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LASSA FEVER: ORIGIN, CAUSES, EFFECT, CONTROLAND PREVENTION

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Abstract

Lassa fever is a zoonotic disease caused by Lassa virus, which is a single-stranded RNA virus. Even though the virus was first described in the 1950s, it was not identified until 19691 and was subsequently named after a town in the present Borno state of Nigeria where the first case of the disease was recorded. The primary host of Lassa virus is a rodent of the genus. Mastomys, also referred to as 'multimammate rat'. Once infected, Mastomys rats do not become ill but can shed the virus in their urine and faeces. Humans become infected from contact with the urine and faeces of infected rats. The infection can also occur in the process of hunting and processing rats for consumption. The virus is spread between humans through direct contact with blood, urine, faeces or other secretions from the infected person. As the world becomes increasingly connected, viral diseases, such as Lassa fever, once endemic to a region can be easily transmitted to other parts of the world, thus increasing the likelihood of a global pandemic. To reduce the probabilities of such events playing out, deliberate and concerted efforts must be applied towards both understanding Lassa fever and limiting infection rates. Therefore, measures that are limited in keeping of rodent out of homes and food supplies, as well as maintaining effective personal hygiene should be employed. Gloves, face masks, laboratory coats, and goggles are advised while in contact with an infected person.

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Introduction:-

The Arenavirus family includes the Lassa virus, which is an encapsulated RNA virus. This virus is responsible for Lassa fever, which is also known as Lassa hemorrhagic fever (Gibb et al., 2017; Lehmann et al., 2017; Hassan et al., 2022). People get infected with the virus when they ingest contaminated foods or utilise contaminated household items that originated from a zoonotic reservoir. The zoonotic reservoir is most often an infected multimammate rat (Lehmann et al., 2017; WHO, 2017). There is evidence to suggest that human infection may also be caused by exposure to aerosolized excreta from vectors (Mylne et al., 2015). The United States Federal Select Agent Program has designated the Lassa virus as a select agent, mandating the execution of biosafety rules comparable to level 4 for all laboratory testing (Gibb et al., 2017). The Mano River Union's member states, particularly Sierra Leone, Guinea, and Liberia, as well as a sizeable portion of Nigeria, have all been affected by the Lassa fever (Gibb et al., 2017). Additionally, Ghana, Mali, and Benin have reported instances (Fichet-Calvet et al., 2009). It is well-known that Lassa fever has a nosocomial origin, suggesting that it may be a sickness that develops in hospitals (Lehmann et al., 2017). Each year, between 100,000 and 300,000 cases of Lassa fever are recorded in the United States, as well as the Centers for Disease Control and Prevention (CDC) estimates that 5,000 of those infected may die abruptly as a result of the illness (CDC, 2015). However, since monitoring efforts vary between places where Lassa fever is widespread, estimates of sick people are inaccurate and may be significantly underreported (Lehmann et al., 2017). Additionally, Lassa fever is less well known outside of the endemic areas due to monitoring efforts that have been oriented toward the nations with the disease, which might have resulted in earlier human epidemics being unnoticed (Peterson et al., 2014). It is against this background that this review summarizes the most recent research advances in the structure, epidemiology, and etiology of the Lassa fever virus. We also focused on mutational patterns, an important feature of viral virology, and examined existing variants of the virus. The clinical features of the Lassa virus, current treatments, and scientific advances to combat the epidemic of the Arenaviridae family were discussed.

Lassa fever

The Lassa virus, often known as LAV, is the culprit responsible for Lassa fever. The Lassa virus belongs to the Arenaviridae family (LF). The LF is a viral hemorrhagic fever that has the risk of being highly harmful to its victims. The Lassa virus is most commonly transmitted by touching contaminated food or household goods soiled by the urine or faeces of infected Mastomys rats (Obeagu et al., 2022). This may occur when an infected Mastomys rat urinates or defecates on an item. This may happen when rats urinate or defecate on the contaminated item. Rodent populations in West African nations including Benin, Ghana, Guinea, Liberia, Mali, Sierra Leone, Togo, and Nigeria are infected with the illness. Other countries in the region affected include Sierra Leone and Togo (Ogbu et al., 2007).

