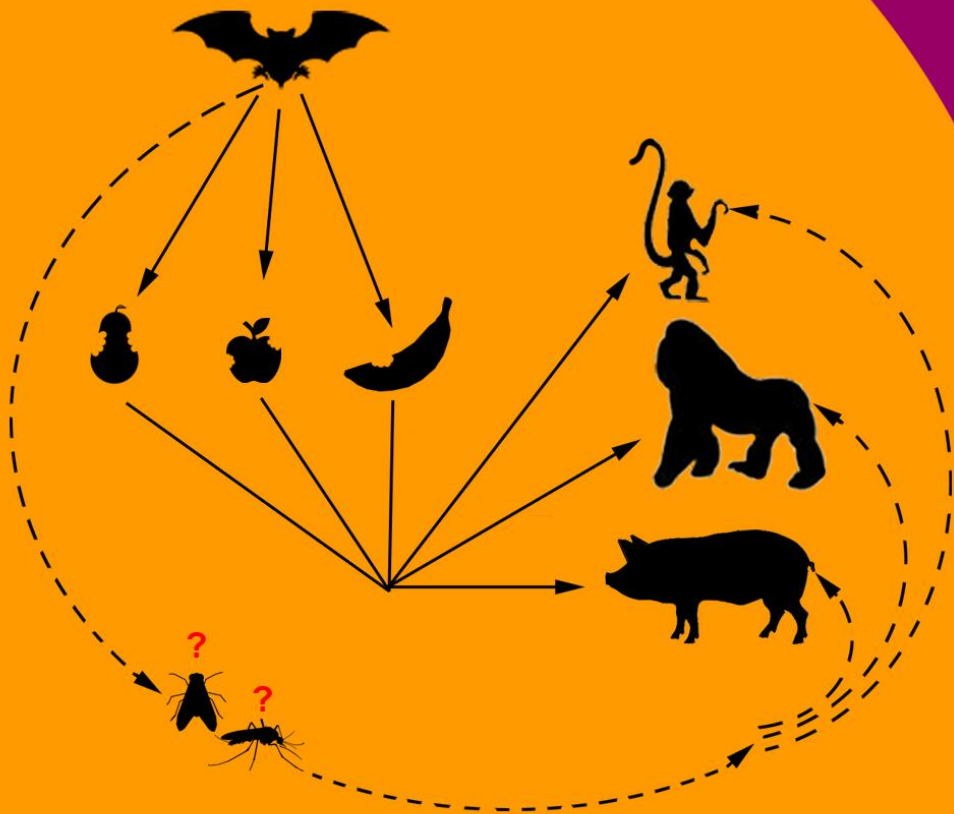


EBOLA

what to do?



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Preface

Ebola: what to do is a publication, which is for common people as well as professional persons like health care workers, physicians, microbiologists, public health workers etc. They can read this book to understand many aspects quickly to react even in emergency. This book is an attempt to make the people to understand with better ways about Ebola virus and its strains along with how the Ebola viruses are transmitted from host to another host or animals to human beings. What are the possible ways of transmission as it is essential to understand such transmission ways in order stop the spreading of the Ebola around the world. These are views of the author how to prepare in a better way to contain such viral diseases like Ebola? How can the Governments work effectively to tackle Ebola viruses? There are needs of better coordination of actions between the world organisations working to tackle the Ebola viruses in different countries. Many health workers are working hard in outbreak areas, hence there is an urgent need to give them more attentions in order to prevent the outbreaks among them. In this book, there is a review of treatment and vaccines under development and which will be perhaps the best therapies and best choice to treat the infected persons. The contents of this book about Ebola viruses are unique and they have been never discussed in the manner as in this book before. Further there are topics about the important issues like how does Ebola cause the disease and how does it spread in the body? There are many lessons to learn how to prevent this virus. Which are preventive measurements important for common person, health care persons, hospitals, airlines and Governments. Therapy is not the only choice to prevent a viral disease, hence there is a need of multiple preventive steps e.g. knowledge of mode of transmission, kind of hosts, effective preventive measurements, efficient detection methods, therapy options and vaccines, therefore these all are discussed here in short cut way, but so that common person and professional persons can understand them. There are diagrams for common people and health workers to understand the Ebola virus in better way. Author of this book is giving his opinion about Ebola viruses and how to deal with these viruses. Author is showing the ways to the press, world organisations, national health authorities and Government, what should be improved in order to reduce such deadly disease like Ebola in future. Still it was not possible to include every and each aspect of the Ebola virus. In future, an attempt will be made to improve these weaknesses to cover the viruses much deeply. One thing should be noted that during outbreak of a viral disease, one should always listen to authorities as they take preventive measurements according to the circumstances. Outbreak of Ebola will be very strong challenge for the countries, where it is first time like Spain and USA as its outbreak causes fear among the population and first duty should to control and understand the reasons about this fear among the population. The main reason for why people reacting so hard is the rate of fatality and speed of transmission of Ebola infection. There are references in this book, many ideas of this book are coming from them, and therefore they are cited at the end. As this book is also written for common persons too, therefore many information are repeated so that these can be understood in better way.

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1. Introduction:

In 1967 Lake Victoria Marburg Virus was found in Marburg, Germany and Belgrade, Yugoslavia (Serbia) in imported green monkeys. It caused outbreak in human beings and it was contained with a few deaths. This virus caused fatal infections in persons and their relatives. Marburg virus belongs to filoviruses and it is somewhat similar to other filoviruses like Ebola virus, which are too filoviruses.

In 1976, there was again outbreak in Zaire and Sudan leading to discovery of Zaire and Sudan strains of Ebola virus. Tai forest Virus was found in 1974 in Africa. In 2007, there was an outbreak caused through Bundibugyo strain in Uganda. In 2012, there was a new outbreak in Uganda and Congo linked to fruit bats.

In 2014 there was again outbreak of Ebola viruses in Africa. In March 2014, analysis of sequences of polymerase (L) gene of Ebola virus revealed that the outbreak is caused through Zaire strain and this strain is detected first time in Western Africa. Zaire Strain of Ebola has up to 88% fatality rate.

Reston Strain of Ebola virus was discovered in 1981 from laboratory macaques imported from Philippines to USA. Reston strain infected animals suffered from the outbreak of this strain. Usually Reston strain is circulating in pigs and it does not infect human beings. It does infect primates. As this strain is circulating in pigs, hence pigs may act as mixing vessels leading to create a much potent and lethal strain, which may pose threat to human and other animals. Therefore there is a strong need to observe this strain in pig population carefully with modern methods like DNA tests.

Now there are 5 different strains of Ebola viruses circulate around the world, Zaire Strain, Sudan Strain, Reston Strain, Tai Forest strain and Bundibugyo along with Marburg strain. All these strains of Ebola virus and Marburg belong to filoviruses. All these strains can be transmitted from human to human except Reston strain. Reston can infect human, but it does not cause disease i.e. it is non-pathogenic to human. Both viruses i.e. Ebola and Marburg cause outbreaks in central Africa.

Ebola disease is classified as neglected disease as it does not come in developed countries until 2014, where most of advanced research on pathogens is going on.

In 1976, the literature is showing that more women than men in age between 20-30 years were infected with Ebola virus and all were pregnant because of needle infection as the same contaminated injection needle was used for these women. Data in 2014 is also again indicating that more women are being effected than men.

Ebola haemorrhagic fever and Marburg haemorrhagic fever are two similar of diseases, which caused through Ebola virus and Marburg viruses respectively.

2. Vectors and Mode of Transmissions:

Usually Ebola viruses as well as other filoviruses like Marburg viruses are circulating in fruit bats in infected areas as mining cases with bat in caves have been involved in a number of outbreaks. These are fruit bats, which play a crucial role during the transmission of Ebola viruses to human beings.

How do they transmit this virus to other animals and human beings, this role is still under investigation. But it is thought that fruit bats generate increased number of viruses during the birthing period because during this period, the rate of infection in other species goes up. Moreover it may be possible that fruits bats eat fruits and these partially eaten fruits are being picked up from other animals like rodents, gorillas, chimpanzees and other primates, which result in infection in these animals. The infection in primates cause outbreak of disease, hence Ebola is a zoonotic disease too. Video studies have shown that bats may drop partially eaten fruits, which are Ebola infected and these fruits are being eaten through other mammals and become infected. Hence the role of fruit bats masting in interspecies transmission of Ebola-viruses is highly suspected. Research institutes need to use Video technology to understand this mode of transmission of Ebola viruses from bat to other species. There are two pictures (diagram 1 and 2), which show how this transmission may be occurring.

