

The emergence of Monkeypox Virus: its complications, connection with smallpox and its future aspects - a short review

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Abstract

Monkeypox Virus (MPXV), a zoonotic orthopox DNA virus related to the smallpox virus, was first identified in humans in 1970. The World Health Organization (WHO) declared monkeypox an “evolving hazard of moderate public health concern” on 23 June 2022. Case reports included in this study showed that all patients with typical rashes and risky sexual behaviour should be encouraged to seek immediate medical attention. If a patient has had sexual contact, a diagnosis of monkeypox should be considered even if the patient does not travel to other countries. According to authentic proof from Africa, smallpox immunization is at least 85% successful at avoiding monkeypox. Given the inadequate health infrastructure in Low and Middle-Income Countries

(LMIC), it would be extremely challenging to implement vaccination as a regular component of immunization programs. Patients with monkeypox may experience complications, including bacterial superinfection, encephalitis, pneumonia, and conjunctivitis/keratitis. Seldom-recorded complications incorporate bronchopneumonia, spewing, and corneal scarring, leading to lasting visual deficiency. Lowering the risk of transmission from person to person, reducing the risk of zoonotic transmission, preventing monkeypox by limiting the trade in animals, engaging the LGBTQIA community, and vaccination may reduce and control monkeypox.

Introduction

Monkeypox Virus (MPXV), a zoonotic orthopox DNA virus related to the smallpox virus, was first identified in humans in 1970, in the Democratic Republic of the Congo. Africa has had sporadic illness outbreaks, usually brought on by contact with wildlife reservoirs (mainly rodents). Human-to-human transmission has been ruled ineffective due to the low secondary spread of such episodes and travel-related infections outside Africa. The World Health Organization (WHO) declared monkeypox an “evolving hazard of moderate public health concern” on 23 June 2022 due to more than 3000 infections with the MPXV being reported since early May 2022 in more than 50 nations across five regions.^{1,2} All sequenced viral genomes recovered from monkeypox patients in Belgium, France, Germany, Portugal, and the United States closely resemble the monkeypox strain found in West Africa, with a low case fatality rate of less than 1%. However, known strains found in Central Africa have a mortality rate of up to 10%.³

The incubation period was measured as part of a surveillance program in 1980. The time between exposure and the beginning of the rash varied from 12 to 16 days, and these intervals ranged from 10 to 14 days. Headache, backache, malaise, and prostration were all symptoms of fever. Around 84% of people acquired rash between one and three days after their fever started, 4% during their fever, and 12% after three days. The time between the commencement of the fever and the rash appeared longer than in people who were not immunized. Like smallpox, there was an asymptomatic time between exposure to the infectious agent and developing a fever.⁴ Ten African nations and four other nations have reported human cases of monkeypox to date. The United States of America, where an epidemic broke out in 2003, and Nigeria, where the disease recurred for the first time in 40 years, are two examples. The number of cases has at least tenfold increased since the 1970s. The median age at which symptoms first appeared changed from 4 years old in 2010 to 21 years old in 2019. This may have something to do with the smallpox vaccine's end. This prevented central mortality, and monkeypox was made up of 3.6 percent of the West African group and 10.6 percent of the African

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group. Monkeypox is slowly becoming a global issue (Figure 1; Table 1).

Materials and Methods

The quick reference guide

This review was guided through the five steps of the Evidence-Informed Decision-Making (EIDM) process, which used rapid review steps. We used the Health Evidence™ tool to locate and access relevant research evidence, assess its methodological value, and summarize the results.⁵

Search strategy

The key search terms “monkeypox,” “immunity,” and “smallpox” were defined using a combination of various study disciplines and the quick review research questions. The search terms now include the words “immunity,” “complication,” and “vaccine,” as well as their synonyms. In addition, the search was made more accurate and impartial by the use of wildcards.⁵

