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Ebola Virus

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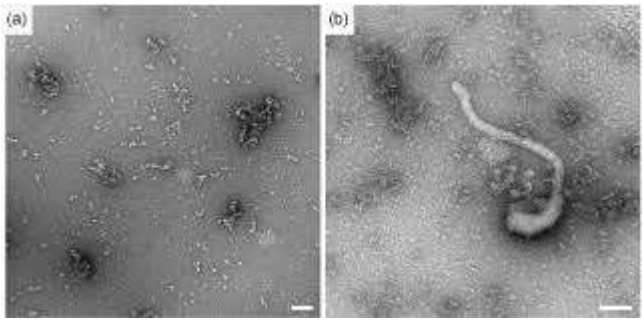
ABSTRACT
ABST RACT Ebola virus disease (EVD) is a life-threatening viral disease with a fatality rate ranging from around 30% to 90%. The first EVD outbreak was reported in the 1970s in Zaire (now the Democratic Republic of the Congo). Until 2013, most outbreaks occurred in the Central Africa region, including Zaire, Sudan and Uganda. However, between March and October 2014, over 10000 cases of EVD have been recorded in West Africa, such as in Guinea, Liberia, Sierra Leone, and Nigeria, and a few hospital or secondary infections of EVD have occurred in Spain and the United States of America. EVD is presently one of the world's most feared diseases. In this literature review, we describe the epidemiology, clinical features, diagnosis, and treatment of EVDEbola Virus Disease

I. INTRODUCTION

Ebolavirusdisease (EVD),alsoknownasEbolahemorrhagicfever(EHF) or simply Ebola, is a viral hemorrhagic fever of humans and other primates caused byEbola viruses.
Signsandsymptomstypicallystartbetweentwodaysand dthreeweeks after contracting the virus with a fever, sore throat, muscular pain, andheadaches.



Vomiting, diarrhea and rash usually follow, along with decreased function of the liver and kidneys. At this time, some people begin tobleedbothinternallyandexternally.Thediseasehasa highriskofdeath,killing25% to 90% of those infected, with an average of about 50%. This is often due to lowbloodpressure from fluid loss, and typically follows 6 to 16 days after symptomsappear.

The virus spreads through direct contact with body fluids, such as blood from infected humans or other animals. Spread may also occur from contact with items recently contaminated with bodily fluids. Spread of the disease through the air between primates, including humans, has not been documented in either laboratory or naturalconditions.

Semen or breast milk of a person after recovery from EVD may carry the virus for severalweeksto months.Fruit batsarebelievedtobethenormalcarrierinnature, able to spread the virus without being affected by it. Other diseases such as malaria, cholera, typhoid fever, meningitis and other viral hemorrhagic fevers may resembleEVD.BloodsamplesaretestedforviralRNA, viralantibodiesorforthevirus itself to confirm thediagnosis.

Control of outbreaks requires coordinated medical services and community engagement. This includes

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rapid detection, contact tracing of those who have been exposed, quick access to laboratory services, care for those infected, and proper disposal of the dead through cremation or burial. Samples of body fluids and tissues from people with the disease should be handled with special caution.

Prevention

includes limiting the spread of disease from infected animals to humans by handling potentially infected bush meat only while wearing protective clothing, and by thoroughly cooking bush meat before eating it. It alsoincludes wearing proper protective clothing and washing hands when around a person with the disease.

An Ebola vaccine has been studied in Africa with promising results. While there is no approved treatment for Ebola as of 2019, two treatments (REGN-EB3 and mAb114) are associated with improved outcomes. Supportive efforts, also, improve outcomes. This includes either oral rehydration therapy (drinking slightly sweetened and salty water) or giving intravenous fluids as well as treatingsymptoms.

Thediseasewasfirstidentifiedin1976, intwosimultaneousoutbreaks:oneinNzara (a town in South Sudan) and the other in Yambuku (Democratic Republic of the Congo), a village near the Ebola River from which the disease takes its name.

EVDoutbreaksoccurintermittentlyintropicalregions ofsub-SaharanAfrica.Between1976 and 2013, the World Health Organization reports 24 outbreaks involving 2,387 caseswith 1,590deaths.

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The largest outbreak to date was the epidemic in West Africa, which occurred from December2013,toJanuary2016,with28,646casesand 11,323deaths.Itwasdeclared no longer an emergency on 29 March 2016. Other outbreaks in Africa began in the Democratic Republic of the Congo in May 2017, and 2018. In July 2019, the World Health Organization declared the Congo Ebola outbreak a world healthemergency.

Ebola virus disease (EVD) is a severe, often fatal illness in humans. EVD outbreaks haveacase fatalityrateofupto90%.Ebola first appearedin1976 intwosimultaneous outbreaks, in Nzara, Sudan, and in Yambuku, Democratic Republic of Congo.1,2 The latter was in a village situated near the Ebola River, from which the disease takes its name. It has not been reported in humans in the Asia Pacific region as of 31 July2012. However, with global travel, it is possible that outbreaks in Africa could result in the spread of the virus to Asia. There are different species of the Ebola virus. Of these, the RestonEbola virus was first discovered in laboratories in Reston, Virginia, United States

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of America (USA) in 1989 after some quarantined, crab-eating macaque monkeys originating from the Philippines became ill and died.