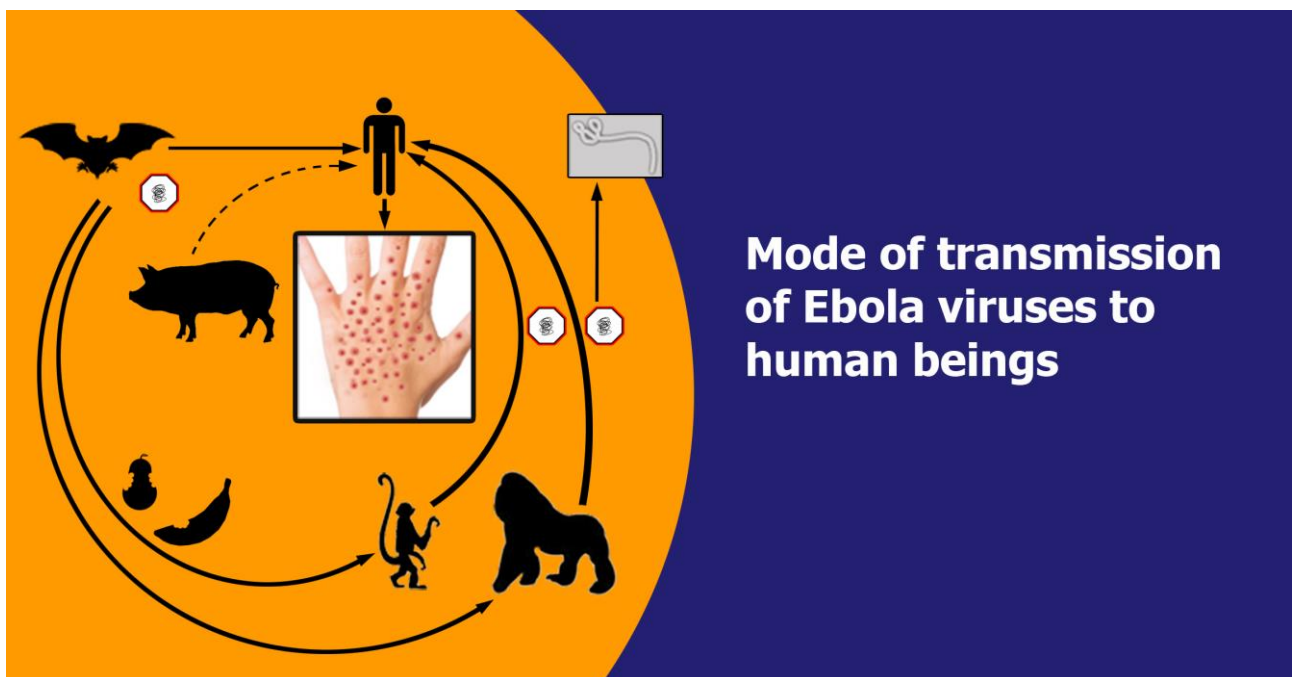


Diagram 1 is showing the transmission cycle of Ebola virus to animals and human beings.

Role of fruit bat is very important for transmitting Ebola viruses to other animals. In the literature, there are indications that pregnant bats are more seropositive for Ebola viruses i.e. they carry bigger load of Ebola virus in themselves during pregnancy period. During the birthing, there is an increase in the number of bats leading to increase in more contacts and ultimately more infections in bat populations and other animals, which lead to more outbreaks in Ebola virus.

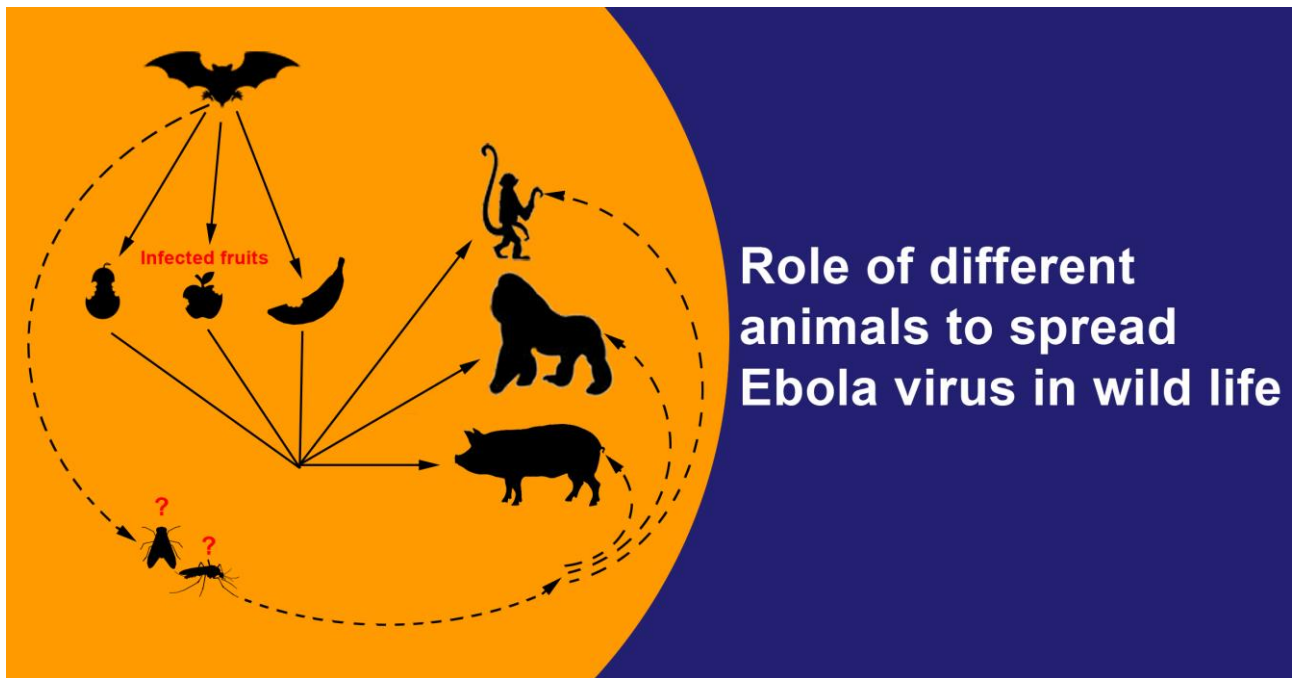


Diagram 2: Transmission cycle to wild life.

Therefore seasonal birthing may decrease the Ebola infections, but the infections increase after the birthing phase of bats. There is a seasonal variation among the bats to shed RNA viruses (bat carries a number of other viruses also like rabies, SARS etc.). There should be some relationship between host ecology and seasonality. There are findings suggesting that bats carry Ebola specific antibodies and these antibody positive bats can survive a long time. It means that fruit bats are latent carriers of Ebola viruses. It has been reported that bats can survive up to 13 months after getting Ebola infection. There is other possibility of transmission that there are secretions, excretions of bats and contact between the bats and with end hosts like great apes. Human to human transmission occurred from single source or multiple sources of wildlife or end wild host. If there is multiple introduction, there will greater genetic variability in virus during human to human transmission. (3, 7)

Bush meat play an important role of spreading of Ebola viruses from bats to human beings. Butchering of bats may be one of important point, where the infections of Ebola viruses can be transmitted to human beings. Here is more need to conduct further studies to understand more deeply these processes of transmission. Butchering of bats should be prohibited to avoid the source of infection.

Outbreak of filoviruses have occurred in many cases during the mining activities or cave exposure. It may be possible that inhalation of droplets of bat secretions have contributed to the infections, therefore one should not exclude the possibility that contact with body secretions of infected source is only possibility of spreading of Ebola infections. Moreover outbreaks in medical persons in Africa and in Texas in October 2014 may indicate that inhalation of droplets of Ebola virus may have contributed to infection. It means that one must take proper precautions during visiting Ebola infected persons or patients as there are strong indications that Ebola viruses can be transmitted through non contacts, if the distance between infected source and healthy person may not sufficient.

Reston strain of Ebola virus has been shown to be in the position to be transmitted through air

infections from pigs to monkeys in research studies without any contact.

Ebola-virus has been found in rodents too. Role of rodents in spreading Ebola virus needs to be investigated. There is an important task to conduct more studies to understand the mode of transmission. Hence there is an urgent need to monitor the role of insects like flies and mosquitoes during the transmission of Ebola virus along with conducting the prevalence studies of these viruses in domestic and wild animals. Such studies can be conducted very fastly as there are a number of companies like Genekam Biotechnology AG are offering a number of ready to use molecular tests for Ebola viruses. Moreover conducting such studies through ready to use kits are most economical and fastest way to find the mode of transmission of such viruses. Such research works can be done as master thesis or doctorate thesis. It does not cost so much money and such studies can give an important information about the hosts carrying this virus. These studies can be used to prevent the spread of this virus and creation of new therapies along with developing effective preventive measurements.

Butchering of primates and eating their meat may be one of big contributing factor for the transmission of Ebola virus from infected animals to human beings. There are reports in literature e.g. a researcher got infection while doing autopsy of a primate.

The spread of Ebola virus can be divided in 3 main categories in human: to family members, to close relatives and to health workers. Therefore these must take precautions. Filoviruses i.e. Marburg and Ebola viruses are highly infectious and can be transmitted from human to human with the infected body fluid and contaminated fomites. The infected persons secrete viruses' particles in different body fluids like tears, semen, vaginal fluid, urine, sputum, nasal fluid. There are chances of getting Ebola viruses through coughing and sneezing, if the distance between two persons is too close as viruses may cross through the mucosa of nose. It is said that shedding of the viruses is increasing with advancement of stage of disease in patient. There are indications that these viruses may spread through other modes of infections than close contacts. Therefore strong precautions are needed to prevent the spreading of the virus while working with infected persons or sources.

Transmission of Ebola virus can occur through kissing and washing of dead bodies during the burial ceremony. Moreover Africans are known to store the nails and fingers of dead relatives, which may act as source of infection, therefore one should strongly avoid such practices during the Ebola outbreaks as storage of such body parts may act as source of new outbreaks and spreading in the wild life. If they want to store them. They should be stored in formalin or ethanol, but these chemicals are not for home use.

3. Methods for data collection:

Collection of clinical data of Ebola infected person poses a strong major challenge. Clinical records of Ebola infected patients should be kept separated from non-Ebola infected patients. Infected record files may be another source of infection in health care workers. These files should be handled with gloves after rinsing in disinfection solution. Usually clinical files are destroyed because of fear of infection as such destruction of files means that so valuable data of Ebola patients can be used for further scientific studies in order to create new strategies for treatment, prevention and detection of this virus. Such files can be photographed for further use as digital cameras are available now.