The following is the final search string: “monkeypox connection against smallpox” and “vaccination against monkeypox” were the search key words. PubMed, Cochrane, Google Scholar, and Scopus Library were the four databases used for the literature search. Due to the lack of publications on the relationship between smallpox and monkeypox, we added Google Scholar and Scopus to provide broader coverage of the grey literature. PubMed and the Cochrane Library also provided adequate coverage of peer-reviewed articles. In addition to conducting a literature search, they used a snowball search to find sources for review articles.⁵

Eligibility criteria

We restricted the literature to English-language sources. It included articles on the emergence of the MPXV, its complications, and its relationship to smallpox; theses and review papers released before September 2022; and studies carried out in developed and developing nations using the World Bank checklist. In addition, we took data from publications that describe the history of monkeypox or smallpox, its progression, and complications experienced by patients.

Data extraction

Two independent reviewers from the university fraternity read the articles to ensure they were appropriately chosen. The two reviewers reached an 85% agreement on the final list of publications that require additional data extraction. Each of the studies selected for the survey contained cases of monkeypox complications and their link to smallpox. The strength of the evidence determined the level of quality.⁶

Results of the literature search

Two independent reviewers reviewed the articles from the university fraternity to ensure fairness. Both reviewers agreed on the final list of publications for additional data extraction by 85%. In addition, they rated the quality according to the strength of the evidence.

Inclusion criteria

Original monkeypox articles that met the requirements were included.

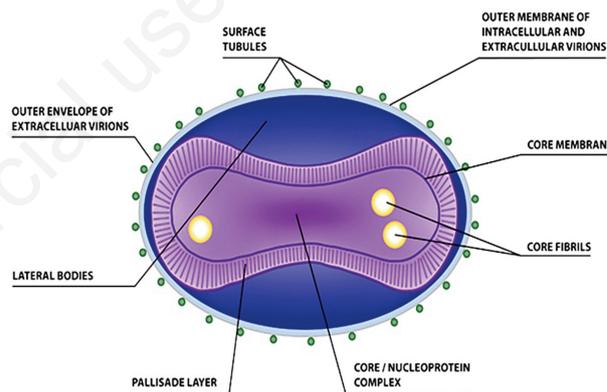


Figure 1. Monkeypox virus structure.

Table 1. Relationship between Smallpox and Monkeypox.

Monkeypox	Smallpox
Differences	
· Spread by contact with an infected individual, but less contagious.	· Spread by contact with an infected individual, but much more contagious.
· Symptoms are more severe.	· Symptoms are more severe.
· Large lymph nodes present on diagnosis.	· Large lymph nodes absent on diagnosis.
Similarities	
· The orthopox virus causes smallpox and monkeypox.	· The orthopox virus causes smallpox and monkeypox.
· The illness is self-limiting and has symptoms that last between two and four weeks. These frequently include skin lesions, fever, rashes, headaches, body aches, enlarged lymph nodes etc.	· The illness is self-limiting and has symptoms that last between two and four weeks. These frequently include skin lesions, fever, rashes, headaches, body aches, enlarged lymph nodes etc.
· A skin lesion sample is required for a PCR test to confirm a case of monkeypox.	· A skin lesion sample is required for a PCR test to confirm a case of monkeypox.
· Since monkeypox and smallpox are genetically similar, the same medications may be used for treatment.	· Since monkeypox and smallpox are genetically similar, the same medications may be used for treatment.

Exclusion criteria

Studies that employed several different therapies (multiple intervention studies), non-tribal studies, and effectiveness studies were all disqualified. To ensure fairness, the university fraternity's articles were reviewed by two independent reviewers. Consequently, the final list of publications for additional data extraction was agreed upon by both reviewers by 85% (Figures 2, Figure 3).

Diagnosis

Skin rashes such as chickenpox, measles, bacterial skin contamination, scabies, syphilis, and drug-related sensitivities ought to be considered within the clinical differential diagnosis. Besides, lymphadenopathy within the prodromal arrange of the malady makes a difference in recognizing monkeypox from chickenpox or smallpox by its clinical highlights.

