

Ebola as an Emerging and Re-Emerging Disease in Africa: Its Conceptual Frame Work and the Missing Link

Agharese Efe-Aigbovo

Department Of Human Kinetics And Sports Science, Faculty Of Education, University Of Benin, Benin City

Fidelis Uchendi Okafor

Department Of Nursing Science, School Of Basic Medical Sciences, University Of Benin, Benin City

Abstract

Ebola has been identified as one of the emerging and re-emerging diseases in Africa. The present paper discusses its conceptual framework and the missing link under: Ebola concept and its historical background, Signs and symptoms, the risk factors, transmission mode, preventive and control measures and the treatment options which are operating primarily as supportive management in nature presently rather than offering curative treatment modalities. Proactive activities rather than complacency towards preventing and controlling Ebola infections should be highly encouraged to avoid re-emerging of the disease in African countries.

Key word: Ebola, emerging and re-emerging, missing link, complacency, Proactive activities.

Introduction

In contemporary times, some diseases have been identified as emerging and re-emerging in Africa. Some of such diseases include: Malaria, Ebola virus, HIV/AIDS, STIs, polio, heart diseases tuberculosis, leprosy, measles, cholera, chicken pox and guinea worms. In some cases, the cause of the re-emergence is unknown while in other cases, it is attributable to the resistance of the disease causative factor(s) to existing preventive and or treatment modalities. It is on this premise that the present discourse has been delimited to Ebola Disease. The outbreak of Ebola has witnessed (emerged and re-emerged) periods in African countries such as the Democratic Republic of Congo, Zaire, Sudan, Sierra Leone, Senegal, Liberia and Nigeria. Sometimes, the gap in the re-emergence may be up to weeks, months, years or even decades.

The matters arising from the topic shall be discussed under the following Sub-headings:

- (a) Ebola concept and its historical background
- (b) Signs and Symptoms
- (c) Sources/ Causes of the Disease
- (d) Mode of Transmission of Ebola Virus
- (e) Preventive and Control Measures
- (f) Treatment of Ebola Disease

Ebola Concept and the Historical Background

Ebola virus disease (EVD), Ebola hemorrhagic fever (EHF) or simply Ebola is a disease of humans and other mammals caused by an Ebola virus. Ebola, previously known as Ebola hemorrhagic fever, is a rare and deadly disease caused by infection with one of the Ebola virus strains (WHO, 2014). Ebola can cause disease in humans and nonhuman primates (monkeys, gorillas, and chimpanzees) and the viruses have been found in several African countries (CDC, 2014). It was first discovered in 1976 near the Ebola River in what is now the Democratic Republic of the Congo (Simpson, 1977). Since then, outbreaks have appeared sporadically in Africa. The natural reservoir host of Ebola virus remains unknown. However, on the basis of evidence and the nature of similar viruses, researchers believe that the virus is animal-borne and that bats are the most likely reservoir (CDC, 2014). Four of the five virus strains occur in an animal host native to Africa.

Signs and Symptoms

Symptoms of Ebola virus start two days to three weeks after contracting the virus, with a fever, sore throat, chest pain, hiccups, shortness of breath, trouble swallowing, muscle pain, and headaches. Typically, vomiting, diarrhea, loss of appetite and rashes follow, along with decreased function of the liver and kidneys. Around this time, affected people may begin to bleed both within the body and externally (WHO, 2014; Gatherer, 2014; CDC, 2014). Death, if it occurs, is typically 6 to 16 days from the start of symptoms and often due to low blood pressure from fluid loss (Sunit, Singh & Daniel, 2014). The average time between contracting the infection and the start of symptoms (incubation period) is 8 to 10 days, but it can vary between 2 and 21 days (CDC, 2014; WHO, 2014).

In about 5-50% of cases, skin manifestations may include a maculopapular rash : a flat, area on the skin that can be red in white skinned people covered with small joined bumps (Hoenen, Groseth, Falzarano & Feldmann, 2006; WHO, 2014). Early symptoms of EVD may be similar to those of malaria, dengue fever, or other tropical fevers, before the disease progresses to the bleeding phase (Gatherer, 2014). In 40–50% of cases, bleeding from puncture sites and mucous membranes (e.g., gastrointestinal tract, nose, vagina, and gums) has been reported (CDC, 2014). In the bleeding phase, which typically begins five to seven days after first symptoms, internal and subcutaneous bleeding may present itself in the form of reddened eyes and bloody vomit (Simpson, 1977; Gatherer, 2014). Bleeding into the skin may create petechiae, purpura, ecchymoses, and hematomas (especially around needle injection sites). Sufferers may cough up blood, vomit it, or excrete it in their stool (Hoenen, Groseth & Feldmann, 2012).

