

# Monkeypox: The Next Global Health Crisis

Mrs. Shilpa Amit Shinde<sup>1</sup>, Mr Sanket Dnyaneshwar Sonar<sup>2</sup>, Miss Payal Pushkar Zope<sup>3</sup>, Miss. Ekta N. Kolhe<sup>4</sup>, Mr Ujwal Pramod Wankhede<sup>5</sup>, Mr Pintu Basi<sup>6</sup>

*R S.C. Institute of Pharmacy Kolhapur<sup>1</sup>*

*R C Patel Institute of Pharmaceutical Education and Research, Shirpur<sup>2</sup>*

*Hon'ble loksevak Madhukarrao College of pharmacy faizpur<sup>3</sup>*

*TVES Institute of Pharmacy, Faizpur<sup>4</sup>*

*Shri vile Parle kelwani mandals institute of pharmacy dhule<sup>5</sup>*

*LNCT University Bhopal MP<sup>6</sup>*

**Abstract - The ongoing multinational outbreak of monkeypox in 2022 is the largest ever recorded outside of Africa. Monkeypox is an emerging zoonotic disease that has long been recognized as an infectious threat with significant epidemic potential due to the rising frequency of human outbreaks in recent years. As public health agencies strive to control the current outbreak, healthcare professionals are increasingly focused on understanding the diverse clinical presentations and management strategies for this infection. This review provides an overview of monkeypox for healthcare providers, informed by the ongoing global outbreaks.**

**Keywords: Monkeypox, Poxviridae, Chordopoxvirinae, Antigen Rapid Test, orthopoxvirus**

## NOVELTY FOR MONKEYPOX

Monkeypox is a zoonotic disease caused by the monkeypox virus, which belongs to the Orthopoxviral genus, the same family as the variola virus responsible for smallpox. Due to this close genetic relationship, there is a significant cross-reactivity between the immune responses elicited by the smallpox vaccine and monkeypox.

Historically, smallpox vaccines have been shown to provide protection against monkeypox. The smallpox vaccine contains live vaccinia virus, which is similar enough to the monkeypox virus that it can prompt an immune response capable of recognizing and combating monkeypox. This cross-protection is particularly important because, after the global eradication of smallpox, routine smallpox vaccinations were discontinued, leading to a growing population susceptible to monkeypox.

In the context of therapeutic interventions, antiviral medications developed for smallpox, such as tecovirimat, have also demonstrated efficacy against monkeypox. Tecovirimat works by inhibiting a protein essential for the virus's replication and dissemination. Because of the similarity between the two viruses, these drugs are being repurposed and tested for their effectiveness in treating monkeypox infections. In summary, the biological similarities between monkeypox and smallpox allow the use of smallpox vaccines and antiviral therapies as potential preventive and therapeutic strategies against monkeypox. This relationship underlines the importance of leveraging existing medical countermeasures for emerging infectious diseases within the same virus family.

## INTRODUCTION

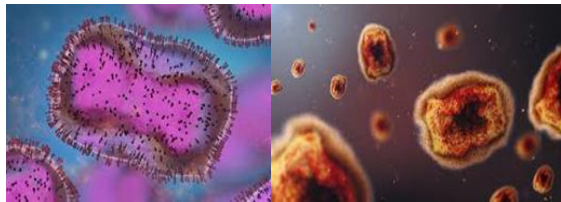
Monkeypox is a virus that is transmitted to humans from animals, presenting symptoms similar to those historically observed in smallpox patients, though it is less severe in clinical manifestation. The monkeypox virus is a member of the Orthopoxvirus genus within the Poxviridae family.

Earlier this month, the World Health Organization (WHO) declared the recent monkeypox outbreak a global health emergency. Approximately 16,000 cases of monkeypox have been reported across 75 countries and territories, with the current fatality rate ranging from 3% to 6%. A recent study revealed that 95% of monkeypox cases between April and June 2022 occurred during sexual contact between men. Currently, two vaccines are available to help protect against monkeypox.