If monkeypox is suspected, an appropriate sample should be taken and transported to a skilled laboratory. The confirmation of monkeypox is based on example sort and quality and research facility tests. Therefore, international, national, and local regulations must be followed when shipping and packaging samples. Polymerase Chain Reaction (PCR) is the most accurate and efficient clinical test. Skin lesions, especially vesicles, pustules, and dry scab roofs, are monkeypox's most useful diagnostic specimens. A biopsy is a choice on the off chance that it is conceivable. Injury examples should be put away dry and refrigerated in sterile tubes without a viral transport medium. Regarding sample collection after the onset of symptoms, PCR blood testing is usually inconclusive due to the short duration of viremia and should only be performed occasionally in patients.⁷

Antigen and antibody detection methods are ineffective against the MPXV because the Orthopox Virus (OPXV) exhibits serological cross-reactivity with the MPXV. When resources are limited, serological and antigen detection methods should be used for something other than case investigation or diagnosis (Table 2).⁷⁻¹¹

Recent outbreak (2023-24)

The WHO detailed cases of monkeypox contamination on May 13, 2022, in 12 nations where the infection isn't endemic. By June 15, 2022, there were 2027 confirmed cases in 36 countries.¹² The UK Health Security Agency (UKHSA) is urging people at risk of pox to get vaccinated following a rise in cases. The latest figures show ten new infections were diagnosed in London between April 30 and May 25, 2023. Half of those were unvaccinated, and in two cases, those infected had only received one dose of the vaccine that can protect against the disease. So far, 20 cases have been recorded in the UK this year. At its peak last year, mpox - previously known as monkeypox - was infecting 350 people per week, with the majority of cases amongst men who have sex with men.¹³

Discussion

The immunizations (vaccinia virus-based antibodies) being assessed for utilization to anticipate MPXV were made for smallpox. Given the inadequate health infrastructure in Low and Middle-Income Countries (LMIC), it would be highly challenging to implement vaccinia vaccination as a regular component of immunization programs.¹² Additionally, there are numerous known adverse side effects of the licensed Dryvax vaccine, and immuno-compromised people should not receive it.¹⁴

Epidemiological proof proposes that earlier smallpox immu-

nization gives at least halfway assurance against extreme MPXV disease, which is upheld by immunological thinking about smallpox antibodies. Remaining Immunoglobulin (IgG) and neutralizing antibodies have appeared to endure in immunized people. Smallpox vaccines target a broad spectrum of viral particles and induce both humoral and cellular responses to OPXV, including MPXV, which interferes with viral replication.¹⁵

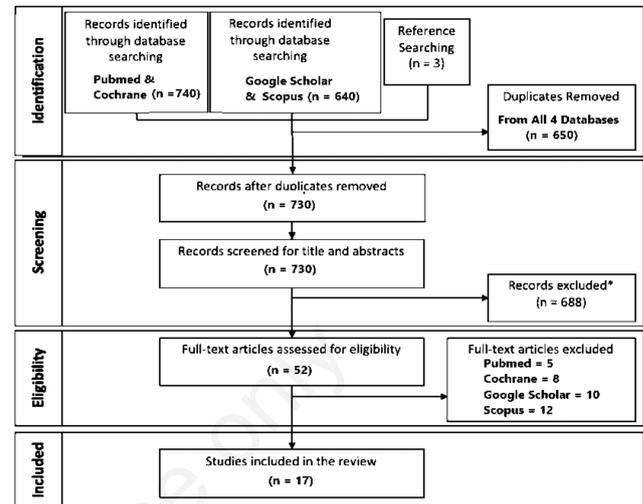


Figure 2. Flowchart: study selection & data collection.

