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ORIGINAL ARTICLE

The Zoonotic Disease Human Monkey Pox: An Insights into Epidemiological, Clinical, and Preventative Features

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ABSTRACT

Monkeypox is no longer "an uncommon viral zoonotic disease" because it has spread all over the world and the outbreak is still occurring. It is concerning that the disease has spread to other regions and countries. There is a lack of information regarding the ecological, zoonotic, epidemiologic, clinical, and public health aspects of monkeypox. Significant adverse effects are associated with the first-generation live attenuated vaccinia virus vaccinations that are stored for use in emergency situations in multiple countries. As a result of the cessation of smallpox vaccinations, an ecological void has been created in which more people have diminished or no protection against MPXV. This will increase the rate of virus transmission from animals to humans as well as from humans to other humans. Urgent research and monitoring should be carried out as part of a global initiative titled "One-Human-Animal Environmental Health."

INTRODUCTION

A virus with two strands of DNA is the human monkeypox virus, also called MPXV. It belongs to the family Poxviridae, which is a subgenus of the genus Orthopoxvirus (Yinka-Ogunleye et al., 2019). It has been determined that the monkeypox virus is related to two genetic clades. In West Africa and Central Africa, respectively, one can find these clades. The MPXV orthopoxvirus is one of the four types of orthopoxvirus that can infect humans. The other three are the cowpox virus, the variola minor virus, and the variola major virus (VARV), which was the cause of smallpox but has since been eliminated. The cause of smallpox was the variola major virus (VARV), which has since been wiped out. The MPXV virus is what causes monkeypox (CPXV). Numerous animal poxviruses can infect humans, and there is a large variety of these viruses. There have been reports of vaccinia virus-related disorders, as well as cases of cowpox, buffalo pox, and even camel pox in people (Pauli et al., 2010). Infections with the vaccine virus are the most frequent. The natural host reservoir for the monkeypox virus has not been identified, even though it can infect a wide range of mammalian species.

Community Health Status: Since its discovery seven decades ago, monkeypox has not received much attention since most people believe that it is a rare and fleeting sickness (Breman et al., 1980). This is the primary reason for this misconception. In areas of West Africa where there is frequent contact between people and wild animal reservoirs, specifically in areas where there is evidence that the infectious attack rate is rising, monkeypox has been identified as a developing public health issue. This is the case in areas where there is also evidence that the infectious attack rate is rising. In a particular region of Africa over the past few years, the incidence and geographic dispersion of human cases of monkeypox have grown, leading to an increase in the number of countries in which monkeypox has been documented. However, the complication rate, the case fatality rate, and the levels of scarification that are associated with monkeypox are often lower than those associated with smallpox. In terms of the beginning of symptoms, the timing of the formation of the rash, and the distribution of the rash, the clinical presentation of monkeypox is analogous to that of smallpox. This is because both diseases are caused by the same virus (Merchlinsky et al., 2019).

Recent research has shown a remarkable similarity between the clinical manifestation of MPXV and that of smallpox, a fatal disease that was eradicated from the world because of vaccinations administered over four decades ago. As a direct consequence of this, more apprehension regarding the MPXV epidemic has been prompted (Fenner et al., 1988). During outbreaks, it has been difficult to clinically differentiate monkeypox from chickenpox, which is an infection caused by a herpesvirus that is not related to monkeypox. However, it is equally essential to be cautious about sporadic zoonotic infections caused by other orthopoxviruses and to follow these infections regularly. There have been several documented cases of the buffalopox virus manifesting itself in human patients in India (Singh et al., 2007). These cases have occurred on multiple occasions. In a manner comparable to this, there is evidence to suggest that epidemics of the vaccinia virus in Brazil's cattle can lead to illnesses in human beings (Oliveira et al., 2017).

Cross-Immune Shield: A large degree of protection against infection with another orthopoxvirus species may be conferred by infection with any one of the diverse orthopoxvirus species, which all share the same genetic and antigenic traits. It is possible to prevent disorders brought on by VARV, MPXV, and CPXV through vaccination with the vaccinia virus (Hammarlund et al., 2005). The immunologic processes that lead to cross-protection after vaccinia virus vaccination is highly intricate, with neutralising antibodies being one of the main parts (Moss, 2011). Like how the smallpox vaccine can provide cross-protection for people against monkeypox, inoculation against the human smallpox can protect monkeys against the disease. In other words, the smallpox vaccine can protect people against monkeypox in the same way as it can protect monkeys. Cross-protective immunity to several orthopoxviruses has decreased since smallpox vaccines were phased out in 1978. Younger people without vaccine-induced immunity are more likely to notice this tendency. In addition, there are more people in the world who have not received the vaccine but are susceptible to the disease. These changes have been accompanied recently by an increase in the number of monkeypox cases in humans as well as a geographic spread of the illness.

