A Review on: Ebola Virus Disease (EVD)

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ABSTRACT

Ebola virus is a fatal illness in humans and non primates. Ebola virus causes Ebola hemorrhagic fever. Ebola Virus Disease (EVD) is transmitted to people from wild animals and spread to humans through human to human transmission. EVD is caused by the sudden onset of weakness, muscle pain, headache, sore throat, fever, vomiting, diarrhoea, liver dysfunction, rashes and also internal- external bleeding. As such no specific treatment foe EVD is available but a number of researches are going on. Oral rehydration therapy or intravenous fluids are some of the treating symptoms.

Keywords: Ebola Hemorrhagic Fever, Ebola Virus, Ebola Virus Disease, Vaccine

INTRODUCTION

Ebola virus disease is a severe, often fatal, zoonotic filovirus infection caused by the virus of the Filoviridae family (genus Ebolavirus). There are five species: *Zaire ebolavirus, Sudan ebola virus, Taï Forest ebola virus, Bundibugyo ebola virus,* and *Reston ebola virus*. [1] Infections with Ebola viruses originating from Africa cause a severe disease in humans, known as Ebola virus disease (EVD). Ebola viruses and Marburg virus, another member of the Filoviridae family, are classified as bio-safety level 4 pathogens (BSL-4; risk group 4) and require special containment measures and barrier protection, in particular for healthcare workers. The map below presents the geographical distribution of Ebola outbreaks from 1976 to 2011 in Africa. Ebola virus is transmitted from person-to-person by direct contact with infected blood, secretions, organs, or semen. The electron micrograph of Ebola virus is as shown in figure no. 1 [2]

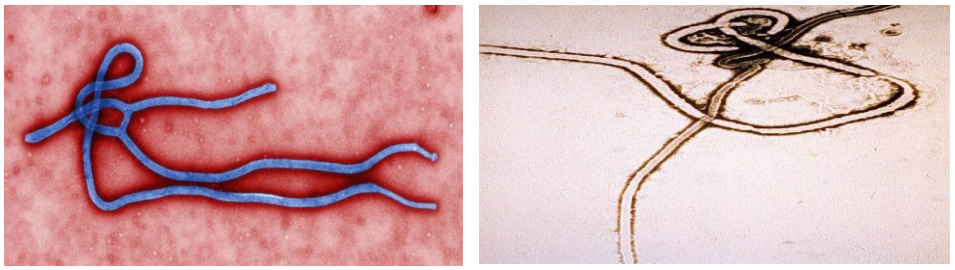


Figure 1: Electron micrograph of an Ebola virus virion

TRANSMISSION

Because the natural reservoir of Ebola viruses has not yet been proven, the manner in which the virus first appears in a human at the start of an outbreak is unknown. However, researchers have hypothesized that the first patient becomes infected through contact with an infected animal. When an infection does occur in humans, there are several ways in which the virus can be transmitted to others. These include:

- Direct contact with the blood or secretions of an infected person
- Exposure to objects (such as needles) that have been contaminated with infected secretions

The viruses that cause Ebola HF are often spread through families and friends because they come in close contact with infectious secretions when caring for ill persons. During outbreaks of Ebola HF, the disease can spread quickly within health care settings

(such as a clinic or hospital). Exposure to Ebola viruses can occur in health care settings where hospital staffs are not wearing appropriate protective equipment, such as masks, gowns, and gloves. Proper cleaning and disposal of instruments, such as needles and syringes, is also important. If instruments are not disposable, they must be sterilized before being used again. Without adequate sterilization of the instruments, virus transmission can continue and amplify an outbreak. The life cycle of Ebola virus is as shown in figure no. 2. [2]

