Ebola: route of transmission, life cycle and treatment

It is hypothesized that Ebola outbreaks are zoonotic in origin, however the true reservoir in unsubstantiated. [8] The conceding belief is that fruit bats are the reservoir for the Ebolavirus, but due to their migration patterns and apparent lack of disease it has been challenging to study this effectively to yield a substantiated conclusion. [28] It is further theorized that transmission to humans comes from preparation and consumption of infected bushmeat or the handling of infected animals. [8] Some scientists believe that non-human primates contract Ebola from eating fruit soiled with body fluids from infected fruit bats, however there may also be direct animal to animal transmission. [8] There is also evidence that domesticated animals such as pigs and dogs contract the virus. [29] Once a human is infected from a zoonotic source it is then transmitted from person to person via direct contact with blood, secretions, organs and other bodily fluids of infected people. Ebolavirus is also transmitted during burial ceremonies where individuals come into direct contact with an infected deceased person. [30] Healthcare workers taking care of those infected have frequently been infected themselves, due to improper infection control procedures. [30] Recent evidence has shown a sexual transmission from Ebola, as semen can test positive for Ebola months after the disease has subsided. [30]

The WHO and CDC both report that Ebolavirus can not be transmitted through aerosols. However, there are a few studies and evidence to support that it is a possible mode of transmission. It is believed that there was animal to animal as well as animal to human transmission of the Reston virus from cynomolgus macaques in a US quarantine facility. [31] The outbreak

demonstrated intercage infection and in some cases with distance between the cages. In a study, rhesus macaques were infected through aerosols of the Zaire virus, with a median mass diameter ranging from 0. 8 and 1. 2m. [32] Evidence of the respiratory tract being the primary site of infection, can be inferred from the viral concentration being the greatest in the lungs. [8]

Pathogenesis

The incubation period for Ebolavirus ranges from 2 to 21 days and humans are non-infectious until symptoms appear. [30] Ebolavirus presents with a sudden onset of fever, fatigue, muscle pain, headache and sore throat. As the disease progresses vomiting, diarrhea and a rash present. During the latent stages of the disease, patients develop impaired kidney and liver function, and in some cases, both internal and external bleeding. [30] Patients will present with labs with low white blood count (WBC), low platelets, elevated liver enzymes (AST and ALT). [30]

The mortality rate varies among the different subtypes of Ebolavirus. The Zaire virus has an average of 77% mortality rate, Sudan virus 49. 8%, Bundibugyo 30. 55% and Reston virus and Tai Forest virus both have a 0% mortality rate. [5] The range in mortality rates across all subgroups go from 100% to 0%. However, when looking specifically at the Zaire virus the range is 47% to 100%. [5]

Diagnosis, Treatment, and Prevention

EBOV is difficult to distinguish early on from other infectious diseases in the area like malaria, typhoid fever and meningitis. [30] In order to confirm initial symptoms are caused by EBOV healthcare workers should perform ELISA, antigen-capture detection tests, serum neutralization test, RT-PCR, electron microscopy, or virus isolation by cell culture. [30] All samples are an extreme biohazard risk and can only be done under biosafety level (BSL) 4. There are currently only 10 BSL 4 labs in the US and 47 worldwide [33] , leading to an insufficient resource for testing and research.

Current treatment for EBOV is supportive care through re-hydration as well as treatment for specific symptoms. There are currently no vaccines or approved treatment for EBOV, however there are many in development. During a recent outbreak, a US physician was treated with an experimental drug (ZMapp). He eventually went on to give a blood transfusion to another patient with EBOV in hopes of treatment; both recovered well. Evidence suggest that antibody support along with platelets and fluids could provide a key in future treatments. Currently, higher level medical facilities pose better outcomes due to their ability to assist with organ deterioration while the patient is trying to survive the viral infection.

Prevention and Control is best achieved through “ case management, surveillance, contact tracing, good laboratory services, safe burials, and social mobilization”. [30] By limiting the interaction with wildlife, which are known to be reservoirs of the disease, we can limit the transmission into human hosts. If an individual becomes infected proper quarantine procedures should be put in place to ensure the disease does not spread.

Proper quarantine measures include isolating infected patients in medical facilities with only essential personal entering and leaving the patient’s room. All essential medical personnel should don personal protective equipment (PPE) at all time, which includes a single use gown, respirator with full face shield, 2 pairs of gloves, single use boot covers, and single use apron. [34] Educating the population in these endemic areas as to these quarantine procedures, not touching infected animals, and proper burial techniques can vastly improve outcomes during outbreaks. [30]