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Monkey Pox: A Review on Transmission, Diagnosis, Treatment and Current Scenario

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Abstract

The world is currently dealing with a second viral outbreak, monkeypox, which has the potential to become an epidemic after the COVID-19 pandemic. Monkeypox is an emerging zoonotic disease that for decades has been viewed as an infectious disease with significant epidemic potential because of the increasing occurrence of human outbreaks in recent years. A monkeypox outbreak is spreading in territories where the virus is not generally prevalent. . The natural reservoir of Mpox is unknown yet. Mpox might be carried by African rodents and nonhuman primates (such as monkeys). The present review provides information on epidemiology, clinical symptoms, risk factors, diagnosis, and preventive measures of Mpox. . In conclusion: Monkeypox poses a severe threat to public health due to the lack of specific vaccinations and effective antivirals. Surveillance studies in affected regions can assist in the early diagnosis of disease and help to control significant outbreaks.

Keywords: Monkey pox, outbreak, infectious, clinical symptoms, vaccination, risk factor

Introduction

The newly emerging and re-emerging viral infection is a significant public health concern. Infectious agents emerge due to imbalances in various ecological, environmental, or demographic factors. Deforestation, global warming, changing climate, high population density, unregulated development, poor sanitation, and vector adaptability put selection pressure on host–pathogen reservoirs, resulting in various viral emergence and re-emergence.

The monkeypox virus (MPXV), an orthopoxvirus (OPXV) with symptoms similar to smallpox, is a viral zoonotic disease. The OPXV genus, which also includes other deadly viruses including variola virus, vaccinia virus, cowpox virus, and others, contains the enveloped double-stranded DNA virus MPXV. MPXV is a member of the Poxviridae family, Chordopoxvirinae subfamily, and Poxviridae family. Monkeypox viruses were first identified in 1959 as a spontaneous outbreak of a pox-like infection of fever and rash in primates confined to a research center in Copenhagen, Denmark. On September 1, 1970, a nine-month-old boy was hospitalized with smallpox-like symptoms at Basankusu Hospital in the Democratic Republic of the Congo as the first human MPXV case in medical history. Between October 1970 and May 1971, six instances of human MPXV were confirmed in Liberia, Nigeria, and Sierra Leone. Between 1971 and 1978, 10 MPXV cases were confirmed in Nigeria as well . Thousands of human cases of monkeypox have been reported in 15 different countries ever since, including 11 of them occurring in Africa. Monkeypox was transported to the UK, the US, Spain, France, Germany, Singapore

and Pakistan. Mpox has been reported in the democratic republic of congo for more than a decate, and the number number of cases reported each year has increased steadily over thet period. In 2023 reported cases increased significantly, and already the number of cases reported so far this year has exceeded last year's total, with more than 15600 cases and 537 deaths.

The rashes in the present outbreak, however, vary from earlier ones and do not exhibit any prodromal symptoms. Monkeypox has been reported to transmit from either animal to human or human to human. Congenital and nosocomial transmission can also occur. Persons living in a forested region, taking care of infected animals and in close proximity to infected individuals within the infectious period (21 days) are at increased risk of getting infected. Children, pregnant women, and immunocompromised patients such as human immunodeficiency virus (HIV)-infected individuals are highly susceptible to MPXV infection. PCR, with or without sequencing and virus isolation, is considered the gold standard technique used to confirm MPXV infection.In remote settings and limited resource areas, most cases are initially diagnosed clinically. Lymphadenopathy is the key feature that distinguishes monkeypox from other OPVX infections. . A selected number of antiviral agents, such as tecovirimat and brincidofovir are approved for treating complicated cases of monkeypox infection under randomized controlled trials or an Expanded Access for an Investigational New Drug protocol. Currently, the majority of mild or uncomplicated monkeypox cases are taken care of with symptomatic treatment and optimizing supportive interventions.(1,2,3,4,5,6,7,8,9,10,11,,26).

Clinical Manifestation

Monkeypox virus as a member of Orthopoxvirus genus, the clinical presentation is similar to the smallpox

. The incubation period in human usually is from 7 to 14 days, but it can ranges from 4 to 21 days . The disease start with a febrile prodrome for 1–4 days and it’s companied by headache, muscle aches and backache and sometimes exhaustion, sweats, fatigue and the cutaneal presentation. Skin rashes appear 1–3 days after the onset of fever. The rash that can appears on the face, inside the mouth, on the hands, feet, chest, genitals, anus and in the eyes. Sometimes, rash is the first symptoms, followed by other symptoms. The number of lesions is variable. Lesions begin as a flat rash (macula) and become raised from the skin (papules); then they get a “vesicle” appearance by filling with clear liquid. The clear liquid inside the vesicles turns into a yellowish liquid and “pustules” form. Pustules, crusts and lesions disappear with the fall of the crusts. After crust fall off, patients are considered noninfectious. The disease is seen to be more severe in people whose immune system is suppressed. The most common outcome following an infection is scarring from the rash. But more serious complications can arise, according to research of monkeypox in humans published in 2009, including pulmonary distress and bronchopneumonia. More severe complications and sequelae are found to be more common among unvaccinated than vaccinated patients and ocular infections can occur and may result in corneal scarring and even permanent vision loss

. Lymphadenopathy is a distinguishing feature of monkeypox from smallpox. This typically occurs with fever onset, 1–2 days before rash onset, or rarely with rash onset. (12,13,14,15,16,17,18,19,20,21,22,23,24,25,26).