Epidemiology

Discovery and hosts: In 1958, caged monkeys that had been sent from Africa to Copenhagen, Denmark, for the sake of research became infected with a vesicular disease that quickly spread across the population (Magnus et al., 1959). It was around this time that researchers made their initial discovery of the monkey papillomavirus. This is where the term "monkeypox" gets its beginnings. Because rodents like huge, pouched rats and squirrels, which are both hunted for food, are the primary animal reservoirs for the virus, the statement is inaccurate (Doty et al.,

2017). The family of rodents contains more than 1,500 unique species, making it the most diverse family of all mammalian groups. To determine the magnitude of the monkeypox reservoir in wild animals, its natural history, and the pathophysiology of the disease in animals and people, there must be additional research conducted in the fields of ecology and epidemiology. To this day, researchers have identified a wide variety of animal species as being carriers of the MPXV virus. Some of these species include monkeys, rats, striped mice, dormice, rope squirrels, and tree squirrels. In 1985, the virus was found for the first time after the deaths of a newborn mangabey monkey in Cote d'Ivoire's Tai National Park and a rope squirrel in the Democratic Republic of the Congo (Randonic et al., 2014). Both deaths occurred in separate national parks (DRC). Both locations were originally from Cote d'Ivoire. At least 14 distinct species of rodents were found to be infected with monkeypox during a big outbreak that was brought on by the virus being introduced into an animal trading company by animals imported into the company (Hutson et al., 2007). The outbreak was caused by the monkeypox virus.

Transmission to Humans: It is not yet understood which animals serve as a reservoir for monkeypox virus (MPXV), nor is it known how the virus moves from animals to humans. There is no evidence that any of these two things are accurate. A nosocomial outbreak in the Central African Republic may have been caused via aerosol transmission, which has been demonstrated in animal studies and is thought to be the source of the disease. On the other hand, the human monkeypox virus is thought to be transmitted to people by either direct or indirect contact with animals, regardless of whether the animals are living or dead. People are required to kill tiny mammals (bushmeat) to obtain food that is high in protein. This increases their likelihood of encountering wild rodents, some of which may contain the monkeypox virus. This is a consequence of the continuous civil instability as well as the poverty that exists in the area (Quiner et al., 2017).

In August of 1970, a 9-year-old child was identified as having the first documented instance of monkeypox in humans. This child had vesicular skin lesions that were like those caused by smallpox. This youngster lived in the Bukenda hamlet, which is in the Equatorial area of Zaire (now DRC). This case was discovered during a period of increased smallpox surveillance nine months after the World Health Organization (WHO) declared that the disease had been eradicated from the Democratic Republic of the Congo (DRC) (Marennikova et al., 1972).

Geographic Endemicity: Since its discovery, the illness has spread throughout the entirety of Central and West Africa. People have been known to contract monkeypox from other animals in the area. According to research that was done in retrospect, incidents of a similar nature took place in Ivory Coast, Liberia, Nigeria, and Sierra Leone in the years 1970 and 1971 (Fine et al., 1988). Following these instances, tracking revealed an increase in the number of people diagnosed with monkeypox. The number of human cases of monkeypox has increased at an exponential rate over the past 20 years and has now surpassed the number of cases that were reported in the first 45 years after the disease was discovered (Reynolds et al., 2013).

A WHO better surveillance programme that ran from 1970 to 1986 and recorded 404 occurrences was compared with studies conducted by the DRC in 2004 and 2005 (Hutin et al., 2001). Research conducted by the DRC indicates that the incidence rate has increased. The highest frequency of smallpox was found in places with dense forests and among younger age groups who had not been immunised against the disease. There have been confirmed cases of human monkeypox in ten different African republics, including the Democratic Republic of the Congo, the Republic of the Congo, Cameroon, Central African Republic, Nigeria, Ivory Coast, Liberia, and Sierra Leone. As a result of the elimination of smallpox in the early 1980s, immunisation against the disease was discontinued. This resulted in a decline in cross-protective immunity, which led to an increase in the number of cases of human monkeypox in Central and West Africa (Rimoin et al., 2010). The eradication of the sickness was the reason of this. The deteriorating immunologic state is not only due to a decrease in vaccine-induced protection among individuals who were initially vaccinated, but it is also due to an increase in the number of younger age groups who are not vaccinated. Both practises make people in Central and West Africa more susceptible to sickness. Increased contact with small mammals, some of which are known to be carriers of the monkeypox virus, may also be a contributor to the disease's widespread occurrence. The habitats of reservoir species are being destroyed because of human expansion in jungles and woods. There is a possibility that monkeypox and increasing human contact were caused by factors such as civil wars, the migration of refugees, farming, deforestation, climate change, demographic upheavals, and population movement. Alterations in the climate, migratory patterns, and demographic shifts could also be factors.