`In 2008, a virus identified in pigs was found to be very similar to the virus identified inmonkeysimportedintotheUSAforresearchfromthe Philippinesin1989.3In2009, six people tested positive for Reston Ebola virus antibodies after contact with sick pigs in the Philippines, but had no significantsymptoms.

Thethreattohumanhealth islikelytobelowforhealthyadultsbutisunknownforall other population groups. Therefore, the Ebolarest on virus is not as great a threat as the other Ebola viruses that are known to be highly pathogenic for humans. However, it is of public health concern in the Asia-Pacific region because, although very rare, it is a newly emerging disease in animals

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andhumans.

Currently there is no vaccine or specific treatment for Ebola virus disease.

Agent:
Ebola virusbelongstotheFiloviridaefamily(filovirus).Ebola viruscomprises5distinct species:

1. Bundibugyo Ebola virus(BDBV)
2. Zaire Ebola virus(EBOV) 4 Ebola virusdisease
3. Sudan Ebola virus(SUDV)
4. Reston Ebola virus(RESTV)
5. Taï Forest (formerly Côte d'Ivoire Ebola virus)Ebola virus(TAFV)

Four of the five subtypes occur in an animal host native to Africa. BDBV, EBOV, and SUDV have been associated with large EVD.

outbreaks inAfrica,whereasRESTVandTAFVhavenot.Pathogenicityvariesamong
Ebola Virus Disease

Epidemiology and surveillance
The disease typically occurs in outbreaks in tropical regions of Sub-SaharanAfrica.From1976(whenit wasfirstidentified)through2013,theWHOreported2,387 confirmedcaseswith1,590overallfatalities.Thelarges toutbreaktodatewastheEbolavirusepidemicinWestAfrica,whichcausedalargenumberofdeathsinGuinea, SierraLeone, andLiberia.
EBOV,whichishighlylethalinhumans,toRESTV,whichcausesdisease inpigsand macaques but asymptomatically infectshumans.

Reservoir
Fruit bats of the P**teropodidae family** are considered to be the natural host of the Ebola virus. Although non-human primates have been a source of infection for humans, theyarenotthoughtto bethereservoirbutrather anaccidentalhost likehumanbeings. Since 1994, Ebola outbreaks from the EBOV and TAFV species have been observed chimpanzees andgorillas.

RESTV has caused severe EVD outbreaks in macaque monkeys (Macaca fascicularis) farmed in Philippines and detected in monkeys imported into the USA in 1989, 1990 and 1996, and in monkeys imported to Italy from Philippines in 1992.

A recent study suggests that bats might be a reservoir for Ebola virus in Bangladesh.

The study found antibodies against Zaire and Reston Ebola viruses circulating in 3.5% of the 276 bats scientists screened in Bangladesh.
Detection of antibodies to Ebola virus infection in Indonesian orangotans suggests the existence of multiple species of f**iloviruses or unknown filovirus-related viruses in Indonesia, some of which are serologically similar to African Ebola viruses.**

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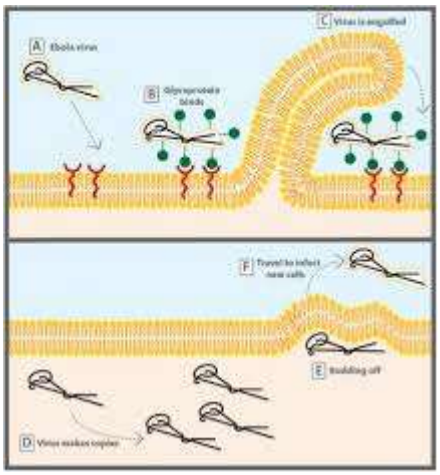
Human infection



Risk factors

- Human contact with infected fruit bats or monkeys/apesand
- Consumption of their raw meat leads to wild-life-to-human transmission of the virus.
- Human to human transmission is through direct or close contact with infected patients, and particularly through contact with blood and body fluids of an infectedpatient.
- Ifproperhospitalinfectioncontrolmeasuresareno tinplace. Ebolavirusdisease
- personnelhandlinginfectedmaterialwithoutprop erbiosafetymeasuresarealso atrisk.

Risk of Exposure

Healthcare during an outbreak, EVD can spread quickly within healthcare settings.Infectioncontrolmeasures, likescreeningpatientsforsigns/symptoms of EVD and practicing proper personal protective equipment procedures, must be in place to ensure exposure to Ebola virus does notoccur.