The origin and classification of MPXV

The family Poxviridae consists of 22 genera and 83 species of two subfamilies: Chordopoxvirinae (18

genera and 52 species) and Entomopoxvarinae (4 genera and 31 species) . The genus Orthopoxvirus affects humans and animals, with 12 identified members. The most well-known member is the variola virus, which causes smallpox; others are MPXV, vaccinia virus (smallpox vaccine virus), Abatino macacapox virus, Akhmeta virus, Camelpox virus, Cowpox virus, Ectromelia virus, Raccoonpox virus, Skunkpox virus, Taterapox virus, and Volepox virus . Two viral clades, the West African and Central African (Congo Basin) clades, have been identified . The central African viruses are more virulent than the West African. During the 2003 U.S. outbreak, the Central African clade of human MPX disease was associated with higher morbidity, death, human-to-human transmission, and viremia . The central African clade is reported to be more severe and shows a higher fatality rate (10%) than the West African clade (4%) . The differences in virulence stem from variabilities in genome organization caused by deleted gene regions and gene fragmentation in open reading frames . Thus, sample collection from the different areas, individuals, and clades is vital for determining the genetic properties of the MPXV and confirming the cases and research facilities (18,33,34,35,36,37,38)

Human MPXV

Since early May 2022, the monkeypox virus (MPXV) has been emerging worldwide. As of October 15, 2022, 73,426 cases have been confirmed in 110 countries. MPXV was first discovered during an outbreak among monkeys at a laboratory in Denmark in 1958. However, it was first acknowledged as a human disease in 1970, when a nine-month-old child became Infected. MPXV is typically found in the Congo Basin, but the other countries of Central and West Africa have also reported cases of monkeypox in humans and wildlife. Several current cases started with vaginal and perianal lesions but no particular temperature or other prodromal indications. As a result, instances may be misdiagnosed as more frequent conditions like varicella-zoster or sexually transmitted. This review will examine the present state of knowledge on human MPX, focusing on epidemiology features, diagnosis, prevention. (1,3,29).

VIROLOGY

Monkeypox Virus (MPV) is an enveloped, double stranded, deoxyribonucleic acid (DNA) orthopox virus in the poxviridae family. It is currently of an international concern. MPV is endemic to Central and Western Africa and has two known clades: a more virulent Congo Basin (Central African), and a less virulent West African clade. The natural reservoirs for MPV are likely small African mammals including Gambian pouched rats, African rope squirrels, dormice, and various primates. Zoonotic transmission occurs from direct contact with infected animals including bites, scratches, or preparation of bushmeat. Human-to-human transmission can also occur through infected respiratory secretions, direct skin-to-skin (or mucosal) contact with infected lesions, or through infected fomites including clothes and bedding.

The MPV genome is large, with about 200 kilo base pairs, and encodes approximately 190 proteins to build viral particles and modulate numerous host processes. Two distinct clades of MPV that show approximately 0•5% genomic sequence difference had been historically identified in different geographical regions of Africa. Clade 1 (which has case-fatality rates of 1–12%) is usually responsible for disease in central Africa and the Congo Basin, whereas clade 2 (which is less virulent, with case-fatality rates less than 0•1%) is found in west Africa. The genomic differences between clade 1 and 2 viruses occur in regions that encode for important virulence genes and probably explain the differences in clinical severity. For example- the gene encoding a complement control protein that prevents initiation of the complement pathway is missing in clade 2 viral strains, and animal models of MPV using the clade 1 virus with a complement control protein

deletion led to reduced morbidity and mortality in prairie dogs.

TRANSMISSION

Risks of transmission can vary in different settings, including households, congregated settings, health-care facilities, and in the community. Before the 2022 outbreak, transmission occurred mainly within the household, and sustained human-to-human spread was rare. In one report from the Democratic Republic of the Congo, the secondary attack rate in households was as high as 9%. Additionally, MPV outbreaks had been described in congregate living situations, such as prisons. By contrast, household transmission has been rare during the 2022 outbreak, accounting for only 0.6 - 3.0% of cases, including several pediatric cases and one neonatal infant who lived in a home with an infected adult. Most infections in 2022 have been associated with community transmission, with an estimated reproductive number ranging from 1•40 to 1•80, which implies a potential for sustainable local Transmission. Health-care-associated transmission MPV had been reported in a dozen cases in Africa, and in one case outside endemic regions before May, 2022. The risk of transmission during the 2022 outbreak has been low, with only a small number of transmission events reported after exposure to fomites or needle stick injuries.

Animal-human (zoonotic) transmission and human-to-human transmission are the two means of spreading the MPV. Zoonotic transmission occurs through direct contact, bite or scratch from an infected animal, or consumption of an animal host, which is usually a rodent or a primate. Risk factors for zoonotic transmission of MPXV include living in forested or recently deforested areas, no smallpox vaccination, handling or eating dead bushmeat or monkeys, and sleeping on the floor (in endemic areas). Human-to-human transmission can result from close contact with respiratory secretions, skin lesions of an infected person, or contaminated objects such as clothes and beddings. However, transmission via respiratory droplet particles usually requires prolonged face-to-face contact, which puts health workers, household members, and other close contacts of active cases at greater risk. The virus can also be transmitted vertically from a mother to a foetus, leading to congenital MPV. While close physical contact is a well-known risk factor for transmission, it is still unclear if MPV can be transmitted sexually.

MODE OF TRANSMISSION

1. Animal to Human

Animal-to-human transmission is also known as zoonotic transmission, occurs through direct contact with infected animals blood, respiratory droplets, lesion material, and body fluids; inoculation from infected animals mucocutaneous lesions, particularly when the skin barrier is lost due to scratches, bites, or other trauma; or during handling of infected monkeys, including hunting, skinning, trapping, cooking, and playing with carcasses. Ingestion of inadequately cooked meat from infected animals or non-human primates, such as Gambian giant squirrels, terrestrial rodents, rats, rabbits, dormice, porcupines, antelopes and gazelles, and tree squirrels, can also result in transmission.

2. Human to human

Human-to-human transmission can occur through direct contact with an infected individual's skin, mucous membrane or mucocutaneous lesions, including face-to-face, skin-to-skin, mouth-to-mouth, or mouth-to-skin contact, as well as oral or respiratory secretion, droplets requiring prolonged close contact. Long-term contact puts caregivers and household members at risk of infection. The virus is believed to enter the body via broken skin, mucosal surfaces, or the respiratory tract. The MPV has been linked to nosocomial transmission. The high prevalence of the current outbreak raises concerns about possible sexual transmission.