Avoiding taking any object out of the filoviruses disease wards or rooms, therefore different kinds of data collection methods are used e.g. clinical records were established from the memory of health

care workers of the patients or one health care person dictates to other person standing behind the fence or clinical records were held up at the fence and photographed or manually copied or entered into a notebook by a person standing outside the fence. Further methods were disinfecting the files and recording through photos from other workers, but disinfecting the files have destroyed many files as chlorine bleach the text. This indicates about serious difficulties during the clinical data collection. As files may be contaminated, therefore they are disinfected with chlorine solution, which destroy the paper or bleach the paper, hence disinfectant resistance paper and ink should be used. (2)

4. Symptoms of Ebola virus:

The incubation period varies between 2-22 days. It is accompanied with symptoms like fever, vomiting, diarrhoea, abdominal pains, haemorrhages or petechiae (small skin red points or spots). It causes abortion in pregnant women. There may be pains in the joints. Other symptoms may follow like headache, weakness, sore throat, flu like symptoms which can lead to misdiagnose as flu. Usually in Africa, Ebola cases are detected during the failure of malaria treatment or antibiotics treatment leading to exposure of other people particularly closely related to Ebola infections and later on may be cause of outbreak. Many times bleedings may appear in eyes, nose, urine as well as faeces because these haemorrhagic manifestations occur in the advanced stage. During the peak stage, there are petechiae and uncontrolled oozing of blood at venepuncture sites along with mucosal haemorrhagic effusions. The death occurs through the failure of multiple organs within 6-16 days. Infected patients are shedding virus in their secretions, hence the contact with such secretions should be avoided. Zaire strain has got very high fatality rate up to 88-90%. Fatality rate is less with Sudan strain, it is 40-60% and followed through Bundibugyo strain as it is 25%. Blood picture of Ebola patient will show lymphocytopenia (in decrease in the number of lymphocytes) and thrombocytopenia (decrease in thrombocytes) along with increase in liver enzyme values. Confirmation of Ebola virus should be done through DNA tests as this is best choice and quick possibility.

The differential diagnosis of the patients should be done from the diseases or infections like typhoid, malaria, yellow fever, E. coli caused diarrhoea (enteritis) or diarrhoea caused through *Campylobacter*, *Shigella*, *Entamoeba histolytica*, Meningococcal sepsis, Rift valley and Marburg haemorrhagic fever etc. Therefore the confirmatory DNA-Test is the best choice to detect this virus in patients. (1)

Route of infection is through broken mucosal or abrasion in the skin or parenteral route with infected syringe needles. Most outbreaks occur through direct contact with infected patients or cadavers. Exposure through needles and blood cause infections. Reused contaminated needles play a key role in infections in 1976 outbreak as already mentioned. Butchering of chimpanzee caused outbreak of Ebola virus in Gabon and contact exposure might be route of transmission. Proper cooking of infected meat does not mean that food is free from Ebola virus and the virus is fully inactivated, it may act as source of infection. Therefore infected meat should not take as meal. Contacts during the burial with death bodies may lead to transmission of the viruses to other persons.

Number of T-cells fall in patients with fatality, but the number of T-cells recovers in patients, who survive. Zaire strain infected primates loses T-cells and natural killer cells rapidly. Blood coagulation defects and fibrinolysis occurs during the infection. Massive loss of blood takes place in some cases, if it takes place, it occurs in gastrointestinal tract.

5. Profile of Ebola virus:

Ebola is RNA virus with filamentous shape under electron microscope. The Ebola viruses are also known as filoviruses. It has 7 genes: NP, GP, Polymerase (L), VP24, VP30, VP35 and VP40. It has around 19000 nucleotides. Usually human body produces neutralising antibodies against GP, hence there is a lot of work going on the site to create vaccine or therapy. Ebola-virus is classified as biosafety level 4 pathogen. It transmits human to human and lacks approved therapy. Diagram 3 is showing the structure of an Ebola virus.

EBOLA VIRUS

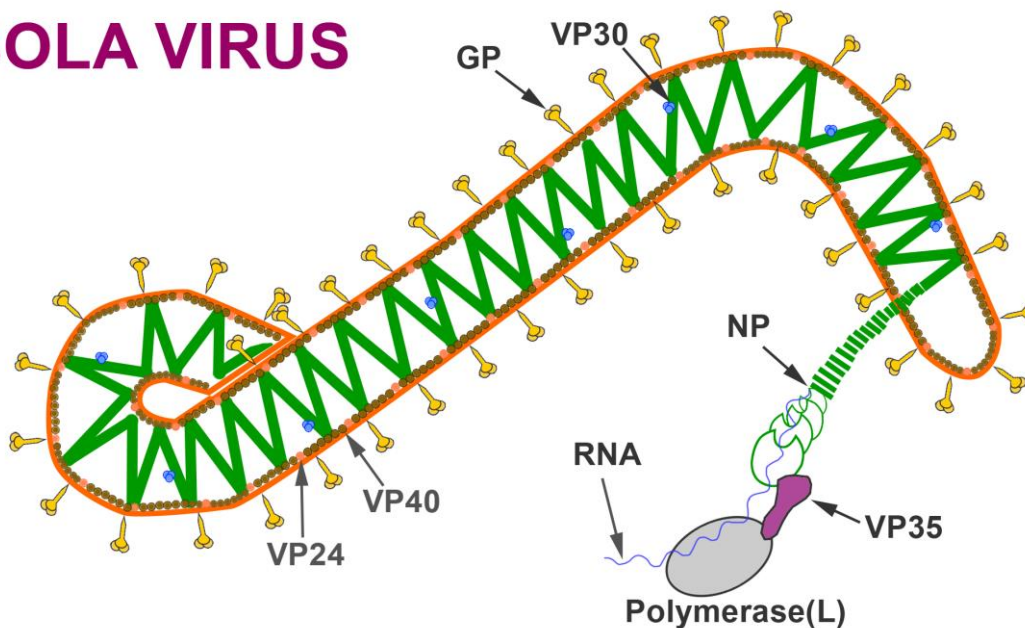


Diagram 3: Ebola virus structure.

Till August, 2014, 4 out of 5 strains of Ebola were found in Africa except Reston strain, which is found in Asia. Reston strain is only one, which does not cause infection in human beings. All other strains infect human beings, leading to a fatal disease with a 20-90% fatality rate. At present, the Zaire strain is causing outbreaks in Africa, USA, and Spain. In USA and Spain, the outbreaks are occurring in medical personnel, who are in charge for the treatment of Ebola-infected patients as well as persons visiting western Africa. There are reports of the death of Ebola-infected patients in USA, Germany, and Spain along with many thousands in Africa in 2014.

6. Therapy:

A number of drug candidates are available e.g. estrogen receptor modulator, antisense oligos, interferons, neutralising antibodies gave protection, if administered shortly after the infection. None of drug candidates are in position to be effective after 2 days of infections. Still some combinations may be helpful after 3 days of Ebola infection. Because of short time window for treatment of Ebola infections, management of symptoms remains only choice to treat the patient at present. Hence it is an essential task to detect the infected persons as early as possible and start with the treatment in order to have the greater success. The earliest detection of Ebola virus increases the success of supportive therapy in many cases. **No drug is approved for therapy of Ebola drugs till today.**

A molecule of a Japanese company called Toyama Chemicals may be used successfully to treat Ebola patients. This molecule is in the final stage of clinical approval for influenza viruses, but it is also effective against other viruses like Ebola virus. The testing of this virus was done through intranasal inoculation of diluted Ebola virus versus phosphate solution. The therapy was effective against Ebola viruses even on 6th day of infection also. This is the unique feature of this molecule against the other molecules, which are effective only 2 days after infection. (8)

Genekam Biotechnology AG has developed 7 different molecules, which may be in position to treat infection, but they are at early stage of development. These molecules have advantage that they are non-immunogenic and non-toxic i.e. if they pass through preclinical stages, they may lead very quickly to pass through clinical stage. Not only this, Genekam Biotechnology AG has developed a new system, which can be used to develop 100% human proteins, which can be used to create therapies against the pandemic viruses within short time of outbreaks. This is an early stage solution and needs to be used through clinical studies.

Other drugs like Ribavirin are of no use against Ebola viruses.

ZMapp is an antibody based therapy. This antibody is a fragment of the whole antibody, which is produced in plant cells. This therapy is only effective within 24 hours after the infection in animals' studies, where the success rate was 100%, but within 48 hours of infection, the success rate was 50%. Adenovirus secreting interferon with ZMapp may extend the treatment window time. This drug is applied once in primates during the studies, hence one needs to answer the following questions too: can this drug be given repeatedly in order to cure Ebola infections without any further complications? There is no answer to these question. It is a fragment antibody, it may be needed in bigger doses because of quick clearance of this drug from the body.

Passive immunotherapy are one of best choice today for treating Ebola infected persons. There were attempts to treat with equine serum containing Ebola specific antibodies and they were unsuccessful. The human serum from the patient recovered from Ebola infection can be used as passive immunotherapy successfully. But such sera should be inactivated to avoid the Ebola infection from donor. In 1977 a commission has recommended to maintain the stock of such sera in order to treat the future outbreaks. The question is whether such stocks are maintained at all?

