



Review Article

EBOLA VIRUS: AN OVERVIEW

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ABSTRACT

Ebola virus disease (EVD), also known as Ebola hemorrhagic fever (EHF) or simply Ebola, is a viral hemorrhagic fever of humans and other primates caused by ebola viruses. Signs and symptoms typically start between two days and three weeks after contracting the virus with a fever, sore throat, muscular pain, and headaches. Then, vomiting, diarrhea and rash usually follow, along with decreased function of the liver and kidneys. At this time some people begin to bleed both internally and externally. The disease has a high risk of death, killing between 25 and 90 percent of those infected, with an average of about 50 percent. This is often due to low blood pressure from fluid loss, and typically follows six to sixteen days after symptoms appear.

The virus spreads by direct contact with body fluids, such as blood, of an infected human or other animals. This may also occur through contact with an item recently contaminated with bodily fluids. Spread of the disease through the air between primates, including humans, has not been documented in either laboratory or natural conditions. Semen or breast milk of a person after recovery from EVD may carry the virus for several weeks to months. Fruit bats are believed to be the normal carrier in nature, able to spread the virus without being affected by it. Other diseases such as malaria, cholera, typhoid fever, meningitis and other viral hemorrhagic fevers may resemble EVD.

Keywords: EVD, Disease, Viral hemorrhagic fever, bleed.

INTRODUCTION

Control of outbreaks requires coordinated medical services, alongside a certain level of community engagement. The medical services include rapid detection of cases of disease, contact tracing of those who have come into contact with infected individuals, quick access to laboratory services, proper healthcare for those who are infected, and proper disposal of the dead through cremation or burial. Samples of body fluids and tissues from people with the disease should be handled with special caution. Prevention includes limiting the spread of disease from infected animals to humans. This may be done by handling potentially infected bush meat only while wearing protective clothing and by thoroughly cooking it before eating it.

It also includes wearing proper protective clothing and washing hands when around a person with the disease.^[1] No specific treatment or vaccine for the virus is available, although a number of potential treatments are being studied. Supportive efforts, however, improve outcomes. This includes either oral rehydration therapy (drinking slightly sweetened and salty water) or giving intravenous fluids as well as treating symptoms.

The disease was first identified in 1976 in two simultaneous outbreaks, one in Nzara, and the other in Yambuku, a village near the Ebola River from which the disease takes its name. EVD outbreaks occur intermittently in tropical regions of sub-Saharan Africa. Between 1976 and 2013, the World Health Organization reports a total of 24 outbreaks involving 1,716 cases. The largest outbreak to date was the epidemic in West Africa, which occurred from December 2013 to January 2016 with 28,647 cases and 11,322

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deaths. It was declared no longer an emergency on 29 March 2016.

SIGNS AND SYMPTOMS

Onset

The length of time between exposure to the virus and the development of symptoms (incubation period) is between 2 to 21 days, and usually between 4 to 10 days. However, recent estimates based on mathematical models predict that around 5% of cases may take greater than 21 days to develop.

Bleeding

In some cases, internal and external bleeding may occur. This typically begins five to seven days after the first symptoms. All infected people show some decreased blood clotting. Bleeding from mucous membranes

or from sites of needle punctures has been reported in 40–50 percent of cases. This may cause vomiting blood, coughing up of blood, or blood in stool. Bleeding into the skin may create petechiae, purpura, ecchymoses or hematomas (especially around needle injection sites). Bleeding into the whites of the eyes may also occur.

Recovery and death

Recovery may begin between 7 and 14 days after first symptoms. Death, if it occurs, follows typically 6 to 16 days from first symptoms and is often due to low blood pressure from fluid loss. In general, bleeding often indicates a worse outcome, and blood loss may result in death. People are often in a coma near the end of life.

