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Applied Microbiology-Open Access

Commentary

Virulence Characteristics of Ebola Virus

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ABOUT THE STUDY

Ebola Virus (EBOV), a member of the genus Ebola virus and belongs to the species Zaire Ebola virus, produces a severe fever illness in humans with Case Fatality Rates (CFRs) of up to 90%. While there are six viral species in the genus Ebola virus, each with a specific type virus, CFRs of Ebola virus infections differ amongst viruses belonging to each different species. On the basis of currently known laboratory and experimental findings, we hope to characterize the Ebola virus species-specific pathogenicity in this study. In addition, by referring to the unique biology and pathogenic properties of EBOV variant Makona, a new EBOV variation isolated from the 2013-2016 EBOV disease outbreak in West Africa, this study will discuss the variant-specific virulence of EBOV.

A greater understanding of Ebola virus virulence in terms of species and variants would help us obtain a better understanding of the genus Ebola virus biology, which will lead to the development of treatments targeting particular pathogenic mechanisms in each Ebola disease. Ebola virus illness is a highly contagious viral zoonotic disease with high Case Fatality Rates (CFRs) of up to 90%. High fever, gastrointestinal symptoms such as diarrhea and vomiting, respiratory symptoms, rash, conjunctival injection, and hemorrhagic presentations are all indications of the disease. Hypovolemic shock and multi-organ failure are the most common outcomes in fatal cases. The Ebola virus, which causes EVD, is a single-stranded negative-sense RNA virus belonging to the genus Ebola virus and the family *Filoviridae*. There are six virus species recognized in the genus Ebola virus, each with a single kind of virus.

EBOV is sometimes described to as the most virulent Ebola virus among them, in part because it has been responsible for the vast majority of Ebola disease outbreaks to far, including multiple epidemics with CFRs over 70%. Aside from the epidemiological component, certain laboratory and experimental data suggest that the virulence/pathogenicity of Ebola viruses in humans varies amongst viruses of different species.

The varied virulence profiles among Ebola viruses belonging to different species are then interpreted, and research gaps in our understanding of the species-specific pathogenicity of Ebola virus in humans are then discussed. Finally, this discusses current virulence findings of the EBOV-Makona variant, a newly found EBOV variant from West Africa's greatest EVD outbreak in 2013-2016 that has distinct virulence characteristics from other EBOV variants/strains. The Nucleo-Protein (NP), Virion Protein 35 (VP35), VP40, the Glyco-Protein (GP), VP30, VP24, and the RNA-dependent RNA polymerase are all encoded by the EBOV's negative-sense, single-stranded RNA genome (L). In addition, the GP gene codes for soluble GP and small soluble GP.

A 3′ leader and a 5′ trailer include replication/transcription promoters and genome packing signals at the genome's termini. The L, coupled with VP35, a polymerase cofactor, and the viral transcription factor VP30, are responsible for viral genome replication and gene transcription. While VP40 is required for virion assembly and budding, GP is responsible for viral entry, including receptor molecule attachment and membrane fusion. The VP24 protein is involved in the condensing of viral nucleocapsids, which is necessary for effective genome/nucleocapsid packaging into the virion.

NHPs and small animal models of EBOV infection have been established so far, including mice, guinea pigs, Syrian golden hamsters, and ferrets. NHPs are the "gold standard" animal model among them because they are particularly susceptible to infection with Wild-Type EBOV (WT-EBOV) obtained from human samples. High viremia, a robust cytokine/chemokine response, coagulopathy, rash, and hemorrhagic symptoms are all clinical and pathological hallmarks of severe/fatal EVD in humans that can be replicated in NHPs. The most often employed NHPs for EBOV infection are cynomolgus and rhesus macaques; illness progression in cynomolgus macaques after EBOV infection is slightly faster than in rhesus macaques.

In EBOV-infected NHPs, pathological studies have clearly demonstrated that cells of the Mononuclear Phagocytic System (MPS) (i.e. monocytes, macrophages) and Dendritic Cells (DCs) are the initial target cells that migrate to target organs (e.g. liver, lymph nodes, spleen), resulting in efficient virus transmission and replication. In addition to NHPs, ferrets having typical clinical symptoms of EVD, such as fever, petechial rashes, hemorrhage, and coagulopathy, can be lethally infected with WT-EBOV.

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Received: 13-Jul-2022, Manuscript No. AMOA-22-16596; **Editor assigned:** 15-Jul-2022, PreQC No. AMOA-22-16596 (PQ); **Reviewed:** 02-Aug-2022, QC No. AMOA-22-16596; **Revised:** 10-Aug-2022, Manuscript No. AMOA-22-16596 (R); **Published:** 19-Aug-2022, DOI: 10.35248/2471-9315.22.8.254

Citation: Usheva A (2022) Virulence Characteristics of Ebola Virus. Appli Microbiol Open Access. 8.254.