Heavy bleeding is rare and is usually confined to the gastrointestinal tract (Fisher-Hoch, Platt, Neild, Southee, Baskerville, Raymond, Lloyd & Simpson, 1985; Hoenen, Groseth, Falzarano & Feldmann, 2006). In general, the development of bleeding symptoms often indicates a worse prognosis and this blood loss can result in death (Gatherer, 2014). All people infected show some signs of circulatory system involvement, including impaired blood clotting (Hoenen, Groseth, Falzarano & Feldmann, 2006). If the infected person does not recover, death due to multiple organ dysfunction syndrome occurs within 7 to 16 days (usually between days 8 and 9) after first symptoms (Simpson, 1977).

Sources/Causes of the Disease

Ebola virus disease, according to Hoenen, Groseth and Feldmann (2012), is caused by four of five viruses classified in the genus *Ebola virus*, family *Filoviridae*, order *Mononegavirales*. The four disease-causing viruses are Bundibugyo virus (BDBV), Sudan virus (SUDV), Tai Forest virus (TAFV), and one called, simply, Ebola virus (EBOV, formerly Zaire Ebola virus). Ebola virus is the only member of the *Zaire Ebola virus* species and the most dangerous of the known EVD-causing viruses, as well as being responsible for the largest number of outbreaks (Th Kuhn, Becker, Ebihara, Geisbert, Johnson, Kawaoka, Lipkin, Negredo, Netesov, Nichol, Palacios, Peters, Tenorio, Volchkov & Jahrling (2010). Hoenen, Groseth and Feldmann (2012) further stated that the fifth virus, Reston virus (RESTV), is not thought to be disease-causing in humans and the five viruses are closely related to Marburg viruses.

Mode of Transmission of Ebola Virus

Ebola isn't as contagious as more common viruses like colds, influenza, or measles. It spreads to people by contact with the skin or bodily fluids of an infected animal, like a monkey, chimpanzee, or fruit bat. Then, it moves from person to person the same way. Those who care for a sick person or bury someone who has died from the disease often get it. Other ways to get Ebola include touching contaminated needles or surfaces but cannot be contacted from air, water, or food. A person who has Ebola but has no symptoms can't spread the disease either. WHO (2014) stated that male survivors may be able to transmit the disease via semen for nearly two months. To diagnose EVD, other diseases with similar symptoms such as malaria, cholera and other viral hemorrhagic fevers are first excluded.

Human-to-human transmission occurs only via direct contact with blood or body fluid from an infected person (including embalming of an infected dead body), or by contact with objects contaminated by the virus, particularly needles and syringes (CDC, 2014). Other body fluids that may transmit Ebola viruses include saliva, mucus, vomit, feces, sweat, tears, breast milk, urine, and semen. Entry points include the nose, mouth, eyes, or open wounds, cuts and abrasions (CDC, 2014). Transmission from other animals to humans occurs only via contact with, or consumption of, an infected mammal, such as a fruit bat, or ape. The potential for widespread EVD infections in countries with medical systems capable of observing the correct medical isolation procedures where needed is considered low as the disease is only spread by direct contact with the secretions from someone who is showing signs of infection (CDC, 2014).

As transmission via air is generally ruled out, the possibility of transmission between non-seat-mate airline passengers is also generally ruled out (WHO, 2014). Because dead bodies are still infectious, traditional burial rituals may spread the disease. Nearly two thirds of the cases of Ebola infections in Guinea during the 2014 outbreak are believed to have been contracted via unprotected (or unsuitably protected) contact with infected corpses during certain Guinean burial rituals (Chan, 2014; WHO, 2014). Semen may be infectious in survivors for up to 7 weeks (WHO, 2014). CDC (2014) pointed out that, it is not entirely clear how an outbreak is initially started. The initial infection is believed to occur after an Ebola virus is transmitted to a human by contact with an infected animal's body fluids.

CDC (2014) stated that the primary reasons for spread is that the health systems function poorly in parts of Africa where the disease mostly occurs. Medical workers who do not wear appropriate protective clothing may contract the disease. Hospital-acquired transmission has occurred in the United States and African countries due

to the reuse of needles or lack of body substance isolation (Chartier, Emmanuel, Pieper, Pruss, Rushbrook, Stringer, Townend, Wilburn & Zghond, 2014). Human consumption of equatorial animals in Africa in the form of bush meat has been linked to the transmission of diseases to people, including Ebola. Bats are considered the most likely natural reservoir of EBOV. Plants, arthropods, and birds were also considered (WHO, 2014). In the wild, transmission may occur when infected fruit bats drop partially eaten fruits or fruit pulp, then land mammals such as gorillas and duikers may feed on these fallen fruits.