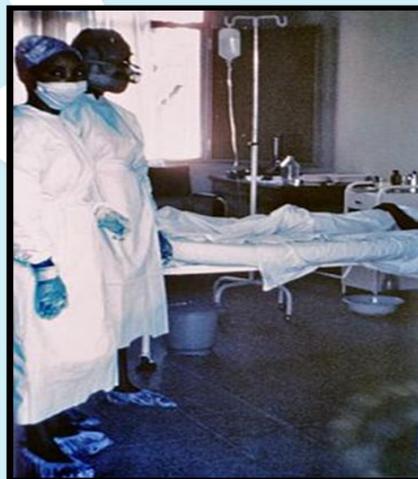


Figure 1: Two nurses standing near Mayinga N'Seka a nurse with Ebola virus diseases in the 1976 outbreak in Zaire. N'Seka died a few days later.

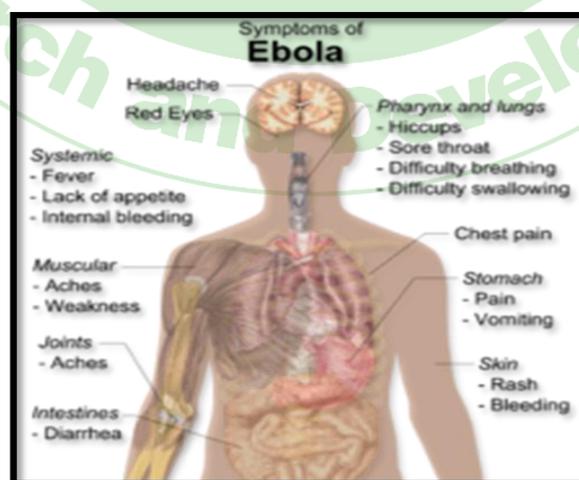


Figure 2: Symptoms of Ebola Virus

CAUSES

EVD in humans is caused by four of five viruses of the genus Ebola virus. The four are Bundibugyo virus (BDBV), Sudan virus (SUDV), Tai Forest virus (TAFV) and one simply called Ebola virus (EBOV, formerly Zaire Ebola virus). EBOV, species Zaire ebola virus, is the most dangerous of the known EVD-causing viruses, and is responsible for the largest number of outbreaks. The fifth virus, Reston virus (RESTV), is not thought to cause disease in humans, but has caused disease in other primates. All five viruses are closely related to marburgviruses.

VIROLOGY

Ebola viruses contain single-stranded, non-infectious RNA genomes. Ebola virus genomes contain seven genes including 3'-UTR-NP-VP35-VP40-GP-VP30-VP24-L-5'-UTR. The genomes of the five different ebola viruses (BDBV, EBOV, RESTV, SUDV and TAFV) differ in sequence and the number and location of gene overlaps. As with all filo viruses, ebola virus virions are filamentous particles that may appear in the shape of a shepherd's crook, of a "U" or of a "6," and they may be coiled, toroid or branched. In general, ebola virions are 80 nanometers (nm) in width and may be as long as 14,000 nm.

