood. A person who has Ebola but has no symptoms cannot spread the disease, either [3,4,11,12].

5. PATHOGENESIS

Ebola virus enters in to the body through the mucous membrane, breaking skin and via the parenteral route. This pathogen may infect many cells like macrophages, monocytes, dendritic cells, endothelial cells, fibroblast, hepatocytes, epithelial cells and adrenal cortex cells. Due to outbreak conditions all data of ebola virus pathogenesis obtained by laboratory experiments on guinea pigs, mice and other nonhuman primates [13].

6. ATTACKING SYSTEM OF EBOLA VIRUS IN HUMAN

When Ebola enters into the human body system, ebola virus protein called VP24 binds with the human host protein known as KPNA5. KPNA5's mainly responsible for the communication between cells and transfer signal into and out of nucleus. It works just like a messenger. After that KPNA5 transfer all these signals to nucleus of other body parts of the cells. These signals regulate various functions in an organism including immune response.

When ebola protein VP24 binds with the messenger protein STAT1, due to this binding it doesn't carry important immune signals; STAT1 is the transporter into the nucleus and activates the genes for antiviral responses said by Daisy Leung. Inhibition of PY-STAT1 by eVP-24 is due to direct competitions by eVP-24 for NPI-1 subfamily KPNA binding. Nucleus receives STAT-1 protein; it sounds like alarm and releases interferon's for fighting with virus, bacteria or whatever other pathogen is attacking the cells. The immune system can't communicate properly because of VP24 is still sitting in STAT1 seat (figure 3) [14].

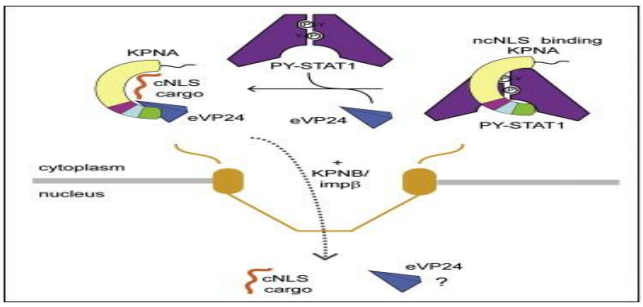

Figure 3 Schematic representation of Ebola virus killing host system

7. SYMPTOMS

Ebola symptoms include headache high fever, Joint aches, muscle aches, weakness, sore throat, pain in stomach and lack of appetite. Bleeding occurs inside the body, as well as from the eyes, ears, and nose in worst condition of disease. Some people will vomit or cough up blood, have bloody diarrhea, and get a rash [3,4,15]. Transaminitis, leukopenia, thrombocytopenia, coagulations abnormalities and renal abnormalities often occur in patient with ebola virus by laboratory findings [16].

8. DIAGNOSIS

Doctors may prescribe tests like CBC (Complete Blood Count), coagulation studies (a test to check for the amount of time a person's blood needs to clot), viral antigen testing (a test to check for the presence of the viral antigen) and a liver function test.

9. PROGNOSIS

As per WHO reports, on an average, 80% of the people infected with Ebola virus do die. Their death is usually due to a drop in their blood pressure and failure of organs [3,4].

10. PREVENTION

10.1. Control:

The basic hygiene is of importance and a must be followed in order to prevent the onset of the condition. Simple activities like washing your hands well, drinking water from a clean source, maintaining general hygiene and cooking your meat well, can all serve as precautionary measures [3,4].

10.2. Treatment:

Standard treatment currently consists of supportive therapy, including maintenance of blood volume and electrolyte balance, as well as analgesics and standard nursing care [17]. Progression of Ebola virus in infected mice is inhibited by some drugs like clomiphene and toremiphene. Amiodarone is used in the treatment of heart arrhythmias, is an ion channel blocker, which blocks the ebola virus entry into cells *in vitro* studied shows in 2014 [18].

Other promising treatments rely on antisense technology. Both small interfering RNAs (siRNAs) and phosphorodiamidate morpholino oligomers (PMOs) targeting the Zaire Ebola virus (ZEBOV) RNA polymerase L protein could prevent disease in nonhuman primates [19,20]. TKM-Ebola is a small-interfering RNA compound, currently tested in a phase I clinical trial in people [21,22].

10.3. Vaccination:

There aren't any vaccinations available as of now but According to BBC News on dated 30 August 2014, ZMapp is a Ebola vaccine shows 100 % success rate, which has been tested on 18 laboratory monkeys, is due to be put through human trials [23, 24].