Neutralising antibodies are not the only for protection against Ebola-virus, but there are other factors, which play the role for full recovery from the infection. During development of therapy and vaccine, these facts should be kept in mind.

Anticoagulation treatments are new options to develop therapeutic solutions for filoviruses, Anticoagulant protein c2 (rNAPc2) have been used to protect Ebola exposed primates

successfully. It inhibits the activated factor VII (fVII a), which is overexpressed and is the cause of coagulation abnormalities and thrombosis related organ failure in Ebola infected primates. Similar type of results were also achieved through using recombinant human activated protein (rhAPC), which is responsible of blood coagulation and inflammation.

7. Symptomatic treatment:

It is supportive treatment. It should be started as early as possible:

1. Hydration
2. Blood Volume
3. Pain Management
4. Fever Treatment
5. Antibiotics to avoid secondary infections
6. Interferon-therapy (if available)

8. How do Ebola viruses cause infection (Pathogenesis):

The type interferon (IFN)-1 response is important factor for establishing an antiviral response in the host cells and activation of host defense system. VP35 protein of Ebola viruses is one of antagonist of interferon-1. VP35 suppresses partially the ds-RNA-independent activation of the IFN- β promoter (gene) as results of some mutations like Arg312, Arg322 and Lys339 leading to loss of IFN inactivation. This may be one of the way how Ebola virus invade body immune system. Collectly, these studies suggest that there could be a high degree of structural conversation of VP35 among the different filoviruses. The mechanism how VP35 contributes to Ebola-virus lethality is not well studied yet. It is important to study these mechanisms of VP35 as IFN-antagonist for invading the host immune system, therefore VP35 is an attractive target for future panfiloviral therapeutic development. VP24 of Ebola Virus appears to be required for formation of fully infectious Ebola viruses as it plays an important role during the virion assembly. VP24 is also involved in the host range expansion. VP35 suppress interferon-1 production while VP24 blocks nuclear translocation of phospho-Stat1, therefore leading to the prevention of interferon-1 mediated signalling response. (10)

Studies have shown that some of cells are target of Ebola viruses as they may have some receptors, where Ebola viruses may dock. **Major cell types, which Ebola viruses invade are dendritic cells, macrophages, monocytes, endothelial cells, fibroblasts, hepatocytes and adrenal cortical cells.** Ebola viruses invade endothelial cells. Such events lead to irregularities in blood circular system leading to haemorrhages and bleedings. Ebola-Viruses does not infect B-lymphocytes, which are responsible for mounting antibody response in healthy body along with other cells, but Ebola-viruses still lead to rapid reduction of immune response of B-lymphocytes through apoptosis. During advanced stage of Ebola infection, it leads to inadequate immune response with pro-inflammatory mediators such cytokines and chemokines failing to activate T- and B-cell response and inducing haemorrhagic shock and multiple organ failure. (10, 11)

9. Vaccines:

Vaccine prepared with conventional methods like heated, formalin inactivated, gamma irradiated, there was no protection against Ebola viruses. Live attenuated filoviruses vaccine poses threat to cause infection instead of causing protection.

Subunit vaccine are made in form of plasmids, but they did not provide protection in spite of the fact that neutralising antibodies against Ebola viruses are present. They are not effective as preventive measurements and there are other factors, which play role for the prevention.

Vector based vaccines: These vaccinations are quite successful as they were used as nasal vaccines. Recent reports show that VSV ZEBOV GP give full protection in primates. Vesicular Stomatitis Virus based Vaccines targeting glycoproteins (GP) were highly effective in macaques even after 3 years of infection of Ebola viruses. (5,12)

Till today there is hardly any such vaccine approved to be used in human beings. WHO is promising to deliver first batch of Ebola vaccine in first quarter of 2015 as there are good clinical results in animals.

10. Role of different organisations to control and prevent the viral diseases particularly Ebola virus in 2014:

Most of the world Governments depend on world organisation like WHO (World Health Organisation) and UNO (United Nation Organisation) for combating the serious virus diseases. In USA, one depends on CDC (Centre for Disease Control), where CDC gives the guidelines for preventing the viral diseases, which can be threat to whole world. Such type of division of work has advantages and disadvantages: Advantage is that one can depend on one or two sources to tackle the serious problems of the world like SARS, Ebola and Influenza viruses. As CDC works most of the time in USA with restricted or limited access to other countries, this makes much difficult to target the diseases at origin. Usually it takes a long time (months or years) till first viral outbreak is taking placing to get attention. It means that serious viral outbreak has sufficient time to spread to other areas. Once it spreads to other areas, the press starts getting attention. Most of the time, press is not interested to promote such bad news as they don't have qualified medical journalists. The role of the press will be discussed elsewhere. Country like Germany, France, UK etc. Have their own agencies like Robert Koch Institute in Berlin along with research institutes like in Hamburg, Goettingen and Marburg in case of Ebola virus. These local agencies also have limited resources and work with WHO and CDC closely. It seems that German Government is not investing too much in virology as many of posts for virology in medical institutes have been reduced a few years ago where one of biggest virologists wrote an article in one magazine serving the German scientists. European community has one agency, which is located in Sweden. The cutting budgets at the national level in EU and developing European structures EU may not be sufficient to combat the future viral challenges arising during world trade and environmental changes.

Now the biggest question arises: are CDC & WHO alone sufficient to combat a viral disease at the world level?

Answer is NO as it is biggest mistake to let CDC along with UNO and WHO to tackle such serious viral diseases as these are not in position to develop country specific protocols. Moreover most of these agencies are not representing the interest of even not their own tax payers, which are paying their jobs. They are working like lobby agencies for some big pharma industries. The CDC and WHO are thinking that the world is closed and they are trying to impress the people through articles in the press as part of great public relation. Now the world has changed through internet and such

agencies must learn that people (also experts) write their concerns in internet and people are reading them particularly that they are not acting independent. Today UNO is complaining that they have asked 1 billion dollar and they got only 100000 US\$ for combating Ebola-virus, why they should ask this question: why? The reasons for such a poor response may be found in this paragraph. I.e. loss of truth. Further it is also one of biggest mistake of many countries around the world to look always for help from CDC and WHO. Therefore it is time for each Government to rethink their policy about monitoring the viruses as viruses are going to be a big threat in future. Each country has big defence budgets and many of the countries do not even invest the cost of one tank in monitoring of the viruses. If they will do this, many of viral diseases can be traced at very early stage and they can be curbed at this stage. Moreover to monitor such viruses, there is sufficient number of products available on the world market. It is duty of each country to set up such laboratories to monitor these viral diseases. Through setting up such laboratories, one can rewrite the guidelines to control Ebola viruses according to national or regional needs. To reduce the viral diseases, there must be industry to tackle such problems as each computer has antivirus software to stop the computer viruses. Have you seen that each household have antivirus kits to reduce Ebola infections, NO because Governments are depending on a few agencies i.e. WHO and CDC to tackle such serious problems of the world, which are effecting billions of people. CDC and WHO do not have enough resources to support all countries around the world. Therefore monitoring viruses and drug resistance strains should be the important part of each government in the world. Monitoring and controlling of virus disease means more peace among the people and less social unrest among the population as one can see how media is releasing news and how much negative effects they have on the economy? Liberia can be taken an example, where the economy is badly hit. Establishment of biotech and nanomedicine industry for combating such viral diseases should be a key part to stop such viral infections at the source or reduce them at effective way before viruses like Ebola become a challenge for human beings in the whole world because of lack of therapy and other mismanagements.

There is an urgent need to reform institutes like WHO and CDC to make them better and efficient in their roles and they should be independent agencies, not lobbyists of some big pharma companies. All scientists and companies working on Ebola viruses should be asked to come to work together with WHO and their products should be screened carefully. WHO and CDC are acting according to press news as they may have fear that bad news can hurt them badly. There should be no sponsorship of WHO direct or indirect from any big pharma in order to be independent. The ways the CDC and WHO handling the Ebola crisis are not able to curb the Ebola outbreaks as there are many small or big mistakes. Each of such mistake lead to more Ebola infections. One of the biggest mistake is that CDC and WHO along with National institutes in Germany, Spain, UK etc. are always overconfident that they can solve any virus problem of the world in spite of the fact that these are complex problems where a number of different factors play crucial roles. Many of factors compounding Ebola viruses problems are like transmission mode are not completely understood, therefore recommendations of the CDC and WHO that Ebola virus cannot transmitted through shared food, water and coughing with Ebola infected are likely to be wrong. These recommendations are circulated in social media from both organisation many times since months. CDC and WHO have circulated that Ebola virus cannot be transmitted through droplet infection, hence one cannot get infection from Ebola infected persons through air; such statements may be wrong as there are scientific proof that Ebola virus can be transmitted through air without contact between animals or shared food as shown in diagram 1 and 2. After the infections in health care workers (taking care of Ebola person, which expired later) in Texas, USA in Oct, 2014, CDC has changed the recommendation now and these are the coughing and sneezing, which may lead to Ebola infection, therefore one should take care of these points. In this book, there is theory, how Ebola spreads from bat to other animals i.e. shared fruits, therefore their recommendations for shared food may not be true and need more to be modified urgently. These examples show how

poorly CDC and WHO have prepared the guidelines to contain the Ebola virus. Not only this, on 17.10.14, there was an open session from Government of USA with CDC, NIH on TV channel like CNN, CDC directors were recommending the following ideas, which may be the biggest accelerator of Ebola virus spread in the whole world:

These were: not banning the people from Ebola infected countries to enter USA (This is one of effective tool to prevent Ebola virus to spread to USA and other countries as USA has 300 million population and the presence of Ebola infections in USA means that it will spread to whole world within very short period as one cannot trace every person, which can get in contact with Ebola infected persons), not to use fire to destroy the Ebola contaminated material (fire is one of important factor to be used to burn the belongings and suspected material). Instead of that CDC was recommending that such waste should be transported to particular destination to be destroyed i.e. giving more chance of exposure of such Ebola waste, CDC is playing here overconfident as such waste may attract insects or may be thrown away through mistake as normal waste leading to spread of this virus in the wild life in USA i.e. USA has difficulty to contain Ebola viruses).