When the first instances of monkeypox were discovered outside of Africa in 2003 in the United States, the rest of the world began to take notice of the danger that monkeypox posed to the health of people all over the world. Before that time, very few people cared. Several people who live in the Midwest experienced fever, rash, respiratory issues, and lymphadenopathy. According to the findings of the investigation, the symptoms were caused by exposure to pet prairie dogs (also known as Cynomys), and the monkeypox virus was the infectious agent. Fast-spreading. During the pandemic, instances of monkeypox were reported in the states of Illinois, Indiana, Kansas, Missouri, Ohio, and Wisconsin. Molecular analysis revealed the presence of a monkeypox virus from West Africa (clade). Analyses conducted in the field of epidemiology revealed that the virus travelled all the way from Ghana to Texas on April 9, 2003. The shipment of African rats included nine different species and six different genera. Rope squirrels (Funiscuirus sp.), tree squirrels (Heliosciurus sp.), African giant pouched rats (Cricetomys sp.), brush-tailed porcupines (Atherurus sp.), dormice (Graphiurus sp.), and striped mice were all discovered in this area (Lemniscomys sp.). Also, porcupines have brush-tailed snouts. Prairie dogs, which were later marketed as pets, were sometimes housed with sick animals (Reynolds et al., 2007).

In September of 2018, three individuals in the United Kingdom were diagnosed with monkeypox, which drew the attention of legislators and academics from around the world (Hobson et al., 2021). Both initial two passengers had recently travelled to Nigeria, one of the countries in which the infection is rampant, and both displayed symptoms during the flight home (Vaughan et al., 2018). The individual who contracted monkeypox in the United Kingdom for a third time was a caregiver for one of the country's first two victims. Before thinking that any of the three patients had monkeypox, infection control measures were initiated because the clinical presentation of the patients hinted at an unusual disease. One patient stated that they had eaten bushmeat and had contact with a family member who was prone to rashes. Human-to-human transmission of monkeypox is a possibility in areas where the disease is endemic. It can be challenging to provide evidence that the disease was passed from person to person in settings where the sickness is prevalent. Cases classified as secondary, and tertiary may have been caused by contact with infected animals. It was demonstrated that the sickness can be passed from person to person when a health care worker in the United Kingdom contracted it from a sick patient. In October of 2018, Israel was infected with monkeypox that originated in Nigeria. It's possible for tourists to act as early warning systems for the spread of infectious diseases in the places they visit. The fact that Nigeria has been reported to have low transmission levels contradicts the fact that three cases have been imported from there in the past few months; consequently, health officials should be frightened (Eteng et al., 2018).

Transmission pathways to Humans: It is still unknown how people become infected with the MPXV virus, which means its

mode of transmission cannot be determined. Although the specific mechanism(s) underlying this transmission have not yet been identified, it is believed that the primary mode of transmission of the virus from animals to humans occurs during the handling of monkeypox-infected animals, whether by direct (touch, bite, or scratch) or indirect contact. Although the specific mechanism(s) underlying this transmission have not yet been identified, it is believed that the primary mode of transmission of the virus from animals to humans occurs during the handling of monkeypox-inf It is generally accepted that the virus entered the body by the respiratory system, mucosal membranes, or broken skin (eyes, nose, or mouth) (Jezek et al., 1988). It is believed that secondary human-to-human transmission occurs frequently. This transmission is thought to take place most frequently through large respiratory droplets or through direct or indirect contact with bodily fluids, lesion material, contaminated surfaces, or other materials such as contaminated bedding or clothing. It is more likely that someone will become infected with a disease if they have prolonged contact with a patient, as is the case with hospital employees and the families of patients. It has been talked about how the infection can spread through the nose (Learned et al., 2005). Up until this time, there has been very little evidence to support the hypothesis that human-to-human transmission of monkeypox is sufficient to keep infection rates at a stable level among humans. The question of where monkeypox outbreaks first began has only been the subject of a limited number of genetic investigations. There have been reports of human-to-human transmission in scenarios involving both primary and secondary humans, and there have been four instances in which serial transmission has been demonstrated. According to the findings of genetic studies conducted on monkeypox virus isolates recovered from patients in Nigeria, the initial case of the current epidemic of monkeypox in the country was not brought into the country from another nation. Therefore, it is assumed that the outbreak was caused by the disease spreading from several sources into the human population. The human population was the target population. It is unknown what environmental or ecological changes, if any, may have been responsible for the sudden recurrence of monkeypox in Nigeria; nonetheless, it is possible that these changes played a role. The investigation into the zoonotic source or sources of the outbreak is now ongoing. However, it is quite likely that several different factors were responsible for the pandemic. There is currently no evidence to suggest that there is an epidemiological link between the states, even though there is evidence of case clustering occurring within each of the states. The identification of three distinct familial groups raises the prospect that the disease is transmitted from one individual to the next. The likelihood of additional illnesses occurring within a single household was determined to be 71% (Faye et al., 2018). Most patients, on the other hand, did not have any clear epidemiologic linkage or person-to-person contact, which brings up the possibility of an epidemic with several sources or possibly an endemic disease that had not been identified before.