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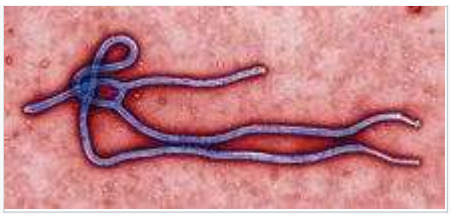
Cause

EVD in humans is caused by four of five viruses of the genus Ebola virus. The four are Bundibugyo virus (BDBV), Sudan virus (SUDV), Taï Forest virus (TAFV)and
one simply called Ebola virus (EBOV, formerly Zaire Ebola virus). EBOV, species Zaire Ebola virus,is the most dangerous of the known EVD-causing viruses, and is responsible for the largest number of outbreaks. The fifth virus, Restonvirus (RESTV), is not thought to cause disease in humans, but has caused disease in other primates. All five viruses are closely related tomarburgviruses.

Virology



Ebola viruses contain single-stranded, on-infectious RNA genomes.
Ebola virusgenomes contain seven genes including 3'-UTR-NP-VP35-VP40-GP- VP30-VP24-L-5'-UTR.ThegenomesofthefivedifferentEbola viruses(BDBV,EBOV, RESTV, SUDV and TAFV) differ in sequence and the number and location of gene overlaps.

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Aswithallfiloviruses,Ebola virusvirionsarefilamentousparticlesthatmayappear in the shape of a shepherd's crook, of a "U" or of a "6," and they may be coiled, toroid or branched.Ingeneral,ebolavirionsare80nanometers(nm)inwidthandmaybeaslong as 14,000nm.

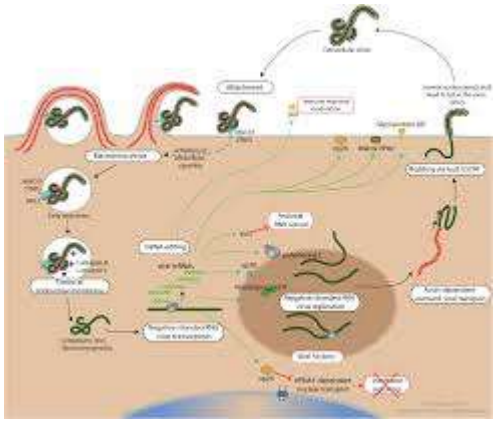
Characteristics

Long filamentous rods composed of a lipid envelope surrounding a helical nucleocapsid 1000nm long, 80nm in diameter

Clinical importance

The virus is widespread amongst populations of monkeys. It can be spread to humans by contact with body fluids from the primates. The resulting haemorragic fever has a 90% case fatality rate Ebola Virus Disease

Life cycle of Ebola virus



Their life cycle is thought to begin with a virion attaching to specific cell- surface receptors such as C-type lectins, DC-SIGN, or integrins, which is followed by fusion of the viral envelope with cellularmembranes.

The virions taken up by the cell then travel to acidic endosomes and lysosomes where the viral envelope glycoprotein GP is cleaved.

Thisprocessingappearstoallowthevirustobindtocellularproteinsenabling it tofuse with internal cellular membranes and release the viralnucleocapsid.

The Ebola virusstructural glycoprotein (known as GP1,2) is responsible for the virus ability to bind and infect targeted cells. The viral RNA polymerase, encoded by the L gene, partially uncoats the nucleocapsid and transcribes the genes into positive- strandmRNAs,mRNAs then translated into structural and nonstructural proteins.

The most abundant protein produced is the nucleoprotein, whose concentration in thehostcelldetermineswhenLswitchesfromgenetranscriptiontogenomereplication.

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Replication of the viral genome results in full-length, positive-strand antigenomes that are, in turn, transcribed into genome copies of negative-strand virus progeny.
Newly synthesized structural proteins and genomes self-assemble and accumulateneartheinsideofthecellmembrane.Virion sbud offfromthecell,gaining their envelopes from the cellular membrane from which they bud. The matureprogeny particles then infect other cells to repeat th

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Virusisolationandreversetranscriptase—polymerasechainreactionareuseful in a few instances as well These results closely parallel those found in Ebola (Reston subtype) virus studies in naturally infected monkeys. Antibodies appear as patients recover;thisprovidesanilluminatingcontrasttohantavirusdiseases,inwhichtheonset of the detectable immune response coincides with the development of seriousdisease.

Monkeys with no likelihood of Ebola infection had positive titers, the titers could rise from negative to high levels, such as 1:256 in an animal under observationandapplicationofWesternblotsfailedtoresolvetheproblem.Thevirus is not readily neutralized by convalescent sera, and no hemagglutinin has been detected, eliminating two of the common confirmatorytests.

An ELISA test appears to eliminate the false-positive results widely seen in normal monkeys and shows positive reactions with every monkey serum from a confirmed infection and with sera obtained from a small number of human Ebola survivors available at the time of test development. This outbreak provided an opportunity to apply the test to humans with acute infection the use of the test in such sera was satisfactory and provides an improved measure of Ebola antibodies, but more experience is indicated.

