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Life Threatening Fatal Viruses groups: Biohazard and Biosafety

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ABSTRACT

Background: Viruses are one of the most serious risks to humanity, as seen by severe epidemics in history, and they have the ability to shut down governments, disrupt whole industries, and inflict immense human misery while spreading through communities, countryside, villages, and forests. Viruses have developed to the point that they are difficult to eradicate. This complexity occurs in dealing with viral diseases and is heightened by the virus's structural and genetic nature. They exist as autonomous beings, neither entirely dead nor completely alive.

Keywords: Viruses groups, Biohazard, and Biosafety

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INTRODUCTION

Viruses are one of the most serious risks to humanity, as seen by severe epidemics in history, and they have the ability to shut down governments, disrupt whole industries, and inflict immense human misery while spreading through communities, countryside, villages, and forests. Viruses have developed to the point that they are difficult to eradicate. This complexity occurs in dealing with viral diseases and is heightened by the virus's structural and genetic nature. They exist as autonomous beings, neither entirely dead nor completely alive. The unusual composition of these infectious agents contributes to their difficulty in fighting. Viruses are small in comparison to other diseases like bacteria. It is also difficult to target them with medicines since they lack live organism features such as metabolism and the ability to reproduce on their own.

Furthermore, numerous lethal viral groups for people and animals are still prevalent in various parts of the world, and the most hazardous aspect of these viruses is that they do not react to therapy. And the most dangerous aspect of some viral groups is that they are transferred from animals to people and cause severe disease in both. Many viral diseases today lack effective vaccinations, and such viruses are characterized by the speed and severity of their infection, which spreads rapidly and kills quickly, needing significant preparation and several delicate therapies to combat them. As a result, they are potentially lethal and can be employed as weapons and assault agents in bioterrorism.

The purpose of this presentation is to introduce these viral groups, their methods of transmission, and how to limit and prevent their spread.

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I. History and examples of viral infections:

- Plague of Athens: 429–426 BC Greece, Libya, Egypt, Ethiopia Unknown, viral hemorrhagic fever.
- 412 BC epidemic, possibly influenza Unknown.
- Antonine Plague 165–180 Roman Empire Unknown, possibly smallpox.
- Jian'an Plague 217 Han Dynasty Unknown, possibly typhoid fever or viral hemorrhagic fever Unknown.
- Plague of Cyprian 250–266 Europe Unknown, possibly smallpox Unknown.
- 735–737 Japanese smallpox epidemic.
- Sweating sickness (multiple outbreaks) 1485–1551 Britain (England) and later continental Europe Unknown, possibly an unknown species of hantavirus.
- 1510 influenza pandemic Asia, North Africa, Europe Influenza Unknown, around 1% of those infected.
- 1520 Mexico smallpox epidemic.
- 1557 influenza pandemic.
- 1561 Chile smallpox epidemic.
- 1592–1596 Seneca nation measles epidemic.
- 1616 New England infections epidemic. Classic explanations include yellow fever, bubonic plague, influenza, smallpox, chickenpox, typhus, and infection of hepatitis B and hepatitis D Unknown.
- Massachusetts smallpox epidemic.
- 1634–1640 Wyandot people epidemic of infections .
- 1677–1678 Boston smallpox epidemic.
- 1687 South Africa Influenza outbreak.
- 1693 Boston yellow fever epidemic.
- 1699 Charleston and Philadelphia yellow fever epidemic.
- 1702–1703 St. Lawrence Valley smallpox epidemic.
- 1702 New York City yellow fever epidemic.
- 1707–1709 Iceland smallpox epidemic.
- 1713–1715 North America measles epidemic.
- 1721 Boston smallpox outbreak.
- 1730 Cádiz yellow fever epidemic.
- 1732–1733 Thirteen Colonies influenza epidemic.
- 1738–1739 North Carolina smallpox epidemic.
- 1741 Cartagena yellow fever epidemic.
- 1759 North America measles outbreak.
- 1760 Charleston smallpox epidemic.
- 1762 Havana yellow fever epidemic Havana, Cuba Yellow fever.
- 1763 Pittsburgh area smallpox outbreak North America.
- 1772 North America measles epidemic.
- 1775–1782 North American smallpox.
- 1775–1776 England influenza outbreak.
- 1778 Spain dengue fever outbreak.
- 1788 Pueblo Indians smallpox epidemic.
- 1789–1790 New South Wales smallpox epidemic.
- 1793 Philadelphia yellow fever epidemic.
- 1800–1803 Spain yellow fever epidemic.
- 1802–1803 Saint-Domingue yellow fever epidemic.
- 1820 Savannah yellow fever epidemic.
- 1821 Barcelona yellow fever epidemic Barcelona, Spain Yellow fever.
- 1828–1829 New South Wales smallpox epidemic.
- 1837 Great Plains smallpox epidemic.
- 1841 Southern United States yellow fever epidemic.
- 1847–1848 influenza epidemic.
- 1847 Southern United States yellow fever epidemic.
- 1848–1849 Hawaii epidemic of infections, Measles, and influenza.

