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Review Article

Monkey Pox Virus: the Coming Danger in Africa

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Abstract

The zoonotic illness known as monkeypox is brought on by the monkeypox virus, an Orthopoxvirus that belongs to the same genus as the variola, vaccinia, and cowpox viruses. Since the identification of the first human case in the Democratic Republic of the Congo in 1970, the disease has caused sporadic infections and outbreaks, largely limited to certain countries in west and central Africa. The WHO declared monkeypox a Public Health Emergency of International Concern in July 2022 because to the extraordinary global spread of the disease outside of formerly endemic countries in Africa and the necessity for international cooperation to combat this previously overlooked disease. Men who have had intercourse with other men have been diagnosed with the majority of cases of the 2022 pandemic, who frequently report with strange symptoms. Close, intimate contact, including sexual activity, has been primarily associated to the outbreak. The majority of patients in the 2022 outbreak have a systemic illness that includes fever, myalgia, and a distinctive rash with papules that progress to vesicles, pustules, and crusts in the genital, anal, or oral regions and frequently involve the mucosa. The incubation period for the outbreak is seven to ten days. Up to 40% of individuals develop consequences, which may include rectal pain, odynophagia, penile oedema, skin abscesses, and anorectal abscesses, and need for medical intervention (such as antiviral therapy, antibiotics, and pain management). Less than 1% of patients' cases result in death, while the majority of patients have self-limiting illnesses.

Key words: monkeypox, outbreak, vaccine trial.

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Introduction

The monkeypox virus, a zoonotic viral illness, causes a similar rash to smallpox, but compared to smallpox infection, case fatality rates and person-to-person transmission past close contacts are far lower. (1)

In 1958, monkeys imported from Singapore included the first instance of monkeypox, according to Danish authorities. Epidemics in captivity-held monkeys were documented in the USA, the Netherlands, and France throughout the course of the next ten years. In 1970, the Democratic Republic of the Congo saw the discovery of the first case of monkeypox, which affected a 9-month-old boy who was the only member of his family who had not had a smallpox vaccination. Although its long-term efficiency is unknown, the smallpox immunization was origin-

nally thought to be 85% effective in preventing monkeypox . [2]

Between 1981 and 2017, there were multiple outbreaks of the monkeypox virus clade 1 in the Democratic Republic of the Congo, with significant death rates (1-12%).The bulk of these incidents were not laboratory confirmed because to a dearth of adequate local diagnostic resources, the majority of patients being located in outlying, challenging-to-access places, challenges associated with civil unrest, and the current healthcare system. [3]

During this time in West Africa, human monkeypox infections were extremely rare, but in 2017, Nigeria saw a substantial epidemic with 122 PCR-confirmed cases of monkeypox virus clade 2. The gradually increasing prevalence in the Democratic Republic of the Congo was attributed to the withdrawal of the smallpox vaccine in 1980, waning immunity, extensive animal slaughter, and the reintroduction of monkeypox in Nigeria in 2017 . [4]

The USA reported 71 instances of monkeypox in humans in 2003, which drew a lot of worldwide attention. Between 2003 and 2022, a few cases of travel-related illness were reported in Europe, North America, and Asia outside of endemic nations. Due to the extensive transmission of a new monkeypox viral lineage, clade 2b, in newly impacted countries all over the world, a global pandemic was declared a Public Health Emergency of International Concern on May 13, 2022. The disease has different epidemiological and clinical characteristics, according to several clinical research, and as of November 2022, there were over 78 000 cases reported across more than 100 countries. [5]

General characters:

The variola virus, which causes smallpox, the vaccinia virus, which is the virus present in the smallpox vaccine, and the cowpox virus are the orthopoxviruses (double-stranded DNA viruses) that produce monkeypox. A brick-shaped virion with a size between 200 nm and 250 nm may be seen when monkeypox virus-infected cells are viewed under an electron microscope This virion is identical to those of the variola or vaccinia viruses . [6]

The global epidemic of 2022 contains a strange lineage B.1, classified as clade 2b because of its resemblance to clade 2. Contrary to RNA viruses, orthopoxviruses have a low mutation rate (one to two nucleotide changes per year), as a result of their highly stable double-stranded DNA and proofreading DNA polymerase. [7]