Duringacutedisease,therewasmRNAevidenceofactivationofmultiple cytokines. These cytokines have been implicated in the pathogenesis of several forms of shock and cause specific defects in vascular permeability in filovirus infections studied in vitro Another interesting finding in acute-phase infections of humans and nonhuman primates was the presence of a circulating soluble glycoprotein, which shares ~300 aminoacids with the viral glycoprotein that is produced through transcriptional editing of the samegene.

These protein may serve as some form of immunologic decoy, preventing an effective immune response. There are several other possible immunosuppressive mechanisms (reviewed in, including the extensive necrosis of spleen and lymph nodes from fatal human and nonhuman primate cases.

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Extensive infection and co-localized necrosis were found in **parenchymal** cells, **macrophages**, and **endothelial cells.** The virologic and pathologic findings are important for the way we think about therapy of patients infected with EBO-Z.

The pathogenetic hurdle is the extensive nature of infection with a cytopathic virus and the lack of an effective immune response. In fact, the infection and related necrotic lesions are so widespread in fatal cases that it seems unlikely that supportive care will have much impact on survival unless some form of antiviral or immunologic therapy can be instituted relatively early in disease.

Theextensivecytokineactivationexplainsomefeaturesofthedisease,and it may well be that disseminated intravascular coagulation occurs on the severely affected endothelial cell surfaces, as seen in some animal models, but these are not the driving forces behind the fatal disease process. Treatment of these phenomena as well as traditional supportive care may be useful in some cases but should not distract research energies from antiviral drugs, effective passive antibody, or other forms of therapy designed to modify the underlyingproblem.

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Transmission

The first patient becomes infected through contact with an infectedanimal such as a fruit bat or nonhuman primate.People can be infected with the Ebola virus through direct contact with bodyfluids.
E.g. Blood or body fluids (urine, saliva, sweat, feces, vomit, breast milk, semen) of a person who is sick with or has died from.
Ebola virus CANNOT spread to others when a person has no signs or symptomsofEVD.Additionally,thevirusisnot spreadthroughtheair,bywater,orin general, by food. However, in certain parts of the world, Ebola virus may spread through the handling and consumption of bush meat (wild animals hunted forfood).

There is no evidence that mosquitos or other insects can transmit Ebola virus.

Mainly Ebola is introduced into the human population through close contact with the blood, secretions, organs or other bodily fluids of infected animals.

In Africa, infection has been documented through the handling of infected chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest.

Among workers in contact with monkeys or pigs infected with Reston ebolavirus,several infections have been documented in people who were clinically asymptomatic.

Thus, **RESTV** appears **less capable of causing disease** in humans than other Ebola

The WHO states that only people who are very sick are able to spread Ebola disease in saliva, and whole virus has **not been reported to be transmitted through sweat.** Most people spread the virus through blood, feces and vomit. Entry points for thevirusincludethenose,mouth,eyes,openwounds,cut sandabrasionsEbolamaybe spread through large droplets; however, this is believed to occur only when a person is very sick. This contamination can happen if a person is splashed withdroplets.
Contact with surfaces or objects contaminated by the virus, particularly needles and syringes, may also transmit the infection
The virus is able to survive on objects for a few hours in a dried state, and can survive for a few days within body fluids outside of a person. The Ebola Virus persistence in semen for over a year has been recorded in a national screening programmer Ebola may also occur in the breast milk of women after recovery, and it is not known when it is safe to breastfeed again.
Health-care workers treating people with Ebola are at greatest risk of infectionTheriskincreaseswhentheydonothaveappro priateprotectiveclothingsuch as masks, gowns, gloves and eye protection; do not wear it properly; or handle contaminated clothing incorrectly. This risk is particularly common in parts of Africa where the disease mostly occurs and health systems functionpoorly.
Mostly causes

ReusehypodermicneedlesSomehealth-carecenterscaringforpeoplewiththedisease do not have running water.
EBOV
Observational data from previous epidemics suggests the actual risk of airborne transmission is low A number of studies examining airborne transmission broadly concluded that transmission from **pigs to primates could happen without direct contact because, unlike humans and primates, pigs with EVD get veryhigh Ebola virus concentrations in their lungs, and not theirbloodstream.**
Therefore, pigs with EVD can spread the disease through droplets in the air or on the ground when they sneeze or cough By contrast. But other primates accumulatethevirusthroughouttheirbodyandspe cificallyintheirblood,butnot very much in theirlungs.

