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MONKEYPOX: EPIDEMIOLOGY, CLINICAL MANIFESTATIONS, AND STRATEGIES FOR GLOBAL HEALTH RESPONSE

Muhammad Asim[1], Hamza Ishfaq[1], Nishwa Ishfaq[1], Adila Umar[1]

[1]Department of Eastern Medicine, Faculty of Medicine and Allied Health Sciences, The Islamia University of Bahawalpur, Pakistan

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ABSTRACT

The animal disease is caused by the monkey virus, an orthopox virus associated with smallpox. Although endemic to central and western Africa, recent outbreaks in germ-free areas have raised global health concerns. The disease spreads through contact with contaminated objects, people, or animals. Clinically, monkeypox manifests as fever, rash, and arthritis. Side effects such as respiratory problems and secondary infections can also occur and in rare cases can be fatal. This work overviews monkey disease research, emphasizing epidemiology, clinical symptoms, and therapeutic approaches. It looks at the role of vectors, the effectiveness of smallpox vaccines, and the challenge of controlling an epidemic outbreak, especially in areas with limited resources requiring monitoring of Si on, public health education, and research on potential chronic infections Reform emphasizes the effectiveness of vaccines, Purpose of this document in and that our knowledge of monkey disease is designed to provide and provide guidance for future research and public health intervention strategies.

Keywords: Monkey pox, Zoonotic, Orthopox Virus, Vaccine.

*Corresponding Author. E-mail: asim32988@gmail.com

INTRODUCTION

The zoonotic disease known as monkeypox is brought on by the monkeypox virus, which belongs to the Orthopoxvirus genus, which also contains the more well-known monkeypox virus figure **[1].** Initially identified in 1958 in laboratory monkeys, the disease was later found to be widespread in several Central and West African locations. Its primary reservoirs are believed to be small mammals, such as squirrels and rodents. Human outbreaks have occasionally been reported outside of Africa, often associated with travel or animal trade. The first human case of monkeypox was reported in the Democratic Republic of the Congo (DRC) in 1970 **[2, 3].** However, since smallpox was eradicated, cases of monkeypox have been reported in other countries, particularly Pakistan, which has raised concerns about the disease's impact on global public health **[4].** When monkeypox was first reported in Pakistan in mid-2022, the disease attracted attention. Before this, Pakistan was not seen as a region at high risk for monkeypox **[5].** The country contracted the virus because of the global connections between trade, migration, and travel. In Pakistan, the Public Health Service is reeling from an outbreak of monkeypox, exacerbated by the country's already inadequate healthcare infrastructure **[6].** The first possible human cases were reported in Pakistan by travelers returning from countries with recent monkey outbreaks such as the UK and Spain**[7].** As worries about the potential spread of the virus grew, the Pakistani government and health agencies took prompt action to isolate suspected individuals, monitor close contacts, and recommend travel **[8].** Essentially monkeypox is contagious, meaning humans transfer the disease to sick animals through direct contact with bodily fluids, blood, or wounds **[9].** Although ineffective, human infection can occur through inhalation of droplets, close physical contact, or contact with contaminated surfaces such as clothing or bedding Usually fever,

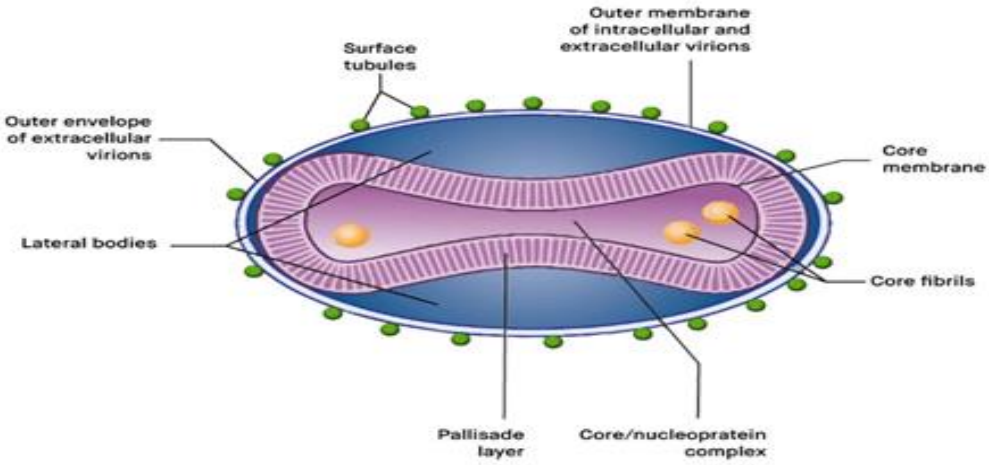

Figure 1: Structure of monkeypox virus.