Indeed, high viral loads were found in saliva, rectal swab, sperm, urine, and fecal sample from infected patients. Transmission can also occur vertically from mother to fetus, known as congenital MPV, and can result in developmental anomaly of the fetus after childbirth. The concurrent primary zoonotic and secondary human-to-human transmission was suggested in studies conducted in Nigeria and Spain. Another study from Spain confirms that monkeypox is a locally transmitted and community-acquired emerging infectious disease.

Person-to-person transmission of MPV can occur through direct contact with infectious skin or other lesions such as in the mouth or on genitals; this includes contact which is ;

- Face-to-face (talking or breathing)
- Skin-to-skin (touching or vaginal/anal sex)
- Mouth-to-mouth (kissing)
- Mouth-to-skin contact (oral sex or kissing the skin)
- Respiratory droplets or short-range aerosols from prolonged close contact.

The virus then enters the body through broken skin, mucosal surfaces (e g oral, pharyngeal, ocular, genital, anorectal), or via the respiratory tract. MPV can spread to other members of the household and to sex partners. People with multiple sexual partners are at higher risk.

3. Environment to human

Direct contact with fomites contaminated by an infected person's lesion fluid, bodily fluids, crust, or scab (e.g., sheets, clothing, towels) may act as a transmission medium. In general, Orthopox virus are more resistant to environmental stress and have a high level of environmental stability. Surrogate pox virus can survive in the environment and on various surfaces for up to 56 days, depending on room conditions. However, there is currently a scarcity of data on environmental transmission. There is currently no information on the presence of the MPV in wastewater.

4. Human to animal

A recent publication in the Lancet describes some convincing evidence of human-to-animal transmission of MPV. The Italian greyhound, who otherwise appeared to be in good health, had frequent and close contact with the two household members from Paris, France, who were infected with MPV, and even shared a bed with them.

EPIDEMIOLOGY

1. OUTBREAK IN AFRICA

Since humans were first infected with the virus through direct contact with diseased animals thousands of years ago, MPV has likely been present in Sub-Saharan Africa for thousands of years. There is currently no information about MPXV's reservoir. Though, there is evidence that monkeys, like humans, are accidental hosts. The reservoir will likely be one or more mice or monkeys found in central Africa's forest. MPV was not known as a unique infection till 1970, when the eradication of Smallpox in Zaire (DRC) showed the persistence of a smallpox-like disease in rural regions. In the worldwide purging campaign, mass immunization in Central Africa appears to have resulted in a temporary decrease in the prevalence of human MPV. However, the disease has returned due to the lack of immunization in subsequent generations and a growing reliance on hunting animals in conflict-torn regions.

Between 1970 and 1980, 59 cases were reported, and after the eradication of smallpox in 1980, a five-year period of active surveillance in DRC identified 338 cases. However, cases have emerged outside Africa in recent years. The first reported case outside Africa was in2003, when Gambian giant rats imported from

Ghana infected prairie dogs in the Midwestern United States, leading to 53 human cases. The Sudanese outbreak of 2005 is the second MPV epidemic outside the Congo Basin and West African regions. In 2017, 122 cases were reported in Nigeria, the first known cases diagnosed in 39 years, with studies showing both zoonotic and human-to-human transmission. Outbreaks worldwide are usually linked to people who recently returned from endemic areas. However, World Health Organization (WHO) reported a new outbreak in May 2022, which led to a paradigm shift with over 780 laboratory-confirmed cases as of June 2nd 2022, from 27 member nations that were not endemic to MPV and with no travel history to endemic areas.

2. OUTBREAK IN THE US

During the summer of 2003, a wave of disease cases associated with MPV were confirmed in the Midwestern United States. MPV was discovered for the first time in the Western World. Thirty seven of 72 human cases in an outbreak were confirmed by laboratory tests.). Because infected people fell ill after associating with dogs, prairie dogs (Cyanoses species) kept with rodents transported from Ghana inn western Africa were assumed to be the primary source of the pandemic.

MPV was first identified during a laboratory outbreak of vesiculopustular skin eruptions among crab-eating macaques in Denmark in 1958. Additional MPV disease outbreaks occurred among laboratory monkeys in subsequent years, with a larger outbreak in the Rotterdam Zoo among anteaters and various primates in 1964. The first human MPV disease cases were identified in Central and Western Africa in the 1970s, primarily among children presenting with diffuse vesiculopustular rash, lymphadenopathy, and fever. In subsequent decades, hundreds to thousands of additional human MPV disease cases arise primarily in the Congo Basin. In 2003, dozens of human MPV disease cases unexpectedly occurred in the Midwest United States in an outbreak linked to pet prairie dogs housed alongside imported African rodents resulting in cross-infection. Prior to 2022, human MPV disease was typically only identified in Central or Western Africa (or linked to international travel or animal importation from these areas). However, in May 2022, the United Kingdom reported several human MPV disease cases without any clear travel or animal links to these areas. By the end of May, additional cases were reported in over20 non-endemic countries suggesting rapid human-to-human transmission. By the end of July, over 20,000 confirmed human MPV disease cases had been reported in over 70 countries across six continents (including more than 5000 in the United States). Although MPV was first found in monkeys, monkeys are incidental hosts, and the animal reservoir remains unknown. Animal-to-human transmission, human-to-human transmission, and asymptomatic circulation of MPV in human communities can occurs. Spread of MPV from forest animals (e.g., monkeys, rodents, squirrels) to exposed humans has been reported, which may be via contact with bodily fluids, bites, or preparation of bushmeat. Spread of MPV among humans occurs via close contact (including sexual contact), fomites, environmental contamination, respiratory droplets, or vertical (maternal–foetal) transmission. Both travel-related and autochthonous community transmission have been reported. Secondary attack rates in contacts unvaccinated against smallpox are estimated to be about 10%. Prior childhood vaccination is not completely protective, as 9% of cases reported prior vaccination in the largest observational study of the 2022 outbreak to date. Epidemiologic investigations identified most but not all these cases were among men who have sex with men and that human-to- human transmission was likely occurring via close respiratory droplet, skin-on-skin, or sexual contact along social networks.Human MPV cases decrease after 1986, with just the 13 cases recorded from 1986 to 1992 and no patients reported from 1993 to 1995. In the Democratic Republic of Congo's Kasai-Oriental province, an outbreak of MPV was recorded in 1996-97. There were over 500 cases of MPV with a lower fatality rate (1-5%), but a significant incidence to man-to-man transmission was higher as compared to previous