- 1853 New Orleans yellow fever epidemic.
- 1855–1857 Montevideo yellow fever epidemic.
- 1855 Norfolk yellow fever epidemic.
- 1857–1859 Europe and the Americas influenza epidemic.
- 1857 Victoria smallpox epidemic.
- 1857 Lisbon yellow fever epidemic.
- 1862 Pacific Northwest smallpox epidemic.
- 1867 Sydney measles epidemic.
- 1870–1875 Europe smallpox epidemic.
- 1871 Buenos Aires yellow fever epidemic.
- 1875 Fiji measles outbreak.
- 1876 Ottoman Empire plague epidemic.
- 1878 New Orleans yellow fever epidemic.
- 1878 Mississippi Valley yellow fever epidemic.
- 1885 Montreal smallpox epidemic.
- 1889–1890 flu pandemic Worldwide Influenza.
- Papua New Guinea kuru epidemic.
- 1915 Encephalitis lethargica pandemic.
- 1916 United States polio epidemic.
- 1918 influenza pandemic ('Spanish flu').
- 1924–1925 Minnesota smallpox epidemic.
- 1937 Australia polio epidemic.
- 1940 Sudan yellow fever epidemic.
- 1946 Egypt relapsing fever epidemic.
- 1948–1952 United States polio epidemic.
- 1957–1958 influenza pandemic ('Asian flu').
- 1960–1962 Ethiopia yellow fever epidemic.
- Hong Kong flu 1968–1970 Worldwide.
- 1971 Staphorst polio epidemic.
- London flu 1972–1973 United States.
- 1972 Yugoslav smallpox outbreak.
- 1974 smallpox epidemic of India.
- 1977 Russian flu 1977–1979 Worldwide.
- HIV/AIDS pandemic 1981–present Worldwide.
- 1986 Oju yellow fever epidemic.
- 1987 Mali yellow fever epidemic.
- 1988 Shanghai hepatitis A epidemic.
- United Kingdom BSE outbreak 1996–2001 United Kingdom Variant Creutzfeldt–Jakob disease.
- 1996 West Africa meningitis epidemic.
- 1998–2000 Democratic Republic of the Congo Marburg virus outbreak
- 1998–1999 Malaysia Nipah virus outbreak.
- 2000 Central America dengue epidemic.
- 2002–2004 SARS outbreak.
- 2003–2019 Asia and Egypt Avian influenza epidemic.
- 2004 Sudan Ebola outbreak.
- 2004 Indonesia dengue epidemic.
- 2005 dengue outbreak in Singapore.
- 2004–2005 Angola Marburg virus outbreak.
- 2006–2007 East Africa Rift Valley fever outbreak.
- 2006 Philippines dengue epidemic.
- 2006 dengue outbreak in Pakistan.
- 2006 dengue outbreak in India.
- Mweka Ebola epidemic 2007 Democratic Republic of the Congo Ebola.
- 2007 Uganda Ebola outbreak.
- 2007 Puerto Rico, Dominican Republic, and Mexico dengue fever epidemic.
- 2008–2017 China hand, foot, and mouth disease epidemic.
- 2008 Philippines dengue epidemic.
- 2008 Cambodia dengue epidemic.
- 2008 Brazil dengue epidemic.
- Queensland 2009 dengue outbreak Australia Dengue fever.
- 2009–2010 West African meningitis outbreak.

- 2009 Swine flu pandemic.
- 2009 Gujarat hepatitis outbreak, India Hepatitis B.
- 2009 Bolivian dengue fever epidemic.
- 2010–2014 Democratic Republic of the Congo measles outbreak.
- 2011 Vietnam hand, foot and mouth disease epidemic, foot and mouth disease.
- 2011 Dengue outbreak in Pakistan.
- 2012 yellow fever outbreak in Darfur, Sudan.
- 2012 Middle East respiratory syndrome coronavirus outbreak present Worldwide.
- Western African Ebola virus epidemic 2013–2016 Worldwide, primarily concentrated in Guinea, Liberia.
- 2013–2014 chikungunya outbreak Americas Chikungunya.
- 2013–2019 Avian influenza epidemic China Influenza.
- 2013 Vietnam measles outbreak.
- 2013 Dengue outbreak in Singapore 2013 Singapore Dengue fever.
- Flint Water crisis 2014–2015 Flint, Michigan, United States Legionnaires' disease.
- 2014 Odisha jaundice outbreak.
- 2015–2016 Zika virus epidemic Worldwide Zika virus.
- 2015 Indian swine flu outbreak India Influenza.
- 2016–2021 Yemen cholera outbreak.
- 2016 Angola and DR Congo yellow fever outbreak.
- 2017 Gorakhpur Japanese encephalitis outbreak India Japanese encephalitis.
- 2017 Dengue outbreak in Sri Lanka Sri Lanka Dengue fever.
- 2017 Dengue outbreak in Peshawar, Pakistan.
- Kivu Ebola epidemic 2018–2020 Democratic Republic of the Congo and Uganda Ebola.
- 2018 Nipah virus outbreak in Kerala India Nipah virus infection.
- COVID-19 pandemic present Worldwide.
- 2019–2020 New Zealand measles outbreak.
- 2019–2020 Dengue fever epidemic Asia-Pacific.
- 2019 Samoa measles outbreak.
- 2019 Philippines measles outbreak.
- 2019 Nigeria Lassa fever epidemic present.
- 2019 Measles outbreak in the Democratic Republic of the Congo.
- 2019 Kuala Koh measles outbreak Kuala Koh, Malaysia Measles.
- 2020 Nigeria yellow fever epidemic present.
- 2020 Democratic Republic of the Congo Ebola outbreak.