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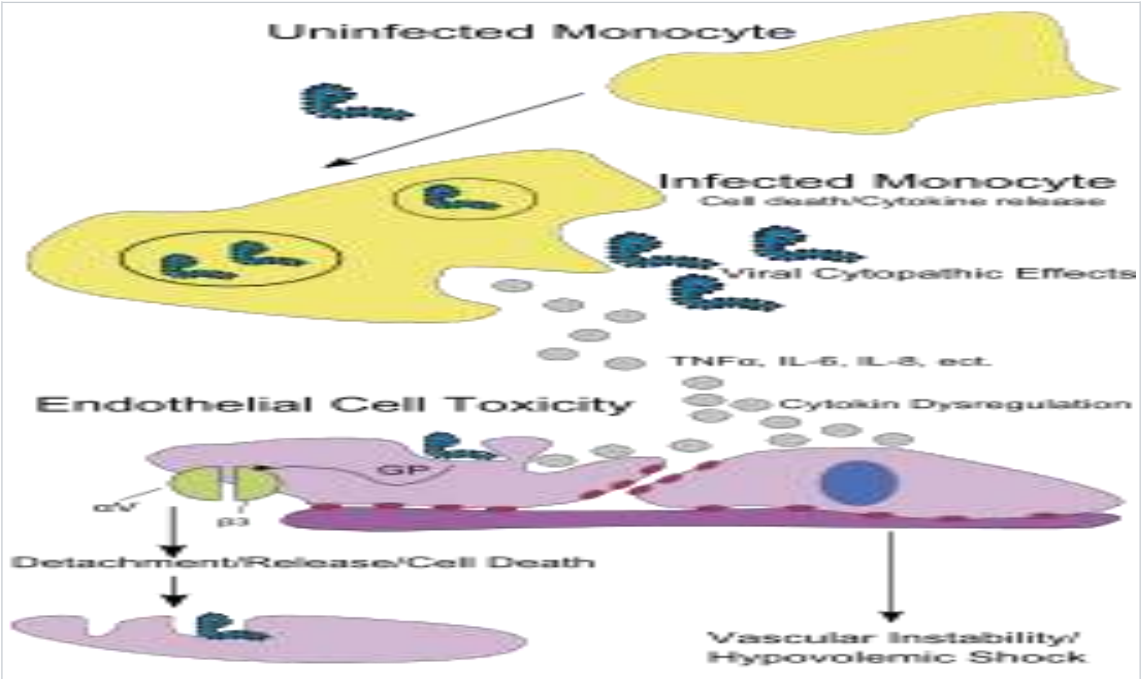
Pathophysiology



- EBOV replicates very efficiently in many cells, producing large amounts of virus in monocytes, macrophages, dendritic cells and other cells including livercells, fibroblasts, and adrenal glandcells.
- Viral replication triggers the high levels of inflammatory chemical signals and leads to a septicstate
- EBOV infect humans through contact with mucous membranes or skinbreaks.

- After infection, endothelial cells (cells lining the inside of blood vessels), **liver cells**, and several types of immune cells such as **macrophages**, **monocytes**, and **dendritic cells** are the main targets of attack.
- Infected area, immune cells carry the virus to nearby lymph nodes where further reproductionofthevirustakesplaceFromtherethe viruscanenterthebloodstream and lymphatic system and spread throughout thebody.
- Macrophages are the first cells infected with the virus, and this infection results in programmed celldeath.

- Other types of white blood cells, such as lymphocytes, also undergo programmed celldeathleadingtoanabnormallylowconcentrati onoflymphocytesintheblood.
- Endothelial cells may be infected within three days after exposure to the virusThe breakdown of endothelial cells leading to blood vessel injury can be attributed to EBOVglycoproteins.
- This damage occurs due to the synthesis of Ebola virus glycoprotein (GP), which reduces the availability of specific integrins responsible for cell adhesion to the intercellular structure and causes liver damage, leading to improperclotting.
- The widespread bleeding that occurs in affected people causes swelling and shock due to loss of bloodvolume.
- The dysfunctional bleeding and clotting commonly seen in EVD has been attributed to increased activation of the extrinsic pathway of the coagulation cascade due to excessive tissue factor production by macrophages andmonocytes.
- After infection, a secreted glycoprotein, small soluble glycoprotein (sGP or GP)is synthesized.
- EBOV replication overwhelms protein

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synthesis of infected cells and the host immune defenses.

- The **GP forms a trimeric complex**, which tethers the virus to the endothelial cells. The **sGP forms a dimeric protein** that **interferes** with the **signaling of neutrophils**, another type of white blood cell.
- This enables the virus to evade the immune system by inhibiting early steps of neutrophil activation.

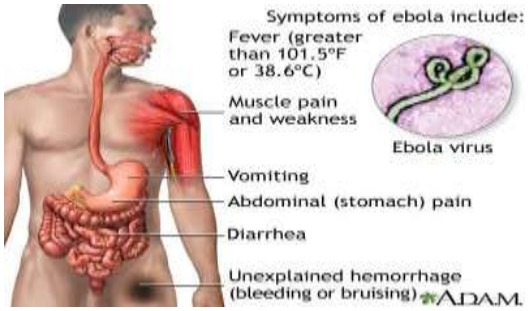
Immune system evasion

Filoviral infection also interferes with proper functioning of the innate immune system. EBOV proteins blunt the human immune system's response to viral infections by interfering with the cells' ability to produce and respond to interferon proteins such as interferon-alpha, interferon-beta, and interferon gamma.

