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Ebola: A Short Review

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ABSTRACT

A brief review on ebola virus disease (EVD) describing its epidemiology, causative organisms, clinical manifestations including its pathogenesis, diagnosis, prognosis and management has been made. The prophylactic and therapeutic measures available currently for the prevention and treatment of ebola and associated disease complications are also described herein. Several ebola vaccines available today are the mainstay for the prevention of such lethal viral infection.

Keywords: *Ebola, Ebola hemorrhagic fever, Yambuku village.*

INTRODUCTION

Ebola is an infectious disease of humans and other primates caused by ebola viruses. This disease is also known as ebola virus disease (EVD) or ebola hemorrhagic fever (EHF). It resembles other viral diseases which are accompanied by viral hemorrhagic fevers and also non-viral infectious diseases like malaria, cholera, typhoid fever etc. Because of unavailability of specific treatment or vaccine for the virus, the ebola has become currently a serious threat to human health worldwide. The name of this disease was derived from the *Ebola* river which is near to the *Yambuku* village where the first outbreak of the disease was identified in the year 1976 [1]. According to the World Health Organization, a total of 24 outbreaks involving 1,716 cases of ebola have been reported between 1976 and 2013. The largest outbreaks are the tropical regions of sub-Saharan Africa and Western Africa centered in Guinea, Sierra Leone and Liberia where ebola is seriously epidemic. As of 12 March 2015, a total of 24,544 cases have been reported which resulted in 10,111 deaths [2-6].

Causative Organisms:

Four of the five viruses of the genus *Ebolavirus* are responsible for causing EVD in humans. These are namely, Bundibugyo virus (BDBV), Sudan virus (SUDV), Taï Forest virus (TAFV) and Ebola virus (EBOV, formerly Zaire ebolavirus). EBOV species is the most dangerous among all EVD causing viruses, and is responsible for the largest number of outbreaks. The fifth virus, Reston virus (RESTV) is not responsible for causing disease in humans, but it causes disease in other primates [7, 8]. The disease spreads through direct contact with body fluids, such as blood of an infected human or other animal. The spread of the disease through air between primates, including humans has not yet been documented [9, 10].

Clinical Manifestations:

Signs and symptoms:

The symptoms of ebola include feeling tired, fever, weakness, decreased appetite, muscle pain, joint pain, headache, and sore throat. The fever is usually higher than 38.3°C (101 °F) which is followed by vomiting, diarrhea and abdominal pain. The normal function of the liver and kidneys are impaired. The shortness of breath and chest pain may also occur along with swelling and confusion. In about half of the clinical cases, the skin may develop a maculopapular rash, a flat red area covered with small bumps which is seen 5 to 7 days after symptoms begin. The incubation period (length of time between exposure to the virus and the development of symptoms) is between 2 to 21 days, usually between 4 to 10 days. In some cases, internal and external bleeding may occur. This typically begins five to seven days after appearance of first symptoms. Bleeding from mucous membranes or from sites of needle punctures has been reported in 40–50 percent of the cases. This may lead to vomiting blood, coughing up of blood, or blood in stool. Bleeding into the skin may cause petechiae, purpura, ecchymoses or hematomas (especially around needle injection sites). Bleeding into the whites of the eyes may also occur. Heavy bleeding is uncommon; if it occurs, it is usually located within the gastrointestinal tract [11-16].

Pathogenesis:

The replication of EBOV resembles replication of other filoviridae (Filoviral infection) in human body. This viral replication ultimately leads to a septic state by triggering the release of high levels of inflammatory chemical mediators. EBOV infects human through contact with mucous membranes or through skin breaks. After got infected, the main targets of the virus are endothelial cells, liver cells, and several types of immune cells such as macrophages, monocytes, and dendritic cells. Further reproduction of the virus takes place in nearby lymph nodes since the immune cells carry the virus to lymph nodes. From lymph nodes the infection spreads throughout the body through blood stream and lymphatic system [17-19].