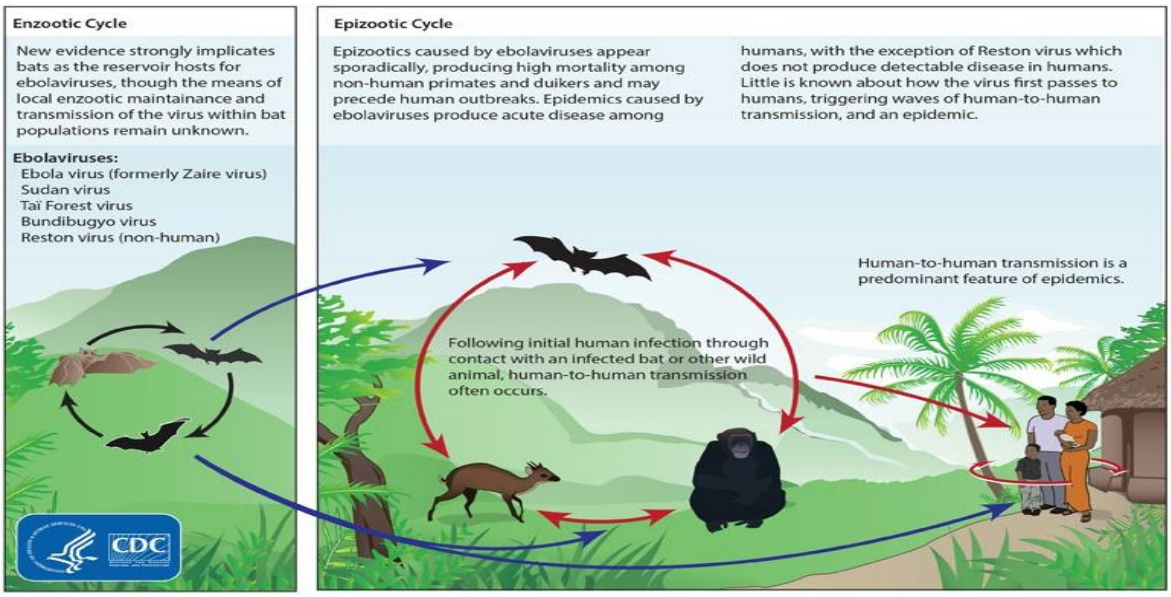


Figure 2: Life Cycle of Ebola Virus

SYMPTOMS

Symptoms of Ebola virus hemorrhagic fever can begin anywhere from 2 to 20 days after exposure to the virus. Ebola virus hemorrhagic fever usually begins with the sudden onset of fever, fatigue, muscle aches, and headache, followed by sore throat, vomiting, diarrhoea, and a rash. The disease can progress until the patient becomes very ill due to severe bleeding which causes kidney problems, liver problems, and shock. Many people who develop Ebola virus hemorrhagic fever will die. [3] Symptoms of Ebola virus is also shown in figure no. 3. [2]

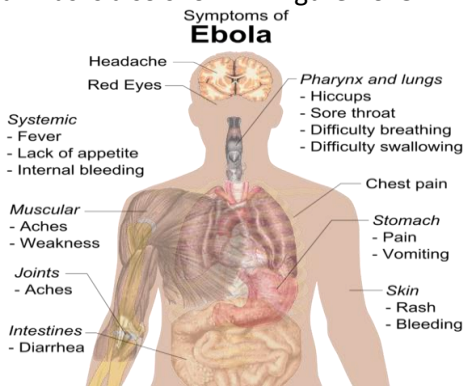


Figure 3: Symptoms of Ebola virus disease

CAUSES FOR EBOLA VIRUS

The virus is thought to be initially acquired by exposure to body fluids or tissue from infected animals, such as bats and non-human primates; however, the natural reservoir and mode of transmission to humans has not been confirmed. Laboratory testing of reservoir competence shows that successful infection is possible in bats and rodents, but not in plants or arthropods. Animal to human transmission may occur during hunting and consumption of the reservoir species or infected non-human primates. The practice of butchering or eating bush meat or food contaminated with bat faeces (three species of tree roosting bats have been implicated as a reservoir) is also thought to contribute. Human to human transmission occurs through contact with body fluids from infected patients. In early epidemics, the re-use of non-sterile injections was responsible for many healthcare associated transmissions. However, although this remains a risk, most cases result from close physical contact or contact with body fluids (such as sweat,