These are a few factors as examples, which are contributing to spread of Ebola virus throughout the world. Further new factors are sending 4000 Americans to Ebola infected areas, these should be avoided. Instead of that alternative should be thought to use local people as they are immune and they can deal with Ebola outbreak in future also in better way. Not USA, Germany is preparing to send 3000 Germans to effected areas, which may lead to more infections. Germany is developing a special aeroplanes for transporting the sick Germans from the infected area. It seems that there is lack of knowledge about virology with German Government as there is no need to develop special aeroplanes for such cases. The matter can be solved with simple ideas of disinfection but the biggest question should be put to German Government, how are they are going to disinfect the instruments like patient monitors, probes of ultrasound machines and other medical instruments needed during the transportation of seriously Ebola infected patients in the special aeroplane or in hospitals. This can be a major factor contributing to costs of treatment.

On 23.10.14 there is a new case of Ebola infected health care worker in New York, who was working as physician in Africa. It shows again that there is likely hood of other route of infection that contact with fluid of infected person.

Guardian UK wrote in 19 Oct, 2014: the death toll rose to 4,546 out of 9,191 cases in west Africa. Médecins Sans Frontières (MSF) warned that international pledges were not having any impact on the spread of the virus. Christopher Stokes, who is leading the charity's response, welcomed pledges of help, but [told the BBC](#) they were "not having any significant impact on the epidemic and it won't now for maybe another month or month and a half"

It shows about the failure to tackle and the reasons should be addressed to achieve the success.

Role of Press is needed to be discussed. The press is trying best to inform the people about Ebola viruses, but they have limited knowledge to provide correct information. It is press, which spread the news about drug like ZMapp, which is not so effective and need a number of questions to be answered, if it is really used. Author of this book think that it will be very difficult for this drug to be used as one needs quite a big dose of this drug and it is effective within 24 hours or it can be combined with other drugs to increase the effectiveness. The press needs more medical journalists with medical background in order to put technical questions. Usually USA press is using some professors of virology as experts to give the predications about Ebola outbreak, it is good idea, but it has also its limitation as such professors understand about the technical part of Ebola, but it has limited knowledge of other compounding factors e.g. medical virologist will not be able to

understand the impacts on economy and which measurements are to be taken to give Ebola effected people financial aids. Such virologists are not in position to tell you the limitations or mistakes made in spite they may know these facts, therefore it is always essential to put such experts also indirect questions or ask the questions how one can improve the work. Another mistake is taking a professor, who never worked on Ebola viruses as this happens in Germany with ZDF because it has one professor as expert, who never worked on Ebola and Influenza viruses, but he was always giving the answers of questions, which were partially correct. Usually many journalists think that their viewers cannot understand complex things, hence they try always to provide some simple things, which may lead to wrong communication in case of Ebola viruses and not effective to prevent it. Therefore role of press needed to be redefined in order to provide better benefit to public. There is hardly any journalist, which put a critical questions on the work of WHO and CDC along with the local agencies in many countries. This should be changed as critic in the press will lead to quick response to the viral outbreaks i.e. effectiveness will increase. Even CNN has a physician as medical journalist, they are not putting any critic on the work of different organisations like WHO. Critic is needed to improve the work of world organisations. There is an exception here, where a journalist called Mr. Andreas Halbach and his team of Frontal21 from German TV called ZDF are working on Ebola reports, which are going to have an important impact on the work of WHO and other organisations. This work as follows:

On 21.10.14 there was a report about the role of WHO in Ebola outbreaks as one of top story in one of biggest TV ZDF in program Frontal21. This program put many critical questions about the fairness of WHO to combat outbreaks of Ebola and other diseases. This report was prepared from Mr. Andreas Halbach and his team as mentioned above. Therefore there is a need of better balanced system in the world to control the viruses. Viruses are going to be one of biggest threat to human beings in future. Therefore there is an urgent need to reform WHO to act as fair organisation in order to select the best solutions on the market, not working as lobby organisations ignoring the German companies like Genekam Biotechnology AG and Partec which are developing better technological solutions and these are economical too. This report can be seen on the website of www.frontal21.de

WHO, CDC and other health institutes are working hard to contain the Ebola outbreaks, but there is need to improve their work and fairness as this should be an urgent task. This can be done through better financial resources and with tougher guidelines e.g. these organisations should act unbiased while dealing with the diseases and all companies with technology for Ebola virus should be involved.

Role of Governments should be needed to put under stress test. Most of Governments around the world are working together and making similar type of mistakes .e.g. measuring the body temperature on airport. It is not effective method and it will lead to many times to wrong results. It may lead to new infections as the rise in temperature may vary between the persons. Here one needs to improve these guidelines. Further each Government is showing in TV that they have ambulances to transport, how silly is this idea as they never show that these vehicles will be able to carry more persons infected with Ebola after they have transported one Ebola infected patient and that will/may lead to infected the instruments and inner part of vehicle e.g. vomiting, how can they disinfect these or this vehicle will be another source of Ebola infections for other patients. This is one of biggest challenge. Many Governments do not have any proper response action to Ebola outbreaks. German Government (News in TV) wants to develop the special aeroplanes to transport the Ebola infected patient, it seems that it is a good idea. Is it essential: Answer is NO as preparing a room or area for Ebola patient needs a better organisation and care? It can be done with simple methods. These examples indicate that there is lack of knowledge among the Government what to do? But they do the things. Governments need to coordinate better and they

need to search the people who understand this field along with other issues. Governments like Germany, France and USA are depending on their professors as they have strong research going on Ebola viruses, but these professors have their own limitations as they do not understand the other factors how to develop economic solutions to tackle a problem in poor countries in Africa and even in their own countries. One can see the costs of treating an Ebola in Germany. Hospital in Hamburg, Germany has asked 2 million Euro for treating one worker of WHO from Africa. If these are costs, how many people can be treated in Germany for Ebola infections? Therefore this example shows that one needs to do economics also and there should be use of industry, which can reduce the costs very rapidly. German Government and EU are trying to give more aid to help organisations, which are going to do emergency work. But there is a need of investment in companies developing solutions for Ebola viruses in order to generate better solutions for Ebola. Such investment should be done on the basis of fairness and experience, not basis how close are they to the Government and EU-commission. German Government and EU are raising their funds to help the needed countries, but there is total lack of transparency and plan of action is full of question marks. These all may lead to more difficult time to control the outbreak.

Outbreak of Ebola in countries like USA and Spain is teaching one thing that Ebola infections in Texas as well as New York are causing fear among the populations, hence fear is one of biggest compounding factor, which may lead to strong negative effects on economy. It should be tackled with different means as each human being has immune system and Ebola virus infection can be avoided, if the precautions are taken properly. The role of health care workers dealing with Ebola patients are playing a crucial role in spread of infection, hence they should be put in quarantine in order to reduce the risk of infection for others. This idea is now being used to prevent the spread of Ebola infections in health care workers in some of states in USA, but not in other countries, but there are protests. These are essential measurements.

Governments should screen some of very important things like there are a number of EBooks being offered from the persons, who never studied virology. They should be banned immediately. There are reports that some companies have shipped fake rapid tests against Ebola, hence these needs to be tackled quickly. There must be guidelines that genuine solutions against Ebola should be there to bring it under control.

USA Government should put question to FDA whether they are working with full fairness as working as lobby institute may cost many countries around the world a lot money and human loss with an outbreak. Can you USA able to react, if there are 100-1000 Ebola infected persons? Please this question to CDC, WHO and FDA?

Canada and Australian Governments have banned VISA from Ebola infected countries, it is painful decision, but it is highly correct as it lowers the risk strongly.

11. Role of Airlines and transportation system:

Public transportation systems are great risk to act as accelerator of Ebola infection, hence there is strong need to put preventive methods. Airlines are very strong risk of accelerating of Ebola infection. They must take precautions that Ebola infected persons should not be on board and there should be regular disinfection of aeroplanes before the passengers enter the aeroplanes for flight. In case of emergency, there should be isolated rooms on the airports to handle such infected persons. Genekam Biotechnology AG has developed here a number of solutions. Moreover airlines and airports should have a department to deal with such viral infections.

12. Lessons learned in Ebola outbreak in USA and Spain: Many countries around the

world have not taken the Ebola outbreak seriously as the results of these mismanagements that they are facing today (Oct, 2014) problems to get this virus tackled. These countries have invited the problems themselves because they made human errors to handle the virus e.g. Spain brought 2 highly infected patients in late stage to treat them from Africa, but both patients ended. During the treatments, some of health care persons have also contacted the infections of Ebola and now these persons are being treated or kept in quarantine areas. The example of Spain shows that many countries have not taken the problem of Ebola seriously and there is a lot of lack of knowledge that country like Spain needs to learn more to tackle the Ebola virus. Such mistakes are being made. Fear in Spain is so much that dog of one of infected health care worker has to be slept as it may act as the source of infection for other animals and wild life.

