# Epidemiology of Monkey Pox (MPOX) and its Rehabilitation

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## Abstract

Monkeypox (Mpox) is a zoonotic viral disease caused by the monkeypox virus (MPXV). MPXV belongs to the genus Orthopoxvirus containing two genetic clades, clade I and clade II. The transmissions happened through direct contact with infected individuals, contaminated materials and animals. The symptoms such as fever, fatigue, swollen lymph nodes and rash evolving to vesiculopustular lesions. Severe complications like secondary infections as well as mucosal tissue's inflammation have been reported. Diagnostic methods include real time PCR. Through vaccinations the preventions against monkeypox can be done. The revival of Mpox linked to vanish the immunity from discontinued smallpox vaccination. It highlights the critical need for enhancement of surveillance, global collaboration and equitable healthcare access. Proactive interventions include improved diagnostics and its targeted vaccinations. Its therapeutic researches are essential to mitigate its global impact. Close contact with an infected person or animal can disseminate MPXV, which is transmitted from animals to humans and has the potential to spread globally. Even in countries with no known epidemiological ties to endemic African regions, the virus can find pathways to transmission.

**Keywords:** Monkeypox, Monkeypox virus (MPXV), Proctitis, post-exposure prophylaxis (PEP), Zoonotic disease

## Introduction

### Monkeypox (MPOX)

Mpox is a zoonotic disease. Monkeypox is a viral illness caused by monkeypox virus a species of the genus Orthopoxvirus (Alakunle et al., 2020). There are two distinct clades of virus: clade I and clade II. Within 2022-2023, global outbreak of Mpox caused due to clade II strain (Alakunle et al., 2020).

- Mpox continues to be a threat today due to clade I and clade II.
- There are vaccines for Mpox. Vaccination should be taken with public health carefulness.
- Monkeypox cause rashes on skin, mucosal lesions, muscle aches and swollen lymph nodes (Konings et al., 2021).
- Monkeypox can be transmitted through close contact with someone who has mpox, with contaminated material or with infected animals (Durski et al., 2019).
- During pregnancy the virus may be passed to the fetus during or after birth (Reynolds et al., 2006).
- Mpox is treated with supportive care for symptoms such as pain and fever with close attention to nutrition, hydration, skin care, prevention of secondary infections and treatment of co-infection including HIV (Yink et al., 2018).

### Epidemiology of Monkey pox

Monkeypox can be diagnosed by Real time PCR. Through this technique, MPXV clades can be differentiated from Orhtopoxviruses (Li Y et al., 2010). Immunity to MPXV was previously conferred through small pox vaccination but the discontinuation of this vaccination has left populations more susceptible leading to resurgence of MPXV cases (Simpson et al., 2020). Since early 2022 monkeypox cases have been reported worldwide with the World Health Organization (WHO) declaring a multi country outbreak on May 13, 2022. By 13 June 2022, 1,423 confirmed cases were recorded in 31 non-endemic countries, primarily in Europe, with no deaths (Doty et al., 2017; Reynolds et al., 2019). Monkeypox is zoonotic, but its animal reservoir is unknown. Rodents like tree squirrels and Gambian pouched rats are likely reservoirs, while African apes and monkeys are potential intermediate hosts. Various animals, including prairie dogs and rabbits are susceptible to infection in captivity (Tesh et al., 2004; Reynolds et al., 2019). Table 1 highlights the classification of MPXV.

