ACTA SCIENTIFIC PHARMACEUTICAL SCIENCES (ISSN: 2581-5423)

Volume 3 Issue 7 July 2019

Review Article

Ebola Virus Disease: A Challenge for Humans

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Received: April 22, 2019; **Published:** June 20, 2019

DOI: 10.31080/ASPS.2019.03.0317

Abstract

Ebola virus also known as Ebola haemorrhagic fever, is a severe, often fatal illness in humans. Ebola virus disease (EVD) is transmitted to people from wild animals and spreads in the human population through person to person transmission. These viruses cause a disease characterised by systemic viral replication, immune suppression, abnormal inflammatory responses, major fluid and electrolyte losses, and high mortality. The World Health Organization (WHO) reports 24 outbreaks, 28633 cases and 11315 deaths in the recent outbreak. Currently, no specific treatment is available of Ebola's affected patients depends only supportive care and symptomatic treatment.

Keywords: Clinical Trials; Deaths; Amiodarone; Z Mapp; *Filoviridae*

Abbreviations

EVD: Ebola Virus Disease; EBOV: Ebola Virus; SUDV: Sudan Ebola virus; MARV: Marburg Ebola Virus; RAVV: Ravn Ebola Virus; BDBV: Bundibugyo Ebola Virus; DRC: Democratic Republic of Congo; U.S.: United State; U.K.: United Kingdom; CFR: Case Fatality Ratio; WHO: World Health Organization; CDC: Centers for Disease Control and Prevention; U.S.FDA: United States Food and Drug Administration.

Introduction

Ebola is the name of a small river in the North West of the Democratic Republic of Congo where the Ebola virus was first identified in humans in 1976 in Zaire (Figure 1). Ebola virus disease is an acute, viral and fatal illness among humans. EVD is a disease caused by infection with one of the five Ebola virus species of the family *Filoviridae* [1-5]. Four species, namely Sudan Ebola virus, Zaire Ebola virus, Bundibugyo Ebola virus and Cote d'Ivoire Ebola virus are capable of human infection with fatal outcomes [6]. Ebola virus transmitted from wild animals to human and could spread from human to human. The first outbreak of EVD was reported in 1967 in the DRC resulting in 318 cases and 88% death rate. According to WHO, the 2014 to 2016 outbreak of EVD in West Africa was the largest since the discovery of the Ebola virus in 1976 [7-9]. More than 28000 cases and 11000 deaths were reported from the 3-disaster affected mainly Sierra Leone, Liberia and Guinea in West Africa. The number of cases and deaths, geographical distribution, social and political impact, and duration of the epidemic have created a global public health crisis. The disease course of EVD is rapid. After about one-week incubation period, victims rapidly develop a high fever, diarrhea, vomiting, respiratory disorders, haemorrhaging and death ensues within a few days. Its exact aetiology was unknown, and there are no approved specific treatment or vaccine for the therapy of EVD. Ebola's affected patient dependent on the maintenance of intravascular fluid volume of the patients and palliative care, even though some tested compounds exhibit promising antiviral activities against the Ebola virus [10-12]. A worldwide effort has been made to develop new therapeutic strategies, several of which were potential vaccines where promising results were demonstrated in non-human primates. Medical volunteers from U.S., Cuba, India, China and many other places around the world travelled to West Africa to support efforts to control the spread of the disease and care for patients, the vast majority of whom had never seen a case of Ebola or encountered such a devastating disease [13,14].

Figure 1: An electron micrograph of Ebola virus, obtained on 13 October 1976 at the CDC.

Transmission of Virus

There have been no cases of sexual transmission; and the life cycle of Ebola virus and its mode of entry to the human body is unknown.

1. Ebola virus get transmitted through direct contact with the bodily fluids of an infected wild animal or human [15].
2. These include blood, saliva, sweat, semen, vomit, urine or faeces.
3. The urine can also be contracted by handling a sick or dead wild animal previously infected. Later on, this can be transmitted from human to human (Figure 2) [16].