In USA, CDC is trying that they can control the outbreak of Ebola, but in reality, they failed: example treatment of Ebola infected person from Liberia showed in USA, how many weaknesses are in their medical systems and how poor they are in reality to handle the Ebola cases. In Texas, there was one case of Ebola patient, who ended. It indicates that USA does not have any treatment for Ebola infected and Ebola virus remains most fatal disease. Not only this, health care persons have contact Ebola infection in spite of the precautions taken. These health care workers after their work have gone to home and meeting the friends, it means that they might have acted the source of new infections. Now one of Ebola prone health workers have travelled in aeroplane in spite of fever i.e. it might have acted the source infection to other people or for the wild life. Such cases are creating panic in USA leading to uncontrollable response of the people in some areas. The airlines are suffering too as Ebola is highly infectious and everybody has fear from it to be get infected. 23.10.14, there is a new case of a physician with Ebola virus infection in New York, which has contacts with other people too.

Similarly Germany is treating some of patients from Ebola infected area. One patient has recovered with cost of 2 million Euro and other has ended in Leipzig. 3rd patient in Frankfurt is being treated, but there is no case of health care worker infection in Germany till today.

13. Lessons learned from Spain and USA are:

1. Never be over confident about Ebola.
2. Each health care worker involved in Ebola treatment should be kept in quarantine or should be isolated in order to avoid contact with the other people at least for 21 days as it means the life safer for others and a lot of press panic can be avoided.
3. There is a need of more stringent measurements for health care workers working for treating the Ebola infected. It means that disinfection procedure after attending the patients' needs to be more effective and there should be video recording to find the mistakes made during attending the patient and leaving the patients.
4. Too much clothes and protective gloves may be not a good idea, but instead of that there should be rinsing of the hands in chlorine based liquid during treatment patient.
5. Similarly contact between the pets and health workers attending Ebola patients should be avoided.
6. There should be limited number of staff attending the Ebola infected patients as this reduces very strongly the number of chances to spread infections to others and it make easier to find the contacts, in case of breach.

7. Towels, tissues papers and needles, which are coming from Ebola patients should be immediately disposed of and soaked in chlorine based solutions.
8. There should be immediately reviewing of precautionary measurements in case of breach of preventive measurements.
9. The treatment of such health care persons, if they infect themselves should be done immediately as there are good chances that health care worker recover from the disease.
10. There is a need of travel ban for the people from the outbreak countries for limited time as this will help to calm the people and there will be no new source of infection. The illegal crossing of boarder will happen, which may pose another threat. If the travel ban is not done, each person coming to Ebola free countries should go for DNA Testing for Ebola virus. This can reduce the risks provided the results are given within 24 hours after arrival. This test should be repeated on 3rd day, 7th day, 14th day along with body temperature and quarantine like isolation till 21 days.
11. Use of the fire to burn the belonging and other things of Ebola infected persons rather giving the infected material to be disposed of through a commercial company as this method is prone to mistakes and infected material can be accessed through insects or small animals leading to spread in wild life or domestic animals. Therefore burning with fire is one of important point.
12. Dialysis and ventilators may act as new source of infection.
13. There is a need to find out breach in protocols as early as possible.
14. All persons coming in contact with Ebola patient and the belongings (waste material) should be maintained in the lists of persons to be watched for 21 days. This task is an important and hence should be done carefully.
5. There should be no unnecessary diagnosis e.g. if the patient has no problem of respiratory tract, there should be no tests needed to be done for respiratory disease. Confirmatory test of DNA test can be done through 2-3 drops of blood, why should one take 5 ml blood of Ebola patient as this is one mistake done at present. Genekam Biotechnology AG has developed a blood collection kit. It is shown in diagram 4.
16. Security persons are taking away the towels or bed sheets from Ebola infected persons without having any safety measurements. It may lead to infection, therefore here one should be careful or security persons are discarding their gloves and masks in normal waste should be avoided. There is a need to train the security persons in better way.

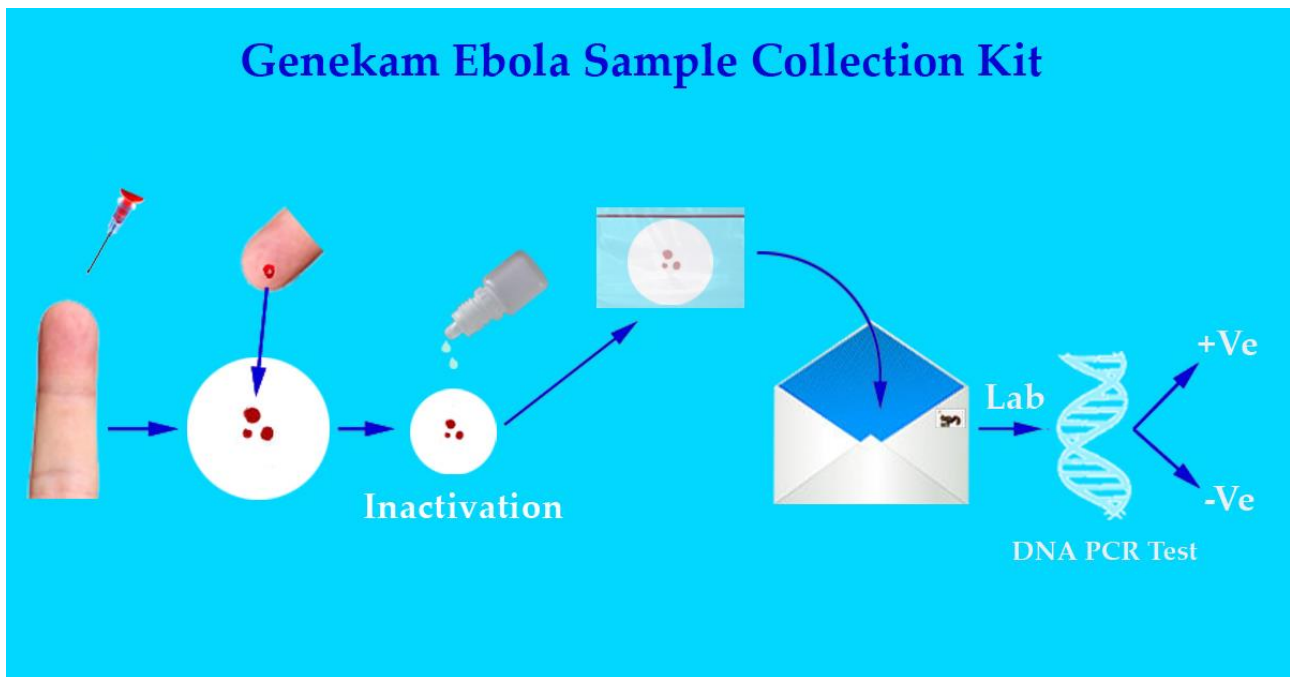


Diagram 4: Genekam Blood collection kit.

17. The confirmatory test should be done through minimum samples as large blood samples are also a risk for Ebola infections during handling. As already mentioned, these can be done through blood collection kit through Genekam Biotechnology AG.

14. Common Precautions to be taken through individuals or health care persons:

1. Maintain the distance from the suspected source e.g. at least 1 meter.
2. Use mouth masks to prevent the infection.
3. Disinfect the hands or suspected area.
4. Clean the surfaces, tables and other objects with chlorine based disinfectant.
5. Best way is to burn the towels, clothes, bed sheets of Ebola infected person in fire. Alternative one can disinfect them in boiling caustic soda to wash them.
6. Do not share any food, water and drinks with suspected person.
7. One can use also disposal overcoats, which are available on the market.
8. Do not use or touch needles as well as IV-fusion sets. Dispose them off carefully after disinfecting them with chlorine solution.

9. Spray the chlorine solution as disinfect on suspected areas, please note that it will cause the bleaching of paper and colours of other materials e.g. clothes.

Genekam Biotechnology AG has developed a preventive kit for this purposes. All most everything is included in this to take the above said precautions e.g. how to prepare chlorine solution and spray with spray bottle. It is shown in Diagram.



Diagram 5: Application of Genekam prevention kit.

15. Common precautions to be taken through health care persons:

1. Please always maintain a distance from the other health care persons and patients while talking at least 1 meter.
2. Use mouth masks to prevent the infection during the working with suspected patients.
3. Use gloves and rinse them in chlorine solution before touching the other patients.
4. Avoid unnecessary touching of the patients.
5. Always take bath after the work as it may reduce the load of infection during the working hours.
6. Always wash the hands with soap and disinfect them during the working hours.
7. Please do frequently disinfect of hands.
8. Always use overcoat.
9. There should be disinfection of the objects like pens, thermometers, electronic instruments and other instruments. This can be done with chlorine solution or alcohol based disinfectants, but the best way is to use chlorine solutions. To disinfect a notebook, one can cover this notebook with a plastic sheets (e.g. it can be bought from the supermarkets or it can be cut from the plastic bags available on the market in case of emergency., this plastic sheet can be removed after the visiting the

suspected person and dispose of after disinfecting with chlorine solutions).

10. Burn the suspected towels, cotton, swabs, tissue paper and belonging from the suspected persons or soak them in chlorine solution or boil in caustic soda. The best way is to burn the suspected waste, if possible.

11. It is highly recommended to fill closed vessel or container with 25% filled with chlorine solution to discard the objects in this disinfectant in order to reduce the contamination. This should be the part of each room in clinics or hospitals. It should be discarded twice a day or once a day. It is shown in diagram 6.



Diagram 6: one container containing chlorinated disinfectant filled up to 25% of the volume of the container for discarded objects.