REFERENCES

1. WHO. Ebola virus disease Fact sheet No.103. 2014-03-01. Retrieved 2014-04-12.
2. Fauquet CM. Virus taxonomy classification and nomenclature of viruses; 8th report of the International Committee on Taxonomy of Viruses.Oxford: *Elsevier/Academic Press*. 2005. p. 648.
3. http://www.thehealthsite.com/diseases-conditions/ebola-virus-causes-symptoms-diagnosis-treatment-prognosis-and-prevention/
4. http://www.webmd.com/a-to-z-guides/ebola-fever-virus-infection
5. WHO. Ebola virus disease: background and summary. Available at: http://www.who. int/ csr/don/2014_04_ebola/en/
6. Klenk & Feldmann 2004, p. 28
7. Klenk HD, Feldmann, H . *Ebola and Marburg Viruses: Molecular and Cellular Biology*. Horizon Bioscience, 2004, ISBN 978-1-904933-49-6.
8. Kuhn Jens H, Becker, Stephan, Ebihara, Hideki, Geisbert, Thomas W, Johnson Karl M, Kawaoka, Yoshihiro, Lipkin W. Ian, Negredo, Ana I. Proposal for a revised taxonomy of the family Filoviridae: Classification, names of taxa and viruses, and virus abbreviations. *Archives of Virology*, 2010; 155 (12): 2083–103.
9. WHO. "Ebola virus disease"
10. Nanbo Asuka, Watanabe Shinji, Halfmann Peter, Kawaoka Yoshihiro. The spatio-temporal distribution dynamics of Ebola virus proteins and RNA in infected cells. *Nature*. 2013.
11. CDC Telebriefing on Ebola outbreak in West Africa. *CDC*. 2014-07-28. Retrieved 2014-08-03.
12. Harden, Blaine (2001-02-18). Dr. Matthew's Passion. *New York Times Magazine*. Retrieved 2008-02-25.
13. The Centres for Disease Control and Prevention. Ebola Virus Disease Information for Clinicians in U.S. Healthcare Settings, http://www.cdc.gov/vhf/ebola/hcp/clinician-information-us-healthcare-settings.html (Accessed on August 11, 2014).
14. http://motherboard.vice.com/read/how-the-ebola-virus-jams-immune-system-signals-and-kills
15. Ebola Hemorrhagic Fever Signs and Symptoms. *CDC*. 2014-01-28. Retrieved 2014-08-02.
16. Kortepeter MG, Bausch DG, Bray M. Basic clinical and laboratory features of filoviral hemorrhagic fever. *J Infect Dis.* 2011; 204 Suppl 3:S810.
17. Ebolavirus and Marburgvirus Infections. The centre for food security and public health, Iowa State University, 2014.
18.Gehring G, Rohrmann K, Atenchong N, Mittler E, Becker S, Dahlmann F, Pöhlmann S, Vondran FW, David S, Manns MP, Ciesek S, von Hahn T . The clinically approved drugs amiodarone, dronedarone and verapamil inhibit filovirus cell entry. *J. Antimicrob. Chemother.* 2014. 69 (8): 2123–31.
19. Geisbert TW, Lee AC, Robbins M, Geisbert JB, Honko AN, Sood V, Johnson JC, de Jong S, Tavakoli I, Judge A, Hensley LE, Maclachlan I. Post exposure protection of non-human primates against a lethal Ebola virus challenge with RNA interference: A proof-of-concept study. *The Lancet*. 2010; 375 (9729): 1896–1905.
20. Warren TK, Warfield KL, Wells J, Swenson DL, Donner KS, Van Tongeren SA, Garza NL, Dong L, Mourich DV, Crumley S, Nichols DK, Iversen PL, Bavari S. Advanced antisense therapies for post exposure protection against lethal filovirus infections. *Nature Medicine.* 2010; 16 (9): 991–994.
21. Pollack, Andrew (07-08-2014). Second Drug Is Allowed for Treatment of Ebola". The New York Times. Retrieved 08-08-2014.
22. Helen Branswell, Nancy Writebol. U.S. missionary didn't get TKM-Ebola drug, Tekmira says. The Canadian Press. 2014.
23. http://www.bbc.com/news/world-28992560.
24.Harish Rajak, Deepak Kumar Jain, Avineesh Singh, Ajay Kumar Sharma, Anshuman Dixit, Ebola virus disease: past, present and future, Asian Pacific Journal of Tropical Biomedicine, 2015, 5 (5), 337–343.