Figure 2: Transmission of Ebola virus.

Epidemiology of virus

The first occurrence of the virus was recorded in the DRC. In West Africa, it was reported that the fatality rate of EVD was 90% in the 2013 outbreak [17]. This was an international public health emergency since there were 5740 cases in Guinea, 9890 in Liberia and 5000 in Sierra Leone as of 2 November 2014 [18]. There has been a big change in the epidemiology of EVD in the countries affected since the most recent outbreak (Table 1,2) [19-21]. A high number of cases are still being reported, most notably from the metropolitan areas of Katwa health zone during the past week. Trends in the number of new cases occurring in DRC health zones January to February 2019 (Figure 3,4 and 5) [22-26].

Figure 3: During the last 21 days (16 Jan to 5 Feb 2019) total 789 EVD cases, overall 488 deaths (CFR 62%).

Figure 4: During the last 21 days (23 Jan to 12 Feb 2019) total 823 EVD cases, overall 517 deaths (CFR 63%).

Figure 5: During the last 21 days (6 Feb to 26 Feb 2019) total 879 EVD cases, overall 553 deaths (CFR 63%).

Month-year	Country	Virus	Cases	Deaths	CFR
Jun-Nov 1976	Sudan	SUDV	284	151	53%
Aug 1976	Zaire	EBOV	318	280	88%
Aug-Sep 1979	Sudan	SUDV	34	22	65%
Dec 1994; Feb 1995	Gabon	EBOV	52	31	60%
May-Jul 1995	Zaire	EBOV	315	254	81%
Jan-Apr 1996	Gabon	EBOV	37	21	57%
Jul 1996; Mar 1997	Gabon	EBOV	60	45	75%
Oct 2000; Jan 2001	Uganda	SUDV	425	224	53%
Oct 2001; Jul 2002	Gabon; Republic of the Congo	EBOV	135	107	79%
Dec 2002; Apr 2003	Republic of the Congo	EBOV	143	128	90%
Nov-Dec 2003	Republic of the Congo	EBOV	35	29	83%
Apr-Jun 2004	Sudan	SUDV	17	7	41%
Aug-Nov 2007	DRC	EBOV	264	187	71%
Dec 2007; Jan 2008	Uganda	BDBV	149	37	25%
Dec 2008; Feb 2009	DRC	EBOV	32	14	45%
Jun-Aug 2012	Uganda	SUDV	24	17	71%
Jun-Nov 2012	DRC	BDBV	77	36	47%
Dec 2013; Jan 2016	**Widespread:** Liberia; Sierra; Leone and Guinea **Limited and local:** Nigeria; Mali; U.S.; Senegal; Spain; U.K. and Italy	EBOV	28616	11310	70-71% general; 57-59% among hospitalized patients
Aug-Nov 2014	DRC	EBOV	66	49	74%
May-Jul 2018	DRC	EBOV	54	33	61%
August 2018- present	DRC	EBOV	1112	582	ongoing

Table 1: List of Ebola virus disease (major or massive) outbreaks.

Year	Country	Virus	Cases	Deaths	CFR
1967	West Germany, Yugoslavia	MARV	31	7	23%
1975	Rhodesia, South Africa	MARV	3	1	33%
1980	Kenya	MARV	2	1	50%
1987	Kenya	RAVV	1	1	100%
1990	Soviet Union	MARV	1	1	100%
1998-2000	DRC	MARV, RAVV	154	128	83%
2004-2005	Angola	MARV	252	227	90%
2007	Uganda	MARV; RAVV	4	1	25%
2008	Uganda; Netherlands and U.S.	MARV	2	1	50%
2012	Uganda	MARV	15	4	27%
2014	Uganda	MARV	1	1	100%
2017	Uganda	MARV	3	3	100%

Table 2: List of other Filoviridae outbreaks.