12. There should be use of disinfectant lights like UV in order to disinfect the areas, where one cannot reach with normal disinfectant liquid.

16. Common precautions to be taken from health workers and relatives during attending Ebola infected patients:

In this case, one can divide between the possibilities in a well-developed country and developing country.

In developed countries, they have well equipped rooms attached with disinfectant baths before and after attending the patient in an isolated room. They have better equipped laboratories to find the indicators of progress of conditions e.g. load of virus in DNA testing laboratory or blood parameters. They have well organised plan to follow up such infected cases. The conditions in developing or under developed countries are to be addressed here. The suggestions are as follows:

1. Please always maintain a distance from the other health care persons and patients while talking.

2. Use mouth masks along with goggles to prevent the infection during the working with suspected patients. There is a need of complete body coverage. Removal of the coat should be done carefully as during the visiting the patients, there may be some secretions remaining on the coat. The best will be disinfect the coat before removing. Put the disinfectant and let us act for a few minutes and remove the coat. The best way is to soak the coat in chlorine disinfectant and after that it can be burned. Please use disposable coats. After removing the clothes, it should be advisable to take bath before wearing the normal clothes or wash the face and exposed body parts with soap at least, if the bathing is not possible.

3. Use gloves and rinse them in chlorine solution before touching the next patients. Rinsing solutions should be discarded after each patient possible or changed frequently. Chlorinated disinfectant may give some unpleasant smell, but it is one of best solution.

4. Avoid unnecessary touching the patients and their belongings like beds and utensils.

5. Always take bath after the work as it may reduce the load of infection during the working hours.

6. Always wash the hands with soap and disinfect them during the working hours.

7. Please do frequently disinfection of hands.

8. Put the utensils of the patient in chlorine disinfectant.

9. There should be disinfection of the objects like pens, thermometers, electronic instruments and other instruments. This can be done with Chlorine solution or alcohol based disinfectants, but the best way is to use chlorine solutions. To disinfect a notebook, one can cover this notebook with a plastic sheets (e.g. it can be bought from the supermarkets or it can be cut from the plastic bags available on the market in case of emergency., this plastic sheet can be removed after the visiting the suspected person and dispose of after disinfecting with chlorine solutions).

2. Burn the suspected towels, cotton from the suspected persons or soak them in chlorine solution or boil in caustic soda. The best way is to burn the suspected waste, if possible.

3. It is highly recommended to put closed vessel 25% filled with chlorine solution to discard the objects in this disinfectant in order to reduce the contamination. This should be the part of each room in clinics or hospitals. It should be discarded twice a day or once a day. It is shown in diagram 6.

4. There should be use of disinfectant lights like UV in order to disinfect the areas, where one cannot reach with normal disinfectant liquid. The light disinfectant can be used to disinfectant the notebooks, computers, medical instruments.

5. The areas should be fumigated with fumigating disinfectants e.g. formalin: please take care that there is no person during the fumigation as formalin will cause irritations or one can use also lights producing ozone in order to do disinfection of infected area.

6. In each hospital, there should be burning fire, where can burn all belongings like clothes, bed sheets, overcoats, used masks and gloves etc. One should not collect the waste or belongings of infected person as it may act one biggest source of new infections. Some may be considering environmental effects of burning, but fire is the cheapest and best way to destroy effectively the

infected material.

7. Drinking water can be also chlorinated in infected areas.

8. Check your body temperature and get checked with a DNA test once a week, if you are attending Ebola infected persons.

9. Keep away from the pets.

17. Special precautions for People or health workers returning from Ebola infected countries:

They must be kept 30 days in quarantine. The temperature must be checked and they must be tested through one first day return, 3rd day, 7th, 14th and 21th day of return through DNA-test. There should be minimum contact with other persons during these days and pets should be avoided. There must be some restrictions on the aeroplanes on which they are travelling.

What to do, if you suspect that you have contacted Ebola virus:

If you suspect that you have contact with the virus. You do not need to fear as human body has immune system, which will start fighting this virus.

Whether you have an emergency access to hospital e.g. one of the developed country like USA and Germany. Call the emergency number to get the help: During the emergency aids arrived, one can take care of the following points in order to reduce the risks for other people:

1. You contact your hotline of country for medical help. You should say in your medical history that you are returning from the Africa or you were in contact with Ebola infected source. Please use also mask or maintain distance from other persons in order to avoid infection. Please do not have fear or feel shy as the chances of recovery are high for the treatment during the early stages of detection of infection.

2. Try to isolate yourself from the other persons or particularly close relative in order not to infect them also. Children should be kept away.

3. Please measure your body temperature. Disinfect a Thermometer.

4. If you are having loose motion, use one toilet and it should be flushed strongly with disinfected particularly chlorine disinfectant (or some liquid soap in case of emergency). The chlorine based disinfectant is the best.

5. Wash your hand and keep your separate towel.

6. You should result on one bed.

7. Try to do all activities in restricted area in order to limit the area of potential infection for others.

8. Pet should be kept away from you.

9. In case you are vomiting, please use basket with chlorinated disinfectant (or in case of emergency, use liquid soap). Wash your mouth after vomiting and clean your hands with water.

11. If you have mask, please use it and put gloves in order to reduce the risk for others.

12. Do not take aspirin as pain killer during Ebola infection as it can accelerate the haemorrhage or bleeding.

13. Drink water with electrolytes or add cooking salt in warm water and drink it to compensate the loss of fluids and electrolytes.

14. Please wait in one bed till the emergency services arrives.

18. Precautions during funeral of Ebola infected persons:

The principles of patient isolation, management on the quarantine ward, cadaver management, and use of body bags are key points to avoid infection. In Kikwit during the epidemic, all the bodies, regardless of the cause of death, were buried by a team of trained Red Cross volunteers who wore gloves and protective clothing i.e. a trained person is needed to do this. This was done to avoid the traditional burying rituals (cleaning of the dead body by family members, kissing and touching the body, transporting the body to the village of origin, keeping hair and nails as souvenirs). These burial rituals were an important cause of Ebola transmission during the epidemic. These precautions are needed during the funeral of a person. The person can be buried with disinfectant and deep in earth. (6)

19. The key reason of success for containing the outbreak in 1976:

There were as follows: isolation of patients, safe disposal of potentially contaminated objects and disposable clothes. Use of goggles along the use of sodium hypochlorite 2%, boiling or burning were the methods used to disinfect potentially infectious excreta, utensils, table, instruments, and clothes. Cadavers were wrapped in shrouds soaked in formalin or phenol and buried deeply. Here is an example of successful applications of preventive measurements to curb Ebola outbreaks in earlier days in 1976.

20. Some of examples of successful measurements for prevention of Ebola viruses:

In Uganda, there are some successful measurements used to reduce the filoviruses infections, these are as follows:

- Awareness about the Filoviruses should be increased in health professionals and public
- Educating the people about the virus
- affected persons should visit a physician rather visiting a natural healer
- Change in the pattern of interaction between human and bats e.g. closing the bat infected areas for

tourists and mining. It was effective way to reduce the infection.

-Establishment of additional awards at the hospitals in potential infected areas in order to have isolated areas for Ebola patients.

Therefore some of essential measurements for Governments to contain Ebola virus are as follows as short list:

- 1.Surveillance
- 2.Distribution of protective clothes
- 3.Quarantine of the suspected cases
- 4.Training of medical persons
- 5.Patient isolation
- 6.Cadaver management and waste management
- 7.Awakness in population through media
- 8.Diagnosis / laboratory services for differential diagnosis as early diagnosis is key of success to prevent the Ebola outbreaks.
9. Readiness with supportive therapies

These above said measurements can be used as outlines to develop an effective strategy for other countries to prevent Ebola virus. (9)

21. Recommendations of Commission in 1977 to control future Ebola outbreaks:

After the outbreak in 1976 was over, there was a commission formed to give the questions and the recommendations of this commission. These are discussed here and the impact of these recommendation can be felt till today.

International commission recommendations was disbanded on 29 January, 1977 and following recommendations were made:

- 1.Maintain active national surveillance for acute haemorrhagic disease. Require regular positive and negative reporting. Investigate all suspected cases and take appropriate actions including collection of diagnostic specimens, the institutions of clinical isolation procedures and the use of protective clothing for medical personnel.
- 2.Distribute pertinent information to medical and other personnel participating in surveillance and update this material by appropriate documents.
- 3.Organise a national campaign to inform health personnel of the proper methods for sterilizing syringes and needles in order to ensure that patients are not infected with diseases from other

patients as a result of poor technique. Reconsider the need for parenteral injections when patients can take medicines by mouth. Prohibit or strictly regulate the activities of itinerant nurses who treat all diseases by injections.

4. Maintain a list of experienced personnel so that appropriate action can be taken without delay in the event of an epidemic.

5. Maintain a stock of basic medical supplies and protective clothing for use in future suspected outbreaks.

6. Keep plasma from immune donors in readiness. Make standardised observations and obtain serial serum specimens following use of plasma in the treatment of suspected cases of Ebola haemorrhagic fever in order to obtain further information concerning the effectiveness of the treatment. Commission members also participated in a consultation sponsored by WHO in January 1977.

Detailed recommendations were made for dealing with future outbreaks wherever they may occur as well as for continued investigations of the biology of Ebola virus. These suggestions have been published and are wholeheartedly endorsed by this commission. (4)

As one can see that these recommendations are highly effective to control the outbreaks today, but these were not implemented properly, hence this breach is also contributing to the outbreak in 2014 in Africa.

