Review Article

10.37821/ruhsjhs.3.2.2018.106-110

Ebola: An Update for the Dentist

Ruchi D Raval [1], Surendra Lodha [2]

[1]Assistant Professor, Department of Periodontics and Implantology, Manubhai Patel Dental College, Hospital and ORI, Vadodara, Gujarat, [2]Practitioner, Umrao Dental Clinic, Bhilwara, Rajasthan, India.

ABSTRACT

A large eruption of Ebola virus disease was reported in March 2014 in areas of West Africa. World Health Organization declared this outburst as the largest a Public Health Emergency in 2014. The spread of virus is rapid with squat incubation period. It has been found to have high rate of mortality and morbidity making the disease a massive distress. To curb this epidemic, the health care professionals should play a dynamic role in treatment and prevention. Dentist, being a part of the health safety team should also have profound knowledge about the disease. The article provides precise guidelines to orient the dentists towards diagnosis, screening, precautions and disinfection while managing Ebola infected patients. Data was collected using electronic media consisting of articles, books, and websites.

INTRODUCTION

Ebola virus causes rare disease of humans and primates known as Ebola virus disease (EVD); Ebola hemorrhagic fever or Ebola. Since March 2014 there has been a large outbreak of Ebola virus disease in West Africa, Spain, the UK, and the USA. This was the largest ever known outburst of the disease, prompting the World Health Organization (WHO) to declare a public health emergency in 2014. To curb the wave, one requires synchronized services by health care providers, dentist being one among them. This article is a short review about the Ebola virus disease and management of Ebola affected patients in dental settings. Data was collected using electronic media consisting of articles, books and websites.

Ebola virus belongs to family *Filoviridae* which comprises of five viral classes, one i.e. *Reston ebolavirus* has not been known to cause any infection in humans while four others (*Zaire ebolavirus*, *Sudan ebolavirus*, *Bundibugyo ebolavirus*, and *Tai Forest ebolavirus*) lead to fatal viral hemorrhagic fever (VHF). *Filoviruses* are enveloped RNA viruses that append to host cells through glycoproteins (GPs) on the viral outer membrane.[1] Formation of filovirus particles can be biologically pleomorphic. It can be long with/without branches or short in various shapes of "6","U" or a circle. Filaments are made up of single-stranded, negative-sense RNA covered in a lipid membrane and are 14,000 nm in length and 80 nm in diameter. New viral particles are assumed to be formed by budding from the surface of their host's cells.[2]

Clinical Features

Clinical characteristics are alienated into four main phases as follows[3]:

Phase 1: Influenza-like syndrome: The onset is sudden with nonspecific features such as high fever, headache, arthralgia, nausea, sore throat, and myalgia.

Phase 2: Acute (days 1 to 6): Constant fever unresponsive to anti-malarial drugs or to antibiotics, headache, and intense fatigue trailed by diarrhoea, abdominal pain, and vomiting.

Phase 3: Pseudo-remission (days 7 to 8): Patient shows improvement in physical condition, with few demonstrating recovery and endurance.

Phase 4: Aggravation (day 9): Many cases show worsening of health with following symptoms:

- Skin manifestations: petechiae, purpura (morbiliform skin rash)
- Respiratory disorders: dyspnea, cough, hiccups, throat and chest pain
- Cardiovascular distress and hypovolemic shock.

The incubation period for clinical manifestations is 2 to 21 days.[4,5] Symptoms start subsiding within 7 to 14 days.[6] However, mortality due to fluid loss is quite frequent.[7]

Transmission

Infection in the first human being is initiated through contact with an infected creature, famously known as spill-over effect. It is not air, water or food borne. Nonetheless it does spread through blood and body fluids.[8-10] Risk depends on the nature of contact. Casual contact with feverish but convalescent patient leads to low risk. High risk is linked to straight contact with infected persons, body fluids, prick injury, participation in funeral rituals, and travel to virus prone areas without personal protective equipments.[11] Brainard et al[12] in 2016 did a systematic review to conclude that the risk of transmission is higher in care givers at home than hospitals. Women's increased exposure can be attributed to time spent at home and their responsibility for caring for the sick, while men's increased vulnerability to the infection can be attributed to their responsibility for caring for livestock and time spent away from home.