epidemics (78%). The Ministry of the Health of Democratic Republic of Congo's conducted surveillance during 1998-2002, and more than the 1200 cases MPV were found.In 2003, the first MPV cases in Western Hemisphere were recorded following an epidemic in the Midwest USA. It was caused by the MPV infected West African from Ghana. In total 72 incidence of MPV were noted based on the clinical presentation.

Diagnosis

The early diagnosis of monkeypox is based on clinical signs and epidemiological links. MPV infection is primarily confirmed by a positive PCR test of skin or mucosal lesion swabs or scabs. A positive PCR test of either serum or CSF is also confirmatory. Monkeypox cases were confirmed based on virus isolation or detection of the virus by polymerase chain reaction(PCR) from a signal specimen (skin biopsy or throat culture). Individuals who presented with fever and rash within 21days of exposure to monkey pox and had serum positive for orthopox immunoglobulin M(IgM),but did not have culture or PCR positive clinical specimen , were classified as having a probable case of infection. The most reliable clinical sign differentiating monkeypox from smallpox and chickenpox is enlarged lymph nodes, especially the submental, submandibular, cervical and inguinal nodes. (29,31).

Laboratory tests:

cell culture, polymerase chain reaction (PCR) enzyme-linked immunosorbent assay (ELISA) ,immunohistochemistry, electron microscopy, or western blot analysis or sequencing are currently available diagnostic tests for MPXV detection, with PCR being used for definitive diagnosis. Lesion fluid, lesion roof, scab/crust , oropharyngeal tissue or nasopharyngeal tissue swab ,tonsillar swab, tonsillar tissue, punch biopsy kit, whole blood and acute convalescent phase sera are all required for laboratory diagnosis.

Polymerase chain reaction (PCR)

Nucleic acid amplification testing(NAAT), which uses real-time or conventional PCR to detect unique sequence of viral DNA, is used to confirm monkeypox infection. Positive results from an OPXV PCR assay followed by monkeypox confirmation via PCR assay in suspected cases, indicate monkeypox infection. To detect MPXV DNA from clinical and veterinary specimens, as well as MPXV-infected cell cultures, reverse-transcription polymerase chain reaction(RT-PCR) target conserved regions of the extracellular-envelop protein gene (B6R),DNA polymerase gene,E9L,DNA-depended RNA polymerase subunit 18,rpo18, and F3L gene are usually considered as target. In conjunction with sequencing, RT-PCR is the technique of choice for routine diagnosis of MPXV.

Immunologic assay

Immunological methods for detecting IgG and IgM antibodies as well as immunohistochemistry for viral antigen detection can we used to detect OPXV DNA. Positive IgM captured enzyme-linked immunosorbent assay(ELISA) result indicate recent exposure to POXV in both unvaccinated and vaccinated individuals , where as positive IgG captured ELISA result indicate previous exposure to OPXV via vaccination or neutral infection. IgM and IgM antibodies are detected in serum 5 to 8 days after the onset of rash respectively. Immunochemistry analysis can be used distinguish between OPXV infection and herpes virus infection.

Electron Microscopy

Electron microscopy with negative staining can be used to examine biopsy specimens from lymph nodes or

scab material, vesicular fluid, blood specimens, or viral cultures.24 MPXV appears intracytoplasmic brick-shaped under an electron microscope, with lateral bodies and a central core measuring approximately 200–300 nm. Although this method does not provide a definitive diagnosis because OPXV species cannot be distinguished morphologically, it does provide evidence that the virus belongs to the Poxviridae family, which aids in distinguishing it from Herpes and Parapox viruses. (31).

Treatment

MPx infection is currently. without a clinically Validated therapy. The septic person must be isolated , keep Covered lesions and Wounds and wear a mask ever more than probable till all Crusts break a than lesion Off C new Skin layer From. There is approved treatment for smallpox known of brincidofovir , tecovirimat and vaccinea immunoglobulin as well as an inhibitor of intracellular viral release known as tecovirimat and which has shown efficacy against MPx in animal. Most cases of MPV infection have a mild, self-limiting disease course without needing specific antiviral therapy. therefore, for mild cases is supportive care with attention to pain relief, hydration and nutrition and avoidance of bacterial superinfection of skin lesion. Skin lesion should be kept clean and dry. Pruritis can be treated with oral antihistamines or topical petroleum jelly.

Tecovirimat is an antiviral medication approved by united states food and drug administration(FDA) and the European medicines Agency (EMA) for the treatment of human smallpox disease.

A vaccination containing a replication fault, the Ankara vaccine is TWO-dose vaccine administered four weeks separately and has a better profile than first-and second- generation smallpox vaccination.

Ankara injection, contrasting live vaccinia virus training, dose not cause skin lesions or provide a danger of extensive or local transmission. The results of medical studies confirmed that altered "Vaccinia Ankara" is safe and increases antibody promotion in people with early or weakened immune systems, both of which are limitations of delivering live vaccines to individuals.

