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Ebola - A fatal Emerging Zoonotic Disease: A Review

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Abstract

Zoonotic viral diseases are one of the threats to human health . Ebola virus is a filamentous virus which results in acute hemorrhagic fever in men and is assumed to pass on to humans by means of animals. The *Filoviridae* family consists of 3 genera, *Cuevavirus* ,*Marburgvirus* and *Ebolavirus*. This virus contain a large, un-fragmented, negative-stranded RNA that encodes glycoproteins, nucleoproteins, viral proteins, and certified RNA polymerase. Ebola virus disease has become a global health concern due to deaths and its rapid outbreaks. Here, the important aspects of the emerging Ebola disease outbreak, how it is transmitted from its natural reservoirs to humans, its pathogenesis, and some ways to prevent it are reviewed. The virus is spread through direct contact with the blood, secretions, organs, or other body fluids of infected wild animals or fruit bats, or through human or indirect contact with an environment contaminated with these fluids. Fruit bats are thought to be the natural carrier that can spread the virus without being affected by it. There is no known effective treatment available. Isolation of exposed animals is essential while severe contagion controlling measures are followed to inhibit transmission of the virus. Health education is important to prevent more people.There is an urgent need for specialists at all levels and in every country to increase care and work with the One Health system in order to be more effective in our battle against emerging diseases of zoonotic origin.

Keywords :*zoonotic disease , Ebola virus, fruit bats.*

Introduction

About 75% of emerging infectious diseases may be zoonotic .Zoonoses are the most important risk factor for human health and well-being when it comes to infectious diseases.This zoonotic infectious diseases outbreak poses many threats to humans[1,2]. Ebola virus disease (EVD) is one of the most deadly viral diseases that affects both humans and primates[3]. The Ebola virus (EV) backs to the family *Filoviridae*, in the order Mononegavirales which take in *Rhabdoviridae* and *Paramyxoviridae*. It was called "Ebola", after a small river near the Catholic Mission of Yambuku, the epicenter of the 1976 epidemic [4-6]. This epidemic disease is characterized by fever, extreme fatigue, joint pain, with haemorrhagic manifestations that lead to fatal environments like shock, organ dysfunction and death[7]. The first outbreak was in Nizara (Sudan) at the end of June 1976, 3 cotton factory workers were reported. However, the route of infection has not been described[8]. Then, in September of the same year, another outbreak occurred near the village of Yambuku (Congo)[9].The outbreak turned into an epidemic in 2014 when an 18-month-old boy from the village of Miliando, in southern Guinea, was infected. This boy was infected by bats or their body fluids[10,11]. Ebola hemorrhagic fever has been associated with large human outbreaks, with case fatality rates as high as 90%. There is some environmental data indicating that EV has played a role to a decrease of up to 98% of home-grown abundant people in Gabon and the Republic of the Congo. Due to the high death rates of Ebola, it is considered as deadliest zoonotic viral diseases in man.To date, no ratified antiviral drugs or vaccines to Filoviruses were figured out[12,13].

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Preventing this zoonosis disease involves enhancing our understanding of some important aspects of the disease, particularly transmission from major reservoirs of disease to humans, pathogenesis of this fatal virus , and measures of prevention.

Ebola virus

Based upon the Baltimore V taxonomy system, *Filoviridae* family embraces triple genera, *Cuevavirus*, *Marburgvirus* and *Ebolavirus*[14]. The genus *Ebolavirus* includes 5 species and each type represents one virus: *Sudan ebolavirus*, *Reston ebolavirus*, *Bundibugyo ebolavirus*, *Tai ebolaforestvirus*, and *Ebola virus*[15].This virus has a complex structure, the viral genome is represented by a single-polar RNA negative molecule, which organizational proteins related with nucleocapsid are nucleoprotein (NP), VP30, VP35, and polymerase protein (L). The virus is surrounded by infected cells and glycoproteins on the outside. As for the membrane-bound proteins, they are matrix protein (VP40), VP24, and peplomer glycoprotein (GP) . Encapsulation of the nucleocapsid is accomplished by an external viral covering making out of the hosting cell membrane with length about 10 nm viral glycoprotein (GP) mutations that initiate binding[16-18]. As shown in figure 1.