blood, faeces, vomit, saliva, genital secretions, urine, and breast milk) of infected patients. In a study of viral shedding in various body fluids, Ebola virus was isolated from saliva, breast milk, stool, tears, and semen up to 40 days after the onset of illness, confirming the possibility of delayed sexual transmission. Virus may be found in urine during recovery, and the duration of this phenomenon needs further study. Infection through inhalation is possible in non-human primates, but there is no evidence for airborne transmission in humans. Outside endemic areas, Ebola virus infection is rare and is usually imported. [4] Travellers from affected areas, and laboratory scientists and others working with potentially infected materials and animals, are at high risk.

DIAGNOSIS IN EBOLA VIRUS

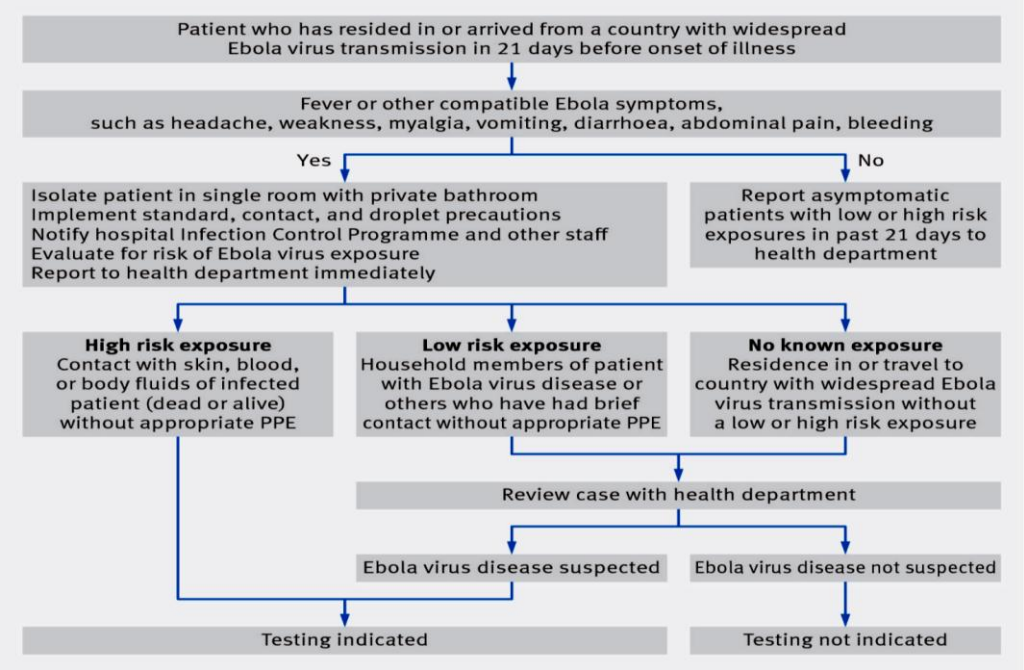
Diagnosing Ebola HF in an individual who has been infected for only a few days is difficult, because the early symptoms, such as red eyes and a skin rash, are nonspecific to ebola virus infection and is seen often in patients with more commonly occurring diseases. However, if a person has the early symptoms of Ebola HF and there is reason to believe that Ebola HF should be considered, the patient should be isolated and public health professionals notified. Samples from the patient can then be collected and tested to confirm infection. [5]

Laboratory tests used in diagnosis include as shown in table no. 1. [1] A diagnostic pathway is shown in figure no.4. [6]

Timeline of Infection	Diagnostic tests available
Within a few days after symptoms begin	Antigen-capture enzyme-linked immunosorbent assay (ELISA) testing | IgM ELISA | Polymerase chain reaction (PCR) | Virus isolation
Later in disease course or after recovery	IgM and IgG antibodies
Retrospectively in deceased patients	Immunohistochemistry testing | PCR| Virus isolation

Table 1: Diagnosis of Ebola Virus

Figure 4: Diagnostic pathway for the investigation of suspected Ebola virus infection



TREATMENT FOR EBOLA VIRUS

Treatment is primarily supportive in nature and includes minimizing invasive procedures, balancing fluids and electrolytes to counter dehydration, administration of anticoagulants early in infection to prevent or control disseminated intravascular coagulation, administration of procoagulants late in infection to control bleeding, maintaining oxygen levels, pain management, and the use of medications to treat bacterial or fungal secondary infections.