II. The most lethal and severe virus families include:

1. Arenaviridae:

A. Chapare Mammarenaviruses.[1]

B. Lassa virus. [2,3,4]

C. Lujo Mammarenavirus. [5]

2. Nairoviridae

A. Crimean-Congo orthonairovirus.[6]

3. Hantaviridae

A. Hantavirus. [7,8,9]

4. Phenuiviridae

A. Rift Valley Fever virus.[10,11]

5. Filoviridae

A. Ebola Virus Disease. [12,13,14,15]

B. Marburg virus. [16,17].

6. Flaviviridae

A. Alkhurma virus. [18]

B. Kyasanur Forest virus.[19]

C. Omsk Hemorrhagic Fever virus.[20]

D. Tich-born Virus.[21.22,23]

7. Paramyxoviruses

A. Hendra Virus Disease. [42,25,26]

B. Nipah Virus.[27,28,29,30,31]

8. Poxvirusesare

A. Smallpox virus. [32,33,34,35,36,37,38,39]

9. Rabdovirideae:

A. Rabies virus. [40,41,42,43,44,45,46,47,48,49].

III. Diseases:

1. **Chapare virus**: Chapare Hemorrhagic Fever.[1]
2. **Lassa virus:** Lassa Fever. [2,3,4]
3. **Lujo Mammarenavirus:** Lujo Hemorrhagic Fever. [5]
4. **Crimean-Congo Orthonairovirus:** Crimean Congo Hemorrhagic Fever [6]
5. **Hantavirus:** Renal Hemorrhagic Fever Syndrome, Pulmonary Syndrome. [7,8,9]
6. **Rift Valley Fever virus:** Rift Valley Fever. [10,11]
7. **Ebola Virus:** Ebola hemorrhagic fever. [12,13,14,15]
8. **Marburg virus:** Marburg Hemorrhagic Fever. [16,17].
9. **Alkhurma virus:** Alkhurma Hemorrhagic Fever. [18]
10. **Kyasanur Forest Virus:** Kyasanur Forest Disease, tick-borne viral hemorrhagic fever. [19]
11. **Omsk Hemorrhagic Fever virus:** Omsk Hemorrhagic Fever [20]
12. **Tich-born Virus:** Tick-borne Encephalitis. [21.22,23]
13. **Hendra Virus:** Hendra Virus Disease (acute neurologic and/or respiratory symptoms that are deadly). [42,25,26]
14. **Nipah Virus:** Neurologic and respiratory disease. [27,28,29,30,31]
15. **Smallpox Virus:** Smallpox. [32,33,34,35,36,37,38,39]
16. **Rabies Virus:** Rabies (Central nerves system infection). [40,41,42,43,44,45,46,47,48,49].

IV. Transmission:

1. Arenaviridae:

Contaminated rodent saliva, urine, and droppings are the primary routes through which these diseases are transmitted. Direct contact includes infectious rodent bites and scrapes. Indirect contact occurs when the virus is dispersed into the air or when food is contaminated with infected rodent urine, salvia, or droppings.

By touching infected people's bodily fluids or conducting medical procedures that aerosolize (spray) their bodily fluids, such as chest physiotherapy, might infect others. [1]

2. Lassa virus:

Humans get the Lassa virus by inhalation or ingestion. Mastomys rats disseminate the virus by their excretions and urine, but also direct contact with contaminated items. Infection can also be produced by unprotected wounds and sores, as well as contaminated food. Given that, Mastomys rats commonly occupy households and feed on leftover human food, as a result, there is a significant chance of direct transmission.

