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Emergency of Marburg Virus A Global Perspective on Fatal Outbreaks and Clinical Challenges

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ABSTRACT
Marburg virus (MV), discovered in 1967, has caused many deaths universal. Although the mortality rate of Marburg virus (MVD) varies depending on the virus and the virus, the average mortality rate is around 50%. However, in previous outbreaks, the mortality rate ranged from 24% to 88%, depending on the disease and management of the data. Identified as an important pathogen by the National Institute of Allergy and Infectious Diseases (NIAID), MV can cause fever, organ failure, and clotting problems in humans and animals. This disease is usually spread from animals through contact with sick people. People who visit shelters such as caves or mines are at higher risk.

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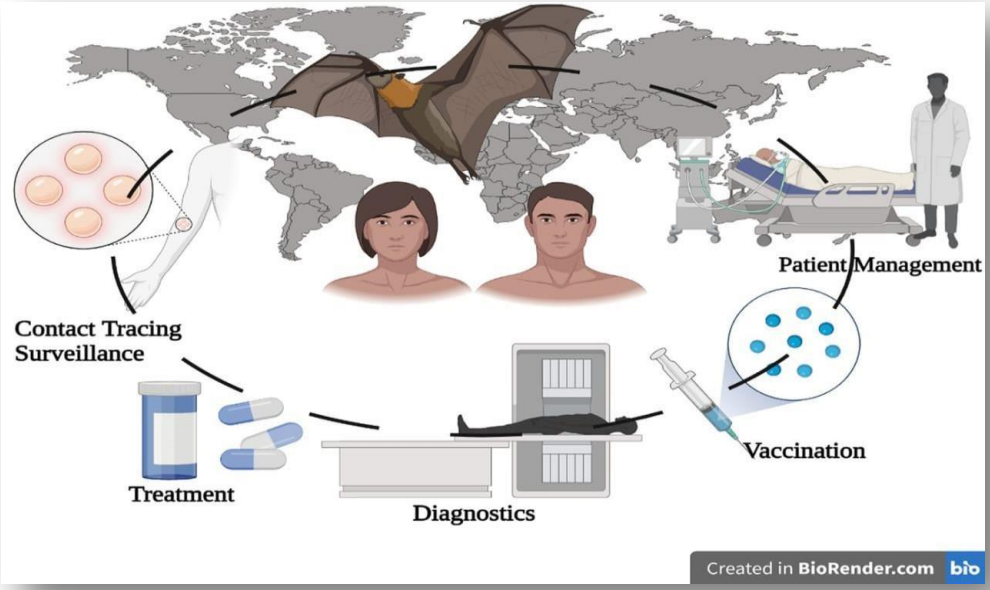
I. BACKGROUND

The World Health Organization considers MV a filovirus of high concern, causing severe morbidity and mortality with a mortality rate of 24%, approximately 88%. The virus often spreads concluded contact with diseased individuals, inventing from animals. Visitors to bat surroundings like caves or mines face complex risk. We personalized this search approach for four databases: Scopus, Web of Science, Google Scholar, and PubMed. We primarily exploited search terms such as "Marburg virus," "Epidemiology," "Vaccine," "Outbreak," and "Diffusion." To enhance understanding of the virus and accompanying disease, this summary offers a inclusive summary of MV outbreaks, pathophysiology, and management strategies. Ongoing research and education holds promise for avoiding and controlling future MVD spates. Although MV receives less media coverage than its Filoviridae cousins, its high mortality demonstrates its importance. Recent cases in Guinea and Ghana and ongoing outbreaks in Equatorial Guinea highlight the need for continued surveillance and control. The latter reported rapid deaths, and Tanzania also reported deaths from the disease, highlighting the ongoing threat (Manohar et al., 2023). The effects of MVD range from hemorrhagic fever and organ failure to coagulation abnormalities in humans and nonhuman primates, affecting the liver, spleen, brain, and kidneys (Mehedi et al., 2011 ; van Paassen et al., 2012). MVs, a member of the family Filoviridae and the genus Marburgvirus of the order Monoviridae, comprise a unique species (Bukreyev et al., 2014).