Tecovirimat is available in oral(200mg) capsule and IV formulations. According to centers for Disease Control and Prevention (CDC), it can be use as treatment for MPXV in the US. Cidofovir or Brincidofovir can also be used; this are the antiviral medication that FDA approves for treating cytomegalovirus(CMV) and human smallpox disease respectively Vaccinia Immune Globulin Intravenous (VIGIV) is an immunoglobulin used to treat complications form vaccinia vaccination. The US CDC allows its use as treatment for monkeypox disease under an expanded access protocol.(30).

Vaccines

Prior immunization with the smallpox vaccine may effectively prevent monkeypox infection and improve clinical manifestation when administered early in the incubation period Prior vaccination with the vaccinia virus is known to provide 85% protection against the MPXV and reduce the severity of the infection, but patients with compromised immune systems should exercise caution. MVA-BN ACAM2000 and LC16m8 vaccines are currently available for monkeypox infection.

MVA-BN:

MVA-BN is a third-generation live viral vaccine derived from the modified vaccinia Ankara- Bavarian Nordic (MVA-BN strain) . In 2019, it was licensed by the United States Food and Drug Administration as Smallpox, Monkeypox Vaccine for monkeypox infection and as IMVANEX for smallpox in Europe, though the United Kingdom has been using it off-label in response to monkeypox cases. It has a better safety

profile because of its decreased ability to replicate in host cells and the lack of a lesion at the site of immunization. It is now indicated for high-risk populations, such as HIV patients, patients with hematological conditions, atopic dermatitis, and immunocompromised individuals aged 18 years, for the prevention of smallpox and monkeypox, and is administered subcutaneously in two doses, 28 days apart, without producing a take. If necessary, MVA-BN should be used as a PPV or PEPV against MPX infection.

ACAM2000

ACAM2000 is a replication-competent live vaccinia virus vaccine produced in cell culture from a clone of Dryvax, a first-generation vaccine indicated for smallpox immunization. The Food and Drug Administration (FDA) approved it in August 2007. ACAM2000 vaccination has been linked to a rash, fever, headache, body aches, and myopericarditis. The vaccine is not recommended for pregnant people, who have eczema or atopic dermatitis, or immune deficiencies (e.g., HIV infection) However, the CDC recommends ACAM2000 vaccination for non-variola OPXV infections, including monkeypox.

LC16m8

LC16m8 is an attenuated vaccinia virus that contains attenuated strains with a better safety profile than first- and second-generation smallpox vaccines. It also stimulates antibody production adequately in atopic and immunocompromised patients. It has fewer side effects than ACAM2000 and is approved for use in Japan.

PPV

PPV is only available as a vaccine and is generally recommended for individuals at high risk of exposure, such as gay or bisexual men, MSM, or individuals who have multiple sexual partners; and health workers, laboratory personnel working with OPXVs, and outbreak response team members designated by appropriate public health and antiterror health authorities. Persons at higher risk of severe diseases, such as immunocompromised people, pregnant women, or children who are potential contacts or members of the same household as people with monkeypox, should be offered vaccination with appropriate vaccine on a case-by-case basis, in addition to those at high risk of exposure.

Complications

The disease is seen to be more severs in people whose immune system is supported. the most common outcome following an infection is scarring from the rash. but more serious complications can arise, according to research of monkeypox in human published in 2009!, including pulmonary distress and bronchopnemonia more severe complications and sequelae are found to be more common among unvaccinated than vaccinated patients and ocular infections can occur and may result in corneal scarring and even permanent vision loss. In severe cases, the areas of lesion can Marge and cause large patches of skin to fall off. Patients often present with characteristics lymphodenopathy , most commonly in the groin and may also be accompanied by range of complications such as secondary bacterial infection, respiratory distress, bronchopnemonia , encephalitis,corneal infection with vision loss and dehydration due to vomitting and diarrhoea.

Monkeypox is usually a self-limited disease ,the symptoms last 2-4 weeks. Children are mostly affected severely. The severity of the disease depends on the extent of virus exposure
,the health status of the patient and the complications.

Self Care And Prevention

According to the Centers for Disease Control and Prevention(CDC) there are five steps can help you protect yourself from getting mpox:

STEP 1 :- Get vaccinated!

- The JYNNEOS vaccine is recommended for prevention of mpox. Getting both doses provides the best protection. You should get two doses 4 weeks apart.
- Even if it has been longer than 4 weeks since you got the first vaccine dose, you should get the second dose as soon as possible.
- If you previously recovered from mpox, you do not need the vaccine.
- Use the Mpox Vaccine Locator to find nearby healthcare locations that provide mpox vaccinations.
- Check with your healthcare provider if the mpox vaccine is recommended for you.

STEP 2 :-Learn steps you can take to lower your risk of mpox during sex or at a social gathering.

- If you are at risk for mpox but haven't received your two-dose vaccine yet, consider temporarily changing activities that involve close personal contact (such as sex).
- A rave, party, or club where there is minimal clothing and where there is direct, personal, often skin-to-skin contact has some risk. Avoid any rash you see on others and consider minimizing skin-to-skin contact.

STEP 3 :- Avoid close, skin-to-skin contact with people who have a rash that looks like mpox and animals that carry the monkeypox virus.

This might include skin with what appears to be a rash, pimples, blisters, or scabs.

- The rash might appear on the hands, feet, chest, face, or mouth and other areas like on the genitals (penis, testicles, labia, vagina). Do not touch the rash or scabs of a person with mpox.
- Do not kiss, hug, cuddle, or have sex with someone with mpox.
- In areas where mpox is endemic (found naturally), particularly in Central or West Africa, avoid contact with animals that can carry the monkeypox virus, such as rodents and primates. Direct contact with infected animals can also pose a risk of exposure to the virus.

STEP 4 :- Avoid contact with objects and materials that a person with mpox has used.

- Do not share eating utensils or cups with a person with mpox.
- Do not handle or touch the bedding, towels, or clothing of a person with mpox.
- If you or someone you live with has mpox, follow steps for Cleaning and Disinfecting your Home.

STEP 5 :- Wash your hands often.

