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Review Article

Ebola Virus Disease

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Abstract

The outbreak of Ebola Virus Disease in 2014 caused by one of member of Filoviridae family in west Africa was the witness of its fatality, which rate is up to 50-90%. Ebola first occurred in 1976 in two simultaneous outbreaks, in Nzara, Sudan, and in Yambuku, Democratic Republic of Congo. Ebola reached in human through animal body fluid, most of researchers think of fruit bats as natural host of Ebola virus. Ebola spreads in the community through human-to-human transmission, with infection resulting from direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and indirect contact with environments contaminated with such fluids. The entry of Ebola Virus is mediated by cholesterol transporter protein Niemann-Pick C1 (21) and T-Cell immunoglobulin &mucin domain 1(TIM-1). The disease is common with the symptoms onset of fever, intense weakness, muscles pain, nausea, headache, & sore throats followed by severe hemorrhage, shocks, breakdown central nervous system, vomiting, diarrhea, loss of kidney and liver function, internal & external bleeding, low WBC & platelet, elevation in liver enzymes. The severe hemorrhage occur due to mixed proinflammatory mediators and vasoactive substances , which is result of immune responses to save the body which result in storm of chemokinins and cytokinins leading in turn bursting of blood vessels. There is neither any specific treatment nor any FDA approved vaccine or medicine. Severely its patient required intensive supportive system, require oral rehydration with solution containing electrolytes, maintenance of circulatory volume, blood pressure & oxygen supplements. Some researches on NPC-1 gene and (TIM-1) showing positive signals on treatment aspects of Ebola virus disease. The mutant NPC-1 and silencing of TIM-1 do not leads to virus replication inside the host.

Keywords: Ebola Virus Disease; Filoviridae Family; NPC-1(Niemann-Pick C1) Protein; TIM-1(T-Cell Immunoglobulin & Mucin Domain 1); Proinflammatory Mediators; Vasoactive Substances.

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Introduction

Ebola virus disease, is an erratic and deadly disease with fatality rate up to 50-90% [1] caused by infection with one of the members of Filoviridae family. The two most lethal genera of Filoviridae family includes Ebola and Marburg viruses which were consecutive agents of 2014-2015 outbreak in West Africa [2] and out breaks in Central Africa respectively [3]. Ebola first occurred in 1976 in two concurrent outbreaks, in Nzara, Sudan, and in Yambuku, Democratic Republic of Congo [4, 5]. There are five identified Ebola virus species and four out of it have pathogenicity highly lethal in humans. Ebola virus (Zaire ebolavirus); Sudan virus (Sudan ebolavirus); Taï Forest virus (Taï Forest ebolavirus), and Bundibugyo virus (Bundibugyo ebolavirus). The fifth, Reston virus which causes disease in pigs and macaques but asymptomatically infects humans [6].

Source

The natural reservoir of the Ebola virus is still unknown nevertheless researchers believe that the virus is animal-borne and that fruit bats of *Pteropodidae* family are the most likely reservoir [7]. In a recent study it has been found that antibodies against Zaire and Reston Ebola Viruses were found in 3.5% of the 276 screened bats in Bangladesh [8] and in Africa [9]. And other studies show in on the antibodies of Indonesian orangotans suggests the existence of numerous unknown species of filoviruses in Indonesian orangotans which are serologically similar to African ebola viruses [10].

Transmission

Ebola spreads in the community through human-to-human transmission, with infection resulting from direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and indirect contact with environments contaminated with such fluids. During incubation period there is no evidence of transmission of disease, the transmission could take place once a person develop all the symptoms [3,23].

The most frequent transmission often occurs in health workers while treating the patients of EVD, and in family members and relatives who come to contact with patients during illness and in burial ceremony. There were certain cases also found who possess ebola virus after several months of recovery. In a study of a female patient ebola virus was detected in her breast milk while there was no sign of virus in her blood stream [11]. However, in some other cases like from urine, Aqueous humour, cerebrospinal fluid and from semen ebola virus was isolated after many months of disease onset [12,13,14].

Pathogenesis Outline

The Ebola Virus, possibly due to its highly glycosylated surface glycoprotein can cause infection to a variety of cells including monocytes, dendritic cell, fibroblast, hepatocytes, adrenal cortical cell, endothelial cells, epithelial cells and including cell-surface lectins [15]. The early targeted cells are macrophages and dendritic cells which are known to trigger the innate immunity on viral infections and to present antigen to naïve T cells. The enormous replication causes necrosis of the cell thus leads to discharge of several new viral particles into extracellular fluids [16,17]. It elicits more cells at the place of infection causing release of proinflammatory mediators and vasoactive substances throughout the body [18] and further initiate stage of clotting ultimately to multi organ failure and shock. The proinflammatory mediators released from infected macrophages further initiate cell surface tissue factor (TF). This leads to the initiation of extrinsic coagulation pathway which results in severity of disease [19].

Entry

Filovirus entry is mediated by the viral spike glycoprotein(GP), which attaches viral particles to the cell surface, delivers them to endosomes and catalyses fusion between viral and endosomal membranes [20]. The two responsible candidates for infection of ebola virus are cholesterol transporter protein Niemann-Pick C1 [21] and T-Cell immunoglobulin & mucin domain 1(TIM-1). Several studies in mice show that heterozygous NPC-1 gene [21] and mutated NPC-1gene will not commence entry of ebola virus. TIM-1 shows tendency to bind with receptor domain of ebola virus and increase receptivity of Vero cells. Silencing its effect with siRNA leads to the prevention of infection [22]. Thus, both candidates are showing positive signals on treatment and diagnosis of Ebola virus disease.

Symptoms

The disease is common with the symptoms onset of fever, intense weakness, muscles pain, nausea, headache, & sore throats followed by severe haemorrhage, shocks, breakdown central nervous system, vomiting ,diarrhoea , loss of kidney and liver function, internal & external bleeding, low WBC & platelet, elevation in liver enzymes [3].

Diagnostic Test

The diagnostic test are done by ELISA test,IgM ELISA, IgM or IgG antibody detection test and by PCR. Ebola virus antigens and nucleic acids can be detected from Day 3 to Days 7–16 after the disease's onset. The other ways are Ebola virus antigen detection &Virus isolation

Treatment

There is neither vaccine nor any specific treatment. Severely its patient required intensive supportive system, require oral and intravenous rehydration with solution containing electrolytes, maintenance of circulatory volume, blood pressure & oxygen supplements [3].

Prevention

It is not always possible to identify patients with EBV early because initial symptoms may be non-specific. For this reason, it is important to take precautions consistently with all patients regardless of their diagnosis in all work practices at all times. These include: Hand hygiene, Safe handling and disposal of sharp instruments, use of personal protective equipment (PPE) according to the risk assessment, Clean and disinfect spills, environment, and reusable equipment safely. Precautions for direct patient contact are Restrict the number of staff dedicated to patient care, Limit the number of visit, Keep log books to register staff caring for the patient as well as visitors. Use of surgical masks, goggles preferably with anti-fog visor, waterproof apron, gloves and closed shoes before entering the patient's room. General use of disposable personal protective equipment can prevent the disease causing virus [23].

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