History of Lassa fever

Even though symptoms like those of Lassa fever have been documented in Sierra Leone since the 1950s, the virus that causes Lassa fever was not found until 1969 in the Nigerian village of Lassa, Borno State. A missionary nurse died one week after getting the disease from a native obstetric patient. Although symptoms that are comparable to those of Lassa fever have been documented in Sierra Leone as early as the 1950s, the virus that is believed to be responsible for the sickness was not discovered in Lassa until 1969 (Ogbu et al., 2007). Later on, one of the missionary nurses who had cared for the first victim's two more victims succumbed to the viral sickness that she had been treating (Olayiwola et al., 2017). In the 1970s and 1980s, extensive research was conducted on the ecological and clinical effects of the Lassa fever virus in West Africa, notably in Sierra Leone and Nigeria. These studies took place during this period (Sogoba et al., 2012). The government of Mali confirmed the country's first incidence of Lassa fever after the death of a British worker in 2009 who had a fever history of 10 days and was believed to be working in the town of Soromba in southern Mali. The worker had been working in the area around the town of Soromba (Sogoba et al., 2012; Lehmann et al., 2017). However, it was not until 2011 that Ghana had its first confirmed cases of Lassa fever. At that time, it is thought that a man from the Ashanti area contracted the disease by eating contaminated mice that he had shot. In the United States, the United Kingdom, Sweden, Germany, as well as the Netherlands, there have been indications of a few imported cases (Asogun et al., 2012).

Causative agent

The Lassa virus, which belongs to the family of Arenaviridae viruses and has two single-stranded segments of RNA, is the causative agent of Lassa disease (a large L segment and a tiny S segment). LASV particle is round, oval or pleomorphic in shape. It ranges between 110 to 130 nanometers in diameter and is enveloped (Bowen et al., 1997).