The VP24 and VP35 structural proteins of EBOV play a key role in this interference. When a cell is infected with EBOV, receptors located in the cell's cytosol (such as RIG-I and MDA5) or outside of the cytosol (such as Toll-like receptor 3 (TLR3), TLR7, TLR8 and TLR9) recognize infectious molecules associated with the virus. On TLR activation, proteins including interferon regulatory factor 3 and interferon regulatory factor 7 trigger a signaling cascade that leads to the expression of type 1 interferons The type 1 interferons are then released and bind to the IFNAR1 and IFNAR2 receptors expressed on the surface of a neighboring cell.

Once interferon has bound to its receptors on the neighboring cell, the signaling proteins STAT1 and STAT2 are activated and move to the cell's nucleus. This triggers the expression of interferon-stimulated genes, which code for proteins with antiviral properties. EBOV's V24 protein blocks the production of these antiviral proteins by preventing the STAT1 signaling protein in the neighboring cell from entering the nucleus. The VP35 protein directly inhibits the production of interferon-beta By inhibiting these immune responses, EBOV may quickly spread throughout the body.

Signs and Symptoms



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EVD is a severe acute viral illness often characterized by the sudden onset of fever, intenseweakness,musclepain,headacheandsorethroat.Thisisfollowedbyvomiting, diarrhoea, rash, impaired kidney and liver function, and in some cases, both internal and external bleeding. Laboratory findings include low white blood cell and platelet counts and elevated liverenzymes.

People are infectious as long as their blood and secretions contain the virus. Men who have recovered from the disease can still transmit the virus through their semen for up to 7 weeks after recovery from illness.23Incubation period: 2 to 21 days.\

Onset

Thelengthoftimebetweenexposuretothevirusandthedevelopment of symptoms (incubation period) is between 2 and 21 days, and usually between 4 and10
days.However,recentestimatesbasedonmathematicalmodelspredictthataround5% of cases may take greater than 21 days todevelop.
Symptomsusuallybeginwithasuddeninfluenza-likestagecharacterized by feeling tired, fever, weakness, decreased appetite, muscular pain, joint pain, headache, and sore throat. The fever is usually higher than 38.3 °C (101 °F). This is often followed by nausea, vomiting, diarrhea, abdominal pain, and sometimeshiccups.
The combination of severe vomiting and diarrhea often leads to severe dehydration. Next, shortness of breath and chest pain may occur, along with swelling, headaches, and confusion In about half of the cases, the skin may develop a maculopapular rash, a flat red area covered with small bumps, five to seven days after symptomsbegin.

Bleeding

In some cases, internal and external bleeding may occur. This typically begins five to seven days after the first symptoms. All infected people show
some decreased blood clotting Bleeding from mucous membranes or from sites of needle punctures has been reported in 40–50% of cases.
This may cause vomiting blood, coughing up of blood, or blood instool.Bleeding into the skin may create petechiae, purpura, ecchymoses or hematomas (especially around needle injectionsites).
Bleeding into the whites of the eyes may also occur. Heavy bleeding is uncommon; if it occurs, it is usually in the gastrointestinal tract The incidence of bleeding into the gastrointestinal tract has decreased since earlier epidemics and is now[when?] estimated to be approximately 10% with improved prevention of disseminated intravascular coagulation.

Recovery and death

Recovery may begin between 7 and 14 days after first symptoms. Death, if it occurs, follows typically 6 to 16 days from first symptoms and is often due to low bloodpressure from fluid loss. In general, bleeding often indicates a worse outcome, and blood loss may result in death. People are often in a coma near the end of life.

Those who survive often have ongoing muscular and joint pain, liver inflammation, decreased hearing, and may have continued tiredness, continued weakness, decreased appetite, and difficulty returning to pre-illness weight. Problems with vision may develop.
Survivors develop antibodies against Ebola that last at least 10 years, but it is unclear whether they are immune to additional infections.

SymptomsofEVDmayappear2to21daysafterexposuretothevirus,buttheaverage is 8 to 10 days. A person infected with Ebola virus is not contagious until symptoms appear. Signs and symptoms of EVDinclude:

Fever ,Severeheadache, Fatigue, Muscle pain, Weakness, Diarrhea, Vomiting
Stomach pain, Unexplained bleeding orbruising

Diagnosis

Early symptoms of EVD such as fever, headache, and weakness are not specific to Ebola virus infection and are seen in patients with more common diseases likemalariaandtyphoidfever.TodeterminewhetherEbolavirusinfectionisapossible diagnosis, there must be a combinationof

- symptoms suggestive ofEVD.
- a possible exposure to the virus within 21 days before onset ofsymptoms.

