AN OVERVIEW OF EBOLA. AN EMERGING VIRUS

Reddy, P.B*

Department of Zoology Govt.PG College, Ratlam, M.P.India.

ABSTRACT
Ebola virus is one of the most virulent virus and emerged as a crisis in West Africa and WHO declared it a “public health emergency of international concern. WHO also declared similar emergencies for polio and the swine flu pandemic in 2009. The present eruption linked with Ebola disease in African continent is believed to be one of the huge epidemic disease caused by the Ebola viral infections. It is believed that Ebola has been transmitted to the Western regions through the tourists from wide spread countries like Guinea, Liberia, Sierra Leone and Nigeria. Now this disease is spreading through the contact in any form from the infected persons or patients. The infection is characterized by unexpected onset of fever, chills, malaise, gastrointestinal, respiratory, cutaneous, and neural symptoms. Until now, no definite therapeutics or vaccines have been approved for this lethal disease. Initially it infects macrophages and endothelial cells by producing an anti interferon Protein 24 (eVP24) which prevents interferon-based signals. The mechanism of Ebola virus on the function of the immune system is still unclear hence no standard treatment is available. Countries affected to date including India do not have the capacity to manage an outbreak of this size and complexity on their own. In this article I reviewed recent research articles from Google scholar, scimago, webscience and other database sources and tried to collect the updated information on epidemiology, pathogenesis and treatment of Ebola virus infection which will be helpful for researchers and doctors to design drugs for the treatment of Ebola virus disease.

KEYWORDS: Ebola, pathophysiology, immune system, treatment.

1. INTRODUCTION
The new incurable diseases are being continuously reported even in the past decade.\textsuperscript{[1]} Ebola virus diseases (EVDs) have always been a challenge and a universal threat since its discovery
in 1976 by Dr. Peter Piotin in Zaire, Africa (now Democratic Republic of Congo) from the blood of a catholic nun who suspected of having yellow fever.\textsuperscript{[2]} Ebola virus is the only member of the species \textit{Zaire ebolavirus} for the genus \textit{Ebola virus} (Kuhn et al,2010). Fruit bats are believed to act as natural reservoir of Ebola \textsuperscript{[3]} and it is mainly transmitted between humans and primates through body fluids. \textsuperscript{[4]} Ebola, previously known as Ebola hemorrhagic fever, (EHF) is a rare and deadly disease caused by infection with one of the Ebola virus species. Ebola can cause disease in humans and nonhuman primates (monkeys, gorillas, and chimpanzees). The virus genome consist of a single-stranded RNA approximately 19,000 nucleotides long. Because of high mortality rate (80-90\%), WHO \textsuperscript{[5]} listed Ebola virus in a select agent risk group 4 while U.S. CDC (Centers for Disease Control and Prevention Category) \textsuperscript{[6]} in 2014 kept this virus in category A as an agent of Bioterrorism. Therefore, in this study, we have reviewed the Ebola virus in terms of virology, immunology, epidemiological profile, transmission, clinical and para-clinical manifestations, prevention and treatment with focus on dermatological points. The content of this review highlights the recent outbreaks, updated pathophysiology, diagnosis, risks and prevention of Ebola which may be very much useful for education and clinical information process.

2. METHODOLOGY

This review paper is based on information from the fact sheets from WHO and USCDC. Information was also obtained on from various web sites and articles addressing the effects of Ebola virus. Selected references to the articles reviewed can be found in the Appendices of the working document. In addition, many press releases have been reviewed on a regular basis. Meetings with local doctors have also been a useful source of information and have provided opportunities for exchanging views. The search comprised all articles published and indexed for all years to June 2014. Electronic searches were also performed in Web of Science \textsuperscript{[7]}, Google scholar \textsuperscript{[8]} and Pub med \textsuperscript{[9]} using CAS registry numbers and common names.