This chain of events forms a possible indirect means of transmission from the natural host species to other animal species, which has led to research into viral shedding in the saliva of fruit bats. Fruit production, animal behaviour, and other factors vary at different times and places that may trigger outbreaks among animal populations (Gonzalez, Pourrut & Leroy, 2007). Bats were known to reside in the cotton factory in which the first cases of the 1976 and 1979 outbreaks were observed, and they have also been implicated in Marburg virus infections in 1975 and 1980 (Pourrut, Kumulungui, Wittmann, Moussavou, Délicat, Yaba, Nkoghe, Gonzalez & Leroy, 2005). Of 24 plant species and 19 vertebrate species experimentally inoculated with EBOV according to Swanepoel, Leman, Burt, Zachariades, Braack, Ksiazek, Rollin, Zaki and Peters (1996), only bats became infected.

In a 2002–2003 survey of 1,030 animals including 679 bats from Gabon and the Republic of the Congo, 13 fruit bats were found to contain EBOV RNA fragments (Leroy, Kumulungui, Pourrut, Rouquet, Hassanin, Yaba, Délicat, Pawesk, Gonzalez & Swanepoel, 2005). Antibodies against Zaire and Reston viruses have been found in fruit bats in Bangladesh, thus identifying potential virus hosts and signs of the filo viruses in Asia (Olival, Islam, Yu, Anthony, Epstein, Khan, Khan, Cramer, Wang, Lipkin, Luby & Daszak, 2013). Traces of EBOV were detected in the carcasses of gorillas and chimpanzees during outbreaks in 2001 and 2003, which later became the source of human infections. However, the high lethality from infection in these species makes them unlikely as a natural reservoir (Pourrut et al, 2005). Transmission between natural reservoir and humans is rare, and outbreaks are usually traceable to a single case where an individual has handled the carcass of gorilla, chimpanzee or duiker (Perterson, Bauer & Mills, 2004).

Preventive and Control Measures

There's no cure for Ebola, though researchers are working on it. Management is primarily supportive in nature (WHO, 2014). Measures may include management of pain, nausea, fever and anxiety, as well as rehydration via oral or by intravenous route (Fauquet, 2005). Doctors manage the symptoms of Ebola with:

- Fluids and electrolytes
- Oxygen
- Blood pressure medication
- Blood transfusions
- Treatment for other infections

There is no vaccine to prevent Ebola. The best way to avoid catching the disease is by not traveling to areas where the virus is found. Health care workers can prevent infection by wearing masks, gloves, and goggles whenever they come into contact with people who may have Ebola. There is no vaccine or cure, and testing to confirm the virus must be done with the highest level of biohazard protection. Severely ill patients require intensive supportive care. Patients are frequently dehydrated and require oral rehydration with solutions containing electrolytes or intravenous fluids. A significant problem with the current outbreak is that families lose faith in Western medicine, which cannot yet cure the patients. They then take them home to traditional village healers, who often mismanage the situation and thus allow the disease to spread. According to the US CDC (2014), treatment for now is thus limited and merely supportive of the body's immune function: providing fluids, electrolytes and oxygen; keeping blood pressure constant; and treating additional infections with antibiotics.

It is unclear why some people infected with the virus survive where so many do not, but it is thought to relate to the strength of the individual's immune system, the strain of the virus and the viral dose the person has been exposed to. In addition to supportive and symptomatic treatment, health workers can only really control the spread of the virus: isolating those infected, raising awareness of the virus and how it is spread in affected communities, ensuring appropriate protective gear is worn by all in contact with Ebola sufferers and ensuring the quick and safe burial of those who have succumbed.

As regards infection control, the Ebola virus is only transmitted via direct contact with the body fluids of an infected mammal (CDC, 2014). Risk of transmission does not end with a person's death, and thus it is recommended that the bodies of people who have died from Ebola be buried or cremated only with proper care (Blaine, 2000). The risk of transmission is increased amongst Ebola caregivers. Recommended measures when caring for people infected with Ebola include barrier-isolation, sterilizing equipment and surfaces, and wearing protective clothing including masks, gloves, gowns, and goggles (CDC, 2014). If a person with Ebola dies, direct contact with the body of the deceased patient should be avoided (CDC, 2014). The care of those individuals who

have become infected with Ebola must be administered while carefully observing a very high-level of barrier-separation from the person infected, along with various certain cleaning and disinfection techniques.