Clinical Physiognomies: The incubation period can last for 5 to 21 days, and the symptoms may last for 2 to 5 weeks. Prior to the development of rashes, the patient may experience fever, chills, headaches, lethargy, asthenia, lymph node swellings, back pain, and myalgia. One to five days after a fever has subsided, rashes of various sizes might start on the face and progress to the body, hands, legs, and feet. The rash starts off as macules, progresses through papules, vesicles (fluid-filled blisters), and pustules, and then resolves into crusts and scabs. The symptoms could appear gradually. Discrete lesions are frequently characterised by erythema and/or hyperpigmentation. Compared to the initial lesion, scabs frequently have a smaller surface area. It's conceivable for the conjunctival, vaginal, and pharyngeal mucosae to itch.

Monkeypox symptoms and lesions closely resemble those of smallpox. Monkeypox can be devastating, with mortality rates ranging from 1 to 10%, while being less severe than smallpox. Immunocompromised people have a higher mortality rate and a more severe course of the illness (Gordon et al., 2011). There have been cases of secondary bacterial infections, bronchopneumonia, respiratory distress, encephalitis, ocular infection with vision loss, gastrointestinal involvement, vomiting, and diarrhoea with dehydration. In addition, some patients have lost their vision. Young people and children were the most probable age groups to die, with case fatality rates during outbreaks ranging from 1 percent to 10 percent. Those with weakened immune systems are more vulnerable to serious illness. Human monkeypox can be distinguished from smallpox by the presence of lymphadenopathy, which can be seen in up to 90% of cases.

When there is cross-protection from smallpox immunisation, the monkeypox sickness is less severe. Between 1980 and 1990, there was an increase in cases of human monkeypox among people who had never received a smallpox vaccination. The rashes on those who had not received the immunisation were more severe, and their mortality rate was higher than that of those who had. First and foremost, it's crucial to rule out a severe case of chicken pox that features lesions on the palms and soles (McCollum and Damon, 2014). Chickenpox lesions are often shallow and clustered. On the trunk, as opposed to the face and limbs, the symptoms are more common. It's crucial to examine a wide range of alternate diagnosis because monkeypox symptoms and indicators are not very specific. Along with medication responses and other non-infectious causes, they include chickenpox, molluscum contagiosum, measles, rickettsial infections, bacterial skin infections (including Staphylococcus aureus), anthrax, scabies, syphilis, and other non-infectious causes of rash. Monkeypox is distinguished from chickenpox and smallpox by the presence of swollen lymph nodes as a defining sign (Osadebe et al., 2017).

Diagnosis: The finest clinical specimens for laboratory investigation are those that are derived from skin lesions. These specimens, which should be kept in a dry, sterile tube at a low temperature, include swabs of vesicular lesions, exudate, and crusts (no viral transport media should be present). It is necessary to use a swab taken from either the oropharyngeal or nasopharyngeal cavity to obtain a viral culture. Skin biopsies taken from vesiculopustular rashes, or a sample taken from the roof of an intact cutaneous vesicular lesion can be highly helpful for diagnostic purposes. These biopsies can be taken from the lesion's ceiling. Because it needs the use of electron microscopy, culture, molecular analysis identification by polymerase chain reaction, and sequencing, a definite diagnosis can only be made in reference laboratories that have high containment facilities. To detect MPXV-specific immunoglobulin M within 5 days of presentation or immunoglobulin G after 8 days, serologic testing needs the collection of matched acute and convalescent samples from the patient. These samples must be matched to ensure accurate results.