headache, and muscle pain. cough, and a distinct rash that goes on and off repeatedly before being rounded **[10].** The severity of monkey diarrhea can vary depending on the species involved and is generally considered to be less pathogenic than smallpox The West African clade is considered to be associated with the recent global pandemic being less virulent and less robust than the Central African (Congo Basin) clade **[11, 12].** In addition, West African ancestry is associated with lower mortality and milder morbidity outcomes.Although the majority of cases have mild to moderate symptoms, problems can occur, particularly in people with weakened immune systems. These side effects include encephalitis, respiratory distress, and subsequent infections **[4].**

RESPONSE OF PAKISTAN'S PUBLIC HEALTH

Given the impact of COVID-19, dengue, and polio on the country's public health system, Pakistan has responded to monkeypox with a combination of caution and urgency[4]. Finding potential cases among tourists as soon as feasible was crucial to preventing the disease from spreading throughout communities. The National Institute of Health (NIH) in Islamabad issued public health advisories to educate the public and medical professionals about the symptoms, causes, and ways to avoid monkeypox.

The NIH also established a nationwide surveillance program to monitor and promptly report any questionable activity **[13].** One of the biggest challenges in managing monkeypox outbreaks in Pakistan was the absence of sufficient healthcare resources. There were not enough isolation facilities or trained personnel to detect and treat monkeypox cases. Additionally, the illness was not widely understood, which led to misconceptions and even stigma against those who showed symptoms **[14].**

Like many underdeveloped countries, Pakistan cannot afford a monkey house. Rabies vaccines are ubiquitous, although there is evidence that they offer some protection against rabies in monkeys. To mitigate the impact of the epidemic, the government of Pakistan has joined hands with the World Health Organization [WHO) and other foreign organizations to trace the sources of vaccines and antibiotics **[15].**

One of the most significant challenges to managing monkeypox in Pakistan has been the detection of the disease **[16].** Medical professionals initially didn't know how monkeypox manifested and spread because it's a relatively new disease in the region. Monkeypox can be difficult to diagnose clinically since the rash might resemble other viral illnesses, such as measles or chickenpox. Therefore, scientific testing like polymerase chain reaction (PCR) testing was necessary to confirm instances of monkeypox (table 1) **[17].** However, in many parts of Pakistan, especially in rural areas, diagnostic facilities and techniques were limited, making early case identification challenging.

Supportive treatment and symptomatic relief are the cornerstones of management for monkeypox, as there are no specific antiviral drugs for this illness **[17].** Antiviral agents such as tecovirimate (TPOXX) have been used for severe infections in a few countries, but their availability is restricted in Pakistan. Furthermore, vulnerable communities often lack a functioning healthcare system with adequate resources, necessary to manage crises such as sepsis or infectious overload.

Table 1: Introduction to monkeypox.

Aspect	Detail
Virus	Monkey disease (orthopoxvirus).
1st Case	In 1970, the D.R.C
The transmission	bacterial animals; Man-to-man possibility
Symptoms	Fever, heat, swollen muscles
The Case of Pakistan	Reported 2022
Challenges	There are a few things, no vaccines
Response	Screening, PCR testing, WHO support
Current Status	which is inside; Keeping happy is working

While its source has been identified, its spread has remained in control thereby preventing relatively large scales of monkeypox by 2024 **[18]**. in Pakistan. While its source has been identified, its spread has remained in control thereby preventing relatively large scales of monkeypox by 2024 **[19]**. The COVID-19 outbreak showed weaknesses in the system of healthcare in managing Communicable diseases, particularly outbreaks. Activities to enhance surveillance of diseases, diagnostic coverage, and train health facility staff have been ramped up, and monkeypox is included among diseases whose surveillance will receive enhanced support **[20].**

But presently monkeypox is not a threat to the population's health in Pakistan compared to other infectious diseases whereas its occurrence has drawn the importance of preparedness to face new and emerging zoonotic diseases **[21].** Pakistan's public health response to monkeypox was extremely robust, but challenges remain in terms of diagnosis, treatment, and vaccination. Increasing public awareness, improving national diagnostic capacity, and strengthening health care are all important to prevent monkeypox and other related diseases

Pakistan has to continue cooperating with foreign health organizations to ensure people can have timely access to vaccines and treatment post-monkeypox outbreak **[20].** This outbreak shows that pathogen agents are easily transmissible across country borders and that local and multilateral efforts are required to maintain global health security.