However, the divergence of up to 50 single nucleotide polymorphisms reveals a mutation rate 6–12 times higher than anticipated (especially for those associated with APOBEC3 changes). It has been established that the strains responsible for the 2017 outbreak in Nigeria belong to the novel B.1 lineage. As a cellular defense mechanism, the human protein APOBEC3 causes errors to be incorporated into the viral genome, which makes mutations of this kind indicative of considerable human-to-human transmission. [8]

Pathogenesis

The viruses that cause monkeypox can enter the body by either the skin or the respiratory system. The spread of the disease may be influenced by the environment in where it was first discovered as well as the monkeypox virus . [9]

The monkeypox virus only infects the keratinocytes, fibroblasts, and endothelial cells of the skin, causing a lengthy and cytopathic sickness. Similar susceptibility to infection exists in the airway epithelial cells of the respiratory system. . [10]

Furthermore, the infection is deadly, allowing antigen-presenting cells to remain long enough to deliver antigens to draining lymph nodes, including macrophages, dendritic cells, and (in the skin) Langerhans cells. In the cytoplasm of the host cell, viral replication, gene expression, and virion assembly all take place to produce virion maturation. [11]

The monkeypox virus travels from the site of infection to draining lymph nodes, where antigen-presenting cells migrate, through direct viral access to lymphatic channels and lymphatic vascular migration. The monkeypox virus can target other large organs, such as the spleen and the liver, where it amplifies and causes a second major viraemia wave, which may then allow the virus to further spread to distant organs like the lung, kidneys, intestines, and skin After initially replicating in the lymph nodes and causing a low-grade primary viraemia. [12]

Cellular and humeral immune responses that are produced in infected people stop the monkeypox

virus from reproducing and offer long-lasting protection. Following a natural infection with monkeypox or vaccination against the vaccinia virus, the body produces orthopoxvirus-specific IgM and IgG antibodies against a variety of antigen targets, as well as long-lasting residual IgG-memory B cells that protect against re-infection or the onset of severe disease. Only 50% of people still have protective levels of neutralizing antibodies 20 years after receiving the vaccination, despite the fact that certain memory B cells can persist for a number of years following inoculation. Cross-protective immunity to monkeypox is predicted to deteriorate over time in a similar manner. [13]

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Transmission

Also possible is transfer from both people and animals. Despite the virus having been found in a range of rodents and non-primate mammals in Africa (including rope squirrels, tree squirrels, Gambian rats, dormice, and monkeys), the specific animal reservoir of the monkeypox virus is still unclear. The disease is believed to have unintentional hosts that include both people and monkeys . [16]

The risk from non-invasive exposures to infected animals (such as caressing the animal, cleaning its cage, or gathering or processing its meat) is higher than the risk from being bitten or scratched by an infected animal.The possibility that the monkeypox virus may sporadically infect people while still being a zoonotic threat has increased as a result of the discovery of several zoonotic spillovers into human populations through genomic research . [17]

The monkeypox virus can spread through respiratory secretions, direct contact, vertical transmission, percutaneous transmission, or indirect contact with fumites. [18]

Respiratory transmission occurs when large respiratory droplets from the transmitter host make contact with the oral and nasal mucosal membranes of the receiver host. Prolonged face-to-face contact, such as that which takes place in the household, is probably necessary for transmission to happen through this channel .Direct contact with infected sores or lesions on mucosal surfaces has been the primary mechanism of transmission throughout the 2022 outbreak. While engaging in sexual activity, a hole in the recipient's skin or mucosa, such as microscopic abrasions that arise during sexual contact, may make it simpler for the monkeypox virus to spread. [19]

Monkeypox virus DNA is virtually always detectable in skin samples taken during the 2022 outbreak, but less frequently and in lower amounts are found in other body areas. For example, only 20% of blood and urine samples, 60% to 70% of anus and throat samples, 50% of semen samples, and 60% to 70% of blood and throat samples contain monkeypox viral DNA. [20]

Though the risk has not been examined at various stages of pregnancy, congenital monkeypox can sporadically arise by vertical transmission to the fetus. During the outbreak in 2022, at least 12 pregnant women fell ill, but vertical transmission was never discovered. Some of this disparity may be explained by the fact that clade 1 is more invasive than clade 2. [21]

Population at risk

In the past, exposure to monkeypox in African nations has been linked to male gender, age under 15, being under 15, and proximity to squirrel habitats. In a survey of 528 cases from 16 countries in 2022, 98% of the patients with monkeypox were men who engaged in high-risk sexual activity, and many of them identified this as a potential risk factor. Some of the patients have admitted to participating in group or off-site sex sessions, having multiple or anonymous sexual partners in the last two weeks, and using recreational substances while engaging in sexual activity . [22]