**Table. 1** Classification of MPXV

| Classification | Details | References |
|---|---|---|
| **MPXV Genetic Diversity** | Classified into two clades: "West African" and "Central African" (Congo Basin) | (Likos et al., 2005) |
| **Geographic Nomenclature** | Geographic names discouraged to avoid stigma, as emphasized during the SARS-CoV-2 outbreak | (Konings et al., 2021) |
| **Current Outbreak** | Linked to the "West African" clade but labels are misleading due to Limited surveillance and diagnostic Capacity. | (Likos et al., 2005) |
| **Global Spread** | In May 2022, MPXV was circulating in over 44 countries suggesting its presence in many more | (Duque et al., 2022) |
| **Recommendation** | A non-discriminatory nomenclature is essential for accurate classification and communication. | (Konings et al., 2021) |

## Morphology

MPXV virions are distinct, brick- or ovoid-shaped particles measuring approximately 200–250 nm, characterized by a corrugated lipoprotein outer membrane that provides structural integrity and protection (Duque et al., 2022). This outer membrane encases a complex core structure that houses a double-stranded DNA genome (~197 kb), various enzymes, and transcription factors essential for viral replication and gene expression. The core, often appearing biconcave in electron microscopy images, is flanked by lateral bodies on either side, although this appearance is partly influenced by imaging artifacts (Beer et al., 2019). The lateral bodies are believed to house proteins essentials for initiating infections such as those responsible for viral uncoating and early manipulation of host cells (Odom et al., 2009).

## Monkeypox virus's life cycle

The replication process involves sequential synthesis of early intermediate and late proteins on host ribosomes with late protein forming IMVs (Intracellular Mature Virions) (Hughes et al., 2021). Some IMVs are converted into intracellular enveloped viruses which are released through actin polymerizations (Khanna et al., 2017). Proteins such as COG4, COG7, VPS52 and VPS54 play essential roles in replication cycle making them potential targets for antiviral strategies (Hsiao et al., 2019). Fig. 1 shows the replicative cycle of MPXV.