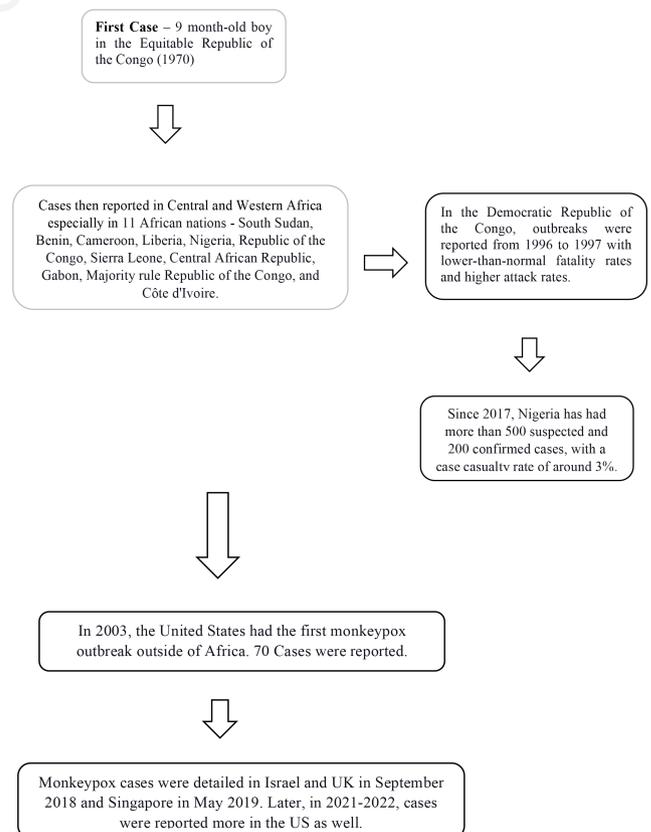


Figure 3. A flowchart on the outbreak of Monkeypox.

Table 2. Case reports on Monkeypox.

Year of outbreak and period	Region	Cases	Any other comment
September 2017	Yenagoa River near government offices in Bayelsa state in southern Nigeria, near Abia State	Case 1 caused blistering injuries two days after his arrival, and the whole family remained confined throughout her 1-week intake. Two days later, the Open Wellbeing UK Rare Imported Pathogens Laboratory confirmed a West African group with monkeypox infection using PCR and sequencing on testing of urine and skin swabs taken that day.	26 states reported 262 suspected cases, 115 affirmed cases, and seven passings.
September 7 th 2018	Naval base in Cornwall, in the southwest of Britain.	Case 2 had a fever, lymphadenopathy, and a crotch. The impulsive had spread to the middle, confront, and arms, and the persistent was confined in his quarters after a moment examination.	N/A
September 12 th 2018	West African group in Blackpool Educating Healing centers	18 months child reliably had premature monkeypox injury 19 days after the onset of the indication for case 1. Monkeypox infection was confirmed by PCR testing of injured swab	N/A

Patients with serious bacterial diseases and sepsis are more likely to be involved in these issues. Case reports included in this study showed that all patients with typical rashes and risky sexual behaviour, especially those who have travelled to countries where monkeypox cases have been reported or who have recently had partners with the same clinical symptoms, should be encouraged by health officials and doctors to seek immediate medical attention. If a patient has had sexual contact, a diagnosis of monkeypox should be considered even if the patient did not travel to other countries. Autonomous and internally approved symptomatic therapy with Z95 infectivity and Z90% specificity was used to detect clinical monkeypox contamination, post-smallpox vaccination 13, 29, and 48. We saw three previously unreported cases of monkeypox in a 20-year-old pre-immune patient. More importantly, cross-protective antiviral resistance to West African monkeypox can persist for decades after smallpox vaccination.¹⁶

Monkeypox infection is closely related to the disease that causes smallpox, so smallpox antibodies can protect people from monkeypox. Previous information from Africa suggests that smallpox vaccination is at least 85% effective in preventing monkeypox. The JYNNEOS survival against monkeypox was concluded from the clinical evaluation of JYNNEOS immunogenicity and survival information from animal studies.¹⁶