CAUSES

The virus that causes measles in monkeys is orthopoxvirus, a member of the Poxviridae virus family that also causes measles **[22].** As a vector, monkey viruses can be transmitted from humans to other humans as well as from animals to humans. Below is a brief summary of why there are monkeys **[23].**

Transmission from Animals to Humans

Transmission through contact with infected animals is the most common technique through which monkeypox spreads **[23]**. One of the popular ways that monkeypox is thought to be transmitted from animals to humans is through coming into contact with infected animals in the Central and West African rainforest, especially rodents and primates.

Direct Contact with contaminated Animals

It is more likely to get the virus when handling animals that are infected for instance hunting or dressing or consuming bush meat, the meat obtained from the hunted wild animals.

Animal Bites or Scratches

It is transmitted through handling animals, being bitten, scratched, or coming into contact with the blood, secretions, or lesions of affected animals **[24].**

Contaminated Materials

Touching an infected bird or coming into contact with the virus through utensils, toys, food or eggs, cages that may have come into contact with sick animals

Transmission from Human to Human

Despite the presence of a common virus, the disease can be transmitted from monkeys to humans, especially during epidemics. Human-to-human transmission is generally less efficient than animal-to-human transmission and therefore requires more contact (**Table 2**) **[1).**

Close Physical touch

The virus can be spread through close contact with body fluids, burns, or skin wounds. Intense or sexual contact, intense, prolonged physical contact, and its causes **[25].**

Respiratory Droplets

If the victim has bruises on the face or neck, prolonged exposure can cause that person to breathe **[25].**

Contaminated Objects or Surfaces

The virus can also be spread through personal contact with infected feces or wounds. Examples of these items are clothes, bedding, and towels **[25].**

Table 2: Causes monkey pox disease.

Causes	Details
Animal to Human	Contact, bite, scratch, or on contaminated surfaces of infected animals.
Human to Human	Close contact with body fluids, wounds, respiratory secretions, or contaminated surfaces.
Risk Factors	Travel to endemic areas, close contact with infected individuals, or bushmeat consumption.

Table 3: Diagnosis of monkey pox disease.

Diagnosis	Description
PCR Testing	detect viral DNA; They are very reliable.
Serology	identify a previous contact; limited accuracy.
Viral Culture	it takes a lot of time; They are rarely used.
Electron Microscopy	It is rarely used for direct bacterial imaging.
Reporting	Outbreaks of infection should be monitored and managed.

Figure 2: Effect of monkeypox on skin.

Hosts and Virus Reservoirs

While a specific monkey virus has yet to be identified, small mammals and wild cats are considered primary hosts, and humans and monkeys are considered invasive hosts, suggesting that they could also be in the absence of specialized reserves have kidnapped people **[26].**

Infection Risk Factors

The following factors contribute to the susceptibility of monkeypox.

Travel to the Area

Residents and visitors from Central and West Africa are most vulnerable **[27].**

Infected people or animals will be severely affected

Those who work in the medical field, are close to infected family members or care for an infected person are at increased risk of contracting the virus **[27].**

Eating Wild Animals (Bushmeat)

Where they hunt, they eat wild animals.

DIAGNOSIS

Testing in Laboratories

Laboratory tests are necessary to confirm the presence of the virus in monkeys, especially when clinical presentation is unclear **[28].**

PCR, or polymerase chain reaction test

The most reliable and popular test for the diagnosis of monkey tumors is PCR. It uses samples from skin lesions, warts, or abscesses to identify the monkey virus genes **[29].**

Sample Collection

Patients provide wound samples (tissue, urine, or tumor) for analysis. Fluid cultures are usually obtained for multiple lesions to ensure an accurate diagnosis.

interest

PCR is highly specific and can distinguish smallpox from other orthopoxviruses, such as monkey smallpox **[29].**

