Marburg virus hemorrhagic fever research papers examples

Law, Security

Introduction

Marburg virus disease (formerly known as Marburg hemorrhagic fever) is a severe zoonotic (animal-borne) disease, affecting both humans and non-primates. The source of infection for primates is unknown. However, research indicates that bats mainly infect the humans. The Ribonucleic acid (RNA) virus belongs to the filovirus family. Filoviruses belong to the order Mononegavirales. These viruses are enveloped, non-segmented, and negative-stranded. Marburg virus and Ebolavirus are the two genera of Filoviradae family. The only species in the genus Marburg virus is Lake Victoria margburg virus (Center for Food Security and Public Health, 2009, p. 1).

The virus has caused epidemics in many countries like Africa, Uganda, Zimbabwe, Kenya, and Angola. World Health Organisation (WHO) has contributed in the disease investigation and control by proper expertise and documentation (World Health Organization [WHO], 2012, p. 1)

History

Marburg virus (MARV) was first recognized in 1967. There was a simultaneous outbreak of viral hemorrhagic fever among laboratory workers exposed to the blood and tissues of African green monkeys (Cercopithecus aethiops) at Marburg and Frankfurt, and Belgrade. There were reports of secondary transmission to medical personnel and the family members. They also found infection in thirty-one patients. Seven of these patients died. A Dutch tourist, in 2008, showed symptoms of Marburg HF after returning from Netherlands to Uganda and later died while; an American traveler developed

the disease after returning to US from Uganda. Both the travelers had visited a cave inhabited by fruit bats. There were reports of fatal cases of Marburg virus in the next two decades among residents and travelers in Southeast Africa. Many outbreaks were also reported among male mine workers (Centers for Disease Control, [CDC], 2014, p. 1)

Pathogenesis

The early targets of MARV are cells of the mononuclear phagocyte system as monocytes, macrophages and dendritic cells. Severe necrotic lesions develop in the spleen, lymph nodes, and liver as form the early sites of viral replication. These organs show a large amount of monocytes and macrophages that migrate to the different tissues resulting in systemic infection. In the late stages of infection, MARV particles can be obtained from every organ. There are also reports of minor inflammation. However, strong liver pathology results in coagulation defects. These factors lead to multiorgan failure (Olejnik, Brauburger K, Hume, & Mühlberger, 2012, p. 1904).

Clinical manifestations

Incubation period for Marburg virus ranges from five to 14 days. The symptoms appear in 4 to 10 days. MVD infection has three phases: an initial generalization phase, an early organ phase, and either a late organ phase or convalescence phase. After an incubation period, is the generalization phase. It involves a sudden onset of illness with symptoms as fever, headache, malaise, myalgia, arthralgia, abdominal pain, nausea, conjunctival injection, and relative bradycardia. Patients may also show other symptoms, for

example, diarrhea, which may be bloody, vomiting, and anorexia. A severe sore throat associated with marked edematous swelling of the soft tissues at the back of the throat is the most common feature of the Marburg viral infection. Around the fifth day of infection, a non-itchy maculopapular rash is observed in white-skinned patients.

The early organ phase involves neurological symptoms like encephalitis, irritability, and aggression. The late organ or the convalescence phase starts from day thirteen. It may result in the death of the patient or a prolonged phase of recuperation (Olejnik et al., 2012, p. 1887).

Diagnosis

Diagnosis of Marburg virus disease involves detection of antigens. Enzyme linked immunosorbent assay (ELISA), or immunostaining can help in the detection of antigens. Another approach involves detection of viral RNA. This involves using reverse transcription polymerase chain reaction (RT-PCR) assays. Virus isolation is also an approach. Cell lines, for example, Vero or Vero E6 may be used for recovering Marburg virus. Electron microscopy helps in identifying virus particles. Under electron microscope, filoviruses appear as pleomorphic, long, and filamentous. For the diagnosis, filoviruses are commonly isolated from blood however; they are isolated from semen, throat washes, urine, and skin. Serological tests, as ELISA is important in the later stages of the disease while, the neutralization tests are unreliable. The tests used for the diagnosis of the disease may give false positive results leading to misdiagnosis. Thus, the results are confirmed by using multiple tests (Center for Food Security and Public Health, 2009, p. 3)

Vaccination

Initially, attempts were made to use inactivated virus to develop a vaccine against MARV. However, the results were contradictory. In a study, the researchers used recombinant GP derived from insect cells. DNA vaccines based on GP were also used to provide protection to guinea pigs. They observed that this approach provided the protection only partially. However, when both the vaccines were used, results were 100%. In another study, when researchers used codon-optimized DNA in increased doses, 100% survival was observed in the animal models. In mice, codon optimized DNA vaccine induced the production of a strong antibody response that provided complete protection to mice without any clinical symptoms. Vaccines based on Venezuelan equine encephalitis virus (VEEV) provided complete protection to guinea pigs. Another approach is the use of the vaccines based on Virus like particles (VLPs) that provided complete protection by inducing virus-specific antibodies. Another vaccine candidate is the viral vector expressing MARV GP. The adenovirus-based vaccine provides protection to guinea pigs and cross protection by inducing high levels of cross-reactive IgG and T cell responses. The other viral vector is the Vesicular Stomatitis Virus (VSV) based vaccine that also provides post exposure treatment. However, the main concern with these vaccines is the safety, particularly in immunocompromised individuals, as they are a replication-competent VSV vector (Olejnik et al., 2012, p. 1907).