Its zoonotic association with the Egyptian fruit bat (Rousettus aegyptiacus) and human-to-human transmission are similar to other Ebola viruses, such as Sudan virus, Bundibugyo virus, and Ebola virus. Ongoing research has identified the origin of MVs, including Hipposideros caffer and Rousettus aegyptiacus (Towner et al., 2009). The virus has an average incubation period of 5 to 10 days (3 to 21 days) and enters the immune system such as monocytes, macrophages, and dendritic cells through damaged skin or mucosal surface. It begins replication in the spleen, liver, and other lymphoid tissues before spreading to hepatocytes, endothelial cells, fibroblasts, and epithelial cells. It also blocks the production of type I interferon (IFN-1) (Yu et al., 2021). This review explores the evolution of MVD epidemics, describes the structure and genome of the virus, describes the history of MV, and describes various forms of human and nonhuman transmission. We carefully investigate the origin of MVD by carefully examining the pathophysiology, cell tropism, immune response, and critical injury sites. Additionally, this content includes up-to-date medical and clinical information that underscores the urgent need for robust research to develop effective drugs and vaccines.

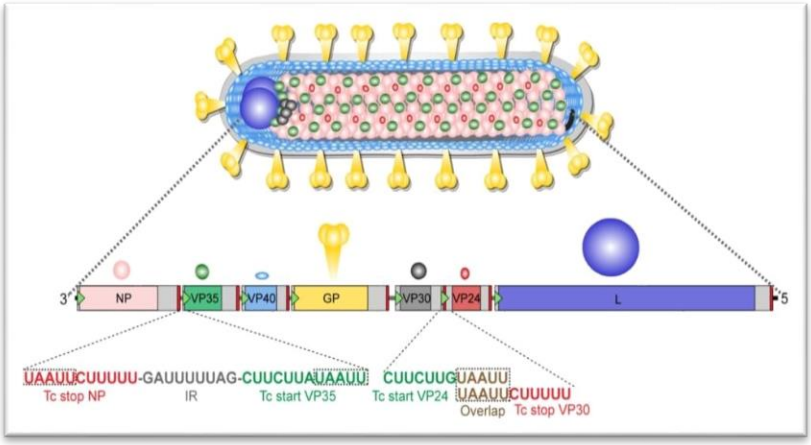


CIRCUMSTANTIAL

The recent outbreak of Marburg virus (MVD) in Tanzania and Equatorial Guinea has caused anxiety and fear in the general population still struggling with the COVID-19 pandemic. Recently, the World Health Organization (WHO) reported that an outbreak of MVD occurred in Equatorial Guinea in February 2023, with 9 confirmed cases and 20 suspected cases. Seven people from confirmed cases have died in Equatorial Guinea, and all suspected cases have also died. As of March 24, 2023, 5 of the 8 confirmed cases in Tanzania were reported to have died. According to the World Health Organization, MVD causes hemorrhagic fever. The mortality rate from MVD has been reported to be as high as 88%. Marburg virus is a zoonotic virus that is similar to Ebola virus and belongs to the Filoviridae (Filovirus) family.Research shows that the natural reservoir of the deadly disease is the Egyptian fruit that lives in hollows or mines. However, human-to-human transmission of the disease is problematic because it can spread through direct contact. There is no specific treatment for the disease, and scientists have not yet found an effective vaccine or vaccine against MVD. For most patients, conduct is helpfully. Besides Africans, the recent demise of MVD has caused panic among people worldwide. A large portion of the population is dealing with the ongoing COVID-19 pandemic with no end in sight.

MUTATION EXAMINATION AND GENOME ALIGNMENT

Marburg virus (MV) has an enveloped and pleomorphic structure, presented as filamentous, non-segmented, rod-shaped, cobra-shaped, round/ring-shaped and branched, uniform diameter but relatively long particles. Viral viruses contain seven open reading frames (ORFs), consisting of nucleoprotein (NP), virion protein 35 (VP35), VP40, VP30, VP24, glycoprotein (GP), and giant viral polymerase, each characterized by a negative-sense RNA () is done. SsRNA; Zhao 2022). The noncoding regions of these seven genes contain cisacting elements involved in DNA replication, transcription, and packaging (Feldmann 1992; Sanchez 1993). The 3′ and 5′ ends of these genes contain long, non-coding nucleotide sequences and are highly efficient initiation and termination signals (Feldmann 1992; Sanchez 1993). Intergenic regions separate all but two MV genes, ranging in length from 4 to 97 nucleotides, and the initiation and termination signals of the VP24 and VP30 genes share a 5-nucleotide overlap (UAA). The nucleocapsid complex, containing structural proteins NP, VP35, VP30, and L, encapsulates the MV genome (Becker 1998). VP35 functions as a polymerase cofactor and L is important for virus genome replication and transcription as an RNA-dependent RNA polymerase (Mühlberger 1999). The host-derived membrane layer of MVs regularly produces spikes in which glycosylated proteins (GPs) play an important role in binding to receptor cells (Feldmann 1991). VP40 is responsible for budding and binding to the matrix and nucleocapsids that form the inner matrix of the virion (Kolesnikova 2004; Swenson 2004). The interaction of VP24 protein with membrane NPs and other cellular membranes is important for the release of virion progeny. Table 1 provides an overview of the properties and functions of proteins in MVs (Bamberg 2005)



