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## THE RISK OF CONTRACTING EBOLA VIRUS AND ITS PREVENTION

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### Abstract

Ebola is a severe, acute viral disease, characterized by the sudden onset of fever, vomiting, and profuse diarrhoea, leading to severe dehydration, haemorrhagic diathesis, significant blood loss, shock, often with a fatal outcome. The disease is transmitted by either direct contact with blood or other bodily fluids of live or deceased infected people. Transmission may also occur by unprotected sexual contact or by direct contact with the blood or body fluids of animals. Before 2013, the maximum number of infected people in a single outbreak of Ebola was 425. This figure was significantly exceeded during the largest wave of Ebola that began in December 2013 in West Africa. The epidemiological situation is being closely monitored by the states of the European Union. The World Health Organization has issued recommendations for travellers to countries affected by the Ebola virus.

Key words: viral disease, transmission, clinical manifestation, incidence, measures

## Introduction

Ebola is a very severe, acute viral disease characterized by the sudden onset of symptoms such as fever, vomiting, profuse and diarrhoea, which leads to severe dehydration, haemorrhagic diathesis, significant blood loss, shock, and often results in a fatal outcome.

## History and incidence

The first acknowledged incidence dates back to 1972, when a particular doctor (Tom Cairns) contracted the disease by being exposed to an eviscerated corpse, but only thereafter did this become publicly recognized.

The first contemporary presence of the disease was publicly acknowledged in 1976, when an outbreak of epidemic haemorrhagic fever emerged in southern Sudan and northern Zaire (now the Democratic Republic of Congo). In southern Sudan—specifically near the settlements of Nzara, Maridi, and Juba—151 people were infected with the Sudan Ebola virus strain; 53% were fatal. In Zaire, specifically in the area of the river Ebola, 280 people were infected by the Zaire strain of the Ebola virus, where fatality was 88%. The Ebola virus took its name from the River Ebola.

The occurrence of the Ebola virus has been rare in subsequent years. By 2013, the maximum number of infected people in a single Ebola outbreak had reached 425 persons (in 2000–2001). This number was exceeded significantly in December 2013 in western Africa, where the most severe outbreak of Ebola ever was recorded. This concerned the Zaire Ebola virus strain. The first occurrence of the virus took place in December 2013 in southern Guinea (the WHO statement was not made until March 2014). From this area, the disease spread to the two neighbouring countries Liberia and Sierra Leone, and consequently spread through travel to several other states.

By October 12, 2014, the total number of reported infected people had reached 8,997 (out of which 5,006 of the infected were laboratory confirmed). Out of these 8,997 cases, 4,493 people died (50% death rate) [1,2,3].

## Etiology

The causative agent is highly pathogenic non-enveloped RNA Ebolavirus of the Filoviridae genus. Serologically distinct strains were isolated and named according to the place of occurrence. We are currently familiar with five kinds of virus of the Ebolavirus genus, in the following order: Zaire Ebolavirus, Sudan Ebolavirus, Tai Forest Ebolavirus, Bundibugyo Ebolavirus, and Reston Ebolavirus.

The first four types have African origin and are the cause of disease in humans and animals. Reston originates from the Philippines and is the cause of disease only in animals. The pathogenicity of the various subtypes to humans is diverse: the most severe mortality has been reported in the Zaire subtype of Ebolavirus that caused a major epidemic in 2014.

Ebola virus is about 80 nm in diameter with a standard length of 970 nm. The virus has a length ratio of about 1:12 and the form can be either twisted or bent. This virus is morphologically indistinguishable from the Marburg virus; however, immunologically it is completely different. The Ebola virus can be reliably deactivated with ultraviolet light, gamma irradiation, 1% formalin, P-propiolactone, hypochlorite, and at a temperature of 60°C for 30 minutes. Ebola can also be effectively destroyed by soap, bleach, sunlight, or drying, therefore laundering in a washing machine is effective. When placed on a surface, or a surface exposed to direct sunlight, the virus can only survive for a short period.