- Wash your hands often with soap and water, or use an alcohol-based hand sanitizer, especially before eating or touching your face and after you use the bathroom.
- Handwashing is one of the best ways to protect you, your family, and your friends from getting sick. Watch for symptoms of mpox for 21 days from the date of your last exposure. If you have symptoms, such as a rash, visit a healthcare provider.

Monkeypox scare: AIIMS Delhi issues guidelines to treat suspected patients

1. The AIIMS stated that patients with fever, rash, or a history of contact with confirmed Monkeypox cases should be flagged for immediate assessment.
2. The medics have been asked to identify key symptoms like fever, headache, muscle aches, back pain, swollen nymph nodes, chills, exhaustion, and characteristic skin lesions.

3. The suspected patients should be immediately placed in a designated isolation area to minimise contact with other patients and staff.
4. AIIMS Delhi notified AB-7 beds no 33, 34, 35 and 36 for isolating the Monkeypox patients.
5. According to the advisory, these beds will be allotted to the Monkeypox patients on the recommendation of the emergency chief medical officer and treated by the medicine department.
6. The AIIMS guidelines has asked the officials of Integrated Disease Surveillance Programme (IDSP) when a suspected Monkeypox case is identified.
7. The IDSP team should be provided with the patient's details, brief history, clinical
8. findings and contact details.
9. The AIIMS notified that Safdarjung Hospital has been designated for managing and treating Monkeypox patients. Any patient suspected of having Monkeypox should be referred to Safdarjung Hospital for further evaluation and treatment.
10. The AIIMS management has earmarked a dedicated ambulance to shift the patients to Safdarjung Hospital.
11. All the patients have to be handled with strict infection control measures. The staff has been asked to use personal protective equipment when dealing with suspected cases. The proper documentation of the patients' details, symptoms and referral process have to be maintained, the AIIMS notification stated.

Current scenario

24 May 2024 – WHO releases strategic framework for enhancing prevention and control of Mpox.

9 August 2024 – WHO invite Mpox vaccine manufacturer to submit dossier for emergency evaluation.

14 August 2024 – WHO director-general declared Mpox outbreaks a public health emergency of international concern.

19 August 2024 – first meeting of the international health regulations (2005) emergency committee regarding upsurge of mpox 2024.

The world health organization (WHO) designated the Mpox outbreak in Africa as a global health emergency, highlighting a concern over a highly infectious variant. This declaration follows one from the Africa centers for disease control and prevention. Notably Sweden and Pakistan have reported their initial cases, making the spread of this more Contagious strain beyond Africa. To date, there have been nearly 100,000 reported cases and 1,100 deaths in 116 countries since 2022.

The outbreak involves two strains of the virus in Congo:an endemic version and a newer, less understood variant. This variant has spread through sexual and close contact, affecting even children in displacement camps across Congo and and neughboring countries like Rwanda,Uganda, Burundi and Kenya.

Transmission of mpox can occur through direct cantact with infected lesions, contaminated items like clothing or linens, and animal-to-human interactions such as bites or when handling wildlife.

Reference

1. Cheng T. CHO and Herbert A. Winner, Monkey pox virus, Bacteriological reviews, volume – 37 ,1973.
2. Fabian patauner, Raffaella Gallo, Emanuele Durante-Mangoni, monkey pox infection-An update for the practicing physician, Eurepean journal of international medicine 104 (2022), 1-6.
3. Eveline M bunge, bernard hoet, liddy chen, Florian lienert, Heinz weidenthaler, Lorraine R bear, Robert Steffen, The changing epidemiology of human Mpox- A potential threat? A systemic review, PLOS

neglected topical disease, February 11, 2022.
4. Sultan ayoub meo, Shaukat ali Jawaid, Human Mpox – fifty two years based analysis and updates, Pak J med. Science, volume -36, No. 6, July – August 2022.
5. Yinka-Ogunleye A, Aruna O, Dalhat M, Ogoina D, McCollum A, Disu Y, Mamadu I, Akinpelu A, Ahmad A, Burga J, Ndoreraho A, Nkunzimana E, Manneh L, Mohammed A, Adeoye O, Tom-Aba D, Silenou B, Ipadeola O, Saleh M, Adeyemo A, Nwadiutor I, Aworabhi N, Uke P, John D, Wakama P, Reynolds M, Mauldin MR, Doty J, Wilkins K, Musa J, Khalakdina A, Adedeji A, Mba N, Ojo O, Krause G, Ihekweazu C; CDC Monkeypox Outbreak Team. Outbreak of human monkeypox in Nigeria in 2017-18: a clinical and epidemiological report. Lancet Infect Dis. 2019 Aug;19(8):872-879. doi: 10.1016/S1473-3099(19)30294-4. Epub 2019 Jul 5. PMID: 31285143; PMCID: PMC9628943.
6. Ihekweazu C, Yinka-Ogunleye A, Lule S, Ibrahim A. Importance of epidemiological research of monkeypox: is incidence increasing? Expert Rev Anti Infect Ther. 2020 May;18(5):389-392. doi: 10.1080/14787210.2020.1735361. Epub 2020 Mar 2. PMID: 32096659; PMCID: PMC9491128.
7. Foster SO, Brink EW, Hutchins DL, Pifer JM, Lourie B, Moser CR, Cummings EC, Kuteyi OE, Eke RE, Titus JB, Smith EA, Hicks JW, Foege WH. Human monkeypox. Bull World Health Organ. 1972;46(5):569-76. PMID: 4340216; PMCID: PMC2480784.
8. Beer EM, Rao VB. A systematic review of the epidemiology of human monkeypox outbreaks and implications for outbreak strategy. PLoS Negl Trop Dis. 2019 Oct 16;13(10):e0007791. doi: 10.1371/journal.pntd.0007791. PMID: 31618206; PMCID: PMC6816577.
9. Bíeman JG, Kalisa-Ruti, Steniowski MV, Zanotto E, Gíomyko AI, Aíita I. Human monkeypox, 1970-79. Bull Woíld Health Oígan. 1980;58(2):165-82. PMID: 6249508; PMCID: PMC2395797.
10. Magnus, P.v., Andersen, E.K., Petersen, K.B. and Birch-Andersen, A. (1959), A POX-LIKE DISEASE IN CYNOMOLGUS MONKEYS. Acta Pathologica Microbiologica Scandinavica, 46: 156-176. https://doi.org/10.1111/j.1699- 0463.1959.tb00328.x
11. Di Gennaro F, Veronese N, Marotta C, Shin JI, Koyanagi A, Silenzi A, Antunes M, Saracino A, Bavaro DF, Soysal P, et al. Human Monkeypox: A Comprehensive Narrative Review and Analysis of the Public Health Implications. *Microorganisms*. 2022; 10(8):1633. https://doi.org/10.3390/microorganisms10081633
12. Petersen E, Kantele A, Koopmans M, Asogun D, Yinka-Ogunleye A, Ihekweazu C, Zumla A. Human Monkeypox: Epidemiologic and Clinical Characteristics, Diagnosis, and Prevention. Infect Dis Clin North Am. 2019 Dec;33(4):1027-1043. doi: 10.1016/j.idc.2019.03.001. Epub 2019 Apr 11. PMID: 30981594; PMCID: PMC9533922.
13. Cheema AY, Ogedegbe OJ, Munir M, Alugba G, Ojo TK. Monkeypox: A Review of Clinical Features, Diagnosis, and Treatment. Cureus. 2022 Jul 11;14(7):e26756. doi: 10.7759/cureus.26756. PMID: 35967174; PMCID: PMC9365327.
14. Alakunle E, Moens U, Nchinda G, Okeke MI. Monkeypox Virus in Nigeria: Infection Biology, Epidemiology, and Evolution. Viruses. 2020 Nov 5;12(11):1257. doi: 10.3390/v12111257. PMID: 33167496; PMCID: PMC7694534.
15. Vaughan A, Aarons E, Astbury J, Brooks T, Chand M, Flegg P, Hardman A, Harper N, Jarvis R,