Human monkeypox was first identified in 1970 in the Democratic Republic of the Congo in a 9-month-old boy from an area where smallpox had been eradicated in 1968. Since that time, most cases have been reported in rural, rainforest regions of the Congo Basin, particularly in the Democratic Republic of the Congo, with increasing reports of human cases from central and west Africa. Globally, the detection of over 16,000 monkeypox cases has led the WHO to declare the outbreak a global health emergency. Monkeypox is a viral zoonotic disease with symptoms resembling those of smallpox, though it is less severe clinically.

**Etiology**

- Subfamily: Chordopoxvirinae
- Genus: Orthopoxvirus
- Species: Monkeypox virus



Under electron microscopy, the monkeypox virus is notably large, measuring approximately 200-250 nm. Poxviruses are brick-shaped, enveloped by a lipoprotein membrane, and contain a linear double-stranded DNA genome. The monkeypox virus is an enveloped double-stranded DNA virus belonging to the Orthopoxvirus genus within the Poxviridae family. There are two distinct genetic clades of the monkeypox virus: the Central African (Congo Basin) clade and the West African clade. The Congo Basin clade has historically been associated with more severe disease and is considered more transmissible.

➤ **Epidemiology**

Monkeypox (MPX) is a zoonotic disease (a disease that is transmitted between animals and humans) and is currently the most prevalent orthopoxvirus infection in humans following the eradication of smallpox and the cessation of global smallpox vaccination. Monkeypox gained significant global public health importance after 2003, following the first outbreak in the USA linked to infected pet prairie dogs. Since 2003, numerous cases of monkeypox have been reported in various countries, with the largest outbreak occurring in Nigeria in 2017. The Centers for Disease

Control and Prevention (CDC) continues to monitor cases of monkeypox worldwide.

**Case of Monkeypox in the world**

Country	Confired Case	Country	Confired Case
Benin	3	Uk	793
Cameroon	3	Israel	13
Congo	2	Singapur	1
Nigeria	41	Denmark	13
Brazil	11	Farnce	277
Germany	511	Hungry	7
Italy	85	Mexico	11
Netherlans	167	America	142
Portugal	317	Lebanon	1
Slovenia	8	Ireland	24
Spain	520	Blegium	77
weden	13	Chile	3
Total			3,043

**Taxonomy of Monkeypox**

Microorganim	Virus
Kingdom	Bamfordvirae
Realm	Varidnaviria
Phylum	Nucleocyotoviricota
Class	Pokkesviricetes
Order	Chitovirales
Family	Poxviridae
Genus	Orthopoxvirus
Species	Monkeypox virus

➤ **Transmission**

The monkeypox virus is believed to have multiple modes of transmission, all associated with direct contact with infected animals or humans. Human infections are typically linked to contact with animals, but identifying the exact exposure in a human case can be challenging, particularly in regions where contact with animals is common through household rodent infestations, hunting, or the preparation of various species for consumption.



Exposure to the excreta of infected animals is a significant risk factor in endemic regions of Africa, where limited resources and infrastructure often lead people to sleep outside, on the ground, or live near or visit forests where infected animals are more prevalent.

The pathogenesis and pathophysiology of monkeypox begin with the transmission of the virus, whether through animal-to-human transmission or human-to-human transmission.

➤ Signs and Symptoms

Common (Nonspecific) Symptoms:

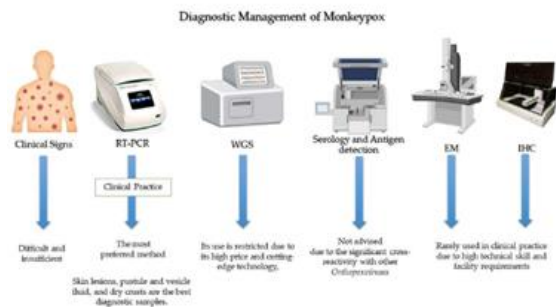
Fever	Headache	Myalgia	Backache	Lymphadenopathy
Chills	Exhaustion	Rashes	Mouth Ulcers	Throat Ulcers

➤ Complications

Bacterial superinfection	Corneal infection/permanent scarring	Bronchopneumonia
Sepsis and septic shock	Cellulitis	Respiratory distress
Encephalitis	Dehydration	

Monkeypox can spread from the onset of symptoms until the rash has healed, all scabs have fallen off, and a new layer of skin has formed. The illness typically lasts 2-4 weeks.