Endothelial cells may be infected within 3 days after exposure to the virus. The breakdown of endothelial cells leading to blood vessel injury occurs due to the synthesis of ebola virus glycoprotein (GP), which reduces the availability of specific integrins responsible for cell adhesion to the intercellular structure and causes liver damage, leading to improper clotting. The dysfunction in bleeding and clotting commonly seen in EVD has been attributed to increased activation of the extrinsic pathway of the coagulation cascade due to excessive tissue factor production by macrophages and monocytes. The infection of macrophages and other white blood cells, such as lymphocytes causes programmed cell death leading to an abnormally low concentration of macrophages and lymphocytes in the blood. These results in weakened immune response seen in those infected with EBOV. The presence of viral particles and the cell damage resulting from viruses budding out of the cell causes the release of chemical signals (such as TNF-α, IL-6 and IL-8), which are molecular signals for fever and inflammation. EBOV proteins interfere with the immune cells' ability to produce interferon proteins such as interferon-alpha, interferon-beta, and interferon gamma and there by blunt the human immune system's response to viral infections [18, 20, 21].

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Diagnosis:

When an individual is suspected with EVD his/her travel and work histories along with exposure to wildlife are important factors to be considered for the diagnosis of the disease. Blood samples are collected and tested for viral RNA, viral antibodies or for the virus itself to confirm the disease. 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 [22].

In microbiological examination, filovirions, such as EBOV, can be identified by their unique filamentous shapes in cell cultures examined under electron microscopy, but this method cannot distinguish the various filoviruses [23].

The specific diagnosis of EVD can be done either by detecting viral RNA in cell culture by polymerase chain reaction (PCR) or by detecting viral proteins or antibodies in patient's blood sample by enzyme-linked immunosorbent assay (ELISA). These methods are best employed in the early stages of the disease. Detecting antibodies against the virus is most reliable in the later stages of the disease. IgM antibodies are detectable two days after the onset of symptoms and IgG antibodies can be detected 6 to 18 days after first symptoms begins [24].

Management and Treatment:

The treatment of ebola is primarily supportive in nature. Early supportive care with rehydration (by oral or intravenous route) and symptomatic treatment improves survival. The supportive care is given to prevent dehydration which may reduce the risk of death. The symptomatic treatment includes management of pain, nausea, fever and anxiety. The World Health Organization (WHO) recommends avoiding the use of aspirin or ibuprofen for the treatment of pain due to the bleeding risk associated with the use of these medications [25, 26].

Blood products such as packed red blood cells, platelets or fresh frozen plasma may be used to compensate the blood loss due to bleeding and restore normal blood volume. Moreover, heparin is used to prevent intravascular coagulation and other clotting factors to decrease bleeding. Antimalarial medications and antibiotics are often used before the diagnosis is confirmed though there is no evidence which suggest that such treatment helps. In case of unavailability of hospital care, the WHO has prescribed guidelines for care at home that have been relatively found successful. Such care includes using towels soaked in bleach solutions when moving infected people or bodies and applying bleach on stains. It is also recommended that the care givers wash their hands with bleach solutions and cover their mouth and nose with cloths. However, intensive care includes maintaining blood volume and electrolytes (salts) balance as well as treating any bacterial infections that is likely to develop. Dialysis can be done in kidney failure, and extracorporeal membrane oxygenation can be used for lung dysfunction [25, 27].

Several promising vaccine candidates have been shown to prevent lethal infection of EVD in nonhuman primates. These vaccines include replication-deficient adenovirus vectors, replication-competent vesicular stomatitis (VSV) and human parainfluenza (HPIV-3) vectors, and virus-like particle preparations [28].

Prognosis:

The disease has a high risk of death, killing about 25-90 percent of infected people. Death occurs 6-16 days after appearance of symptoms and is often due to low blood pressure from fluid loss. If an infected person survives, recovery may be quick and complete. Prolonged clinical cases are often complicated by the occurrence of long-term problems, such as inflammation of the testicles, joint pains, muscle pains, skin peeling, or hair loss etc. Eye symptoms, such as light sensitivity, excess tearing, iritis, iridocyclitis, choroiditis, and blindness are also seen [29].

CONCLUSION

Because of poor treatment status ebola has currently become a life threatening infectious illness in the developing world. Therefore, development of reliable diagnostic tests through specific molecular marker identification and discovery of new antiviral vaccines are urgently needed to combat the ebola viral disease.

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