Early treatment may increase the chance of survival. A number of experimental treatments are being studied. The Animal Efficacy Rule exists, because the normal path for testing the safety and efficacy of drugs is not possible for diseases caused by dangerous pathogens or toxins. The FDA allowed two drugs, ZMapp and an RNA interference drug called "TKM-Ebola", to be used in people infected with Ebola under these programs during the 2014 outbreak. 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. TKM-Ebola is a small-interfering RNA compound, currently tested in a phase I clinical trial in people. [7]

MEDICATIONS FOR EBOLA VIRUS

Favipiravir looks like it may be useful in a mouse model of the disease. Estrogen receptor drugs used to treat infertility and breast cancer (clomiphene and toremifene) inhibit the progress of Ebola virus in infected mice. [8] Ninety percent of the mice treated with clomiphene and fifty percent of those treated with toremifene survived the tests. Given their oral availability and history of human use, these drugs would be candidates for treating Ebola virus infection in remote geographical locations, either on their own or together with other antiviral drugs.

PREVENTION AND CONTROL OF EBOLA VIRUS

If infection is suspected on the basis of initial screening, immediate isolation is warranted before any further investigations. This is crucial to reduce contact with other patients and healthcare workers while the patient is being investigated. Isolation measures should be continued until the patient has tested negative. Prevention includes decreasing the spread of disease from infected monkeys and pigs to humans. Efforts to help those who are infected are supportive and include giving either oral rehydration therapy (slightly sweet and salty water to drink) or intravenous fluids. The disease has high mortality rate: often killing between 50% and 90% of those infected with the virus. [9]

VACCINE FOR EBOLA VIRUS

No vaccine is currently available for humans. The most promising candidates are DNA vaccines or vaccines derived from adenoviruses vesicular stomatitis Indiana virus (VSIV) or filovirus-like particles (VLPs) because these candidates could protect nonhuman primates from ebolavirus-induced disease. DNA vaccines, adenovirus-based vaccines, and VSIV-based vaccines have entered clinical trials [10]. Vaccines have protected nonhuman primates. Immunization takes six months, which impedes the counter-epidemic use of the vaccines. Searching for a quicker onset of effectiveness, in 2003, a vaccine using an adenoviral (ADV) vector carrying the Ebola spike protein was tested on crab eating macaques. Twenty-eight days later, they were challenged with the virus and remained resistant . A vaccine based on attenuated recombinant vesicular stomatitis virus (VSV) vector carrying either the Ebola glycoprotein or the Marburg glycoprotein in 2005 protected nonhuman primates, opening clinical trials in humans. Trying the vaccine on a strain of Ebola that more resembles one that infects humans is the next step. On 6 December 2011, the development of a successful vaccine against Ebola for mice was reported. Unlike the predecessors, it can be freeze-dried and thus stored for long periods in wait for an outbreak [11]. An experimental vaccine made by researchers at Canada's national laboratory in Winnipeg was used, in 2009, to pre-emptively treat a German scientist who might have been infected during a lab accident. However, actual EBOV infection could never be demonstrated without a doubt .Experimentally, recombinant vesicular stomatitis Indiana virus (VSIV) expressing the glycoprotein of EBOV or SUDV has been used successfully in nonhuman primate models as post-exposure prophylaxis.

CONCLUSION

The entry and development of an infectious agent in the body of a person or animal. In an apparent "manifest" infection, the infected person outwardly appears to be sick. In an apparent infection, there is no outward sign that an infectious agent has entered that person at all. Ebola virus disease is transmitted by human to human. Still there is lack of treatment for the same and also no FDA-licensed blood donor screening test exists.

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