Education of those who provide care in these techniques, and the provision of such barrier-separation supplies has been a priority of the Doctors without Borders organization (CDC, 2014). Successfully addressing one of the "biggest danger(s) of infection" faced by medical staff requires their learning how to properly suit-up with personal protective equipment and to remove it afterwards. In Sierra Leone, the typical training period for the use of such safety equipment lasts approximately 12 days (WHO, 2014).

One step recommended by the World Health Organization (2014) is the education of the general public of the risk factors for Ebola infection and of the protective measures individuals can take (WHO, 2014). These include avoiding direct contact with infected people and regular hand washing using soap and water (Plan International, 2014). Bush meat, an important source of protein in the diet of some Africans, should be handled with appropriate protective clothing and thoroughly cooked before consumption (WHO, 2014). Some research suggests that an outbreak in the wild animals used for consumption may result in a corresponding human outbreak. Since 2003, such outbreaks have been monitored through surveillance of animal populations with the aim of predicting and preventing Ebola outbreaks in humans (Rouquet, Froment, Bermejo, Kilbourn, Karesh, Reed, Kumulungui, Yaba, Délicat, Rollin, & Leroy, 2005).

Older burial rituals, which might have included making any kind of direct contact with a corpse, require reformulation such that they consistently maintain a proper protective barrier between the corpse and the living (Rouquet et al, 2005; WHO, 2014). Social anthropologists may help find alternatives to traditional rules for burials. Ebola viruses can be eliminated with heat (heating for 30 to 60 minutes at 60 °C or boiling for 5 minutes). On surfaces, some lipid solvents such as some alcohol-based products, detergents, sodium hypochlorite (bleach) or calcium hypochlorite (bleaching powder), and other suitable disinfectants at appropriate concentrations can be used as disinfectants (Alazard-Dany, Ottmann, Volchkov, 2006 ; WHO, 2014). In laboratories where diagnostic testing is carried out, biosafety level 4-equivalent containment is required, since Ebola viruses are World Health Organization Risk Group 4 pathogens. Laboratory researchers must be properly trained in BSL-4 practices and wear proper personal protective equipment.

Quarantine also known as enforced isolation, is usually effective in decreasing spread (Schultz, 2009; Lewis, 2014). Governments often quarantine areas where the disease is occurring or individuals who may be infected. In the United States, the law allows quarantine of those infected with Ebola viruses. During the 2014 outbreak, Liberia closed schools. On October 16, 2014, some schools were closed in Ohio and Texas as a precaution after one of two nurses who contracted Ebola after caring for Dallas Ebola victim, Thomas Eric Duncan who had returned to the Cleveland area and may have been on the same plane as some students and teachers from those schools (Choi & Croyle, 2013).

Another technique is Contact Tracing which is regarded as important approach to contain an outbreak. It involves finding everyone who had close contact with infected individuals and watching for signs of illness for 21 days. If any of these contacts comes down with the disease, they should be isolated, tested, and treated. Then repeat the process by tracing the contacts' contacts (Clark, Jahrling & Lawler, 2012).

Treatment of Ebola Diseases

No Ebola virus-specific treatment is currently approved. However, survival is improved by early supportive care with rehydration and symptomatic treatment (Blaine, 2000). Treatment is primarily supportive in nature. These measures may include management of pain, nausea, fever and anxiety, as well as rehydration via the oral or by intravenous route. Blood products such as packed red blood cells, platelets or fresh frozen plasma may also be used. Other regulators of coagulation have also been tried including heparin in an effort to prevent disseminated intravascular coagulation and clotting factors to decrease bleeding (Fauquet, 2005). Antimalarial medications and antibiotics are often used before the diagnosis is confirmed, though there is no evidence to suggest such treatment is in any way helpful (Fauquet, 2005). Intensive care is often used in the developed world. This may include maintaining blood volume and electrolytes (salts) balance as well as treating any bacterial infections that may develop. Dialysis may be needed for kidney failure while extracorporeal membrane oxygenation may be used for lung dysfunction (Feldmann & Geisbert, 2011).

Conclusion

It has been established that due to the nature of the causative factors, the mode of transmission and the fact that there is yet no known treatment or cure for Ebola, it presents itself as an emerging and re-emerging disease particularly in Africa. Proactive activities towards preventing and controlling Ebola infection should therefore be highly encouraged and complacency abhorred and discouraged to avoid re-emergence of the disease.

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