22. Diagnosis:

Ebola infections cannot be detected through symptoms only as symptoms are similar to many diseases like Typhoid, Influenza, Malaria, Yellow fever virus etc. In 1976, the Ebola patients were misdiagnosed as typhoid patients and the reality came after that antibiotics were not working. Therefore a fastest diagnosis is essential to isolate the patient and start with the treatment along with taking the measurements for safety of other people. There are different methods available for diagnostic of Ebola infections. These are serological methods as well as DNA based methods. But the DNA based methods are more accurate and much faster. Moreover these methods offer the possibility to reconfirmation with the genesequencing.e.g. DNA signature of virus can be found and analysed with software. DNA-Tests are presently the methods of choice and widely used through the reference laboratories to confirm the results. The serological methods have their disadvantages as they are prone to false positive or negative, therefore they may lead to wrong course of the therapy in some patients.

23. Diagnostic methods:

23.1 Cell culture methods: These are limited to special laboratories as they need very high degree of safety. These methods are not applicable under field conditions and they need specially trained people and many days to give results.

23.2 Serological methods: These are applicable under field conditions, but one must take strict safety precautions during conducting these tests. These are antigen and antibody tests. They can be performed in the form of ELISA, where one can detect the colour change with photometer or optically as well as in form immunofluorescence tests, where one can see the colour of fluorescence dye through special microscope indicating the presence of Ebola viruses. Ebola viruses enter into endothelial cells, hence skin biopsies can be seen with this method under field conditions, and

therefore it is one of commonly used diagnostic method in 1995 outbreak of Ebola. This method of skin biopsies was a standard method of detection of positive patients. ELISA tests can be used on plasma or serum samples. Genekam biotechnology AG is trying develop here nanotechnology based assays.

23.3 DNA Testing method: This is one of fastest and accurate method. It is in a position to give the results from a few drops of blood or skin biopsies. In this assay, one has to isolate the RNA of virus and this RNA is converted into cDNA during the testing process and at the end the results can be seen in the form of a band in conventional PCR on gel agarose or as Ct value in form of the curve. The real time PCR has an advantage as it can increase whether the infection load is increasing or decreasing i.e. One can predict whether a patient is recovering or not (or it is responding to therapy or not). The real time PCR is shown in diagram 7 and 8. Diagram 8 shows the rising curves for positive samples.

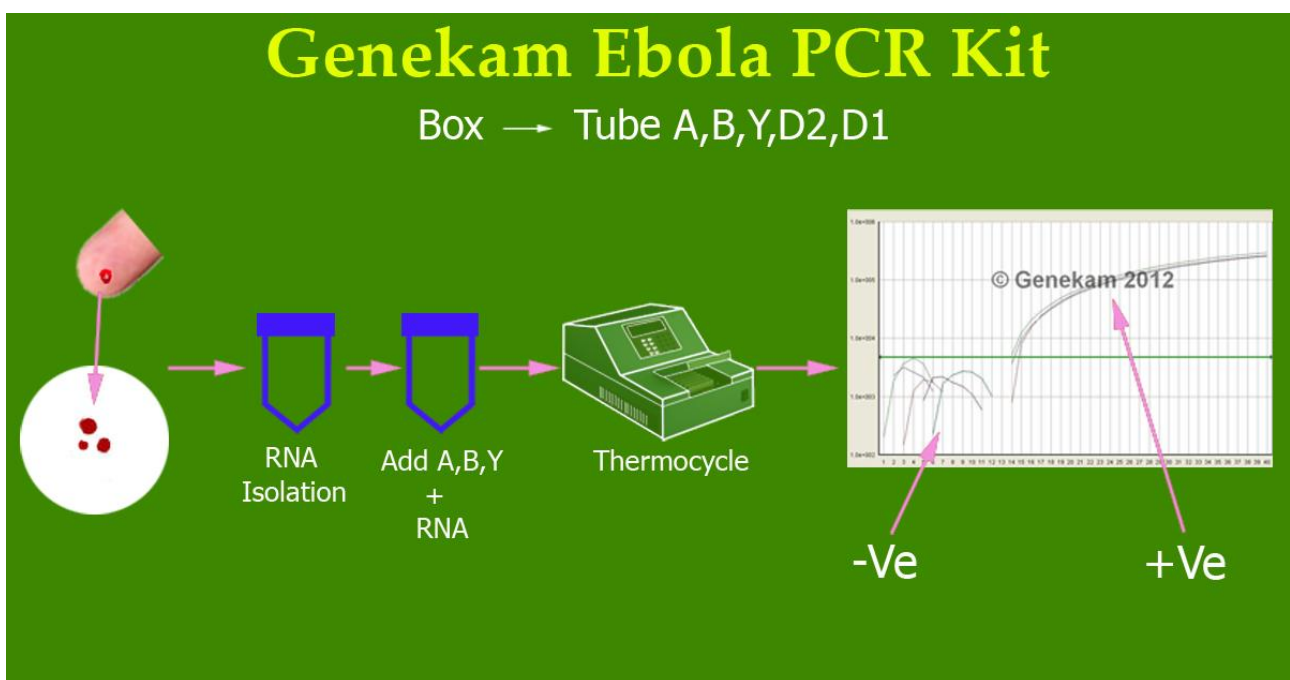
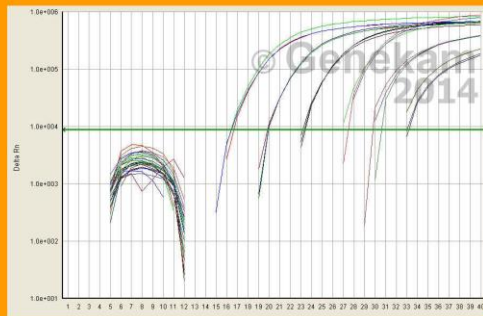


Diagram 7: It shows how a real time PCR for Ebola virus can be performed.



Realtime PCR test for Ebola viruses showing results

Diagram 8: It shows results can be seen as curves and Ct values.

Conventional PCR lab set up can be made as it is economical, but the real time PCR lab set up is expensive as one need expensive real time machine. The convention PCR is shown in diagram 9. Genekam Biotechnology AG has developed a number of assays here e.g. single check as well as double check as double check assays are better because they target more than one gene in Ebola virus therefore if one gene of the virus is mutated, still it will be able to detect the virus through another virus. Therefore it makes sense to use double check assays under the field conditions. PCR assays need usually isolated RNA and they should be performed in 3 different parts in order to avoid the cross contaminations. There are a number of companies on the market offering assays with plasmids with different dilutions in order to calculate the number of copies as such plasmids can be a reasons for cross contaminations in laboratory leading to wrong results i.e. The patients, who are negative in reality are positive in these assays because the DNA is circulating in air of laboratory because too much plasmids are being used during the tests. It means that they are getting unnecessary therapies because of such poor quality of assays. Main reason is that many companies do not understand the field of virology properly, but still they made assays for viruses and distribute them on the world markets. Such issues must be carefully checked as one should run the assays without any positive control and if you are getting these tests with the positive results, the user has a problem of cross contaminations and most of time strong cross contamination can be removed with the solutions available on the market. If one cannot get rid of cross contamination problem, it will lead to closure of the laboratory in order to relocate it to other part of city. Therefore one should be very careful about using PCR technology to detect the viruses and other targets. PCR technology can increase the safety during the transportation of blood as blood collection kits can be used to collect only 2-3 blood drops on a special paper against transporting 5 ml blood vials, which pose a serious threat to other people and environment. Genekam blood collection kit should be used as an alternative.

Genekam Ebola PCR Kit

Box → Tube A,B,Y,D2,D1

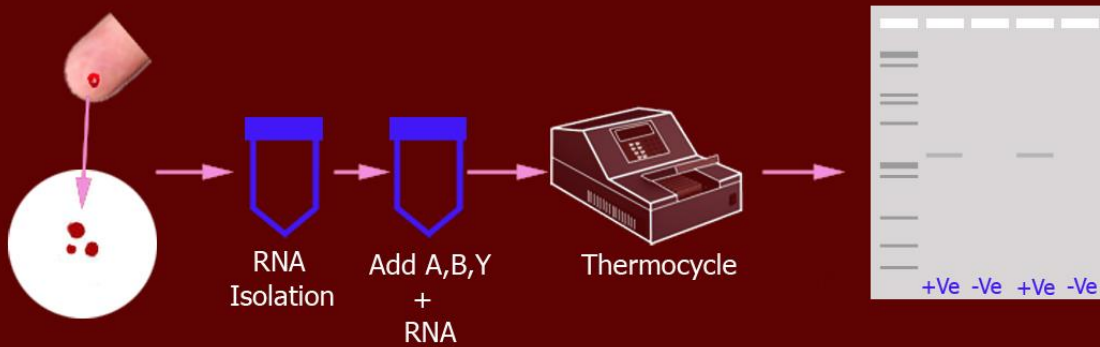


Diagram 9: It shows how a conventional PCR test can be performed for Ebola virus.

One recommendation:

Ebola groups on Facebook: We made an Ebola group, where people can join and discuss about this. One can join us under Genekam Biotechnology AG in Facebook or in Twitter.

24. Summary

Ebola virus is one of major threat to the world. To control, there are a number of issues needed to handle like prevention through preventive measurements e.g. disinfectant, masks and goggles, remove the source of infection e.g. animals like bat and infected persons, supportive treatment of infected persons as early as possible along with detection with reliable DNA tests and further development of adequate therapy and vaccines.

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