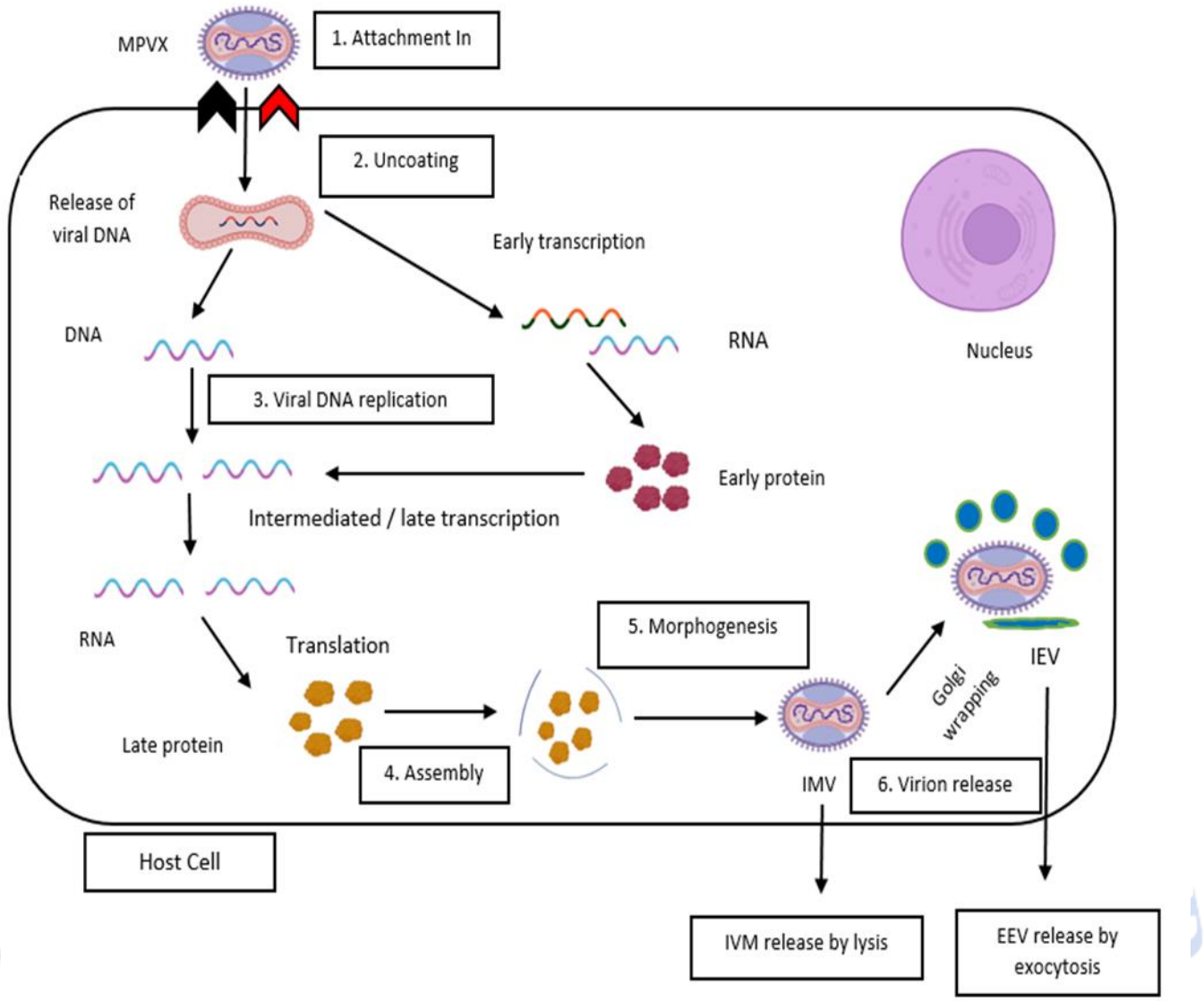


**Fig. 1: Life Cycle of MPXV**

## Clinical Profile

Traditional MPXV infections usually begin with general symptoms like fever, fatigue, headache, muscle pain and swollen lymph nodes. These initial signs are typically followed by the development of painful or itchy maculopapular rash that progress to vesiculopustular lesions. The rash often starts on the face, spreading to trunk, limbs, palm and soles (Minhaj et al., 2022). The disease generally lasts 2 to 4 weeks and has low fatality rate. However, the current outbreak has shown a marked change in how virus presents. Rashes are present on the particular parts of the body such as mouth, genitals and anus (Beer et al., 2019).

## Evolving Complications and Diagnostic Challenges of MPXV

Serious complications, such as inflammation of the rectum (proctitis), urethra (urethritis), and glans penis (balanitis), along with secondary bacterial infections, have been observed in some cases, emphasizing the importance of timely medical care (Hsiao et al., 2019).

## Clinical Features of MPXV

The persons having MPXV outbreaks have some critical clinical features such as high fever, rashes, asthenia, fatigue, headache, enlarged lymph nodes, myalgia and genital necrosis (Eltvedt et al., 2020).

## Epidemiology of MPXV

Epidemiology of MPXV Clade I evolve mainly from Zoonotic origin. It's a sporadic human to human transmission that occurred only within households (Minhaj et al., 2022). Sexual transmission of MPXV clade I was observed during an outbreak investigation in Kwango province during March 2023 (Saxena et al., 2023). The prevalence of MPXV were recorded in September 4, 2023. There were 89,752 confirmed cases of MPXV infection resulting in 157 fatalities including 113 countries that have substantial infectiousness and various complications related to health (Minhaj et al., 2022).

## Transmission

Monkeypox is a viral infection that can be transmitted by close contact with an infected person or animal or by touching contaminated objects. It includes skin to skin contact with an MPXV infected persons. The clothes or surfaces that are contaminated with the viruses also transferred the disease. When the animals that have MPOX virus bite the persons and sometimes the uncooked meat which have virus could be the source of this disease. The virus can be passed to the baby during pregnancy or after birth. Transmission of MPXV is thoroughly explained in Fig. 2 (Eltvedt et al., 2020).