FIGURE

The structure of the Marburg virus and the organization of its genome are shown in the figure. The upper half of this image shows the structure of the virus and identifies structural proteins. The genome structure of the seven-gene Marburg virus is shown at roughly scale in the lower half of the image. The light blue box indicates the non-coding region of the gene, and the colored box indicates the coding part of the gene. Except for the overlap between VP24 and VP30 (i.e., black triangles), the genes are separated by intragenic regions as indicated by black arrows. Finally, the 3' and 5' fragment sequences are also shown.

EPIDEMIOLOGY

1.MVD OUTBREAKS IN 1967

In European cases, patients regularly advance a nonpruritic rash 2 to 7 days after the onset of signs. The disease was linked to three laboratories in different cities, each of which received shipments of African red-green virus. This material caused the first recorded outbreak of MVD in 1967, when laboratory workers in Germany and Serbia handled African monkeys called Chlorocebusathiops. According to Griwitz's report, workers are often exposed to meat and organs from infected wild animals, causing them to become infected with MV. Seven patients died from the disease, and a total of 31 patients were affected, caused by 25 primary infections and 6 secondary infections.

2.MVD OUTBREAKS IN 1975

The MVD epidemic in 1975 marked the second recorded occurrence of the disease and its first appearance in Africa. The incident occurred in Johannesburg, South Africa, with three cases and one death. This phenomenon began when a 20-year-old Australian man went to Zimbabwe (then Rhodesia) and investigated several caves inhabited by bats. After returning to Johannesburg, he developed fever, headache, myalgia and vomiting and eventually died on 5 February 1975. His traveling companion and nurse who cared for him were the second infection and both survived with care. Rapid isolation and successful contact tracing brought the disease under control. Although the source of the infection has not been confirmed, it is suspected that the source of the test was infected through contact with bats in the cave or their feces.

3.MVD OUTBREAKS IN 1980

In 1980, Kenya experienced its third recorded outbreak of Marburg disease. The first patient was infected in western Kenya, and a doctor in Nairobi who later became close to the patient also became infected, eventually causing severe vomiting of blood. However, no other cases were found in treatment centers. Observation in western Kenya originate no indication of Marburg virus, but suggested the possibility of Ebola hemorrhagic fever.

4.MVD OUTBREAKS IN 1987

A case of MVD occurred in Kenya in 1987, the patient was a 15-year-old Danish boy, the boy died after contracting the disease. The boy contracted the infection in a cave where Egyptian fruit bats lived. This is the first evidence of infection with Lavin virus, a close relative of the Marburg virus that causes MVD. Effective prevention has been implemented against the emergence of secondary cases through patient isolation and contact tracing.

5.MVD OUTBREAKS IN 1998-2000

A case of MVD occurred in Douba, Democratic Republic of Congo (DRC), in 1998 and 2000. Those affected were feverish workers in a fruit mine in Egypt who were carriers of the disease. There were 154 cases of the

disease, resulting in 128 deaths, and the mortality rate was 83%. This marked the first outbreak of particularly severe MVD epidemics and the first example of co-occurrence of Marburg and Lavin viruses. Two closely related diseases cause
MVD

6.MVD OUTBREAKS IN 2004-2005

A second outbreak in the Uige region of Angola began in October 2004 and lasted until July 2005. The studies were carried out at the death hospital in Uige. The result was the highest death toll ever seen in an epidemic, with 252 cases and 227 deaths (fatality rate 90%). The 2007 outbreak in Uganda resulted in only four confirmed cases. The patient is a worker in the Ibanda area of the Kitaka mine. Two workers in the Kashoya-Kitomi Central Forest Reserve near the mine contracted the disease after sharing a tent with a data meter. The fourth patient underwent surgery in the absence of personal protective equipment (PPE) during the outbreak. Mining tunnels are infested with bats, and the only personal protective equipment (PPE) available is a pair of gloves; not a mask, respirator or goggles. The main source of infection is direct contact with bats or bat feces. During this outbreak, MV was isolated from Egyptian brown bats, and the first true filovirus reservoir was discovered by testing bats.