3. RESULTS AND DISCUSSION

The first outbreak of Ebola virus disease (EVD) or Ebola hemorrhagic fever (EHF) occurred in Yambuku and surrounding area and caused death of 88\% of the infected people. It was believed to spread by close personal contact and by use of contaminated needles and syringes in hospitals/clinics. \textsuperscript{[10]} Then after, it occurred in Sudan and England in 1976 and USA in 1989 and caused high percentage of mortality. The 2014 outbreak of Ebola virus infection in
West Africa linking Zaire ebolavirus, is the major outbreak of Ebola virus disease in history. Ebola virus is one of at least 30 known viruses capable of causing viral hemorrhagic fever syndrome.\textsuperscript{[11]} The warning signs resembled malaria, and subsequent patients received quinine. The ongoing outbreak of this virus across multiple countries in West Africa is the longest and largest outbreak so far, recording more than 11020 deaths out of 26628 patients till 11\textsuperscript{th} November 2014.

3.1 Transmission: Ebola is not spread through the air, by water, or even by food. Even there is no confirmation that mosquitoes or other insects can transmit Ebola virus. Only a few species of primates (e.g., humans, bats, monkeys, and apes) have shown the ability to become infected with and spread Ebola virus. It is thought that fruit bats of the Pteropodidae family are natural reservoir hosts for Ebola virus. Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest. Transmission has also been endorsed to reuse of unsterilized needles and close personal contact, body fluids and places where the person has touched. Burial ceremonies in which mourners have direct contact with the body of the deceased person can also play a role in the transmission of Ebola.\textsuperscript{[12]} Healthcare providers caring for Ebola patients and family and friends in close contact with Ebola patients are at the highest risk of getting sick because they may come in contact with infected blood or body fluids. Ebola also can be spread through direct contact with objects (like clothes, bedding, needles, syringes/sharps or medical equipment) that have been contaminated with infected body fluids. Ebola virus has been found in the semen of some men who have recovered from Ebola infection. It is possible that Ebola could be transmitted through sex. But No formal evidence exists of sexual transmission, but sexual transmission from recovery patients cannot be ruled out. There is evidence that live Ebola virus can be isolated in seminal fluids of recovery men for 82 days after onset of symptoms. Since the risk of sexual transmission of the virus cannot be ruled out, men and women who have recovered from EVD should withdraw from all types of sex (including anal- and oral sex) for at least three months after onset of symptoms.

3.2 Symptoms of Ebola include
- Fever
- Severe headache
Symptoms may become visible anywhere from 2 to 21 days after contact to Ebola, but the average is 8 to 10 days. Recovery from Ebola depends on good supportive clinical care and the patient’s immune response. People who recover from Ebola infection develop antibodies that last for at least 10 years.\[2\]

3.3 Pathophysiology

The Ebola virus can enter into the human body through skin cuts and mucous membrane.\[13\] The virus can enter the bloodstream and lymphatic system and spread throughout the body.

EBOV reproduces very powerfully in many cells, producing large amounts of virus in neurons, monocytes, macrophages, hepatocytes and adrenal gland cells.\[14\] Viral replication activates the release of high levels of inflammatory chemical signals and leads to a septic state.\[15\] Macrophages are the first cells infected with the virus, and this infection results in programmed cell death.\[16\] Later, lymphocytes also undergo programmed cell death leading to a low concentration of lymphocytes in the blood. This contributes to the weakened immune response seen in those infected with EBOV.\[13\] The liver cell damage cause improper blood clotting which leads wide spread bleeding in affected persons.\[14\] The presence of viral particles and the cell damage resulting from viruses growing out of the cell causes the release of special and molecular chemical signals for fever and inflammation.