Children, expectant mothers, immunocompromised people, particularly those with uncontrolled HIV infection, and citizens of African countries were more likely to experience serious illness. However, among the few children, teenagers, and expectant women who contracted the illness during the 2022 outbreak, there haven't been any serious incidents or bad neonatal outcomes. (23)

Clinical presentation

Patients with monkeypox linked to the outbreak in 2022 present clinically differently than in earlier reports. The incubation time for the monkeypox virus infection was typically 5–13 days (range: 4–21) prior to the epidemic in 2022. People who have already experienced a tactile exposure, such as being bitten or scratched by an animal, may experience an earlier incubation period (9 days vs. 13 days, respectively). The usual incubation period during the 2022 outbreak lasts 7 to 10 days after exposure. Sexual transmission that results in direct virus injection may be the cause of the reduced incubation time . (24)

After a rash, systemic symptoms like fever, exhaustion, myalgia, and headache—which may be more widely spread or restricted to the lymph catchment area—appear.

Symptomatic features of the rash

Progression There were some lesions that developed concurrently in various phases, thus they did not all progress from one stage to the next in a straight line. Phases progress sequentially one after the other.usually only affecting one to three locations on the body, but occasionally affecting more than three

The perianal region (34–44%), oropharyngeal region (14–43%), trunk (25–57%), arms and legs (50–60%), face (20–39%), genitalia (55–61%), and palms or soles (0–10%) are the locations.The perianal (unrecorded), oropharyngeal (38%), genitalia (67-68%), arms and legs (81-91%), face (96-98%), and palms (28-55%) were among the other body parts examined. (25)

Outcome

Complications A secondary bacterial infection (3-4%), conjunctivitis (1%), sore throat (17-36%), penile oedema (8-16%), proctitis (1-25%), and rectal pain (14-36%). difficulties swallowing caused by tonsillar or pharyngeal ulcers (5–14%). Skin lesions (19%), bronchopneumonia (12%), sepsis (1%), encephalitis (0•4%), keratitis (0•4%), and retropharyngeal abscess (0•4%) are all examples of secondary bacterial infections. (26)

Diagnostic investigations

Based on likely epidemiological and clinical evidence, nucleic acid amplification testing (NAAT), such as real-time or conventional PCR tests, is utilized to confirm monkeypox diagnoses . (27)

The clinical management of the condition includes both the use of antivirals that are effective against the monkeypox virus and general supportive care. In the 2022 outbreak, about half of the victims needed medication (for things like oral or anogenital sores). Proctitis has also been treated with warm baths and oral antihistamines, while pruritus has been treated with topical lidocaine and stool softeners. Catheterization may occasionally be necessary as part of supportive care for patients who need more intensive pain management, those with severe disease or sequelae, and those who are dehydrated or at risk of becoming dehydrated . (28)

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In order to get enough viral DNA, the lesion must be swabbed properly. Although a throat swab can be examined for the monkeypox virus using DNA technology, this is rarely carried out in a clinical environment. Despite certain blood samples having significant NAAT readings, the clinical relevance of viraemia is unknown. (31)

Serological testing for the monkeypox virus may be performed to support the diagnosis of monkeypox if NAAT testing is not practical. IgG in paired serum samples (collected at least 21 days apart, with the first sample being taken during the first week of sickness) or IgM in patients who are acutely ill (4–56 days after the rash first emerged) can be used to make a diagnosis. individuals who have. Additional clinical specimens, such as skin biopsies, should only be used for diagnostic testing in certain clinical situations. The histological

characteristics of monkeypox and those of smallpox, vaccinia, cowpox, herpes simplex virus, and varicella are distinct despite being somewhat similar. [32]

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A rectal MRI should be performed as part of the assessment if a rectal wall perforation is suspected. Some patients can develop tonsillitis or ulcerative pharyngitis in addition to having a sore throat and difficulty swallowing. The group's outcome suffered as a result of these symptoms. Monkeypox may have been the root of the problem, according to a quick streptococcus test. [34]

Treatment

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There have been no randomized or nonrandommized studies performed to ascertain the effectiveeness of any antiviral medications in treating monkeypox. Effective therapies for monkeypox include tecovirimat (intravenous and oral), cidofovir (intravenous and topical), and brincidofovir (oral). It is anticipated that these antivirals will be effective against monkeypox. They received their smallpox treatment license based on safety evaluations in both healthy subjects and animal models. [36]