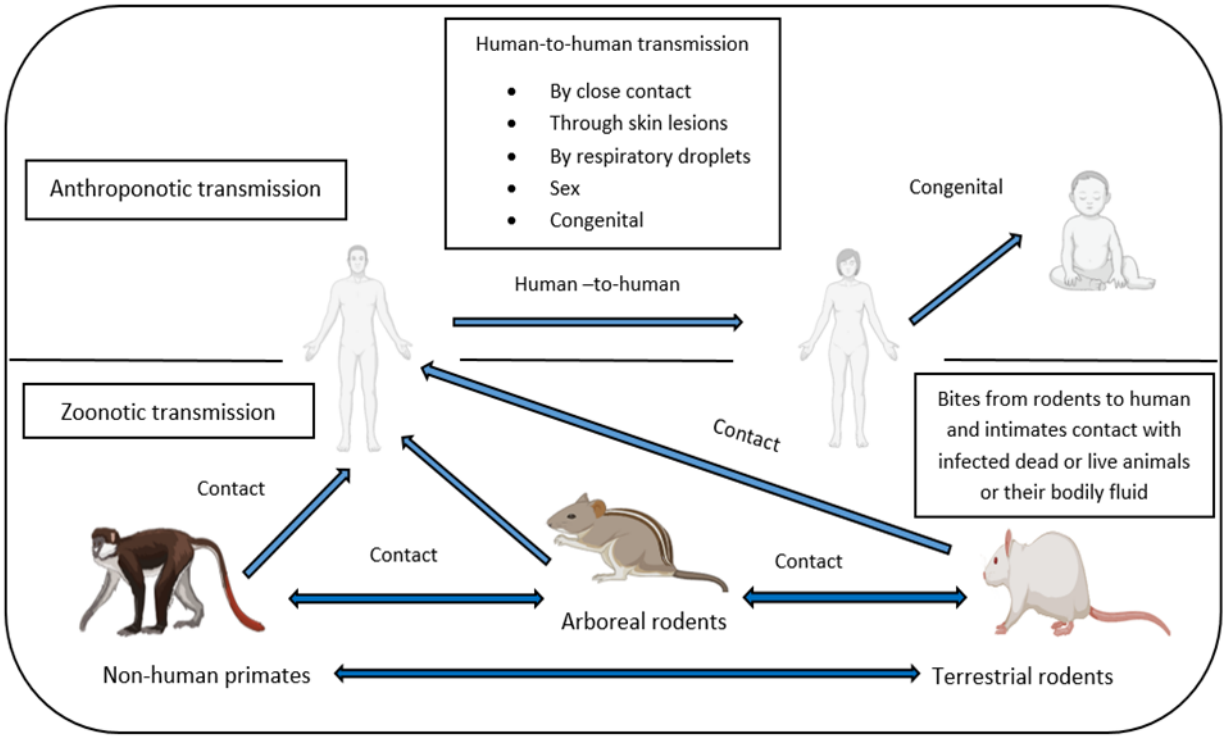


**Fig. 2: Mode of Transmission of MPXV**

## Laboratory diagnosis

Through genetic, phenotypic and immunological methods the collected samples of monkeypox can be diagnosed. The gold standard is polymerase chain reaction (PCR) but it requires high-quality labs which are scarce in low-resource countries. Upcoming technologies aim to make PCR more accessible. Immunological tests can help but cross-reactivity with other

orthopoxvirus may complicate diagnoses. A detailed medical history including travel and vaccination history aids in diagnosis but is not definitive. Improved diagnostic methods are needed in resource-limited areas (Alakunle et al., 2020).

**Prevention:** Most monkeypox patients recover without treatment though rehydration is needed for gastrointestinal symptoms. Antivirals for smallpox may help but have undefined efficacy. Two smallpox vaccines JYNNEOS and ACAM2000 are about 85% effective against monkeypox. JYNNEOS has fewer risks and is safer for immunocompromised individuals and pregnant women. The ACIP recommends pre-exposure vaccination for those at risk of occupational exposure (Adler et al., 2022). Fig. 3 shows current monkeypox PEP strategies.