Mawdsley S, McGivern M, Morgan D, Morris G, Nixon G, O'Connor C, Palmer R, Phin N, Price DA, Russell K, Said B, Schmid ML, Vivancos R, Walsh
A, Welfare W, Wilburn J, Dunning J. Human-to-Human Transmission of Monkeypox Virus, United Kingdom, October 2018. Emerg Infect Dis. 2020 Apr;26(4):782-785. doi: 10.3201/eid2604.191164. Epub 2020 Apr 17. PMID: 32023204; PMCID: PMC7101111.

16. Zambíano PG, Acosta-España JD, Mosqueía Moyano F, Altamiíano Jaía JB. Sexually oí intimately tíansmitted infections: A look at the cuíient outbíeak of monkeypox in 2022. l'íavel Med Infect Dis. 2022 Sep-Oct;49:102383. doi: 10.1016/j.tmaid.2022.102383. Epub 2022 Jun 14. PMID: 35714856; PMCID: PMC9528244.
17. Sklenovská N, Van Ranst M. Emergence of Monkeypox as the Most Important Orthopoxvirus Infection in Humans. Front Public Health. 2018 Sep 4;6:241. doi: 10.3389/fpubh.2018.00241. PMID: 30234087; PMCID: PMC6131633.
18. McCollum AM, Damon IK. Human monkeypox. Clin Infect Dis. 2014 Jan;58(2):260-7. doi: 10.1093/cid/cit703. Epub 2013 Oct 24. Erratum in: Clin Infect Dis. 2014 Jun;58(12):1792. PMID: 24158414.
19. Gíant R, Nguyen LL, Bíeban R. Modelling human-to-human tíansmission of monkeypox. Bull Woíld Health Oígan. 2020 Sep 1;98(9):638-640. doi: 10.2471/BLl'.19.242347. Epub 2020 Jul 8. PMID: 33012864; PMCID: PMC7463189.
20. Angelo KM, Peteísen BW, Hameí DH, Schwaítz E, Bíunette G. Monkeypox tíansmission among inteínational tíavelleís-seíious monkey business? J l'íavel Med. 2019 Jun 11;26(5):taz002. doi: 10.1093/jtm/taz002. PMID: 30657959; PMCID: PMC6682460.
21. Guínani B, Kauí K, Chaudhaíy S, Balakíishnan H. Ophthalmic manifestations of monkeypox infection. Indian J Ophthalmol. 2023 May;71(5):1687-1697. doi: 10.4103/ijo.IJO_2032_22. PMID: 37203020; PMCID: PMC10391517.
22. Ogoina D, Izibewule JH, Ogunleye A, Ederiane E, Anebonam U, et al. (2019) The 2017 human monkeypox outbreak in Nigeria—Report of outbreak experience and response in the Niger Delta University Teaching Hospital, Bayelsa State, Nigeria. PLOS ONE 14(4): e0214229. https://doi.org/10.1371/journal.pone.0214229.
23. Vaughan A, Aaíons E, Astbuíy J, Balasegaíam S, Beadswoíth M, Beck CR, Chand M, O'Connoí C, Dunning J, Ghebíehewet S, Haípeí N, Howlett-Shipley R, Ihekweazu C, Jacobs M, Kaindama L, Katwa P, Khoo S, Lamb L, Mawdsley S, Moígan D, Palmeí R, Phin N, Russell K, Said B, Simpson A, Vivancos R, Wade M, Walsh A, Wilbuín J. l'wo cases of monkeypox impoíted to the United Kingdom, Septembeí 2018. Euío Suíveill. 2018 Sep;23(38):1800509. doi: 10.2807/1560-7917.ES.2018.23.38.1800509. PMID: 30255836; PMCID: PMC6157091.
24. Rado→ıić A, Mctzgcí S, Kabíowski PW, Co"acQ-Hymann E, Schuenadel L, Kuíth A, Mutz-Rensing K, Boesch C, Leendeítz FH, Nitsche A. Fatal monkeypox in wild-living sooty mangabey, Côte d'Ivoiíe, 2012. Emeíg Infect Dis. 2014 Jun;20(6):1009-11. doi: 10.3201/eid2006.13-1329. PMID: 24857667; PMCID: PMC4036778.
25. Bíown K, Leggat PA. Human Monkeypox: Cuíient State of Knowledge and Implications foí the Futuíe. l'íop Med Infect Dis. 2016 Dec 20;1(1):8. doi: 10.3390/tíopicalmed1010008. PMID: 30270859; PMCID: PMC6082047.
26. https://www.who.int/news/item/14-08-2024-who-diíectoí-geneíal-declaíes- mpox-outbíeak-a-public-health-emeígency-of-inteínational-conceín