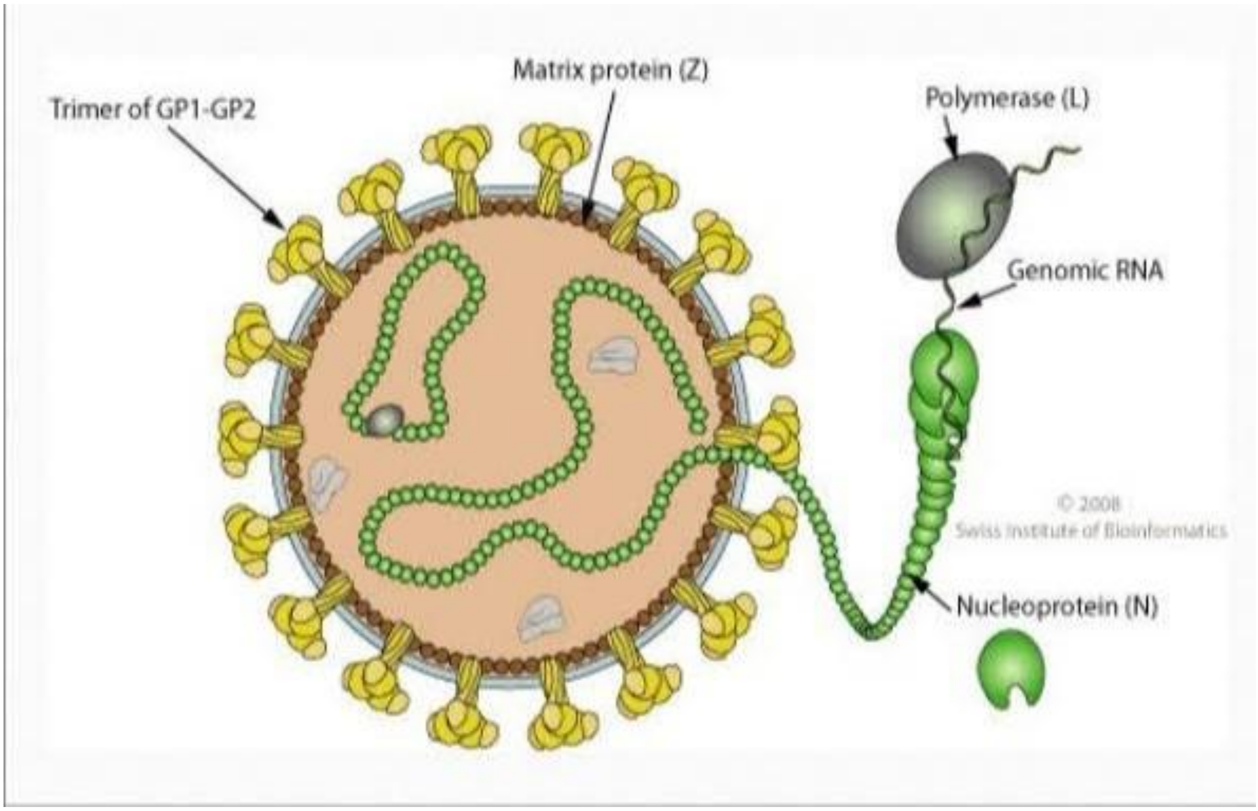

Figure 1:- Lassa virus (Bausch et al., 2010).

Lassa fever vector

It is a rodent that belongs to the family Muridae and is often recognised to contain the virus. The Natal multimammate mouse, also known as Mastomys natalensis, is another name for this species (Lozano et al., 2007). The term refers to the female's many, noticeable mammary glands. They are African soft-furred mice or ordinary African rats. There are six major generic groups of them south of the Sahara in Africa (Lozano et al., 2007). Natural habitats include subtropical or tropical dry forests, moist lowland forests, dry savannahs, subtropical or tropical dry shrubland, arable land, and pastureland, rural gardens, urban areas, irrigated land, & seasonally flooded agricultural land. Irrigated land and periodically flooded agricultural land are two more natural habitats. These rodents are often spotted in and near human settlements in Africa and have close ties to the human population (Granjon et al., 2012).

Mode of transmission

Contact with the urine or faeces of an infected "multimammate rat" (Mastomys natalensis), which acts as a reservoir host and can induce infection in humans, is a common way for the Lassa virus to be transferred (Olayemi et al., 2016). Direct contact with a person suffering from Lassa fever's blood, urine, faeces, or other body fluids can also lead to the transmission of the Lassa virus. If this mouse contracts the virus, it will very certainly continue to shed the pathogen via its urine for the rest of its life if it is infected. Numerous rodents belonging to the genus Mastomys inhabit the savannas and woodlands of West, Central, and East Africa. They have a high reproductive rate and a large progeny population (Gryseels et al., 2016). Mice infected with Mastomys are sometimes used as a source of food, which may lead to the spread of infection during the capturing and processing of rodents. In addition, Mastomys quickly penetrate human residences and food storage areas. All of these factors make it more likely that the Lassa virus will transmit from rats that have been infected to humans (Gryseels et al., 2016). Person-to-person transmission (also known as nosocomial transmission) may occur in both public and clinical settings when proper personal protective equipment (PPE) is unavailable or not used. In situations like these, the virus might potentially spread via infected medical devices, such as needles that have been used more than once. There is also evidence that the Lassa virus may be sexually transmitted in certain people. People are especially at risk in rural areas where Mastomys are widespread, particularly in filthy or densely populated areas. All age groups and both sexes are susceptible to lasa fever (Saka et al., 2017).

Signs and symptoms of Lassa fever

Lassa fever often appears as an illness between one and three weeks after the first infection. Signs and symptoms that are difficult to distinguish from the majority of other febrile diseases. Fever, overall weakness, and malaise are all present. Symptoms such as a headache, sore throat, muscular aches, nausea, vomiting, diarrhoea, coughing, and stomach discomfort may appear after a few days. Hospitalized patients with significant vascular instability and multiple organ failure had a case fatality rate of around 20% (Iacono et al., 2016).

Diagnosis

Because Lassa fever shows similar symptoms to most viral haemorrhagic diseases like Ebola, clinical diagnosis tends to be difficult to ascertain, hence definitive diagnosis requiring laboratory testing is very key (Bausch et al., 2010). Since the test cannot be done in routine laboratories due to the high level of hazardousness/infectious the samples the complexity of the machines and the expertise required, they can therefore only be done in specialized reference laboratories (Bausch et al., 2010). These laboratories, though few across Nigeria, pride themselves in state of heart technologies and sophisticated equipment requiring special training and the use of complete PPEs (Bausch et al., 2010).