Ebola virus can be detected in blood after onset of symptoms. It may take up to three days after symptoms start for the virus to reach detectable levels,

Laboratory testing

- Possible non-specific laboratory indicators of

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EVDinclude

- a low plateletcount;
- an initially decreased white blood cellcount
- followed by an increased white blood cellcount;
- elevated levels of the liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase(AST);
- abnormalities in blood clotting often consistent with disseminated intravascular coagulation (DIC) such as a prolonged prothrombin time, partial thromboplastin time, and bleedingtime.
- FilovirionssuchasEBOVmaybeidentifiedbythei runiquefilamentousshapes in cell cultures examined with electronmicroscopy.
- The specific diagnosis of EVD is confirmed by isolating the virus, detecting its RNA or proteins, or detecting antibodies against the virus in a person'sblood.
- Isolating the virus by cell culture, detecting the viral RNA by polymerase chain reaction (PCR)n and detecting proteins by enzyme-linked immunosorbent assay(ELISA)aremethodsbest used intheearlystagesofthediseaseandalsofor detecting the virus in humanremains.
- Detecting antibodies against the virus is most reliable in the later stages of the disease and in those whorecover.
- IgM antibodies are detectable two days after symptom onsetand
- IgG antibodies can be detected six to 18 days after symptomonset.

- During an outbreak, isolation of the virus with cell culture methods is often not feasible. In field or mobilehospitals,

The most common and sensitive diagnostic methods are real-time PCR and ELISA. In 2014. With new mobile testing facilities deployed in parts of Liberia, test results were obtained3–5hoursaftersamplesubmission.
In2015,arapidantigentestwhichgives resultsin15minuteswasapproved forusebyWHO. Duetoapplicationofthistest.
It is able to confirm Ebola in 92% of those affected and rule it out in 85% of those not affected.

Differential diagnosis

The symptoms are also similar to those of other viral hemorrhagic fevers such as Marburg virus disease, Crimean Congo hemorrhagic fever, and Lassafever.
The complete differential diagnosis is extensive and requires consideration of many

Other infectious diseases - such as

- typhoidfever,
- shigellosis,
- Candidiasis,
- Histoplasmosis,
- rickettsialdiseases,
- cholera,
- sepsis,
- borreliosis,
- EHECenteritis,
- leptospirosis,
- scrubtyphus,
- plague,
- Qfever,

Non-infectious diseases - That may result in symptoms similar to those of EVD include - acute promyelocytic leukemia, hemolytic uremic syndrome, snakeenvenomation,clotting factordeficiencies/platelet disorders, thromboticthrombocytopenic purpura, hereditary hemorrhagic telangiectasia, Kawasaki disease, and warfarinpoisoning.

Prevention
Vaccines

Many Ebola vaccine candidates had been developed in the decade prior to 2014,but as of November 2014, none had been approved for use in humans in the United States.In December2016,Ebolawasfoundtobe70–100%preventedbyrVSV-ZEBOVvaccine, making it the first proven vaccine against the disease. More than 100,000 people have been vaccinated against Ebola as of2019.

Infection control

PeoplewhocareforthoseinfectedwithEbolas houldwearprotectiveclothing including masks, gloves, gowns and goggles. The U.S. Centers for DiseaseControl (CDC) recommend that the protective gear leaves no skin exposed. These measuresarealsorecommendedforthosewhomayhan dleobjectscontaminatedbyan infected person's bodyfluids.

In2014,theCDCbeganrecommendingthatm edicalpersonnelreceivetraining onthepropersuit-

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upandremovalofpersonalprotectiveequipment(PPE) ;inaddition, adesignatedperson,appropriatelytrainedinbiosafety, shouldbewatchingeachstepof theseproceduresto ensuretheyaredonecorrectly.InSierraLeone,thetypic altraining period for the use of such safety equipment lasts approximately 12days.

The infected person should be in barrier-isolation from other people. All equipment, medical waste, patient waste and surfaces that may have come into contact with body fluids need to be disinfected. During the 2014 outbreak, kits were put together to help families treat Ebola disease in their homes, which included protective clothing as well as chlorine powder and other cleaning supplies. Education of caregivers inthesetechniques,andprovidingsuchbarrier-separationsupplieshasbeen a priority of Doctors WithoutBorders.

Ebola viruses can be eliminated with heat (heating for 30 to 60 minutes at 60°Corboilingfor5minutes).Todisinfectsurfaces,so melipidsolventssuchassome alcohol-based products, detergents, sodium hypochlorite (bleach) or calciumhypochlorite (bleaching powder), and other suitable disinfectants may be used at appropriate concentrations.

Education of the general public about the risk factors for Ebola infection and of the protective measures individuals may take to prevent infection is recommended by the World Health Organization. These measures include avoiding direct contact with infected people and regular hand washing using soap and water.

Bushmeat, an important source of protein in the diet of some Africans, should be handled and prepared with appropriate protective clothing and thoroughly cooked before consumption. Some research suggests that an outbreak of Ebola disease inthewildanimalsusedforconsumptionmayresultinac orrespondinghumanoutbreak. Since 2003, such animal outbreaks have been monitored to predict and prevent Ebola outbreaks in humans.

If a person with Ebola disease dies, direct contact with the body should be avoided. Certain burial rituals, which may have included making various direct contacts with a dead body, require reformulation so that they consistently maintain a proper protective barrier between the dead body and the living. Social anthropologists may help find alternatives to traditional rules for burials.