➤ Diagnosis



It is crucial to maintain a high index of suspicion for monkeypox infection, particularly given the atypical presentations observed in the ongoing 2022 outbreak. When monkeypox is clinically suspected, healthcare providers should inquire about the patient's sexual history and any contact with individuals confirmed to have monkeypox. Behaviors such as close contact, sharing the same room, eating or drinking from the same container, or living in the same household should also be explored.

Monkeypox Antigen Positive:

➤ Antigen Rapid Test Procedure for Monkeypox

- 1) Screw up the cap of the bottle of buffer, precisely dispensing all buffer into the extraction tube.
- 2) After the collection of sample from skin lesions with thin swab, the swab inserted into the extraction tube, the swab dive up and down in the fluid for a minimum of 10 seconds. the swab held against the bottom of the tube, three times turned. The liquid should not be soaked out of the tube.
- 3) The swab taken out while pinching the sides of the tube to extract the liquid from the swab. The nozzle cap pressed tightly onto the extraction tube. Mixed thoroughly by swirling or flicking the bottom of the tube.
- 4) Softly squeezed the tube's hard body, two drops were dispensed of the buffer-specimen mixture into the sample well on the monkeypox antigen test cartridge.
- 5) Read the test results between 15 and 20 minutes. Do not check the results after 20 minutes.

➤ Monkeypox Antigen Negative

A coloured band appears on the control line (C line); no coloured band shows up on the test line. A negative result indicates there is no presence of monkeypox antigen in the specimen, or the level of monkeypox antigen is below the detection limit.

Therapy	Mechanism of Action	Formulation & Typical Dosing	FDA Approval Status	Side Effects and Adverse Events
Cidofovir	Blocks viral DNA synthesis through competitive inhibition DNA polymerase	IV topical, intravesicular 5 mg/kg per Dose once doses (with concomitant probenecid)	CMV retinitis in patients with AIDS [1] (1996)	Nephrotoxicity; neutropenia; decreased intraocular pressure, nausea, vomiting

Brincidofovir	Lipid conjugate prodrug of cidofovir	Oral; 4 mg/kg once weekly for 2 doses (max 200mg/dose)	Smallpox (2021) [2]	Abdominal pain, nausea, vomiting, diarrhea, elevated liver transaminases and bilirubin
Tecovirimat	Inhibits activity of the protein VP37, which prevents creation of virion that can be released from an infected host cell, thereby preventing replication and dissemination within the host	IV: 35 to <120 kg: 200 mg q12 hours ≥120 kg: 300 mg q12 hours Oral: 40 to <120 kg: 600 mg q12 hours ≥120 kg: 600 mg q8 hours All regimens for 14 days	Smallpox (2018) [3]	IV: pain and swelling at infusion site; extravasation at infusion site; headache [86] Oral: headache, abdominal pain, nausea, vomiting
VIGIV	Passive immunity through OPXV-specific antibodies collected from pooled human plasma of persons immunized with smallpox vaccine	Iv; 6000 units/kg as a single dose (up to 9000 units/kg) Dose can be repeated depending upon symptoms	Complications of vaccinia vaccination (progressive vaccinia, severe generalized vaccinia, etc) (2005) [4]	Infusion reaction; local injection-site reaction (contraindicated in persons with IgA deficiency and Possible IgA hypersensitivity)

A coloured band become visible on the control line (C line), a second coloured band.

### PATIENT EDUCATION

1) Avoid direct skin-to-skin contact with individuals who have a rash, and steer clear of objects and materials used by someone with monkeypox. Do not use eating utensils or cups that have been used by a person with monkeypox. Avoid handling or touching the bedding or clothing of an individual with monkeypox.

2) Wash your hands frequently

Regularly wash your hands with soap and water, or use an alcohol-based hand sanitizer, especially before eating, touching your face, or after using the restroom. Avoiding contact with contaminated bedding and other materials used by an infected person can reduce the risk of transmission. Recognizing monkeypox symptoms, particularly in individuals with a relevant travel history, is crucial. Important areas include specimen collection, infection control procedures at home and in healthcare settings, clinical recognition, and the characteristic rash associated with monkeypox.