Viral Culture Viral Isolation

Specimens from wounds can be used to isolate and culture monkey viruses. Because it takes more time to conclude and requires a specialized laboratory, this approach is not very popular (**table 4**) **[30].**

Examination of Sera

Testing for Antibodies

Serologic testing can be done to detect monkey virus antibodies in the patient's blood. These tests are not very helpful in determining the current infection but can reveal whether the patient is already infected **[31].**

Limitations

Co-existence with other orthopoxviruses, including measles virus or vaccine smallpox, can further complicate serologic testing **[9].**

Microscopy of Electrons

In a few exceptional cases, the monkey virus can be seen directly with an electron microscope **[4].**

Histopathology

Skin Biopsy

The skin should be examined for microscopic vascular changes **[9].** Monkey diarrhea can be highlighted by specific characteristics of orthopoxvirus infection, such as significant cellular changes. However, this test is rarely used for diagnosis because it requires additional surgery.

Distinguishing Smallpox from Monkeypox

Because of the similarities between cystitis and syphilis, syphilis should be ruled out, especially in its early stages. But smallpox is relatively easy to diagnose because the disease was declared extinct in 1980 and routine smallpox vaccinations have ceased **[32]**.

Tools for Point-of-Care Diagnostics

Efforts are being made to provide rapid, point-of-care diagnostic devices where access to sophisticated laboratory tests is prohibited These are only available or accessible to clinicians in limited access areas the rapidity of monkey disease and the strategies needed to initiate treatment or isolation **[33].**

Reporting and Notification

Health care providers are required to report confirmed or suspected cases of monkeypox to public health authorities in countries where the disease is considered reportable to monitor and control outbreaks role **[34].** To stop the spread, early detection and reporting are essential.

OUTBREAKS

Effective May 6, 2022, HMPX will operate in the United States. On 6 May 2022, the UK High Consequence Infectious Disease (HCID) network confirmed a monkey case with a recent travel history to West Africa.12 As of 13 May 2022, several countries have documented that many people come from endemic areas and not humans and previously infected animals **[35].** First of all, human cases of plague have been reported from countries with no epidemiological links to endemic Africa and the long chain of identification of monkeys in some areas without historical epidemics raises questions about evolution and the ability of viruses to spread to long-term failed populations **[32, 36].** There have been 54,709 laboratory-confirmed cases and 397 suspected cases, including 18 deaths, in all 102 member states from the 6 WHO regions since 1 January. These data have been available since 10 September The Western Pacific and European regions are categorized as low, medium, and high risk, but overall Risk to Global Health The Organization Classified as moderate [**37**]**.** On September 10, 2022, the United States of America (n = 19,833), Spain (n = 6,749), Brazil (n = 5,525), France (n = 3,646), Germany (n = 3,505), The United Kingdom (n = 3,484), Peru (n = 1,724), Canada (n = 1,289), the Netherlands (n = 1,172), and Colombia (n = 938) were the ten nations with the highest cumulative number of cases worldwide. Of all cases recorded worldwide, these countries account for 87.5% of cases **[37].**

According to well-established data, the epidemic mainly affects young people; Of the cases with gender data, 98.1% (27875/28401) were males with a mean age of 36 years (interquartile range 30-43 years). Of the 28,991 cases for which age data were available, 0.6% (171) were 0–17 years, respectively **[46].** The age range was 0–4. 1.9% (526/28401) of all accessible cases have a female gender identity.8 The current craze outbreak, unlike previous ones, includes MSM (who learn to be gay or sex official) especially if... although not always with one or more through their partner. There was no evidence of ongoing infection beyond these networks.8 Of the 12,247, 878 cases involving sexual orientation, 95.1% of the cases were reported[**37**]. The only data on race and ethnicity statistics are those reported by the CDC and UKHSA in the US and Europe. Race or ethnicity was known in 59.2% of cases (n = 10,297). Of these, 33.1% (n = 3413) were non-Hispanic white, 31.1% (n = 3218) were Hispanic (of any race), 31.1% (n = 3205) were non-Hispanic black, and 3.7% (n = 381). There were no Hispanic Asians. According to the CDC, less than 1% of cases had accessible race or ethnicity, and the most common responses were American Indian or Alaskan (n = 34), Native Hawaiian or other Pacific Islander (n = 12). or ethnicity (n =34)(38] is available. The UKHSA report states that the majority of respondents were white (76.4%), mixed (9.1%), Asian (7.1%), black (4.3%), and other (0.1%). **[39]** Graph 1.