3.4 Diagnosis

Travel and work history, exposure to wild life are important factors for diagnosis of an Ebola patient. The probable non-specific laboratory markers of EVD include a low platelet count, an initially decreased white blood cell count followed by an increased white blood cell count, elevated levels of the liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST) and abnormalities in blood clotting and prolonged bleeding time are useful for the identification of the Ebola patient.\[17\] PCR and ELISA tests are also useful for
detecting the virus in human remains in early stages. But detecting antibodies against the virus is most reliable in the later stages of the disease.\textsuperscript{[2]} Recently, in 2015 a rapid antigen test was approved for use by WHO which gives results in 15 minutes. It is able to confirm Ebola in 92% of those affected and rule it out in 85% of those not affected.\textsuperscript{[5]}

### 3.5 Prevention

- People who care for those infected with Ebola should wear protective clothing including masks, gloves, gowns and goggles.\textsuperscript{[5]}
- Isolate patients with Ebola from other patients.
- Do not touch items that may have come in contact with an infected person’s blood or body fluids (such as clothes, bedding, needles, and medical equipment).
- Avoid funeral or burial rituals that require handling the body of someone who has died from Ebola.
- Avoid contact with bats and nonhuman primates or blood, fluids, and raw meat prepared from these animals.
- Do not have contact with the semen from a man who has recovered from Ebola (for example, avoid having oral, vaginal, or anal sex).
- Avoid direct, unprotected contact with the bodies of people who have died from Ebola.

### 3.6 Treatment:

There is no FDA-approved vaccine available for Ebola. But practice of careful hygiene, Avoiding funeral or burial rituals can prevent from the infection. No FDA-approved vaccine or medicine (e.g., antiviral drug) is available for Ebola. Symptoms of Ebola and complications are treated as they appear. The following basic interventions, when used early, can significantly improve the chances of survival:

- Providing intravenous fluids (IV) and balancing electrolytes (body salts).
- Maintaining oxygen status and blood pressure.
- Treating other infections if they occur.

Recovery from Ebola depends on good supportive care and the patient’s immune response. People who recover from Ebola infection develop antibodies that last for at least 10 years, possibly longer. It is not known if people who recover are immune for life or if they can become infected with a different species of Ebola. Some people who have recovered from Ebola have developed long-term complications, such as joint and vision problems.
Experimental vaccines and treatments for Ebola are under development, but they have not yet been fully tested for safety or effectiveness by the United States Food and Drug Administration (USFDA) for clinical use in humans.[18] Several promising vaccine candidates have been shown to protect nonhuman primates (usually macaques) against lethal infection.[19] Recently, researchers from the Icahn School of Medicine and the National Institutes of Health in December 2014 identified 53 existing drugs that may be effective at preventing the Ebola virus from entering human cells. The research effort will continue in order to investigate the safety and potential effectiveness of these compounds.[20]

CONCLUSIONS

Ebola virus has been a threat to human health due to its dangerous, highly lethal and infectious behavior for which there is no specific remedy available. The spread among humans occurs mainly through the exchange of blood and body secretions. Other noticeable forms of transmission include hospital acquired infection and inadequate hygiene practices. There is an urgent requirement of dissemination of information to community and training programmes for doctors, nurses and other hospital staff. There is an urgent demand for more field studies into the ecology of reservoir species and shedding procedures. The awareness programmers should be organized on large scale to develop the attention about disease for its eradication. It is expected that outcome of research investigations would result in development of easily available and affordable drug for the treatment of this lethal virus.

REFERENCES

2. USCDC (2015). CDC Health Topics A to Z.
7. (https://webofknowledge.com/)
8. https://scholar.google.co.in/scholar?q=e+bola+virus&hl=en&as_sdt=0,5
20. Kouznetsova, Jennifer; Sun, Wei; Martínez-Romero, Carles; Tawa, Gregory; Shinn, Paul; Chen, Catherine Z; Schimmer, Aaron; Sanderson, Philip; McKew, John C; Zheng, Wei; García-Sastre, Adolfo. "Identification of 53 compounds that block Ebola virus-like particle entry via a repurposing screen of approved drugs". Emerging Microbes & Infections, 2014; 3(12): e84.