Rodents are sometimes eaten as food, and infection can happen during the collecting and cooking method. Inhaling small particles of air contaminated with infectious rodent excrement can potentially cause viral exposure. When cleaning, such as sweeping, it's possible that this aerosol or airborne transmission will ensue. Human to human transmission can occur after exposure to viruses in the excretions, secretions, tissues, fluids, and blood of an infected individual. [2,3,4]

3. Lujo Mammarenavirus:

Humans get Virus through infected rodents. Lujo virus aerosolized in contaminating rodent urine and feces can be transmitted by inhalation or touch directly. The tiny nosocomial cluster of hemorrhagic illness that led to the identification of the Lujo virus showed person-to-person transmission. Arenaviruses, and Lujo virus in particular, are likely spread by direct contact with infected bodily fluids. [5]

4. Nairoviridae:

Hyalomma are a viral reservoir and vector. The virus uses amplifying hosts like cattle, goats, sheep, and hares to spread. Insects or animal blood can infect humans. Virus is spread via contaminated blood or bodily fluids. Hospitals have also reported virus spread owing to poor sterilization, reuse of injection needles, and contamination of medical supplies. [6]

5. Rift Valley Fever virus:

Rift Valley fever is transmitted through contact with the blood, body fluids, or tissues of infected animals, which are primarily cattle, sheep, goats, buffalo, and camels. Direct contact happens when animals are slaughtered or butchered, when sick animals are cared for, when animals are born, and when raw or undercooked animal products are consumed.

Infected mosquitoes and other biting insects spread virus. The virus has been breathed in labs (known as aerosol transmission). [10,11]

6. Ebola Virus:

Humans and other primates are both affected by this disease. The virus is transmitted via direct contact (such as eyes, injured skin, or mucous membranes in the mouth or nose). The exposure period of an Ebola patient is measured with this app. Blood or body fluids from an Ebola virus-infected or Ebola-deceased individual. Objects infected with Ebola body fluids (medical equipment, bedding, clothes, and needles).

Infected bats or nonhuman primates (such as apes and monkeys). Sperm from an Ebola survivor considered infectious through sexual (vaginal, anal, or oral) contact. There is no evidence that Ebola may be transmitted through intercourse or other contact with a woman who has had Ebola's vaginal secretions. [12,13,14,15]

7. Marburg virus:

Marburg Hemorrhagic Disease is a uncommon but deadly hemorrhagic fever that affects humans and nonhuman primates alike. Blood or bodily fluids (amniotic fluid, breast milk, urine, perspiration, saliva, vomit, sperm, and feces) from a person who is sick with or has died from Marburg virus disease, or objects contaminated with body fluids from a person who is sick with or has died from Marburg virus disease (such as clothes, bedding, needles, and medical equipment).

The sperm of a Marburg Hemorrhagic Fever survivor transmits infection through vaginal, anal, or oral intercourse). Caregivers at home or in hospitals are one example (nosocomial transmission). [16,17].

8. Alkhurma Virus:

viral transmission is unknown. As tick hosts, Ornithodoros savignyi and dromedari spread a zoonotic virus broadly. Tick bites or crushing infected ticks can both cause infection. Contact with domestic animals or livestock has been related to a higher risk of infection in humans.

The virus has not been reported from person to person. The function of cattle in the transmission of virus to humans is unknown. [18]

9. Hantavirus:

The virus infects people through aerosol, urine, feces, and saliva, as well as infected rodent bites. [7,8,9.,

10. Kyasanur Forest virus:

When people come into touch with an infected animal or whether people come into contact with an infected A tick bite, particularly from a sick or dead monkey, can spread the infection to humans. This hasn't been explained yet.

Large animals such as sheep, cows, and goats can contract disease but play a little role in its transmission. Ticks feed on the blood of bigger animals, and infected animals can spread the virus to other ticks, however viral transmission from larger animals to humans is uncommon. (19)

11. Omsk Hemorrhagic Fever virus:

Humans become infected by tick bites or contact with deceased, infected, or diseased animals, the most common of which are rats. Hunting and trapping may increase the danger of human infection. Because the virus appears to be very persistent in many environments, transmission can occur without the presence of a tick or a rodent.

The virus has been identified from both aquatic and terrestrial environments, and evidence shows it may be transmitted to people through tainted sheep or goat milk. (20)

12. Tich-born Virus:

Ticks, particularly Ixodidae hard ticks, are both the virus's reservoir and vector. Humans, as well as small rodents, are accidental hosts. Large animals are tick feeders, but they do not keep the virus alive. The virus is passed among ticks transtadially (from larva to nymph then adult) and transovarially (from tick to other) (from adult female tick to eggs).