## **Epidemiology**

Susceptibility to Ebola fever disease is generalized. It is assumed that there is a reservoir in animals. Bats appear to be the most probable animal reservoir, because only they are able to replicate the virus without contracting severe disease. Reservoir animals may also be living or deceased wild animals such as monkeys and forest antelopes.

Transmission from human to human has yet been clearly demonstrated, only perhaps by direct bodily contact with infected (also deceased) people or animals, or through blood contact and other bodily fluids. [4] Transmission may occur through unprotected sexual contact with recovered patients, even when several weeks have passed since recovery.

The main reason for the unrecognized rapid spread of Ebola fever in hospitals is human-to-human transmission in the early days of the epidemic stages, with health professionals affected the most, in particular those who do not use barrier protection due to ignorance or unconfirmed diagnosis. [5]

Transmission of infection is also possible by objects infected by bodily fluids (materials, needles, etc.), as the virus most likely survives outside the body on objects for several days. However, the virus is deactivated after a few days when exposed to dry surfaces in direct sunlight. [6]

The virus is able to survive on objects, especially at low temperatures (e.g., in one study at 4°C for more than 50 days on a glass object) and at room temperature. According to some studies, the virus seems to have survived on objects only for a few hours or not at all. [7] Aerogenic transmission only occurs in the Reston sub-types, whereas in others it is very rare. The WHO currently states that transmission of the disease by air has not yet been proven. [8] However, according to

Smith 2006, in some cases, disease transmission could possibly be air born, particularly in the Reston Ebolavirus strain. The study suggests that Zaire Ebolavirus has been transmitted in some cases without direct contact with an infected person. In 1995, isolation of Ebolavirus took place from lung tissue. [8] A different kind of test on monkeys proved that the virus could also be transmitted by directly breathing via water droplets via air onto monkeys [7]. In another test, Zaire Ebolavirus was transferred from pigs to monkeys without direct contact, although, paradoxically, the virus was not transmitted from monkey to monkey under the same conditions. [9] It is assumed (at least for the Sudan and Zaire Ebolavirus), that the virus gets transmitted specifically through mucous membranes and conjunctivas, throat surfaces, the digestive tract, through small skin abrasions, and possibly by aerosols. [9]

Incubation time most commonly lasts for 14–16 days, but may range from 2–21 days. The pathogenesis is not very clear. The virus attacks different tissues, including lymphoid and endothelial cells. This process involves extensive production of cytokines, development of SIRS and multiple organ dysfunction. Dysfunction of the vascular endothelium promotes the formation of DIC and necrosis of the liver and other organs. Persistent viremia continues for the entire acute phase of the disease, and with a favourable course of treatment the disease disappears and clinical recovery is achieved.

### **Clinical manifestation**

Typical onset of the disease begins with sudden fatigue, malaise, fever, chest pain, general pain, nausea, vomiting and diarrhoea. Macula-papulosis rash, pharyngitis with painful ulceration, dry cough, myalgia and arthritis begin to appear around the fifth day. Profuse diarrhoea and vomiting lead to significant dehydration. In about 70% of cases, bleeding gums, and nasal and vaginal bleeding appear on the seventh day. Internal haemorrhage (typically of the gastrointestinal tract) and haemorrhagic skin lesions appear very often. Jaundice occurs in only about 5% of cases. Patients die in the second week of the disease due to substantial blood loss, dehydration and shock. [10]

### **Diagnostics**

In terms of recognition of the disease, emphasis is placed on travel history in affected areas.

Significant thrombocytopenia, leukopenia, and a significant increase in transaminases can be sought in laboratory examinations.

In the serological diagnosis, a widely used indirect immunofluorescence test often leads to false positive results. Significantly, the ELISA test or standard-

ized “Western blot essay” is more accurate. Seroconversion occurs between the 8th and 12th day of illness. IgM antibodies can be detected by the ELISA test in the period near to recovery.