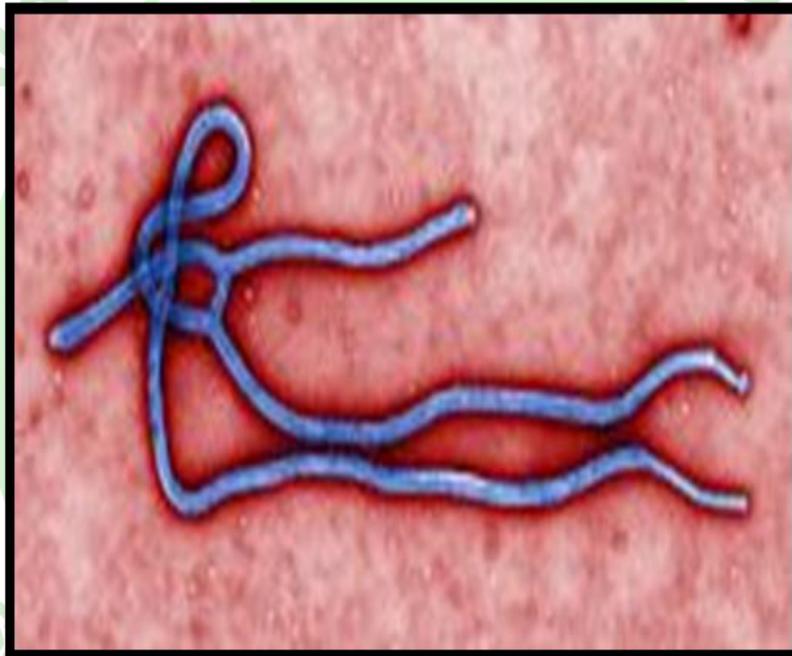


Figure 3: Electron micrograph of an Ebola virus virion

Transmission

It is believed that between people, Ebola disease spreads only by direct contact with the blood or other body fluids of a person who has developed symptoms of the disease. Body fluids that may contain Ebola viruses include saliva, mucus, vomit, feces, sweat, tears, breast milk, urine and semen. The WHO states that only people who are very sick are able to spread Ebola disease in saliva, and whole virus has not been reported to be transmitted through sweat. Most people spread the virus through blood, feces and

vomit. Entry points for the virus include the nose, mouth, eyes, open wounds, cuts and abrasions. Ebola may be spread through large droplets; however, this is believed to occur only when a person is very sick. This contamination can happen if a person is splashed with droplets. Contact with surfaces or objects contaminated by the virus, particularly needles and syringes, may also transmit the infection. The virus is able to survive on objects for a few hours in a dried state, and can survive for a few days within body fluids outside of a person.

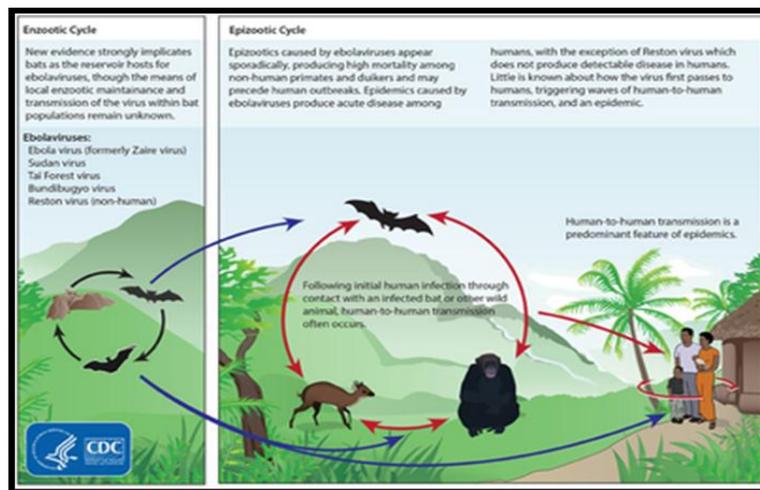


Figure 4 : Life cycles of the Ebola virus

Initial case

Bushmeat being prepared for cooking in Ghana. In Africa, wild animals including fruit bats are hunted for food and are referred to as

bushmeat. In equatorial Africa, human consumption of bushmeat has been linked to animal-to-human transmission of diseases, including Ebola.



Figure.5: Initial case

Reservoir

The natural reservoir for Ebola has yet to be confirmed; however, bats are considered to be the most likely candidate species. Three types of fruit bats (*Hypsignathus monstrosus*, *Epomops franqueti* and *Myonycteris torquata*) were found to possibly carry the virus without getting sick. As of 2013, whether other animals are involved in its spread is not known. Plants, arthropods and

birds have also been considered possible viral reservoirs.

PATHOPHYSIOLOGY

Similar to other filo viruses, EBOV replicates very efficiently in many cells, producing large amounts of virus in monocytes, macrophages, dendritic cells and other cells including liver cells, fibroblasts, and adrenal gland cells. Viral replication triggers the release of high levels of inflammatory

chemical signals and leads to a septic state. EBOV is thought to infect humans through contact with mucous membranes or through skin breaks. Once infected, endothelial cells (cells lining the inside of blood vessels), liver cells, and several types of immune cells such as macrophages, monocytes, and dendritic cells are the main targets of infection. Following infection with the virus, the immune cells carry the virus to nearby lymph nodes where further reproduction of the virus

takes place. From there, the virus can enter the bloodstream and lymphatic system and spread throughout the body. Macrophages are the first cells infected with the virus, and this infection results in programmed cell death. Other types of white blood cells, such as lymphocytes, also undergo programmed cell death leading to an abnormally low concentration of lymphocytes in the blood. This contributes to the weakened immune response seen in those infected with EBOV.