27. https://www.cdc.gov/poxviíus/mpox/píevention/píotect-youíself.html
28. Khattak S, Rauf MA, Ali Y, Yousaf MT, Liu Z, Wu DD, Ji XY. The monkeypox diagnosis, treatments and prevention: A review. Front Cell Infect Microbiol. 2023 Feb 6;12:1088471. doi: 10.3389/fcimb.2022.1088471. PMID: 36814644; PMCID: PMC9939471.
29. Cheema AY, Ogedegbe OJ, Munir M, Alugba G, Ojo TK. Monkeypox: A Review of Clinical Features, Diagnosis, and Treatment. Cureus. 2022 Jul 11;14(7):e26756. doi: 10.7759/cureus.26756. PMID: 35967174; PMCID: PMC9365327.
30. Pastula DM, Tyler KL. An Overview of Monkeypox Virus and Its Neuroinvasive Potential. Ann Neurol. 2022 Oct;92(4):527-531. doi: 10.1002/ana.26473. Epub 2022 Aug 18. PMID: 35932225.
31. Ferdous J, Barek MA, Hossen MS, Bhowmik KK, Islam MS. A review on monkeypox virus outbreak: New challenge for world. Health Sci Rep. 2022 Dec 25;6(1):e1007. doi: 10.1002/hsr2.1007. PMID: 36582623; PMCID: PMC9791242.
32. Javelle E, Ficko C, Savini H, Mura M, Ferraris O, Tournier JN, de Laval F. Monkeypox clinical disease: Literature review and a tool proposal for the monitoring of cases and contacts. Travel Med Infect Dis. 2023 Mar-Apr;52:102559. doi: 10.1016/j.tmaid.2023.102559. Epub 2023 Feb 22. PMID: 36809829; PMCID: PMC9946014.
33. Kaler J, Hussain A, Flores G, Kheiri S, Desrosiers D. Monkeypox: A Comprehensive Review of Transmission, Pathogenesis, and Manifestation. Cureus. 2022 Jul 3;14(7):e26531. doi: 10.7759/cureus.26531. PMID: 35928395; PMCID: PMC9345383.
34. Thornhill JP, Barkati S, Walmsley S, Rockstroh J, Antinori A, Harrison LB, Palich R, Nori A, Reeves I, Habibi MS, Apea V, Boesecke C, Vandekerckhove L, Yakubovsky M, Sendagorta E, Blanco JL, Florence E, Moschese D, Maltez FM, Goorhuis A, Pourcher V, Migaud P, Noe S, Pintado C, Maggi F, Hansen AE, Hoffmann C, Lezama JI, Mussini C, Cattelan A, Makofane K, Tan D, Nozza S, Nemeth J, Klein MB, Orkin CM; SHARE-net Clinical Group. Monkeypox Virus Infection in Humans across 16 Countries - April-June 2022. N Engl J Med. 2022 Aug 25;387(8):679-691. doi: 10.1056/NEJMoa2207323. Epub 2022 Jul 21. PMID: 35866746.
35. Sah R, Abdelaal A, Reda A, Katamesh BE, Manirambona E, Abdelmonem H, Mehta R, Rabaan AA, Alhumaid S, Alfouzan WA, Alomar AI, Khamis F, Alofi FS, Aljohani MH, Alfaraj AH, Alfaresi M, Al-Jishi JM, Alsalman J, Alynbiawi A, Almogbel MS, Rodriguez-Morales AJ. Monkeypox and Its Possible Sexual Transmission: Where Are We Now with Its Evidence? Pathogens. 2022 Aug 17;11(8):924. doi: 10.3390/pathogens11080924. PMID: 36015044; PMCID: PMC9414346.
36. Hutson CL, Abel JA, Carroll DS, Olson VA, Braden ZH, Hughes CM, Dillon M, Hopkins C, Karem KL, Damon IK, Osorio JE. Comparison of West African and Congo Basin monkeypox viruses in BALB/c and C57BL/6 mice. PLoS One. 2010 Jan 27;5(1):e8912. doi: 10.1371/journal.pone.0008912. PMID: 20111702; PMCID: PMC2811726.
37. Chen N, Li G, Liszewski MK, Atkinson JP, Jahrling PB, Feng Z, Schriewer J, Buck C, Wang C, Lefkowitz EJ, Esposito JJ, Harms T, Damon IK, Roper RL, Upton C, Buller RM. Virulence differences between monkeypox virus isolates from West Africa and the Congo basin. Virology. 2005 Sep 15;340(1):46-63. doi: 10.1016/j.virol.2005.05.030. PMID: 16023693; PMCID: PMC9534023.
38. Likos AM, Sammons SA, Olson VA, Frace AM, Li Y, Olsen-Rasmussen M, Davidson W, Galloway R, Khristova ML, Reynolds MG, Zhao H, Carroll DS, Curns A, Formenty P, Esposito JJ, Regnery RL, Damon IK. A tale of two clades: monkeypox viruses. J Gen Virol. 2005 Oct;86(Pt 10):2661-2672.

doi: 10.1099/vir.0.81215-0. PMID: 16186219.