Human infected cases occur most often in rural regions and during peak tick activity (between April and November). Raw milk from sick goats, lambs, or cows can potentially cause infection. (21.22,23)

13. Hendra Virus:

Humans can get Hendra virus via horses' bodily fluids, tissues, or excretions. Horses can get infected via infected flying foxes' urine. (42,25,26)

14. Nipah Virus:

Nipah virus spreads from: Contact with sick bats or pigs or their bodily fluids (such as blood, urine or saliva). Using food tainted with diseased animal bodily fluids (such as palm sap or fruit contaminated by an infected bat). Contact with a infected individual or their bodily fluids (including nasal or respiratory droplets, urine, or blood). (27,28,29,30,31)

15. Smallpox virus:

It was mostly spread through prolonged face-to-face contact. After mouth and throat sores appeared, those who had smallpox in the early stages of the rash were infectious. They spread the infection by coughing, sneezing, or spitting on others. Their smallpox scabs remained infectious. The variola virus was discovered in the patient's scabs and painful fluid.

The virus can spread via these materials or infected things like beds or clothing. People who cleaned smallpox victims' bedding or clothing had to wear gloves and avoid being infected. It has happened in a confined location, like a building (airborne route). Only people can spread smallpox. Insects or animals cannot spread smallpox, according to research. (32,33,34,35,36,37,38,39)

16. Rabies virus:

Any hot mammal, including humans, can be infected with the rabies virus. In 1884, rabies was first experimentally transmitted to birds; afflicted birds are mostly asymptomatic and recover. Other bird species have developed rabies antibodies after eating rabies-infected animals. The virus can now grow in cold-

blooded vertebrate cells. Most animals can get the virus and spread it to people.

Domestic dogs are responsible for nearly all human rabies cases. Humans can get rabies from bats, cats, wolves, cattle, coyotes, and mongooses are some of the animals that live in the wild (normally either the small Asian mongoose or the yellow mongoose). Rabies can be transferred by a bear, a domestic farm animal, a groundhog, a weasel, or another wild carnivore. Rabies is known to be carried by rabbits and other lagomorphs, but not by chipmunks, rats, mice, or other small rodents.

Because rats, mice, and squirrels are generally killed by larger rabid animals and so are not carriers, rabies prophylaxis is seldom required. The Virginia opossum is resistant to rabies, but not immune, due to its lower internal body temperature. (40,41,42,43,44,45,46,47,48,49).

V. Prevention:

1. Arenaviridae:

Improving rodent management around buildings and houses can help decrease exposure to rats carrying arenaviruses. Seal up holes and gaps in homes and other structures near the residence to avoid or limit rat infestation. Set traps around your house to control rodents.

Remove any food sources for rats. People should avoid places infected with rats or other small animals. The virus is contagious. It is possible to contract Virus from people who have symptoms for months after they stop having symptoms.

The presence of viruses in the bodily fluids of infected or recovering patients should be investigated since infected people can infect others. (especially household members, healthcare personnel, and perhaps sexual partners).

As a result, it's best to avoid contact with ill people's bodily fluids. The risk coming into touch with the body fluids of diseases associated (blood, urine, semen, respiratory secretions, saliva, and other biological materials). (1)

2. Lassa virus:

Because controlling the Mastomys rat population is impossible, Some remedies include repelling rodents away from the home and food sources, conserving grain and other commodities in resistant containers, and removing waste well away from the place. Avoid contact with an infected individual by using gloves, masks, lab coats, and goggles.

In many nations, a public health agency monitors these concerns. These groups may not have the resources to successfully suppress epidemics in less developed nations. Humans have no vaccination as of 2019. (2,3,4)

3. Lujo Mammarenavirus:

While rodent management is beneficial, it will not prevent outdoor exposures from causing Lujo hemorrhagic fever. As with other hemorrhagic fevers, complete barrier nursing techniques should be used when treating Lujo Hemorrhagic Fever. (5)

4. Nairoviridae:

Farm animals must be de-ticked before even being transported or sent for slaughter, according to agricultural regulations. Using insect repellents, wearing proper clothing, and checking for ticks are among personal tick prevention strategies.

Isolate the body material when feverish patients with bleeding require resuscitation or urgent care. (6)

5. Hantavirus:

The easiest way to avoid hantavirus is to avoid or minimize contact with rats in the home, office, or camping. Because the virus is spread via rodent saliva, excretions, and bites,

controlling rats and mice in human-populated regions is critical. General prevention includes removing rodent nests, closing holes and crevices in dwellings where mice or rats may enter, placing traps, poisoning, or utilizing natural predators like cats.

The length of time hantaviruses stay infectious in the environment is affected by food, temperature, humidity, and whether the rodent is indoors or outside. The viruses may survive for 2-3 days at room temperature, but UV radiation from direct sunlight destroy them within hours. Indeterminate-age rodent droppings or urine should always be considered as contagious.[7,8,9]

6. Rift Valley Fever virus:

The risk of infection can be decreased by avoiding contact with affected animals' blood, bodily fluids, or tissues, and by using insect repellent. When working with animals in Rift Valley fever endemic regions, it's critical to put on protective equipment to avoid being exposed to potentially infected blood or tissues.