Treatment

There is no approved treatment suggested for MARV infection so far. During the outbreaks, the primary treatment involves providing supportive care that includes fluids, anti-microbial, and blood transfusions. Cytokine inhibition, IFN treatment, or antibody transfer are the other applied treatments. Another treatment approach is to block the viral protein expression using antisense technology. This approach involves is the use of phosphorodiamidate morpholino oligomers (PMO) after 30 to 60 minutes of MARV infection. In addition to this, a small molecule inhibitor provided protection to MARV-infected mice. The VSV-based vaccine that expresses the MARV GP has been successful in post-exposure treatment. If the patient delays the time before, incomplete protection is observed. Thus, when the vaccine is administered 20 to 30 minutes after the infection, complete protection is expected (Olejnik et al., 2012, p. 1906).

Prognosis and Statistics

Marburg hemorrhagic fever usually occurs in those who butcher caresses or enter caves and mines. The infected people can spread and transmit the infection to others through contact. The mortality rate varies for Lake Victoria Marburgvirus that was first isolated in the 1967 outbreak in laboratory workers. The case fatality rate for this outbreak was 22-23%. Three of the six patients died. In the 1998-2000 outbreaks in the Democratic Republic of the Congo (DRC) and the 2004-2005 outbreaks in Angola, the fatality rate was 83%. The high mortality in the recent outbreaks is associated with the increased virulence of the virus, higher doses, and

concurrent malnutrition and disease (Center for Food Security and Public Health, 2009, p. 4).

Bioterrorism information

Post-exposure prophylaxis

Absence of effective vaccines and antiviral medications hampers the post-exposure prophylaxis treatment. Studies suggest that patients treated with a high level of care have lower death rate as compared to the recent outbreaks in Angola. Antibiotics, clotting factor concentrates, and antipyretics were administered to treat patients during the 1967 MARV outbreak. This approach mainly reduced the fever, prevented, and treated secondary infections. Hence, it forms part of the treatment approach even today. Convalescent serum transfer was also used in a few secondary cases. The use of ribavirin that shows virustatic activity against different DNA and RNA viruses did not show successful results. Administration of Desferal ®, which is an IL-1 and TNF-α antagonist, provided complete protection to guinea pigs (Ebihara, Mehedi, Groseth, & Feldmann, 2012, p. 8).

Infection control and environmental decontamination

Since there is no evidence about the effective vaccines or therapies, the transmission of infection has to be prevented by implementing and complying with infection control and decontamination measures. Filoviruses are highly infectious agents. Thus, it is important to report the hospital epidemiologist immediately any suspected case of an MARV infection. In turn, the hospital epidemiologist should inform the clinical laboratory and public health officials.

In many cases, the transmission of infection occurs due to the direct contact with the infected blood and body fluids. Therefore, it is necessary to implement specific precautions immediately. The precautions involves strict hand hygiene along with the use of gloves, impermeable gowns, face shields, and eye protection. It is also important to use leg and shoe covering. To prevent airborne transmission, people should take airborne precautions. Thus, any individual entering the room should use high efficiency particulate respirator. HICPAC standards states that the patient should stay in a room with negative air pressure, before recirculation the air should be passed through high-efficiency particulate air (HEPA) filter and the doors should be kept closed.

The linen handlers and the workers who are a part of the environmental decontamination should use personal protective equipment. Contaminated medical equipment and the surfaces of the patient’s rooms must be disinfected with an Environmental Protection Agency that is, registered hospital disinfectant or using a household bleach that is 1: 100 diluted (Borio, Inglesby, & Peters, 2009, p. 2409).

Conclusion

MARV outbreaks have caused a lot of damage than estimated. These outbreaks have high case fatality rates and affect a large geographical region. Thus, they pose a potential threat not only in Africa but also in other parts of the world. Not much data is available regarding the MARV pathogenesis. Hence, much research is needed to provide greater insights into the MARV disease. The most significant advances in combating the

infection involve the development of vaccines. Developing new technologies as RNA interference (RNAi) may be helpful as a new therapeutic intervention. Successful treatment approach involves targeting viral replication and controlling the manifestations of the disease. There is a need to develop quick diagnostic methods to use in both laboratory and field settings. It is also important to push the current products through the regulatory process. Thus, helps in obtaining a license in less time (Ebihara et al., 2012, p. 10).

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