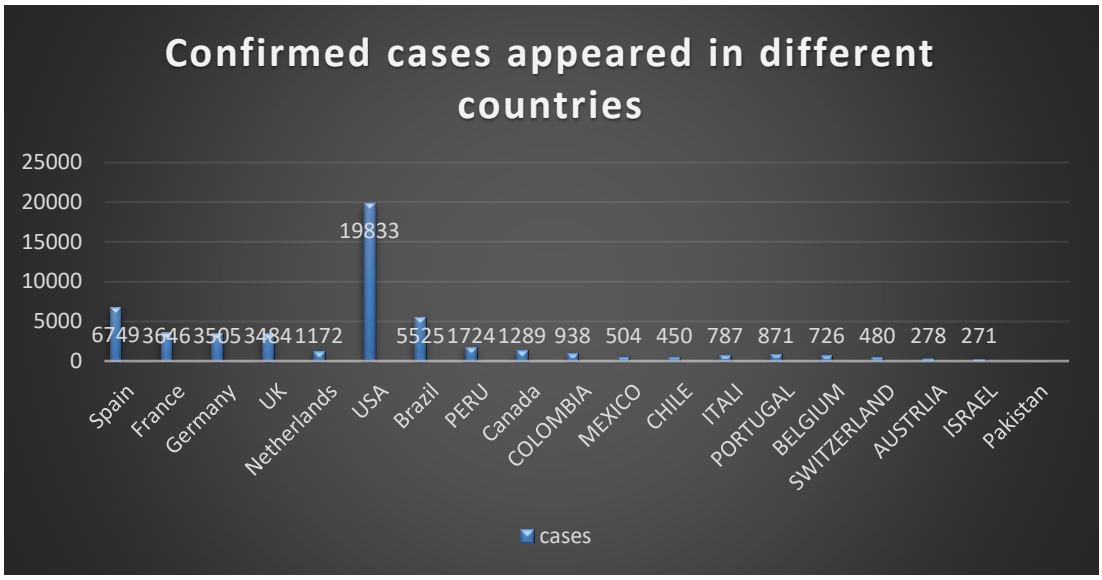

Figure 3: Outbreaks and cases of monkeypox in different countries.

PREVENTION

Evidence suggests that measles vaccination in monkeys can protect itself and improve symptoms of infection [**40**]. Aventis Pasteur measles vaccine (APSV) can be used under the investigational new drug (IND) program for measles. Three drugs are currently available in the United States. National Storage Systems (SNS): JYNNEOS™ (also known as IMVAMUNE, IMVANEX, MVA-BN) and ACAM2000® **(41]**. Ankara-Bavarian Nordic (MVA-BN strain) is the attenuated, nonreplicating orthopoxvirus used in a live mouse vaccine in JYNNEOS™ upon empowerment letter from outside the USA. Following the Food and Drug Administration (FDA) in September 2019, adult vaccines are recommended for those who have a higher risk of developing measles or mumps These are adults 18 years of age or older **[42].** ACAM2000® contains live vaccinia virus. Previously Dryvax® was an orthopoxvirus vaccine that the manufacturer withdrew upon receiving FDA approval in August 2007. ACAM2000® is recommended as an active antimeasles therapy for individuals identified as at high risk for acquisition akisikuru. In an outbreak, the CDC maintains an emergency IND program that allows the use of ACAM2000® for diseases other than variola orthopoxvirus (e.g., monkeypox) **[43]**. The recombinant vaccinia virus is ACAM2000® and the modified vaccinia Ankara virus is JYNNEOS™. As a result, although JYNNEOS™ causes less skin reaction at the injection site, ACAM2000® does. Thus, there are risks associated with accidental vaccination and ACAM2000® vaccination, but not JYNNEOS™. Slow and eczematous absorption of modified products such as ACAM2000® may occur in some individuals due to uncontrolled bacterial reproduction **[44].** Aventis Pasteur Smallpox Vaccine (APSV), a replication vaccine, can be provided under an IND or Emergency Use Authorization (EUA) to prevent smallpox when approved vaccines are not available or recommended but can this vaccine be used to treat seizures in monkeys **[45].**