7.MVD OUTBREAKS IN 2012-2017

On November 29, 2012, the Ugandan Ministry of Health announced that the MV epidemic had broken out in Uganda. About 15 deaths and eight suspected cases have been recorded in Kabale, Ibanda, Mbarara and Kampala districts of Uganda. This outbreak in the Ibanda district overlaps with the MV disease outbreak in the Kitaka mining district in 2007. As a result, Egyptian red bats continued to appear in 2012. Interestingly, the disease infects Egyptian red bats for half of each year. This MV type and its genome sequences were previously found in the Egyptian fruit bat. The virus is also present in Kampala, Uganda, where a healthcare worker contracted the disease and died in 2014. In 2017, a new martensivirus outbreak occurred in the Kween district of Uganda. In this outbreak, only one in four family members was infected with MV because there was insufficient evidence of this disease.

8.MVD OUTBREAKS IN 2021

Finally, the last outbreak in Guinea occurred in August 2021 and was finally brought under control in September 2021. During this time, a man fell ill and died, but it is still unknown. The most current MVD outbreak occurred in the Nation of Guinea in August 2021 (1 confirmed case). Countries in the African region that have previously reported MVD include Angola, Democratic Republic of Congo, Kenya, South Africa and Uganda. On June 8, 2023, after no new cases were reported for two consecutive periods (42 days), the Ministry of Health of Equatorial Guinea declared the end of the Marburg virus (MVD) epidemic, in line with Worldwide recommendations.

9.MVD OUTBREAKS IN 2023

In the middle of January 7 and February 7, 2023, there were at least eight deceases in two parishes in the Nsock Nsomo district of Ro Muni region in eastern Kie-Ntem province. The injured have symptoms such as fever, weakness, vomiting and diarrhea. Skin and ear bleeding were also observed in two cases. On February 9, 2023, health authorities collected blood samples from eight contacts and sent them to the Franceville Medical Research Center (CIRMF) in Gabon. However, CIRMF's real-time polymerase chain reaction (RT-PCR) test results are negative for Marburg and Ebola viruses (WHO, 2023a). On February 12, 2023, additional blood samples were taken from different individuals and sent to the Pasteur Institute in Dakar, Senegal. RT-PCR testing confirmed that one of the samples was positive for Marburg virus. The patient associated with this confirmed case presented with symptoms of fever, vomiting blood, diarrhea, and vomiting, and finally died of the disease on February 10, 2023, at Ebebiyin District Hospital. The incident was linked to four other deaths in a village in the Nsoc-Nsomo district. As of February 21, 2023, a total of 9 cases have been reported, including 1 confirmed case, 4 cases and 4 cases, all of which resulted in death. Healthcare workers were not affected and investigations of 34 contacts are ongoing. Following the outbreak, two people from Kié-Ntem Province and one person from Litoral Province tested positive for Marburg virus by RT-PCR on March 15, 2023. Three more confirmed cases were reported in Maritime Province between March 18 and 20, and two more cases were found in Central Sur Province on March 20.

10.SOCIOECONOMIC IMPACT OF MVD OUTBREAKS

The economic impact of MVD may have a negative impact on weak countries, resulting in inadequate governance and regulation. Infectious diseases can affect households and affect each other's weight and competition when they occur at the same time. Exposure to MVD can lead to death and economic loss, including loss of mobility. Given the relationship between MVD and MV disease and the high mortality rate of this disease, up to 90%, research on MVD is warranted. Filoviridae, including MV, have caused significant extinctions in

humans and animals. Previous results have shown a difference in mortality rates ranging from 24% to 88%, depending on the disease and management of the data. According to the World Health Organization (WHO), MVD is a highly contagious disease that causes fever and has a mortality rate of up to 88%. THE WHO endorses symptomatic treatment, oral or venous fluids, and life sustenance. There is currently no cure for MVD, although future treatments such as blood products, antibiotics, and chemotherapy are continually being reviewed. Information management, tracing, contacts, functional controls, safe and dignified burials and social support are just some of the things that will be required to prevent the spread of the disease. Social participation is also important for effective control of the epidemic. Direct contact (injured skin or mucous membranes) with the blood and other body fluids of an infected person (urine, saliva, feces, vomit, breast milk, amniotic fluid, and semen) may lead to infection, or indirect contact with dirty places and equipment such as dirty clothing, bedding, and medical equipment are the two main ways to infect people with the same disease. It spreads if the patient is buried.