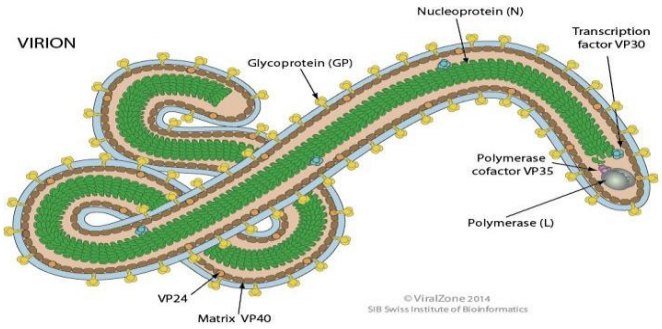

Figure (1): Ebola virus structure

Reservoir

The exact natural reservoir of infection is not yet known, but it is clear that the virus has an zoonotic origin[19]. Researches to discover the host reservoir have shown that Ebola passes on to humans by close connection with the blood, secretions, meat, organs, or other body liquids of diseased animals like monkeys, chimpanzees, gorillas, bats, forest antelope and porcupines in the rainforest. That non-human prelates and other mammals were involved in the earlier cases of Ebola virus disease, and the hosting reservoir has not yet been maintained, they appears likely that the candidate reservoir are the triple kinds of fruit bats (*Hypsignathusmonstrosus, Epomopsfranqueti and Myonycteristorquata*) [20,21].

Transmission

Figure (2) summarizes the ways of transmitting the Ebola virus. It is passed on to human through connection with the skin or through bodily liquids released by animals having infected, like a monkey, chimpanzee, or fruit bat. Via medical supplies used to treat Ebola patients. Consuming raw infected meat, like bats or chimpanzees, is a major cause of oral transmission of the Ebola virus, especially in African

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countries.Animals could be possibly becoming infected once they consume parts of fruit which were eaten by bats that carry the virus[22-27] .Counting on the Centers for Disease Control and Prevention taxonomy, the Ebola virus is classified as a level 4 and class A biological pathogen with a high potential for nationally conduction[28].Airborne transmission only occurs in lab settings, specifically out of pigs to prelates, but not from primates to primates.As for the outbreak of the Ebola virus through food or water except bushmeat, it was not detected. Also, there have been no reports of mosquitos or other insects spreading the disease. reported[29,30].Pigs infected with Ebola virus disease have very high concentrations of virus in their lungs, compared to their bloodstream. Thus, they will transmit disease by dropping disease-causing particles in the air or on the ground. when sneezing or coughing[31,32].Corpses remain infectious, so people who handle human remains in traditional burial rituals or embalming are at risk of infection [33].