Pre-exposure Prophylaxis

Vaccination is recommended for selected groups of occupational exposure to orthopoxvirus, and in joint laboratory and hospital laboratory orthopoxvirus testing based on clinical judgment, healthcare providers treat patients who have been infected with the orthopoxvirus by repeating them for ACAM2000®, may also be administered the vaccine ACIP if contraindicated JYNNEOS™ for PrEP and ACAM2000® have been described **[46].**

Post-exposure Prophylaxis

Monkey disease can be spread only through prolonged close contact with the disease. Postprophylaxis (PEP) is generally not appropriate in situations where exposure is brief and includes users of well-protected personal equipment (PPE) and routine procedures, as it is stationary for low-risk CDC, PEP, has also developed informed guidelines to assist decision-making in conducting risk assessments. To prevent disease, the CDC advises that the first dose of vaccine should not be administered more than four days after exposure. Vaccination may reduce symptoms but vaccination 4–14 days after the date of use does not prevent the onset of the disease **[47].**

Informed clinical judgment at the role, function, and individual level is encouraged to determine whether the benefits of PEP outweigh the risks. Following are the properties of the function assigned to the inner layer.

Table 4: Vaccination and guidelines.

Aspect	Description
Use of vaccines	Lister, NYCBH, Dryvax®, EM-63, Tian-Tan (vaccinia virus-based vaccine).
ACAM2000 Specification	Live Depleted, approved by the FDA (2007), for at-risk adults; With a transdermal injection.
Bad consequences	Myocardial infarction, encephalopathy, risk of viral infection.
Mass vaccination	Advice is not given due to risks and limited resources.
After installation	Recommended within 3–6 days of exposure; up to 14 days to reduce symptoms.
Before publication	for high-risk groups; Imvamax® suggested.
Public health programs	Detection, isolation, and case follow-up to prevent transmission.

Sitting in front of a naked patient for three hours or more without wearing at least a surgical mask. Examples include changing, bathing, assisting with transfers, or activities that involve wearing gloves but are not uniforms and may involve patients' skin injuries, bodily fluids, soiled linens, or bandages. Monitoring is recommended but not limited or unspecified use of PEP **[48].**

VACCINE

Several smallpox vaccines have been developed throughout the 20th century based on biologically different vaccinia-pox viruses The strain used in this vaccine was normal, living clones with varying ability to induce human behavior. Lister/Elstree, New York City Board of Health (NYCBH), Dryvax® vaccine, EM-63, Tian-Tan, etc. were used as vaccines in campaigns to eradicate human measles These viruses due to high safety therefore compared to others a variety, such as Copenhagen or Berne The choice**[49].** The ability to induce tissue-specific infection sets this first generation of vaccines apart; Consequently, NYCBH was developed on bovine or water buffalo skin cells, whereas the Lister vaccine grows on the chorioallantoic membrane (CAM) of villous embryos and in addition is expressed differently—controlled control frozen or lyophilized (Table 4) **[50].** When smallpox was eradicated, these vaccines contained very few chemicals until the rest were disposed of in more secure laboratories. In the United States, programs for all civilians ended in 1972 and for the military in 1989. Although 15 million doses of Dryvax® vaccine were placed in storage as a precaution, vaccines were discontinued the protection is done in 1978 **[51].**

The U.S. government resumed research in the 1990s to improve the safety and immunogenicity of the Dryvax® vaccine against infectious diseases in calves, with many abnormalities, and rose unchallenged in the new by Acambis, Inc. (Cambridge, MA) was produced. of molecular research in measles vaccine development and validation took the lead. This vaccine was heterogeneous, with six virological clones differing in virulence and immunogenicity according to preliminary studies **[52].** Replaced by the FDA in April 2007, the ACAM2000 vaccine is a live isolated vaccinia virus originally developed as Dryvax® 18. People at risk of developing measles can get this vaccine individually immunocompromised, pregnant, or nursing mothers. It should be administered once, and each dose contains 2.5–12.5 x 105 infectious agents. Two injections are used to transfer the dose through the skin (scarification). It requires extreme caution during use because the infection can be spread if healthcare workers come into contact with the vaccinated person **[44].** Upon initial injection, an injection site-like rash develops, eventually developing into a papule in two to five days Papule vesicles develop in 8–10 days and dry out in 14–21 days, crust was under the development of conventional inoculation until 1980. 19 This inoculation alone enables sudden movement, and the result of results in Vertical transmission can be severe and from genital Pox virulent. The reported frequency of myocardial infarction and/or pericarditis and encephalopathy following administration of the ACAM2000 vaccine was 5.7/100,000 Coverage **[53].**