Preventive measures and potential treatments for monkeypox should be emphasized, as well as monitoring those who have been exposed to the virus. Public health messages should stress the importance of wearing protective gloves and other equipment when in contact with an infected person or animal. Individuals should also wash their hands thoroughly after touching infected animals or people and ensure that meat is thoroughly cooked to prevent contamination or infection.

### CONCLUSION

Although monkeypox is not yet widespread, the warning signs are concerning. As there is currently no vaccine specifically for this disease, it is important to recognize its seriousness. Monkeypox is a viral zoonosis (a virus transmitted to humans from animals) with symptoms similar to those previously seen in smallpox patients, though it is less severe. With the eradication of smallpox in 1980 and the subsequent cessation of smallpox vaccination, monkeypox has emerged as the most significant orthopoxvirus for public health. Initially found in central and west Africa, often near tropical rainforests, monkeypox is increasingly being reported in urban areas. Animal hosts include various rodents and non-human primates. The characteristics of this disease, its implications, and the risks it poses to human life, along with details about the virus and its species, are discussed in detail. Scientists are optimistic that a newly developed vaccine will soon offer a cure for this disease.

### REFERENCE

- 1) Website World health organization introduction of monkeypox Available at <https://www.who.int/news-room/factsheets/detail/monkeypox>
- 2) Website Medical News Today. Monkeypox : Why it is now a health emergency ,and how to avoid infection Available at <https://www.medicalnews-today.com/articles/monkeypox-why-it-is-now-a->

health-emergency-and-how-to-avoid-infection#Whatis-monkeypox?

3) Website Mint e-paper Available at <https://www.livemint.com/news/india/delhireports-1st-case-of-monkeypox-total-4-casesnow-in-india-11658648513514.htm>

4) Research paper Alakunle E, Moens U, Nchinda G, Okeke MI. Monkeypox Virus in Nigeria: Infection Biology, Epidemiology, and Evolution. *Viruses*. 2020 Nov 05;12(11)

5) Website World health organization. Available at <https://www.who.int/newsroom/factsheets/>

6) Website European Central for Disease Prevention and Control Available at <https://www.ecdc.europa.eu/en/newsevents/epidemiological-update-monkeypoxmulti-country-outbreak>

7) Website Monkeypox. (2022). Accessed: June 22, 2022:<https://www.who.int/newsroom/factsheets/detail/monkeypox>.

8) Since 2003, several cases of monkeypox have been reported in various countries with the largest outbreak experienced in Nigeria in 2017.

9) Website Central for disease Control and prevention 2022 global map & case count. (2022). Accessed: July 1, 2022 <https://www.cdc.gov/poxvirus/monkeypox/response/2022/>

10) Research paper McCollum AM, Damon IK Human monkeypox. *Clin Infect Dis*. 2014, 58:260-710.1093/cid/cit703

11) Research paper Bunge EM, Hoet B, Chen Lienert Weidenthaler H, Baer LR, Steffen R: The changing epidemiology of human monkeypox—a potential threat? A systematic review. *PLoS Negl Trop Dis*. 2022, 16:e0010141

12) Research paper Microbiology and molecular biology Reviews Available at Joklik WK:

13) Website Microbiology and molecular biology Reviews Available at Joklik WK: The poxviruses. *Bacteriol Rev*. 1966, 30:33- 66. 10.1128/br.30.1.33-66.1966 <https://www.cdc.gov/poxvirus/monkeypox/symptoms.html>

14) Research paper Bunge EM, Hoet B, Chen L, et al. The changing epidemiology of human monkeypox-a potential threat? systematic review.

15) Research paper Monkeypox: diagnostic testing From:UK Health Security Agency. Published 24 May 2022. Last updated 1 August 2022

16) Research paper Reynolds MG, McCollum AM, Nguete B, Shongo Lushima R, Petersen BW.

Improving the Care and Treatment of Monkeypox Patients in Low-Resource Settings: Applying Evidence from Contemporary Biomedical and Smallpox Biodefense Research.

17) Website Central For Disease Control and prevention Available at <https://www.cdc.gov/poxvirus/monkeypox/prevention/protect-yourself.html>

18) Website MD Medindia monkeypox Available at <https://www.medindia.net/patients/patientinfo/monkeypox.htm>

19) Website MD Medindia monkeypox Available at <https://www.medindia.net/patients/patientinfo/monkeypox.htm>