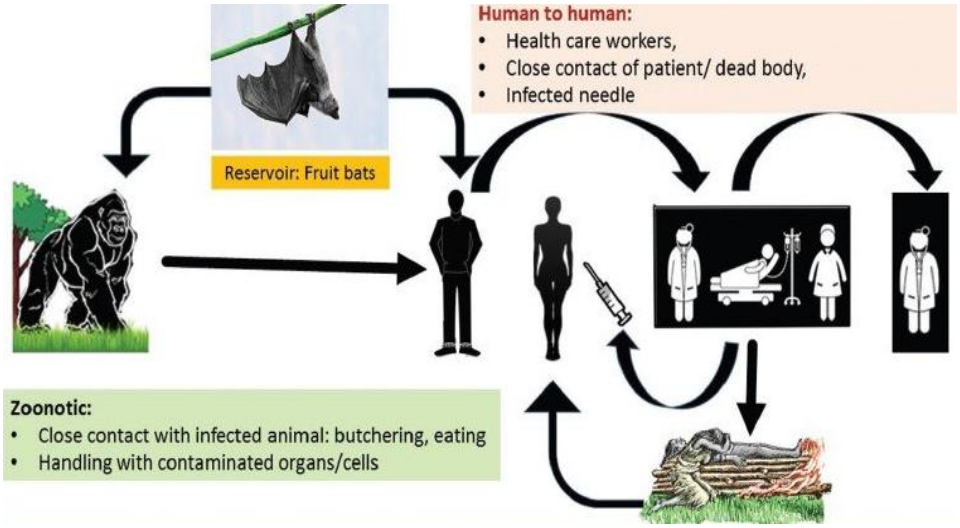

Figure (2) : Mode of Ebola virus transmission

Pathogenesis

In humans, Ebola virus infection happens when contaminated body fluids come into contact with mucous membranes or skin wounds, allowing viruses to enter without coming into close contact with target cells (figure3). This virus infects adrenal cells, endothelium, dendritic cells, macrophages, monocytes, and cells of Kupffer found within the liver, according to in vivo experiments in nonhuman primates (NHP). The ability of Ebola virus's GP1 to contact with a number of hosting cell proteins is largely responsible for this variation of target cells. [34,35].Infected corpse tissues exhibited enormous many viruses with widespread necrosis in parenchyma for various parts of the body, such as the kidneys, liver, spleen, and reproductive organs [36]. Subsequently, Once the causative agent has been transmitted and lack of interest in healthcare, improper immunity, failure of the affected organs, impaired blood vessels and thrombosis lead to a loss of life 10 days after complications begin [37]. Virus level in the blood of an infected patient has been associated with a potentially fatal infection [38]. The main target of Ebola virus are the lymphoid organs. Dendritic cells and macrophages are targets of the virus capable of spreading the virus to nearby lymph nodes. Upon entering lymphoid tissue, retinal fibroblasts (FRC), which are located in the T-cell region of the cortex, become infected. FRC injury is associated with apoptosis in lymphocytes. On the other hand, histopathological analyzes of EV infection in NHP models inside lymph nodes showed enormous lymphocyte damage, wastage of follicular structure

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withshattering parenchyma. This strong destruction of the structure of the lymphatic organ possibly justifyfor the immunosuppression noticed during EV disease[39,40].Another potentially fatal feature isDisruption of the endothelium that causes permeability of the blood tissue barrier. This, in turn, leads to vascular permeability, blood outflow, Incomplete haematological rotation,as well as intravascular coagulation that contribute to disease strictness[41,42].Hemorrhagic episodes have also been observed during different EV outbreaks[43]. Diffuse intravascular coagulationsyndrome, which is characterised by triggering the clotting system and the formation of a blood clot, is another irregularity in the coagulation process seen in EV disease. This is related to the disease severity[44].

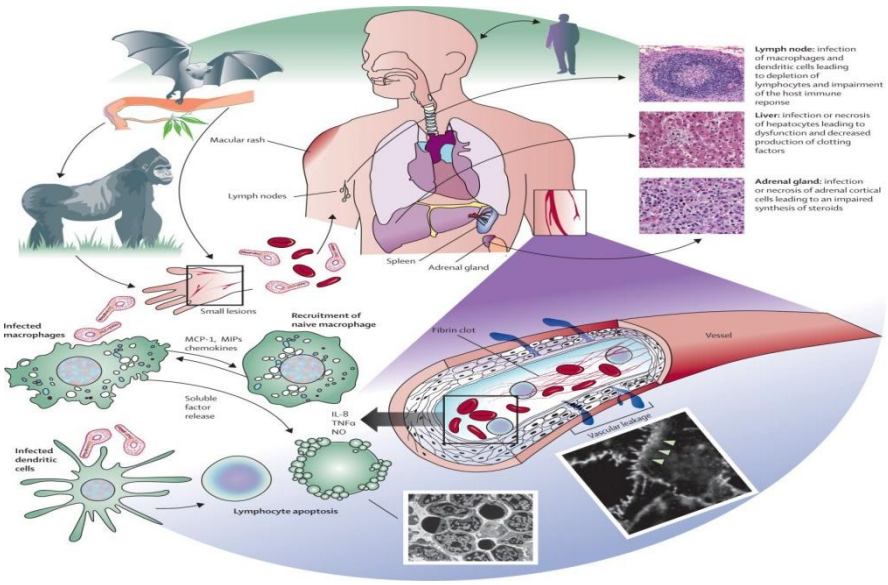

Figure (3) :Pathogenesis of the Ebola virus[45]

Prevention

Health education for high-risk groups such as doctors, nurses, veterinarians, etc. Health care workers should use personal protective clothing to prevent exposure to blood and body fluids that may be contaminated. Also, all equipment and façades that possibly in contact with body liquids must be hygienic.Bury infected dead people with caution and avoid contact with them.Avoiding direct contact with bush meat (wild animals that are hunted for sustenance) and bats (which are the primary natural host for the Ebola virus) could get rid of the risk of catching the Ebola virus to humans[46,47]. Animals suspected of being infected should be stated instantly in order to defend people exposed to them and to help control outbreaks.Suspected and infected animals need to be isolated after confirmation of disease[48]. Implementation of severe infection controlling measures is essential to inhibit passing on the virus when infected.

Conclusions

Ebola virus disease is a sample of viral epidemics of animal origin that are emerging on humans and are dangerous and dead on them.This epidemic is a source of great public health concern, especially in Africa, so there is an urgent need for an effective vaccine.The natural reservoir for zoonotic viruses is the main link in emerging infectious diseases.It is imperative that health workers, scientists and specialists at all levels - physicians, veterinarians, biologists and others - work together in every country to increase the care and maximize One Health practices so that we can be more effective in our future battle against

emerging and re-emerging zoonotic diseases.

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