The following test methods can be employed to diagnose Lassa fever;

1. **Enzyme-linked Immunosorbent Assay (ELISA)**: It is the cornerstone of Lassa fever diagnosis. Along with the Lassa virus, it can also detect IgM and IgG antibodies (LASV). Antigens (Shaffer et al., 2014).
2. **Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)**: It is effective in treating Lassa fever in its early stages.
3. **Immunofluorescent antibody assay:** Although issues with sensitivity, specificity, and subjective test interpretation have been observed, this test procedure is still usable (Shaffer et al., 2014).
4. **Lassa Virus isolation by cell culture:** The Gold Standard for diagnosing Lassa fever is still cell culture. Virus cell culture is not routinely done also, as it requires special cell lines and a biosafety cabinet Level four (BSL4) for cultivation (NCSC, 2019).
5. **Gene sequencing:** This is a new trend in Molecular diagnosis in which the genome of an organism or virus is flanked, analyzed and mutant or virulent factors identified for further research of vaccine production (NCDC, 2019).

Clinical management

In isolation, facilities should be admitted any suspicious patients. Hospital transmission occurs when infection control measures are poor (Fisher-Hoch et al., 2005). Maintaining rigorous isolation between patients and practises for the management of body fluids and excreta (Merlin et al., 2012).

Treatment

We need ribavirin and all-around assistance. When delivered intravenously as opposed to orally, ribavirin is about twice as effective, and if provided within six days after infection initiation, it may reduce mortality by 90 per cent. Due to the incidence of dehydration, edoema, hypotension, and reduced renal function, fluid replacement or the use of blood transfusions must be closely monitored (McCormick et al., 2006).

Surveillance and disease control

Following the patient's isolation, a search for unreported or undiagnosed instances was launched, along with surveillance for the last three weeks for all of the patient's close contacts. Both the treatment of undiagnosed cases in hospitals—where crowding and poor hygiene standards increase the risk of the disease spreading to other patients, staff, or visitors—and the customary burial practises for infected corpses—which raise the risk of the disease spreading to large populations of people—are causes for concern. The likelihood of the disease spreading to a wide population is increased by the treatment of undiagnosed patients in hospitals and the burial practices for infected bodies. The treatment of untreated patients in hospitals, where there is a higher risk of disease transmission due to overpopulation and subpar sanitation, is the first problem (Massawe et al., 2007).

Prevention

Community cleaning programmes are one of the most successful ways for preventing the spread of Lassa fever in geographical regions where the sickness is prevalent (WHO, 2017). People can lower their chance of catching the Lassa virus by avoiding contact with multimammate rats, particularly in places where the virus is widespread, according to the Centers for Disease Control and Prevention (CDC). This finding comes from research conducted by the CDC (2015). In addition, it is recommended that food be stored in containers that are resistant to rodents and that the area around the house be maintained clean, to eliminate the possibility of rats reproducing within the home (CDC, 2015). It is thought that by implementing these safety measures, the risk of people contracting the Lassa virus would be lower. Furthermore, it is important to prevent people from eating rats since the Lassa virus may infect humans during the capture, catching, or cleaning of an infected mouse. It is hard to catch multimammate rats owing to their vast dispersion over West Africa. Even doing so could help reduce the number of animals that might serve as Lassa virus reservoirs (CDC, 2015).

There are other circumstances in which it is required to provide care for a Lassa virus patient. It is recommended to take preventative action to stop the virus from spreading, according to the CDC (2015). Some measures that may be done to prevent the virus from spreading to those who do not have immunity to it include establishing biological containment conditions, wearing protective clothes (including masks, gloves, gowns, and goggles), properly sterilising equipment, and isolating sick people. Other possible actions include isolating people who are ill with the virus. It is possible for travellers who visit Lassa fever endemic regions to carry the virus back with them to their own country or neighbouring countries. As soon as possible, travellers with fever symptoms returning from West Africa to their home countries should be checked for Lassa fever (2017). Residents in endemic areas, especially those who live in rural areas, should get education on efficient ways to decrease rodent populations to avoid the continued spread of Lassa fever (CDC, 2015).

Conclusion:-

There is an increased likelihood of a worldwide pandemic as a result of increased global connectivity and the increased ease with which formerly endemic viral diseases, such as Lassa fever, might spread to neighbouring countries. To lessen the likelihood of such occurrences, concerted efforts need to be made to expand understanding about Lassa fever and lower the number of people who get infected with it.

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