Setting up environmental and case surveillance systems may help forecast and control future Rift Valley fever outbreaks. Human vaccinations are presently unavailable. Human vaccinations have only been tested on scientific people in high-risk situations. Various veterinary vaccinations are available. [10,11]

7. Ebola Virus:

Protective equipment like as gloves, masks, goggles and gowns, should be used by anyone caring for Ebola patients. According to the CDC, the protective gear should leave no flesh exposed. Everyone who may come into touch with an infected person's body fluids should take these measures. In 2014, the CDC recommended that medical personnel be taught on how to correctly dress and remove personal protective equipment. All equipment, medical waste, patient waste, and surfaces that have come into contact with body fluids should be disinfected.

During the 2014 Ebola outbreak, families were given protective gear, chlorine powder, and other cleaning supplies to treat Ebola at home. Ebola viruses can be killed by heat (heating for 30-60 minutes at 60° C or boiling for 5 minutes).

Lipid solvents, such as alcohol-based products, detergents, sodium hypochlorite, calcium hypochlorite, or can be used to disinfect surfaces in the correct proportions. The WHO recommends educating the public about Ebola risk factors and preventative measures. Avoiding direct contact with sick persons and regularly washing hands with water and soap. Bush meat, a major protein source for certain Africans, should be handled with care and fully cooked before eating.

Direct contact with a deceased Ebola patient should be avoided. Certain burial rites that include direct contact with a deceased person must be reformulated to ensure a consistent protective barrier between the deceased and the living social anthropologists can assist discover burial rules alternatives. If someone shows signs of Ebola, transportation workers are required to isolate them. The WHO no longer considers travel limits effective in reducing disease transmission. [12,13,14,15]

8. Marburg virus:

Due to ongoing research on wildlife-to-human transmission, there are no known prevention measures for Marburg virus infection. Avoiding fruit bats (Rousettus aegyptiacus) and infected non-human primates is one way to avoid infection.

Other hemorrhagic fevers have secondary (person-to-person) transmission prevention methods that are comparable. Infection prevention and control procedures should be used if a patient has been diagnosed with Marburg virus illness.

Included in these are the use of protective clothing and masks, isolation of sick individuals, and sterilization or correct disposal of needles, equipment, and patient excrement. When it occurs, it can spread to others, especially healthcare workers and family members caring for the patient. Increasing community and healthcare provider knowledge of disease clinical signs is essential. Increasing public knowledge can help prevent the transmission of Marburg virus among family members and healthcare workers. [16,17].

9. Alkhurma virus:

Since there is no therapy or particular prophylactic for virus, only prevention and improved awareness are advised. In endemic areas, avoid tick-infested areas and restrict contact with livestock and domestic animals. Tick repellents should be used on skin and clothing, and ticks should be removed as soon as feasible.

Tick collars for pets are available, and immersing cattle in acaricides works well. Workers in farms or slaughterhouses handling animals or animal products should avoid unprotected contact with possibly infected or viremic animals. [18]

10. Kyasanur Forest virus:

Vaccination is suggested., as are protective clothes and tick management. The viral vaccination is formalin-inactivated virus. After two doses, vaccination is 62.4 % effective. An extra dosage improves efficacy to 82.9%. No specific therapies exist. [19]

11. Omsk Hemorrhagic Fever virus:

Preventing Omsk Hemorrhagic Fever involves preventing tick exposure. Camping, farming, forestry, and hunting (particularly the Siberian muskrat) are riskier activities that require protective gear or bug repellant. The same goes for those in sheltered areas. [20]

12. Tich-born Virus:

Prophylaxis can be non-specific such as tick inspections, tick bite avoidance) or specific like vaccination). In many diseases endemic locations and travel clinics, Tick-borne encephalitis vaccinations are available. Especially FSME-IMMUN® and Encepur® vaccine. [21.22,23]

13. Hendra Virus:

Only infection of intermediate animals such as horses has been connected to human infection. Early identification in the intermediate animal host reduces the risk of possible human cases. Avoiding horses who are sick or may be infected with the Hendra virus and wearing protective clothing when necessary, such as during veterinary operations, are two ways to avoid contracting the virus. In Australia, a commercial vaccination for horses was just licensed, and it may be beneficial to other humans and animals. [42,25,26]

14. Nipah Virus:

Prevention is the best defense. In places where the infection is endemic, avoid contact with infected bats and pigs. Bats are known to be resistant to many zoonotic viruses, probably due to their evolved immune systems built to cope with the stress of flying. Drinking bat-infested palm toddy or raw palm sap, eating bat-infested fruits, and drinking water from bat-infested wells can all cause bat illness.

Bats have been observed to eat and urinate in open-top toddy, infecting it with the virus. Surveillance and awareness can help to keep outbreaks to a minimum. It's unclear whether the illness has anything to do with bat reproduction.