Vaccination strategies

WHO has issued guidelines with recommendations for the use of MV vaccines. It makes the following decisions: Multivaccination is not recommended for unvaccinated individuals due to vaccine risk, efficacy, and limited availability b) Through public health measures (which will be identified, isolated, and context follows). M.V. c) after prophylaxis, if possible, a third-generation vaccine, is recommended for the first 3-6 days of close contact with infected persons (and up to 14 days when there are no symptoms) however, when administered 4– 14 days after vaccination, it alleviated symptoms but did not prevent disease; and d) prevention primarily before exposure to high-risk activities **[54].** Spanish health authorities have published several guidelines for the early identification and management of suspected cases of MV. Imvamax® vaccination before exposure to confirmed cases in the current outbreak could be an important prophylactic measure, potentially helping to prevent or reduce disease. However, in the absence of vaccination, vaccination after exposure may be

preferred. Current vaccination and patient measurement in clinical and epidemiological settings help account for the slow decline in current monkey outbreaks**[55].**

DISCUSSION

Experience from previous months in non-endemic countries provokes concern about the global monkeypox health threat. The disease has to be managed and controlled through proper diagnosis because monkeypox has symptoms similar to other viral diseases, for instance, chickenpox and measles **[56]**. The various methods of diagnosing monkeypox, the challenges associated with such a process especially for a country with limited facilities, and the general impacts concerning health and disease prevention will all be discussed in this talk **[57]**. So a proper diagnosis is the primary element of any plan to address diseases caused by pathogenic microorganisms. The correct diagnosis of monkeypox fulfills several vital roles in this case **[58].** Preventing Transmission: In a way, it prevents follow-up transmission since those affected persons as well as their close ones are isolated and the disease identified earlier. Guiding Treatment: Though there are no unique antiviral approaches to monkeypox a concrete diagnosis assists clinicians manage issues and provide optimal support care **[59]**. Surveillance and Public Health Response: The diagnosis also enhances epidemiologic monitoring helping officials identify areas where the virus is spreading and setting up quick interventions **[60]**. Differentiating from Other Diseases: This is because most symptoms of monkeypox are akin to those of other conditions, that require skin lesion sampling for confirmation: syphilis, chicken pox, and smallpox **[61].**

The human population is at a high risk of developing human monkeypox. Fortunately, we can see that the clinical phenotype and the epidemiology of this disease are rather changing, mainly out of Africa. Of all patients, women with pregnancy, patients with weakened immune systems, and babies under the age of eight years are likely to be at greater risk. The vaccines for smallpox and monkeypox are currently maintained in the United States strategic national stockpile inventory together with two possibly beneficial antiviral drugs. Unfortunately, few other countries have done the same.

One critical decision concerning the use of vaccines and antivirals at the national and WHO level is at present under review[**55]**. Because the risk of infection in the general population is relatively low, it makes more sense to vaccinate people who are at high risk due to behavior, occupation, or close contact increased protection of people is thus necessary due to its rapidly spreading ring vaccination campaigns. We also recommend that healthcare organizations engage specialized medical teams trained and immunized against high-risk infectious diseases such as monkeypox. Such decisions influence different risk benefits, as well as the benefits and availability of vaccines such as ACAM2000, MVA-Bavarian Nordic, LC16m8, etc. Recall that risks seemed to be about benefits estimates are high in populations and may change over time.

CONCLUSION

Today, there is also concern about the possibility that the evolution of the monkey virus genome will have one or more of the following effects: increased transmission capacity, antioxidant toxicity, or mutation of the genetic code to suppress proteins that reduce the efficacy of antibiotics. Given the ongoing challenges of COVID-19, climate change, a weak economy, emerging conflicts, and ongoing supply chain issues, such concerns are justified and he needs to be prepared

The general public, physicians, and public health authorities must now be informed about the ongoing risk of emerging diseases. To maintain global security, countries must rethink pandemic-like pandemic preparedness and build their national defenses accordingly. Training, prevention, diagnosis, surveillance, and medical resources.

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