Pathophysiology

Ebola virus disease has been found to be genetically predisposed by 20 recognized genes (*CLDN3*, *ILF2*, *ILF3*, *NDUFA12*, *RUVBL2*, *SLC38A5*, *ACCN1*, *CEBPE*, *CRHR2*, *FAM63A*, *HMP19*, *IL2RA*, *LTF*, *PSMA1*, *RCHY1*, *SLC9A7*, *AC009283*, *LOC100289371*, *LOC440871*, *miR-122*).[13] After entering the host, virus duplicates in endothelium, liver, and immune system with release of inflammatory mediators ensuing septic shock.[8] Its pathogenesis is also affected by psychosomatic side effects of fear related behaviour.[14]

Epidemiologic update

A total of 13,703 confirmed, probable, and suspected cases of Ebola virus disease (EVD) have been reported in the affected countries (Guinea, Liberia, Mali, Sierra Leone, Nigeria, Senegal Spain, and the United States of America) by the end of October 2017 and there have been 4,922 deaths. The outbreaks of EVD in Senegal and Nigeria were declared on 17th October and 19th October 2014, respectively. Yet EVD transmission remains persistent and widespread in Guinea, Liberia, and Sierra Leone.[15] Climate conditions affect the biology of the virus and host, as its epidemic coincides with the end of the monsoon period.[16]

Diagnosis

Within few days of appearance of the clinical manifestations, few tests like antigen-capture ELISA testing, IgM ELISA, PCR, and virus isolation tests are done for initial gauging. In the terminal stages of disease and during the period of convalescence, detection of IgM and IgG antibodies serve as a reasonable marker. Other non-specific laboratory indicators of EVD include low platelet count; elevated levels of liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST); disseminated intravascular coagulation (DIC) and prolonged prothrombin time, partial thromboplastin time, and bleeding time.[17]

Treatment

No concrete treatment has been established yet for the Ebola virus disease. Supportive and palliative treatment like oral rehydration therapy (drinking slightly sweetened and salty water) and intravenous fluids[18,19] are done by many physicians to enhance the well being of the patient. Many Ebola vaccines are under investigations but still not accepted by United States Food and Drug Administration (US-FDA) for clinical use in humans. Furthermore, two drugs have been recently mapped for therapy namely ZMapp and TKM-Ebola. ZMapp is a blend of three monoclonal antibodies meant to target specific viral GPs while TKM-Ebola interferes with viral RNA polymerase crucial for replication. But FDA approval of these therapies is still awaited.[20] A simplified guide for symptomatic treatment of Ebola virus disease is given in table 1.

FACETS FOR DENTIST

Screening Protocol

Early diagnosis and prompt treatment forms the main protocol. Medical assistance include timely detection of case, pursuing those who have come into contact with infected persons, quick access to laboratory services, adequate health management of infected patients, and proper disposal of the dead through cremation or burial.[4] Returning travellers are categorized into 1, 2 or 3 and asked to observe respective category advice for 21 days since their departure from Ebola affected area.[23] Category 1 individuals carry low down risk of infection as they have merely travelled to Ebola affected locale without any direct encounter with the virus in any form. Category 2 and 3 individuals include those who had some contact with Ebola. It has been proposed to put an Infrared thermography (IRT) into practice at airports to defer the feverish patients from spreading the disease to other countries; however its competence is yet question-able.[24]

Table1: Symptomatic treatment of Ebola virus disease[21,22]

Symptom	Recommended	Not recommended or second-line drugs
Fever	Paracetamol	NSAIDS (bleeding and nephrotoxicity)
Pain and headache	Paracetamol	NSAIDS (bleeding and nephrotoxicity) opioids in severe cases
Vomiting	Metaclopramide, Chlorpromazine, Ondansetron	
Diarrhea	Rehydration as described above, Zinc sulfate for children	
Heart burn	Antacids or PPIs (omeprazole)	
Secondary infection, sepsis	Broad spectrum antibiotics (as third-generation cephalosporins)	
Seizures	IV or, if no access, IM or rectal diazepam	Phenobarbital if repeated or persistent
Psychological symptoms (anxiety, agitation, and confusion)	Psychic support, keep the patient in calm room	With caution sedatives such as diazepam can be used in severe cases

NSAIDs-Nonsteroidal anti-inflammatroy drugs; PPI-Proton pump inhibitor; IM-Intramuscular; IV-Intravenous

Treatment Protocol

Treatment plan depends on the category of the patient. For category 1 patients, standard protocol is followed. Patients in category 2 or 3 should be kept under observation for 21 days, while delaying non-essential treatment. If they present with an urgent dental problem, symptomatic relief of pain and infection should be considered by medicines during the 21 days observation period. Nevertheless, if it is not possible to delay the treatment, contact the local health protection team (HPT) for individual case risk assessment and support.[23] Basic life support interventions of CAB, i.e. circulation, airway and breathing should also be performed by the dentist to pick up the odds of endurance.