Monkeypox infection was confirmed in 54 individuals, all Men who have Sex with Men (MSM), with a mean age of 41 years (Interquartile Range, IQR, 34-45). Of the 54, 38 (70%) were Caucasian, 26 (48%) were born in the UK, and 13 (24%) were living with Human Immunodeficiency Virus (HIV). Of the 54 subjects, 36 (67%) reported weakness or laziness, 31 (57%) reported detailed fever, and 10 (18%) had no prodromal adverse events. All patients had skin lesions, 51 (94%) of which were anogenital. Of the 54 subjects, 37 (89%) had skin lesions affecting multiple anatomical sites, and 4 (7%) had oropharyngeal injuries. Thirty of the 54 (55%) had lymphadenopathy. One in four patients had a concurrent STI. Five of the 54 (9%) required consent to a healing center, primarily because of pain or localized bacterial cellulitis requiring antibiotic treatment or lack of pain.¹⁷

Conclusions

Given the similarity between the smallpox and MPXV, getting the smallpox vaccine before coming into contact with monkeypox can help avoid infection. The smallpox vaccine prevents monkeypox at least 85% of the time. According to doctors, vaccination after exposure to monkeypox may also help prevent the sickness or minimize its severity and stop the disease from starting. Immunological studies of the smallpox vaccine provide more evidence that past smallpox vaccination offers at least partial protection against severe MPXV infection.

Future aspects

Indeed, even though MPXV episodes have been subsiding for months, specialists see that the chances of resurgence remain owing to the fact that the infection still circulates within African nations. A preliminary examination by the US Centers for Illness Control and Evasion found that unvaccinated people were 14 times more at risk of getting monkeypox. A likely situation is that the infection remains at a generally low level, with intermittent episodes “nearly only” among men who have sex with men, the ECDC said. Monkeypox might melt away or indeed be completely disposed of. Monkeypox is much less infectious than COVID, and does not transform into other variations as rapidly. However, “the

more cycles of disease there are, the more likely monkeypox is to alter and adjust” said Dr. Carlos Maluquer de Bits, leading virologist and poxvirus expert.¹⁸

Scientists hope the new name, “mpox,” which the WHO has suggested as a new name, will help de-stigmatize monkeypox. They have asked nations to forego the original term in favor of the new one. However, the request is arriving late in the United States. The outbreak has been slowly decreasing here for months, and many Americans have forgotten about it.¹⁸

Tests and treatments for the virus are becoming more readily available after a sluggish and erroneous early rollout; over 1,000,000 portions of the two-shot Jynneos smallpox immunization have tracked down their direction into arms. Two of the first cities in the nation to declare mpox a public health emergency last summer, San Francisco and New York, have since allowed those orders to expire; Illinois and New York have also done so. “I think this is the final stage,” says Caitlin Waterways, a sickness disease transmission specialist at the Johns Hopkins Community for Wellbeing Security.¹⁸

However, the “final stage” doesn’t imply “over” — and pox will accompany us for years. Only now are we beginning to see the long, odious tail of the US outbreak: 15 cases per day is not zero cases per day; inequalities are increasing despite a decrease in the number of new infections. Black and Latino people account for the majority of new cases of mpox, and while their rates of infection are three to five times higher than those of white Americans, they have received significantly fewer vaccines.¹⁹

The development and distribution of effective vaccines, such as JYNNEOS, have shown promise in preventing and mitigating MPVX infections. However, there remain critical uncertainties regarding dosing, safety, indications, and contraindications that require further research. Nucleic-acid-based vaccines offer a potential alternative, especially in situations of vaccine supply shortages.²⁰

Hidden infections can become fast-spreading ones. Monitoring an infectious disease is far more accessible when the people at risk have insurance coverage and access to savvy clinicians and are inclined to trust public health institutions. “That’s predominantly white people,” says Ace Robinson, the CEO of the Pierce County Acquired Immunodeficiency Syndrome (AIDS) Foundation, in Washington. Lastly, addressing the MPVX outbreak and future viral threats demands a multifaceted approach encompassing research, vaccine development, strengthening healthcare systems, and global cooperation. The current crisis serves as a stark reminder of the need for sustained vigilance, investment in public health infrastructure, and a commitment to science-based solutions for safeguarding global health.¹⁷

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