Symptoms of virus

Symptoms may appear anywhere from 2 to 21 days after contact with the virus, with an average of 8 to 10 days. Many common illnesses can have these same symptoms, including influenza (flu) or malaria [27]. First symptoms are the sudden onset of fever fatigue, muscle pain, headache and sore throat (Figure 6). This is followed by vomiting, diarrhea, skin rash, symptoms of impaired kidney and liver function, and in some cases, both internal and external bleeding (e.g. oozing from the gums, blood in the stools). Laboratory findings include low white blood cell and platelet counts and elevated liver enzymes [28].

Figure 6: Occur 2 to 21 days after exposure, but 8 to 10 days is most common.

Prevention and control of virus

1. Regular hand washing after handling patients.
2. Using protective gloves, wearing facial masks in vicinity of Ebola patients.
3. Use personal protective equipment's and proper sterilization of equipment's.
4. Early detection/contract tracing/isolation [29].
5. Burial of the dead- people who have died from Ebola should be promptly and safely buried.
6. Screening travelers from affected countries from EVD [30].
7. Public awareness from EVD and health messages should focus on reducing the risk of pig to human transmission as a result of unsafe animal husbandry and slaughtering practices, and unsafe consumption of fresh blood, raw milk or animal tissue (Figure 7) [31].

Figure 7: Prevention and control.

Treatment of virus

According to U.S. FDA currently, there is no licensed vaccine available for the treatment of EVD. Treatment against EVD mainly consist of providing medical care based on symptomatic therapy to maintain the vital respiratory, cardiovascular and renal functions (Table 3). However, a range of potential treatments including blood products, antibodies, immune therapies and drug therapies are currently being evaluated in clinical trials (Table 4) [32,33].

S. No.	Condition	Recommended care
1	Concomitant infections	Broad spectrum antibiotics, empirical systematic malaria treatment in malaria-endemic areas
2	Nausea or vomiting	Antiemetic drugs (metoclopramide, ondansetron and haloperidol)
3	Severe pain	Opiates
4	Palliative care	Opiates
5	Mild to moderate pain	Paracetamol
6	Critical ill patients	Oral feeding wherever possible, enteral feeding
7	Hypoxaemia	Oxygen therapy
8	Encephalitis/encephalopathy	Opiates for symptomatic management

Table 3: Symptomatic therapy for Ebola virus disease.

S. No.	Vaccines and antibodies therapy	Company/country origin
1	cAd3	GlaxoSmithKline, Brentford (London)
2	rVSV	National Microbiology Laboratory in Winnipeg, Manitoba (Canada)
3	Favipiravir (T-705)	Toyama chemicals, Tokyo (Japan)
4	Z Mapp	MappBio, San Diego, CA, (United States of America)
5	TKM-130803 (TKM)	Arbutus Biopharma, formerly Tekmira Pharmaceuticals, Burnaby (Canada)
6	mAb114	Ridgeback Biotherapeutics LP., Biotechnology company, Miami, (Florida)
7	Galidesivir (BCX4430, Immucillin-A)	BioCryst Pharmaceuticals, Inc., Pharmaceutical company, Durham, North Carolina (United States)
8	Triazavirin (TZV)	Ural Center for Biopharma Technologies and Medsintez Pharmaceutical (Russia)
9	MK-608	Merck & Co., Inc, American pharmaceutical company

Table 4: Therapeutics evaluation in clinical trials of vaccines and antibodies in EVD.

Conclusion

Ebola virus disease or Ebola haemorrhagic fever is caused by Ebola viruses. Disease has high mortality and no specific treatment or vaccine. Diagnosis by detection of viral RNA, viral antibodies or virus itself. Treatment is mainly supportive in nature. This article can be used as a basis for further research that could be conducted to explore the knowledge of EVD among healthcare professionals in other parts of the world.

Acknowledgements

Author would like to thanks to Mr. Ravi Tomar, Manoj Kumar, NitishTyagi and Peeyush Kumar Shukla of B. Pharm final year students of Meerut Institute of Engineering and Technology Meerut (Uttar Pradesh), India; for her support and helpful in cooperation in the data collection process.

Conflict of Interest

The Author declare that there is no conflict of interest.

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