Precautions

*Ebola virus*es are biosafety level-four pathogens requiring singular method of protection for health care workers. The viruses can stay alive in liquid or dried material but are inactivated by gamma irradiation, heating for 60 minutes at 60°C, or boiling for five minutes and are susceptible to sodium hypochlorite. Freezing or refrigeration will not inactivate *Ebola virus*es.[25] Additive measures like doffing with Pulsed xenon ultraviolet (PX-UV) can also be used as an adjunct to sterilization.[26] CDC guidelines recommended for the dentists for safe handling of Ebola infected individuals and Ebola contaminated objects are as follows:[27]

- Procedure should be performed in closed area with negative pressure by using N95 respirators or powered air purifying respirators (PAPR).
- Personal protective equipments (PPE) are mandatory for example double gloving, shoe, and leg covers etc.
- Minimize the number of staff present in the room

with documented details about them.

- Use disposable medical apparatus (if possible).
- Adhere to all the guidelines of CDC while disinfecting the room.
- Respiratory shield should be of good quality if aerosol generating procedure cannot be avoided.
- All the laboratory samples must be transported in person rather than utilizing tubing systems. The entire laboratory staff should be alerted about infectious nature of the samples.[28]

Infection Control

Disinfection of dental clinic is mandatory. Equipments can be treated by heat (30-60 minutes at 60 °C) or boiled for five minutes. Lipid solvents like alcohol-based products, detergents, sodium hypochlorite (bleach) or calcium hypochlorite (bleaching powder) at passable concentration have been seen to be efficient.[29]

Apart from category 2 or 3, the dentists have been advised not to treat patients if they have any signs and symptoms of Ebola virus disease. However, if the patient presents with serious oral health conditions such as dental infections and pain, follow the same protocol as is followed for category 2 or 3.

CONCLUSION

As a part of infection control expert team, dentists should have thorough understanding and comprehension regarding the Ebola virus disease. They should have sufficient time and resources to manage a case of Ebola. Staying up to date on infection control is the responsibility of all dental health care professionals. However, dentists are advised to handle infectious disease by working in close collaboration with health protection team.