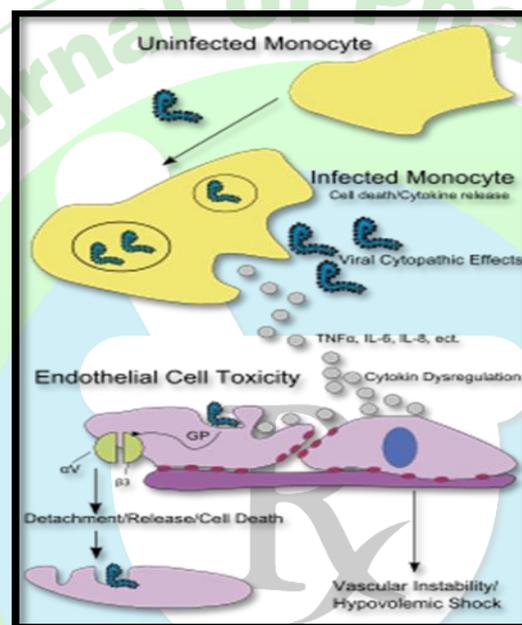


Figure.6: Pathogenesis schematic

DIAGNOSIS

When EVD is suspected in a person, his or her travel and work history, along with an exposure to wildlife, are important factors to consider with respect to further diagnostic efforts.

Laboratory testing

Possible non-specific laboratory indicators 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 often consistent with disseminated intravascular coagulation (DIC)

such as a prolonged prothrombin time, partial thromboplastin time, and bleeding time. Filovirions, such as EBOV, may be identified by their unique filamentous shapes in cell cultures examined with electron microscopy, but this method cannot distinguish the various filo viruses.

Differential diagnosis

Early symptoms of EVD may be similar to those of other diseases common in Africa, including malaria and dengue fever. The symptoms are also similar to those of other viral hemorrhagic fevers such as Marburg virus disease.

The complete differential diagnosis is extensive and requires consideration of many other infectious diseases such as typhoid

fever, shigellosis, rickettsial diseases, cholera, sepsis, borreliosis, EHEC enteritis, leptospirosis, scrub typhus, plague, Q fever,

candidiasis, histoplasmosis, trypanosomiasis, visceral leishmaniasis, measles, and viral hepatitis among others.

PREVENTION

Infection control



Figure 7: British woman wearing protective gear

People who care for those infected with Ebola should wear protective clothing including masks, gloves, gowns and goggles. The US Centers for Disease Control (CDC) recommend that the protective gear leaves no skin exposed. These measures are also recommended for those who may handle objects contaminated by an infected person's body fluids. In 2014, the CDC began recommending that medical personnel receive training on the proper suit-up and removal of personal protective equipment (PPE); in addition, a designated person, appropriately trained in biosafety, should be watching each step of these procedures to ensure they are done correctly. In Sierra Leone, the typical training period for the use of such safety equipment lasts approximately 12 days.

Isolation

Isolation refers to separating those who are sick from those who are not. Quarantine refers to separating those who may have been

exposed to a disease until they either show signs of the disease or are no longer at risk. Quarantine, also known as enforced isolation, is usually effective in decreasing spread. Governments often quarantine areas where the disease is occurring or individuals who may transmit the disease outside of an initial area. In the United States, the law allows quarantine of those infected with ebola viruses.

Prognosis

EVD has a high risk of death in those infected which varies between 25 percent and 90 percent of those infected. As of September 2014, the average risk of death among those infected is 50 percent. The highest risk of death was 90 percent in the 2002–2003 Republic of the Congo outbreak.

Death, if it occurs, follows typically six to sixteen days after symptoms appear and is often due to low blood pressure from fluid loss. Early supportive care to prevent dehydration may reduce the risk of death.

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