Transportation crews are instructed to follow a certain isolation procedure, shouldanyoneexhibitsymptomsresemblingEVD.As ofAugust2014,theWHOdoes not consider travel bans to be useful in decreasing spread of thedisease.

In October 2014, the CDC defined four risk levels used to determine the level of 21-day monitoring for symptoms and restrictions on public activities. In the UnitedStates,theCDCrecommendsthatrestrictionson publicactivity,includingtravel restrictions, are not required for the following defined risklevels:

- Having been in a country with widespread Ebola disease transmission and having no known exposure (low risk); or having been in that country more than 21 days ago (norisk).
- Encounterwithapersonshowing symptoms;butnotwithinthreefeetoftheperson with Ebola without wearing PPE; and no direct contact with bodyfluids.
- Having had brief skin contact with a person showing symptoms of Ebola disease when the person was believed to be not verycontagious.
- Countries without widespread Ebola disease transmission: direct contact with a person showing symptoms of the disease while wearingPPE.
- ContactwithapersonwithEboladiseasebeforethe personwasshowingsymptoms (norisk).

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Precautions

- When living in or traveling to a region affected by the Ebola virus, there are ways to protect yourself and prevent the spread of the virus. Practicing good handhygiene is an effective method of preventing the spread of dangerous germs, like the Ebola virus. Proper hand hygiene means washing hands often with soap and water or an alcohol-based handsanitizer.
- While in an area affected by Ebola virus, you shouldAVOID:
- Contact with blood and body fluids (such as urine, feces, saliva, sweat, vomit, breast milk, semen, and vaginalfluids)
- Itemsthatmayhavecomeincontactwithaninfecte dperson'sbloodorbodyfluids (such as clothes, bedding,needles,
- Funeral or burial rituals that require handling the body of someone who died from EVD.Contact with bats and nonhuman primates or blood, fluids, and raw meat prepared from these animals (bush meat) or meat from an unknownsource.
- Contact with semen from a man who had EVD until you know the virus is gone from thesemen.
- After returning from an area affected by Ebola virus, monitor your health for 21 days and seek medical care immediately if you develop symptoms ofEVD.

Precautions for Healthcare workers who may be exposed to people with EVD should:

- Wear appropriate personal protective equipment(PPE).
- Practice proper infection control and sterilizationmeasures.
- Avoid direct contact with the bodies of people who have died fromEVD.
- Notify health officials if you have direct contact with blood or body fluids of a person sick withEVD.
- It is important that health-care workers apply standard precautions consistently with all patients – regardless of their diagnosis – in all work practices at alltimes.
- Include basic hand hygiene, respiratory hygiene, the use of personal protective equipment and safe injectionpractices.
- Samples collected of suspected human and animal cases for laboratory diagnosis should be handledbytrainedstaffandprocessedin suitablyequippedlaboratories.

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Diagnostic tests and Treatments

- The diagnostic tests currently available require specialized equipment and highly trained personnel. Since there are few suitable testing centers in West Africa, this leads to delay indiagnosis.
- Recovery from EVD depends on supportive care and the patient's immune response. People who recover from EVDdevelop
- On29November2014,anew15-minuteEbolatestwasreportedthatifsuccessful, "not only gives patients a better chance of survival, but it prevents transmission of the virus to otherpeople."
- Thenewequipment,aboutthesizeofalaptopandsolar-powered, allowstestingto be done in remoteareas.
- On 29 December 2014, the FDA approved the **LightMix Ebola Zaire rRT- PCR test** for patients with symptoms ofEbola.
- AsofAugust2019,twoexperimentaltreatmentsknownas**REGN-EB3**and**mAb- 114** were found to be 90%effective.
- SymptomsofEVDaretreatedastheyappear.When usedearly,basicinterventions can significantly improve the chances of survival. Theseinclude:
- Providing fluids and electrolytes (body salts) through infusion into the vein (intravenously).
- Offering oxygen therapy to maintain oxygenstatus.
- Using medication to support blood pressure, reduce vomiting and diarrhea and to manage fever andpain.
- Treating other infections if theyoccur.
- Antibodies that can last for 10 years. It is not known if people who recover are immune for life or if they can become infected with a different species of Ebola virus. Some survivors may have long-term complications such as joint and vision problems.
- There is currently no antiviral drug licensed by the U.S. Food and Drug Administration (FDA) to treat EVD inpeople.
- Drugs that are being developed to treat Ebola virus infection work by stopping the virus from making copies ofitself.

II. CONCLUSION

We have described current knowledge of EVD based on a review of the literature. With the knowledge we have thus far, it appears that it will be difficult to predict the extent and outcomes of EVD epidemics in the future. However, about 30 years ago, human immunodeficiency virus HIV) infection suddenly emerged and spread throughout the world, and now, thanks to continuous efforts by the medical community, effective treatment methods against HIV infection are available, although thediseasecannotyetbeeradicated.EBOVandEVDare poorlyunderstoodatpresent, but there is hope that effective treatment methods to combat EVD will soon be developed.

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