REFERENCES

1. Iversen PL, Warren TK, Wells JB, Garza NL, Mourich DV, Welch LS, et al. Discovery and early development of AVI-7537 and AVI-7288 for the treatment of Ebola virus and Marburg virus infections. Viruses 2012; 4(11):2806-30.
2. Ebola haemorrhagic fever in Sudan, Report of a WHO/ International Study Team. Bull World Health Organ 1978; 56:247-70.
3. Casillas AM, Nyamathi AM, Sosa A, Wilder CL, Sands H. A current review of Ebola virus: pathogenesis, clinical presentation, and diagnostic assessment. Biol Res Nurs 2003; 4(4):268-75.
4. Ebola virus disease Fact sheet No. 103". World Health Organization. September 2014. (http://www.who.int/en/news-room/fact-sheets/detail/ebola-virus-disease).
5. Ebola Hemorrhagic Fever Signs and Symptoms. CDC. 28 January 2014. Retrieved 2 August 2014. (http://www.who.int/en/news-room/fact-sheets/detail/ebola-virus-disease).
6. Magill, Alan. Hunter's tropical medicine and emerging infectious diseases. (9th ed.). New York: Saunders, 2013;332. ISBN 9781416043904.
7. Ruzek, edited by Sunit K. Singh, Daniel. Viral hemorrhagic fevers. Boca Raton: CRC Press, Taylor & Francis Group, 2014;444. ISBN 9781439884294.
8. Funk DJ, Kumar A. Ebola virus disease: an update for anesthesiologists and intensivists. Can J Anaesth 2015; 62(1):80-91.
9. Ebola (Ebola Virus Disease) Transmission. CDC. 5 November 2014. Retrieved 7 November 2014. (https://www.cdc.gov/vhf/ebola/transmission/index.html).
10. Drazen JM, Kanapathipillai R, Campion EW, Rubin EJ, Hammer SM, Morrissey S, et al. Ebola and quarantine. N Engl J Med 2014; 371(21):2029-30.
11. Rewar S, Mirdha D. Transmission of ebola virus disease: an overview. Ann Glob Health 2014; 80(6):444-51. (https://www.cdc.gov/vhf/ebola/transmission/index.html).
12. Brainard J, Hooper L, Pond K, Edmunds K, Hunter PR. Risk factors for transmission of Ebola or Marburg virus disease: a systematic review and meta-analysis. Int J Epidemiol 2016; 45(1):102-16.
13. Garamszegi S, Yen JY, Honko AN, Geisbert JB, Rubins KH, Geisbert TW, et al. Transcriptional correlates of disease outcome in anticoagulant-treated non-human primates infected with ebolavirus. PLoS Negl Trop Dis 2014; 8(7):e3061.
14. Shultz JM, Cooper JL, Baingana F, Oquendo MA, Espinel Z, Althouse BM, et al. The Role of Fear-Related Behaviors in the 2013-2016 West Africa Ebola Virus Disease Outbreak. Curr Psychiatry Rep 2016; 18(11):104.
15. Ebola response roadmap situation report 29 October 2014, World Health Organization, Geneva (2014). (http://apps.who.int/iris/bitstream/handle/10665/135600/roadmapsitrep_1Oct2014_eng.pdf?sequence=1).
16. G Carballal. Emerging or re-emerging viruses? Medicina-Buenos Aires 1996; 56:97-101.
17. Kortepeter MG, Bausch DG, Bray M. Basic clinical and laboratory features of filoviral hemorrhagic fever. J Infect Dis 2011; 204(3):810-16.
18. Statement on the WHO Consultation on potential Ebola therapies and vaccines. WHO. 5 September 2014.

Retrieved 1 October 2014. (http://www.who.int/media centre/news/statements/2014/ebola-therapies-consultation/en/).

19. Galvani AP, Ndeffo-Mbah ML, Wenzel N, Childs JE. Ebola vaccination: if not now, when? Ann Intern Med 2014; 161(10):749-50.
20. Beeching NJ, Fenech M, Houlihan CF. Ebola virus disease. BMJ 2014; 349:g7348.
21. WHO. Clinical management of patients with viral haemorrhagic fever: a pocket guide for the front-line health worker. 2014.(http://apps.who.int/)
22. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. Crit Care Med. 2013;41:580-637.
23. PHE publications gateway number: 2014616 Published (v2): 13 February 2015.
24. Mass Thermography Screening for Infection and Prevention: A Review of the Clinical Effectiveness [Internet]. Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2014 Nov 19.
25. Ebola virus. Pathogen safety data sheet - infectious substances, Public Health Agency of Canada, 2014.(https://www.canada.ca/en/public-health/services/laboratory-biosafety biosecurity/pathogen-safety-data-sheets-risk-assessment/ebolavirus.html).
26. Jinadatha C, Simmons S, Dale C, Ganachari-Mallappa N, Villamaria FC, Goulding N, et al. Disinfecting personal protective equipment with pulsed xenon ultraviolet as a risk mitigation strategy for health care workers. Am J Infect Control 2015; 43(4):412-14.
27. Centers for disease control and prevention. Infection prevention and control recommendations for hospitalized patients with known or suspected Ebola hemorrhagic fever in U.S. hospitals, 2014. (https://www.cdc.gov/vhf/ebola/clinicians/evd/infection-control.html).
28. Koenig KL, Majestic C, Burns MJ. Ebola virus disease: essential public health principles for clinicians. West J Emerg Med 2014; 15(7):728-31.
29. Infection prevention and control guidance for care of patients with suspected or confirmed filovirus haemorrhagic fever in health-care settings with focus on Ebola. WHO. August 2014. Retrieved 21 August 2014. WHO reference number: WHO/HIS/SDS/2014.4 Rev.1. (http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/)

Corresponding Author

Dr Ruchi D Raval, Assistant Professor, Department of Periodontics and Implantology, Manubhai Patel Dental College, Hospital and ORI, Munjmahuda, Near Vishwamitri Bridge, Vadodara, Gujarat, India.

email: ruchi.raval18@gmail.com