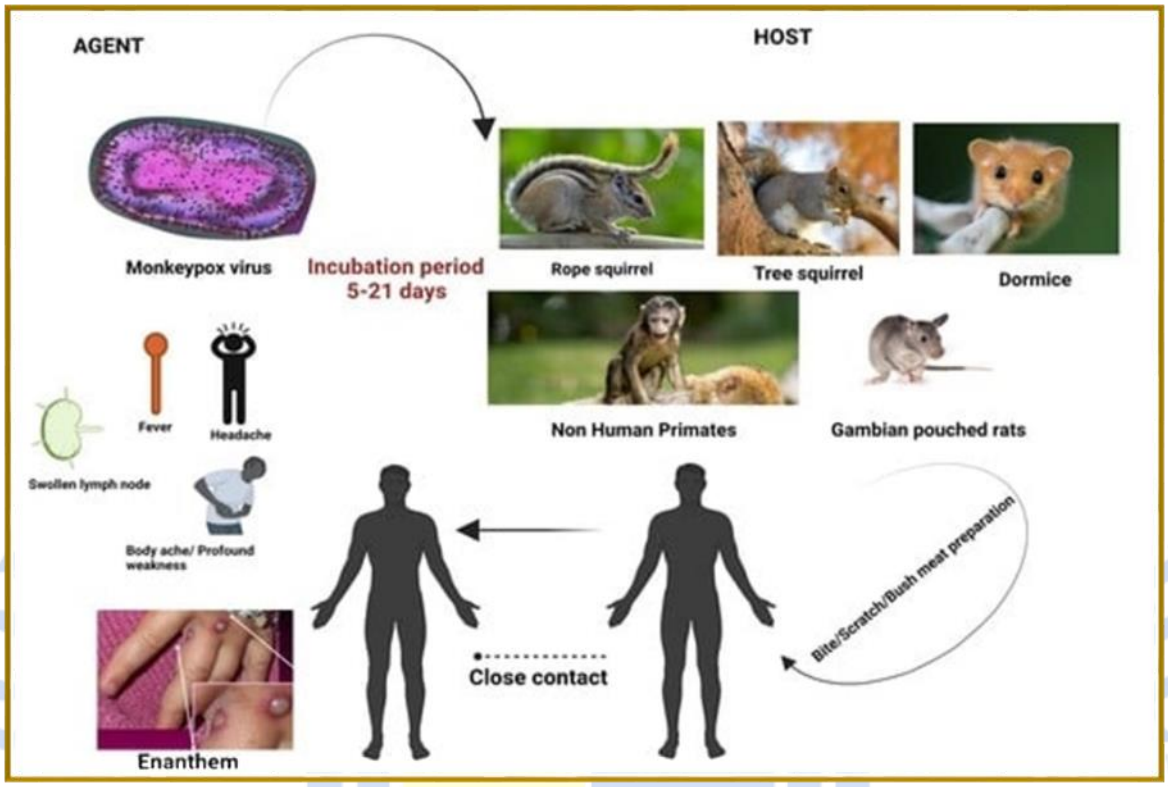


**Fig. 3: Representation of Current Monkey pox PEP Strategies**

## Treatment

Monkeypox treatment includes supportive care and antivirals like such as Tecovirimat, Cidofovir and Brincidofovir though their efficacy remains unproven in humans. Pain management, rehydration and wound care are essential with antibiotics prescribed for secondary infections. Tecovirimat is preferred for severe cases but is available only under emergency authorization. Cidofovir display potential but have safety concerns particularly nephrotoxicity. Research continues on improving treatment options especially for immunocompromised patients (Rizk et al., 2022).

## Conclusion

Close contact with an infected person or animal can disseminate MPXV, which is transmitted from animals to humans and has the potential to spread globally. Even in countries with no known epidemiological ties to endemic African regions, the virus can find pathways to transmission. This underscores the importance of global surveillance, proactive measures, and targeted interventions, such as post-exposure prophylaxis (PEP) and ring vaccination strategies, to halt its spread.

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