Vaccination

ACAM2000, a replication-competent smallpox vaccine, and IMVANEX, a live, non-replicating vaccine (also known as JYNNEOS or IMVAMUNE; Bavarian Nordic, Heller bjerg, Denmark), are the only second- and third-generation vaccines that are currently licensed. The smallpox vaccine was created using medical technology from three distinct eras. [37]

These can be used either before exposure (preferably within four days of exposure) to protect those who are most susceptible to infection and disease, or after exposure (ideally within four days of exposure), to improve the outcomes of infection and disease Live, unattenuated vaccinia virus is the major component of first-generation vaccinations like Dryvax from Wyeth Laboratories, Madison, NJ, USA (now a division of Pfizer). It was proven to be effective at preventing the condition . [38]

The replication-deficient modified vaccinia Ankara (MVA) was used to generate the third-generation vaccine known as IMVANEX. In non-human primates, the vaccination induces potent humoral and cellular immune responses as well as clinical resistance against dangerous and severe monkeypox infections. Human clinical effectiveeness testing for monkeypox are still pending. The highest concentrations of neutralizing antibodies were seen in healthy human volunteers. [39]

The third-generation vaccine known as IMVANEX was produced using the replication-deficient modified vaccinia Ankara (MVA). The immunezation produces strong humoral and cellular immune responses in non-human primates, as well as clinical protection to harmful and serious monkeypox infections. Trials on humans are currently being conducted to determine whether monkeypox is successful. In healthy human volunteers, levels of neutralizing antibodies peaked. [40]

Disease control

The national health authorities in nations with endemic disease, like Nigeria and the Democratic Republic of the Congo, developed detailed disease control programs.

A few of the regional capacities that were developed to implement efficient local interventions include enhancing research efforts, acquiring laboratory diagnoses, and carrying out concentrated epidemiological studies in high-risk areas . [41]

Even if these vaccinations are made available, many countries are unable to control the spread of disease or implement a thorough immunization program due to a lack of vaccine availability. In the west and central African woodland regions where zoonotic spillover frequently causes epidemics, risk groups may need to be targeted for immunization in order for vaccination to be effective. Understanding how increased sexual transmission affects regional is also crucial . (42)

In order to prevent an outbreak of monkeypox in 2022, the current recommendations do not advocate widespread immunization of the populace; instead, they rely on surveillance, contact tracing, and vaccination of high-risk populations. As a result, intervention focusing in significant groups would be necessary for newly impacted countries. The epidemiology of this newly emerging virus may evolve over time, although early interactions with males who have sex with men may have been influenced by social, environmental, or biological variables. Particularly interesting are heterosexual people's sexual networks and limited settings like jails, dorms, and schools. (43)

The United States and Europe have started mobilizing their smallpox immunization stocks in response to the concepts covered above. On the other hand, the WHO has not yet started distributing the vital strategic supplies for the smallpox epidemics in Africa. The WHO has explicitly committed to a coordinated response to the monkeypox emergency in 2022, including the elimination of the difference between endemic and non-endemic nations, despite the severe discrepancy in access to vaccines. (44)

Why monkeypox represent a new threat?

Due to vaccine delays, the trade in exotic animals, worldwide travel, and a rise in human sensitivity, the MPXV was able to spread to new locations. The ongoing outbreak, which has more than 10,000 cases in more than 50 countries between May and July 2022, demonstrates that MPXV can spread rapidly among people and may as a result be a significant public health concern with major worldwide ramifications.

Here, we review the present understanding of this reemerging virus, talk about potential preventative strategies to reduce its pathogenicity and dissemination, and assess the harm it could potentially cause to the general populous as a potential threat to all populations, but particularly to the African population. (45) غير مذكور

Conclusions

The widespread smallpox vaccination program contributed to the disease's eradication and the averting of millions of fatalities. Keypoxmon virus (MPXV) is a close relative of the Variola (smallpox) virus. Due of antigenic similarities, smallpox vaccines cross-protect against MPXV. On the other hand, more than 70% of those who are still alive today have never had smallpox immunization. Monkeypox (MPX) symptoms include fever, headache, muscle pains, lymphadenopathy, and a visible rash that develops into papules, vesicles, and pustules before eventually scabbing over and recovering. MPX has a lower fatality rate (case fatality rates ranging from 1% to up to 11%) than smallpox (up to 30%).

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