Acanthosis, individual keratinocyte necrosis, basal vacuolization, and both a superficial and deep perivascular lymphohistiocytic infiltrate in the dermis were all observable in the histology and immunohistochemistry of papular lesions. In addition, papular lesions exhibited a lymphohistiocytic infiltrate in the perivascular spaces. Vesicular lesions exhibit characteristics of vasculitis as well as viral inclusions in keratinocytes, in addition to spongiosis with reticular and ballooning degeneration, multinucleated epithelial giant cells with epidermal necrosis, a significant number of eosinophils, and neutrophils. Vesicular lesions also have a great deal of eosinophils. These lesions also have traits that are like vasculitis. Under an electron microscope, it is possible to make out intracytoplasmic inclusions that have a centre that is formed like a sausage, that might be spherical or oval, and that measure between 200 and 300 m.

Cure and Prevention: There is currently no cure or therapy available for monkeypox. The primary recommendations continue to centre on providing supportive care, managing symptoms effectively, and treating subsequent bacterial infections.

The best strategy to stop the transmission of MPXV in endemic areas is to avoid all contact with rodents and primates, as well as avoiding direct contact with blood and improperly prepared meat. However, this method is also the most challenging. For both cultural and economic reasons, it is extremely difficult to prohibit the trade in bushmeat and the eating of wild animals. This is since consuming bushmeat may be the sole protein source available to some of the world's poorest populations.

To increase public awareness and educate people on the proper handling of potential animal reservoir species (gloves, protective clothing, surgical mask), as well as the significance of avoiding close contact with anyone who is affected, extensive health education programmes are required.

To prevent the transmission of disease from patient to patient, infection control procedures are crucial in medicine. To practise improved nursing (gloves, protective clothing, and surgical masks), isolation, as well as having adequate facilities and employees, education is required.

National health authorities should think about setting up this immunisation for healthcare workers as well as anyone who treat or encounter patients who have monkeypox or their samples. According to calculations, smallpox vaccination provides cross protection against monkeypox infection to an amount of 85%. 32 The Centres for Disease Control and Prevention (CDC) advised getting vaccinated against smallpox within two weeks, and in the best-case scenario, before four days, after significant, unprotected exposure to an infected animal or a confirmed human case (Fine et al., 1988). The transmission of the virus can be halted during a monkeypox outbreak by putting infected animals in confinement for at least six weeks after their last exposure and tracking down every animal that encountered them. It is essential that people follow certain guidelines issued by regional and international public health authorities. It is crucial that authorities both locally and internationally increase awareness and take proper action (enough medical staff, right decisions, sample, surveillance, and education).

The patient should be immediately isolated in a room with negative air pressure or a private room if such facilities are not available when a patient in a hospital in a developed country is suspected of having monkeypox because they have fever, skin lesions, and a history of visiting an endemic area or interacting with other patients. It is important to take precautions against droplets, contact, and common risks. The prompt notification of those with training in infection control is essential. Raising knowledge of the illness and the areas where it is endemic among individuals who work in healthcare is a crucial preventative approach in wealthy nations as well.

Immunization: Controlled clinical studies must be conducted to assess the impact of employing smallpox vaccines for avoiding monkeypox or altering the severity of the disease, even if new monkeypox vaccines are currently being developed. Research should concentrate on alternate vaccination tactics, such as restricting immunisation to afflicted areas, contacts, and healthcare providers, as well as cost-benefit analysis of vaccination at the population level and geographic expansion of the study. The Centres for Disease Control and Prevention (CDC) currently advises pre-exposure vaccination against smallpox for field researchers, veterinarians, animal control personnel, contacts of patients with monkey pox, researchers, and healthcare professionals who treat patients with monkey pox and their contacts (Di Giulio and Eckburg, 2004).

Concluding Remarks: Most of the information regarding monkeypox comes from individual case reports, outbreak reports, and passive intermittent surveillance. None of these portrays the disease in a way that is accurate. There are significant knowledge gaps, variable epidemiologic and clinical presentations, and several mechanisms implicated in the transmission of monkeypox, which is why outbreak preparedness measures need to be intensified. It is urgently necessary to develop public health and surveillance capacities in Central and West Africa to direct surveillance, data collecting, preventive, readiness, and response operations to monkeypox and other newly emerging and re-emerging illnesses with the potential to cause epidemics. It will be necessary to increase public health preparedness and connect proactive monitoring activities with priority research through interdisciplinary efforts that are coordinated at the local level and directed by local leaders.

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