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Exploring the Pathophysiological Concepts of Ebola Virus

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The Ebola virus is a member of the filoviridae family. Five distinctive species of ebolaviruses have been identified, four of which are known to cause disease in humans. (Martines, Ng, Greer, Rollin, Zak, 2014). The specific species known to cause disease in humans are: Zaire, Sudan, Reston, and Zaire Ebola virus (Sudan, Reston, Slam, 2015). Macrophages and monocytes are thought to be the first cells to be infected, causing the release of pro-inflammatory cytokines (Grard, Becker & Leroy, 2014). While lymphocytes are not directly infected, apoptosis of a lymphocyte is common. Ebolavirus enters the body through damaged skin, or mucous membranes and attaches to the host’s receptor cell where it penetrates the cell through endocytosis, uncoils itself, and is then transcribed into positive-strand RNA (Jarrett, 2014). The rapid replication of the virus within the host’s receptor cell leads to cellular necrosis, and a subsequent release of a large number of new virions into the surrounding space (Bray & Chertow, 2015). “In cases of severe infection, there is a massive release of pro-inflammatory mediators and vasoactive substances, which produces a hyperinflammatory cascade and coagulopathy but renders the immune system unable to effectively present systemic spread of the virus.” In late stages of the disease, the infected macrophages release tissue factor causing disseminated intravascular coagulopathy (DIC), shock, and multiorgan failure (Jarrett, 2014). The multiplication of virions in the extracellular fluid then allows travel to surrounding cells, especially monocytes and dendritic cells, which are highly susceptible to viral infection. The liver, spleen, kidney, and bone marrow may also be affected due to the presence of macrophages. The organ damage and destruction ultimately lead to shock and death.

**Pathophysiology**

**Case Study**

J.M is a 34-year-old E.R. nurse who is employed at a large metropolitan hospital in Columbus, Ohio. J.M cared for a middle-aged man approximately one week ago who embarked on a mission trip to West Africa educating the community on the prevention of sexually transmitted infections (STIs). This patient’s health rapidly declined and he ultimately expired in the hospital for reasons that are currently being investigated by the coroner. The patient was placed under the care of J.M. J.M now presents to the urgent care with complaints of generalized weakness, fatigue, myalgia, abdominal pain, diarrhea and vomiting that began approximately 3 days ago and her symptoms have progressively worsened. She states that she has been feeling a body weight loss around.

**Clinical Manifestations**

Ebola virus has an incubation period of 2 to 21 days, but generally causes sudden symptoms of severe illness. (Bray, Chertow, 2015). Early symptoms are nonspecific and include flu-like symptoms such as fever, chills, and generalized weakness. These early symptoms are often difficult to distinguish from other common viral illnesses, making it challenging to diagnose early. As the disease progresses, gastrointestinal symptoms such as abdominal pain, vomiting, and diarrhea become apparent along with the development of a rash; cough, and jaundice (Feldmann & Geisbert, 2011). “In cases of severe infection, there is a massive release of pro-inflammatory mediators and vasoactive substances, which produces a hyperinflammatory cascade and coagulopathy but renders the immune system unable to effectively present systemic spread of the virus.” In late stages of the disease, the infected macrophages release tissue factor causing disseminated intravascular coagulopathy (DIC), shock, and multiorgan failure (Jarrett, 2014). In cases of severe infection, there is a massive release of pro-inflammatory mediators and vasoactive substances, which produces a hyperinflammatory cascade and coagulopathy but renders the immune system unable to effectively present systemic spread of the virus.

**Abbreviations**

- CDC: Centers for Disease Control and Prevention
- WHO: World Health Organization
- UMD: University of Maryland
- UG: University of Georgia
- UTHSC: University of Tennessee Health Science Center
- NEJM: New England Journal of Medicine
- JAMA: Journal of the American Medical Association
- Sci: Science
- PNAS: Proceedings of the National Academy of Sciences
- J Clin Invest: Journal of Clinical Investigation
- J Clin Virol: Journal of Clinical Virology
- JAMA Internal Medicine: Journal of the American Medical Association—Internal Medicine
- J Infect Dis: Journal of Infectious Diseases
- JAMA Oncology: Journal of the American Medical Association—Oncology
- JAMA Neurology: Journal of the American Medical Association—Neurology
- JAMA Cardiology: Journal of the American Medical Association—Cardiology
- JAMA Dermatology: Journal of the American Medical Association—Dermatology
- JAMA Surgery: Journal of the American Medical Association—Surgery
- JAMA Ophthalmology: Journal of the American Medical Association—Ophthalmology
- JAMA Otolaryngology–Head 

**References**


**Introduction**

The increase and ease of globalization has allowed travelers to go to more places and interact with a larger population. The number of international travelers has grown from 6.5 million passengers in 1950 to 296 million passengers in 2011. The reality of continued terrorism remains a concern for the United States. According to Bray and Chertow (2015), “In cases of severe infection, there is a massive release of pro-inflammatory mediators and vasoactive substances, which produces a hyperinflammatory cascade and coagulopathy but renders the immune system unable to effectively present systemic spread of the virus.” In late stages of the disease, the infected macrophages release tissue factor causing disseminated intravascular coagulopathy (DIC), shock, and multiorgan failure (Jarrett, 2014). In cases of severe infection, there is a massive release of pro-inflammatory mediators and vasoactive substances, which produces a hyperinflammatory cascade and coagulopathy but renders the immune system unable to effectively present systemic spread of the virus.

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