Nosocomial infections can be avoided by following standard infection control procedures. Monkeys developed cross-protective antibodies against Henipavirus and Nipah virus after receiving a subunit vaccine based on the Hendra G protein. [27,28,29,30,31]

15. Smallpox virus:

Smallpox vaccinations are available. The smallpox vaccination is no longer recommended for the general population due to its eradication. To suppress a smallpox outbreak, doctors would employ a smallpox vaccination. While certain antiviral medicines may assist treat smallpox, no smallpox therapy has been proved successful in humans. The smallpox vaccination (vaccinia virus vaccine) can prevent smallpox. The vaccine uses vaccinia, a poxvirus related to smallpox. (32,33,34,35,36,37,38,39)

16. Rabies virus:

Until 1885, almost all human rabies exposure was deadly. The first vaccination was made from sick rabbits whose nerve tissue was dried for five to ten days to weaken the virus. Nerve tissue-derived vaccinations are still used in some countries because they are less expensive than modern cell culture vaccines. In 1967, this vaccine was created.

Purified Vero cell rabies vaccinations and pure chicken embryo cell vaccines are now accessible. V-RG recombinant immunization has been used in undomesticated animals in Germany, the United States, France, and Belgium. When domesticated animals must be vaccinated, this approach has been used in both nonhuman and human cultures. After being bitten by a rabid animal, a small toddler is given Post-Exposure Prophylaxis.

The following can help reduce the risk of rabies, according to the Missouri Department of Health and Senior Services' 2007 Annual Report: Ferrets, cats, and dogs are all vaccinated. Pet supervision Taking care of stray or wild animals. A wild or stray animal acting strangely should also be reported to an animal control officer.

If individuals 've been bitten by an animal, clean the wound with water and soap for 10–15 minutes before seeking medical attention. (40,41,42,43,44,45,46,47,48,49).

VI. Control and prevention protocols of bioterrorism:

1. The following aspects must be taken into account while dealing with viruses:

Workers are exposed to germs, viruses, and poisons as tiny airborne particles in biological warfare. Biological substances can infect the respiratory mucosa or lung tissues by one or more of the following modes of exposure:

(a) Contact with the mucous membranes of the eyes or nasal tissues;

(b) Skin penetration through abrasions or sores .

(c) Inhalation

(d) Swallowing.

In the air, biological agents behave similarly to inert or inorganic particles because they have comparable aerodynamic properties. Biological weapons do not permeate materials used to make respirators or protective equipment's since they are particles.

Environmentally-sensitive biological particles, on the other hand, may be able to penetrate protective cloths. To safeguard first responders, personal protective equipment must be properly chosen, built, and fitted.

Some bioterrorism technologies may be able to disperse large amounts of biological components in aerosols Level A ensembles are When airborne concentrations and hazards are unknown or expected to be high, this is necessary. Once the conditions are understood and exposure is limited, lower-level personal protective equipment (level B or C ensembles) is usually permitted.

Responders to a terrorist assault should wear NIOSH-approved biological respirators and NFPA-certified protective ensembles.

Whether any of the following details are unknown or the occurrence is out of the control:

(a) If dispersion is ongoing or has ceased, but no information on dispersion time or exposure concentration is available.

(b) There is a risk of vapor or splash. (50,51,52,53,54,55,56,57,58,59).

2. Any Suspected Bioterrorism Occasion: Basic Recommendations by Category:

A. Reporting and contact information requirements.

B. Communication and information administration.

C. Detection of epidemics and the identification of possible bioterrorist agents produced. by bioterrorist agents.

D. Epidemiological Investigations.

E. Identifying, Diagnosing, and Isolating Cases

F. Enhanced Surveillance and Reporting of Cases.

G. Vaccination Programs and Large-Scale (Mass) Vaccination.

3. Protective isolation:

A. An item infected with blood or bodily fluids is washed after touching it.

B. When handling blood, bodily fluids, excretions, secretions, or contaminated items, cleaning non-sterile gloves is required.

C. A face shield consists of a mask and eye protection (or) that protects the mucous membranes of the mouth, nose, and eyes from body fluids, excretions, secretions, and blood.

D. A gown is worn to protect the skin and keep items devoid of bodily fluids, feces, blood, and secretions.

2. Precautions for isolation

a. For smaller events, standard facility patient placement and infection control procedures should be used.

b. Most bioterrorism-related diseases are not spread from patient to patient.

c. Equipment and environment cleaning, disinfection, and sterilization.

d. Management of discharge.

e. Postmortem care.

E. Post-Exposure Control:

1. Decontamination of the patient and the environment

2. Large-scale triage and control of possible exposures.

3. The psychological impact of bioterrorism.

F. The following aspects are included in the strategic plan for bioterrorism planning and response:

1. Improved detection, diagnosis, and management of disease outbreaks.

2. Improved characterization and identification of toxins, elected chemical exposures, causative agents.

3. Improved public health response capabilities to control and contain such events. (50,51,52,53,54,55,56,57,58,59).

VII. Diseases Caused by High-Consequence Viruses:

The majority of high-risk viral infections Pathogens classified as Biosafety Level 4 (BSL-4) must be handled in specialist laboratory equipment with the most stringent safety procedures.