SOURCES AND TRANSMISSION OF MARBURG VIRUS

The fruit bat species Rousettus aegyptiacus is the most important vector of MV. Some chiroptera and sphenoptera can also be infected. There are several ways that MV strains are transmitted between bats. Recent studies have found MV in rectal, oral, and urine samples from infected bats, as well as in blood and oral samples from bats that have been in contact with humans. According to this study, MV is subsequently transmitted from infected bats to bats. Previous findings have shown that MV is present in the lungs, intestines, kidneys, bladder, salivary glands, and immune system of pregnant women, supporting the hypothesis that both vertical and horizontal MV transmission may occur in lakes. Others believe that bats can transmit diseases to each other through their bites. Direct contact with the patient's blood and other body fluids (urine, saliva, feces, vomit, breast milk, amniotic fluid) and semen (injured skin or mucous membranes) or indirect contact with diseases and materials such as dirty clothing, bedding and bedding. medical equipment are the two main ways of person-to-person transmission. It spreads if the patient is buried. Infected animals, especially fruit-bearing animals (such as monkeys, chimpanzees, wildebeest, and bats), whether alive or dead, can also transmit the disease to humans. There is increasing concern about the risk of filovirus in the testicles as a potential route of transmission. Experimental studies have identified persistent MV infection of immune cells in male monkeys.

RISK FACTORS

RISK FACTORS	ADJUSTED	SAMPLES SIZE (SIGNIFICANT)	SAMPLE SIZE (NOT SIGNIFICANT)
INFECTIONS			
Contact with animal	Unknown	unknown	
Gathering	Unknown	128	
Household contact	Unknown	102	
Occupation-funeral and burial services	Unknown	102	
Other	Unknown	102	26
Sex	Unknown		26
SEROPOSITIVITY			
Contact with animal			912
Contact with animal			300
Gathering			300
Hospitalization		915	
Household contact			912
Occupation-funeral and burial services			912

II. CONCLUSION

The emergence of Marburg virus (MV) has led to a global problem resulting in high mortality and significant clinical complications. The comprehensive analysis performed in this study revealed many aspects of MV, including its history, epidemiology, clinical manifestations, and disease interactions with the human host. Attack data demonstrates the urgency of understanding and effectively responding to the threat MV poses to global health security. Throughout the investigation, it became clear that the medical problems caused by MV were significant, with its toxic effects leading to high mortality rates and many serious symptoms. The lack of specific vaccines or additional vaccines puts pressure on prevention and control strategies. The cases studied demonstrate the need for rapid coordination and intervention by doctors, scientists, and government agencies to reduce the impact of MV. The global outlook on the emergence of MV highlights the need for effective, multifaceted measures to prevent and reduce its devastating effects.

CONTROL AND PREVENTION OF MARBURG

In order to prevent the spread of the disease, the World Health Organization has developed various measures to control the disease. When caring for patients suspected of having Marburg disease, healthcare providers need to take extra precautions to avoid exposure to the virus. This means avoiding contaminated objects and surfaces, including the patient's blood and body fluids, as well as tissues and clothing. Healthcare workers should wear gloves, sterile gowns, and face protection (face mask or medical mask and goggles) when close to MVD patients (within 1 m).

People living in affected areas should try to educate the public about the signs and symptoms of the disease and the precautions that should be taken to prevent spread. Health authorities should consider creating isolation rooms to immediately isolate MV patients and prevent person-to-person transmission. By accurately identifying and diagnosing patients' needs, the concept of infection prevention will be strengthened. Unlike previous epidemics, the provision of medical equipment and training of hospital staff benefited the population and reduced the incidence of disease in the hospital. Safe burial practices, hygiene standards and public awareness are necessary to control the disease because, as previously mentioned, contact with the remains of sick people can spread the disease.

It is also recommended to stay away from living and dying humans (such as monkeys, chimpanzees, gorillas, fruit bats and pigs). In addition, people visiting the mines and caves in the region where the fruit is found must wear other protective equipment, including gloves and masks. The World Health Organization added that men who recover from MV infection practice safe sex and hygiene for 12 months from the onset of disease symptoms or until sperm tests return negative for MV twice.

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