Viral cultivation of blood and other biological materials is possible during the febrile stage. For the purposes of isolating and cultivating the virus, primary isolation on guinea pigs may be used on a number of cell lines (Vero, clone E-6, E 13, the MA-104 Reston sub-type).

In suspected cases or early laboratory diagnosis of Ebola virus, the detection of viral ribonucleic acid (RNA) or viral antigen is recommended. Tests are based on the identification of viral RNA by real-time polymerase chain reaction (RT-PCR) PCR using the reverse transcriptase assay or detection of specific antigen of Ebola virus. Negative laboratory testing for the presence of Ebola virus requires two negative results of RT-PCR from a specimen, taken at least 48 hours apart. Laboratory diagnosis can only be performed in maximum safety laboratories.

## **Therapy**

There is only symptomatic treatment for the disease: no specific treatment is available. Administration of interferon is ineffective and usually results in fever and other symptoms that only complicate the underlying condition. Positive results have been shown in transfusion of blood from patients with recent illness. The monitoring of blood clotting and maintaining fluid and electrolyte balance appears to be very important.

## **Prevention and prophylaxis**

Unfortunately, there is no vaccine against the disease. Even though a DNA vaccine is currently under development, the results are currently not very promising.

The risk of contracting Ebola infection is low when travelling to affected areas (Guinea, Liberia and Sierra Leone and Nigeria), unless directly exposed to bodily fluids of infected live or deceased people and animals. The disease is not transmitted through casual contact in public with people who do not exhibit signs of the disease. Ebola virus is not transmitted by handling money or food, or swimming in pools. Transmission by mosquitoes has been detected.

## **Health measures**

Disease or suspected Ebola fever should be reported immediately. [11]

The health of persons who have returned from affected areas should be monitored for at least 21 days after leaving the affected area. This reflects the maximum incubation period of the Ebola Virus (2–21 days).

Travellers returning from affected areas should stay at home and contact their family doctor if experiencing symptoms such as body temperature  $\geq 38.6^{\circ}\text{C}$ , headache, vomiting, diarrhoea, abdominal pain, or unexplained bleeding. The doctor should be informed about the clinical condition and travel anamnesis of the affected person.

Transport of patients suspected of carrying the disease is carried out by Coordination centres of the Emergency Medical Services (EMS KOS) in Bratislava, Banská Bystrica and Košice (in the headquarters designated for infectious workplaces). Paramedic staff will then place the person suspected of carrying the disease into a Biovak transport, and surface disinfection of staff members and the Biovak vehicle takes place. Subsequently, the Biovak containing the suspected case and other involved individuals are transported to the relevant department of infectious diseases at the local hospital.

During the transportation period, the patient is looked after by two persons equipped with protective devices.

The patient and caregivers are immediately placed into isolation for a period of 3 weeks in a separate part of the isolation ward. If the infectiology unit decides to collect biological material for laboratory testing for Ebola, the National Reference Centre for Haemorrhagic Fevers is informed, and biological material is collected.

The Public Health Office of the Slovak Republic (PHO SR) provides transport of clinical specimens via certified services to an accredited laboratory in Hamburg (Germany). The Public Health Authority ensures reporting of confirmed cases to the European Centre for Disease Prevention and Control (ECDC) and the World Health Organization (WHO).

The patient is isolated for a period of 5 days after the last measured elevated temperature. Specimen collection should be carried out in a mask, coat, apron, cap, goggles, face shield, rubber gloves, and boots. Infectious material is then dispatched by a special security team. Sample examination is carried out at a limited number of laboratories that co-operate with the World Health Organization and are equipped with maximum-security facilities.

## **The World Health Organisation**

Due to the fact that since December 2013 attempts aimed at trying to stop the epidemic of Ebola have failed, the World Health Organization (WHO) has declared a state of emergency for the affected areas, effective August 08, 2014. The state of emergency for the affected areas allows WHO to issue recommendations in order to take additional precaution measures. In this particular matter, all affected countries were invited by WHO to declare a state of emergency and adopt the strictest health measures ever.