This model operates a BSL-4 laboratory that is specifically intended to contain hazardous BSL-4 diseases through the use of special precautions and controls. (50,51,52,53,54,55,56,57,58,59).

IX: Routes of Laboratory Infection:

The most prevalent routes for Laboratory-acquired infections include inhalation of infectious aerosols and exposure

or ingestion through eyes or touching mouth or mouth pipetting with contaminated things or fingers; animal bites and scratches (research activities or facilities).[50,51,52,53,54,55,56,57,58,59].

X: Biosafety Levels:

BSL-4 is for working with exotic materials that provide a high individual risk of life-threatening aerosol infections for which there is no treatment. The facility requirements for these high-containment laboratories are complex and advanced. [50,51,52,53,54,55,56,57,58,59].

XI: CONCLUSION :

There are four different virus families that are responsible for causing hemorrhagic fever. These families are the Arenaviridae, Bunyaviridae, Filoviridae, and Flaviviridae. These viruses are potential candidates for use as agents of biological warfare due to the fact that they are stable when aerosolized and induce severe diseases that are incapacitating. The importation of these agents into places where they are not naturally found poses a significant risk to the public health of those countries.

The only way for a local population to become infected is for there to be a visitor from a place where they are found naturally, or for there to be purposeful transmission.

The clinical manifestations of hemorrhagic fevers, which include fever, rash, malaise, and hemorrhagic signs, are known as major clinical features. Any individual who has a history of prolonged fever and any sign of hemorrhage should be treated as though they have viral hemorrhagic fever because of the similarities between the syndromes. Appropriate treatment should be administered to these individuals. In order to arrive at a definitive diagnosis, laboratory testing is required. This is necessary in order to recognize the possibility of a biological warfare attack and to organize an adequate response.

This article provides a review of the viruses that can cause hemorrhagic fever, as well as their potential role as agents of warfare. An acute systemic febrile illness known as viral hemorrhagic fever is caused by a group of single-stranded ribonucleic acid viruses that come from four different viral families.

These families are Arenaviridae, Bunyaviridae, Filoviridae, and Flaviviridae. Combinations of prostration, malaise, increased vascular permeability, and coagulation maladies are some of the symptoms that the condition might cause.

In severe conditions, very high fever may be accompanied with widespread bleeding, but this type of blood loss does not normally pose a significant risk to the patient's life. It is a symptom of damage to the vascular endothelium and an indicator of the severity of the disease in particular target organs, to a certain extent.

Even though the viruses that cause hemorrhagic fever are capable of productively replicating in endothelial cells, it is believed that the majority of the disease pathology, including the impairment to the vascular system, is thought to result primarily from the release of a variety of mediators from virus-infected cells, such as monocytes and macrophages, that subsequently alter vascular function and trigger the coagulation disorders that are characteristic of these infections.

Although significant headway has been made over the past few years in elucidating the molecular biology and pathogenesis of viruses, there are still no vaccines or drugs that have been approved for the majority of the VHFs. This is despite the fact that there has been significant progress made in this area.

Any individual who has a history of prolonged fever and any sign of hemorrhage

should be treated as though they have viral hemorrhagic fever because of the similarities between the syndromes. Appropriate treatment should be administered to these individuals.

In order to arrive at a definitive diagnosis, laboratory testing is required. This is necessary in order to recognize the possibility of a biological warfare attack and to organize an adequate response. This article provides a review of the viruses that can cause hemorrhagic fever, as well as their potential role as agents of warfare.

The employment of a viral agent would present a challenge for the terrorist because of the difficulties associated with acquisition, cultivation, and transmission of the agent. Anyone, including humans, animals, and even plants, could be the victim of an attack carried out by a viral agent.

Agricultural targets are of particular concern since a bioterrorist strike requires only a little amount of specialized knowledge and equipment but can have extremely severe repercussions for the economy.

The fight against viral illnesses has been complicated by nature's many obstacles. Agents that are viral are considerably more likely to undergo genetic variation and mutation, and they can be manipulated or generated in the lab to take on any traits that are wanted.

When there are only a few outliers, it can be difficult to tell the difference between natural and planned epidemics of viral diseases. When it comes to dealing with viral infections, there are fewer medical countermeasures to apply as opposed to when dealing with bacterial diseases, many of which are treatable.

For a wide variety of viruses, diagnostic procedures and reagents in the laboratory need to be continuously improved so that they can take into account changes and variances in genetic makeup.

As a result, the difficulty of designing defenses against bioterrorism is enormous. The good news is that this work contributes to more successfully combating natural illness outbreaks, which in turn has benefits for the entire world.

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