## **Action of European Commission**

Ebola epidemics have become an issue for the European Commission (EC) to deal with through the Health and Safety Committee (HSC) in collaboration with the European Centre for Disease Prevention and Control (ECDC). EK communicates with all Member States and seeks to determine the readiness of all member states. ECDC has issued traveller guidelines that have been translated into the languages of all member states. The Public Health Authority guidelines in Slovak language were placed on its website immediately. The EC document is currently under discussion and will soon be available to all State Members for publication.

## **Measures in the Slovak Republic**

Slovakia has taken measures of the Public Health Authority of the Slovak Republic (PHA), the Ministry of Foreign Affairs of the Slovak Republic (MFA), and the Ministry of Transport, Construction and Regional Development (MDVaRR)

MFA to issue series of guidelines and recommendations on its website for the inhabitants of the Slovak Republic aimed at reconsideration of travel arrangements to affected areas. However, those who decide to travel have the opportunity to register electronically in the MFA database.

MDVaRR has secured an insulated box at MR Stefanik Airport in Bratislava for contacting emergency services and distributing recommendations for travellers at the airport.

There is a medical establishment available in Slovakia that is suitable for the purposes of receiving, monitoring and patient treatment of those who have tested positive for Ebola viral disease. This is the Infectiology and Geographical Medicine Clinic in Bratislava, the only establishment in the Slovak Republic with beds that meet the 4<sup>th</sup> level BSL bio-security standard.

Due to haemorrhagic fevers, the National Reference Centre (NRC) does not have the methodology to diagnose Ebola virus, nor does it have bio-safety level BSL 4; therefore, it is necessary to conduct laboratory diagnostics abroad (accredited laboratory: Robert Koch Institute, Germany).

The Public Health Office of the Slovak Republic (PHO SR) is in constant contact with competent European authorities. The Public Health Authority regularly receives updates from the ECDC about the current epidemiological situation, which it publishes on its website and supplies to media bodies, with the objective being to provide objective information to the public. The Public Health Authority asked the head hygienist MDVaRR for synergy, in case of travellers carrying suspected Ebola viral disease by air to the Slovak Republic.

Although the risk of introducing Ebola epidemics in Slovakia is low, the Public Health Authority recommends the following procedure:

- When travellers return from affected areas with clinical symptoms such as fever, unexplained fatigue, diarrhoea, sore throat, cough, or other severe symptoms, staying at home is advisable, followed by an immediate call to a physician and submitting travel history;
- Those returning from affected areas should monitor their clinical condition for a minimum of 21 days after arrival (disease incubation period is 2–21 days);
- The medical care facility team that accepts a person under suspicion of being infected should use protective equipment (in accordance with the approved operating rules);
- Physicians should evaluate the patient's clinical status, providing samples if it proves necessary for laboratory examinations;
- In accordance with Annex 5 of Act 355/2007 Coll. on protection, support and development of public health haemorrhagic fevers in group A, disease and suspected disease should be reported immediately (by telephone, fax, electronically, messenger, in person) and sent to the competent regional public health authority;
- Referential infectious disease clinics or isolation wards are recommended to consult with the Department of Infectiology and Geographical Medicine in Bratislava;
- The competent regional office should provide a complete epidemiological investigation of the case, take relevant anti-epidemic measures, and report the result to the Public Health Authority;
- Epidemic measures are issued by the competent Regional Public Health Authority and the Public Health Authority in accordance with the Act 355/2007 Coll. on protection, support and development of public health;
- In public health emergencies of the second degree, where special regulations should be put in place, the Public Health Authority or the regional public health office submits a proposal to authorities competent in the field of civil protection for declaration of an emergency;
- In accordance with the International Health Regulations of the Public Health Authority, these cases are reported to the WHO and via a prompt alert system to ECDC and the European Commission.

## Conclusions

The risk of Ebola infection spreading in European countries and the Slovak Republic is small. The World Health Organization and the Public Health Authority of the Slovak Republic constantly monitors the Ebola situation. The public is informed through the website. Measures are adopted according to the progression of the epidemiological situation.



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