



सत्यमेव जयते
Ministry of Health & Family Welfare
Government of India



A Comprehensive Learning Guide

MPOX (Monkeypox)



**NATIONAL CENTRE FOR DISEASE CONTROL
DIRECTORATE GENERAL OF HEALTH SERVICES**
Ministry of Health & Family Welfare, Government of India



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National Centre for Disease Control
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स्वास्थ्य सेवा महानिदेशक

DIRECTOR GENERAL OF HEALTH SERVICES



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स्वास्थ्य एवं परिवार कल्याण मंत्रालय
स्वास्थ्य सेवा महानिदेशालय

Government of India
Ministry of Health & Family Welfare
Directorate General of Health Services



Message

Zoonotic diseases pose a significant and ongoing threat to biodiversity, human and public health and economic stability. Given India's diverse ecosystem, high population density and increasing human-animal action, the country remains particularly susceptible to zoonotic outbreaks. Past occurrences of plague, Nipah virus, avian influenza, leptospirosis, and Kyasanur Forest Disease emphasizes a critical need for robust surveillance, early detection, and a coordinated, intersectoral response.

Recognizing the importance of addressing zoonotic diseases as a public health priority, the Centre for One Health, under the National Centre for Disease Control (NCDC), is committed for strengthening surveillance, prevention, and response mechanisms through an integrated One Health approach. As part of this effort, the Centre for One Health has developed comprehensive learning guides on Priority Zoonotic Diseases. These modules provide scientifically validated, evidence-based guidance on the epidemiology, diagnosis, treatment, and prevention of key zoonotic diseases.

Strengthening disease surveillance, ensuring early diagnosis, and implementing timely interventions through a coordinated and multi-sectoral approach are critical to mitigating the risks associated with zoonotic diseases.

I am pleased to release these learning guides as a significant step in our ongoing efforts to combat zoonotic diseases. I urge all healthcare professionals, veterinary experts, and community leaders to actively utilize these resources to enhance their clinical index of suspicion for zoonosis and eventually contribute towards strengthening our health care system for responding timely and more efficiently to future outbreaks.

(Atul Goel)



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MESSAGE

It is my pleasure to know that the Centre for One Health at NCDC has prepared **Comprehensive Learning Guides** on 10 priority zoonotic diseases, which is now being shared with all concerned.

These resources become relevant in considering; India has encountered multiple zoonotic disease outbreaks in recent years, highlighting their persistent and evolving threat to public health. The re-emergence of **Nipah virus** in Kerala, **Kyasanur Forest Disease (KFD)** in Karnataka, and **avian influenza** across several states underscores the complex interconnections between human, animal, and environmental health. The rising cases of **leptospirosis** and **scrub typhus**, driven by climatic changes and ecological disruptions, further illustrate the unpredictable nature of zoonotic spillovers. With the additional challenges posed by **emerging coronaviruses** and **antimicrobial resistance (AMR)**, there is an urgent need for a **cohesive, evidence-based approach** to mitigate these risks effectively.

In recognition of this pressing need, the **National Centre for Disease Control (NCDC)** has intensified its efforts to fortify **zoonotic disease surveillance, outbreak preparedness, and intersectoral coordination**. As part of this initiative, the **Centre for One Health, NCDC**, has meticulously curated **Comprehensive Learning Guides** on priority zoonotic diseases. These guides, underpinned by the latest scientific insights and global best practices, serve as indispensable resources for **healthcare professionals, veterinarians, and epidemiologists**, equipping them with the knowledge to anticipate, detect, and mitigate zoonotic threats with precision.

To effectively curtail the impact of zoonotic diseases, a **harmonized One Health approach** is paramount—one that transcends disciplinary boundaries and fosters synergies across the human, animal, and environmental health sectors. I urge all stakeholders to **leverage these scholarly resources, enhance disease intelligence networks, and champion research-driven interventions**. By embracing a proactive and interdisciplinary ethos, we can **bolster pandemic preparedness, fortify national health security, and avert future spillover events**.

I sincerely **appreciate** my colleagues at the Centre for One Health, NCDC for their dedication to strengthening zoonotic disease control. Their efforts in enhancing surveillance, preparedness, and public health response are crucial in preventing and managing emerging health threats.

I am glad to see their commitment translating into evidence-based interventions and capacity-building initiatives that enhance zoonotic disease surveillance, outbreak preparedness, and overall health system resilience.

Through continuous innovation, collaboration, and unwavering dedication, we can fortify our health systems and safeguard our nation against zoonotic threats.

Wishing you all happy learning and skill enhancement wherever possible.

रंजन दास 19/3/25

Prof. (Dr.) Ranjan Das



Antibiotic resistance Containment Stewardship: Our Role, Our Responsibility
Judicious Use of Antibiotic: Key to Contain Antibiotic Resistance





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Message

Zoonotic diseases of public health importance continue to pose significant challenges to public health. These diseases, often driven by intricate human-animal-environment interactions, present substantial health risks, particularly to vulnerable populations, and demand a coordinated and robust response from the health sector.

In recognition of the pivotal role healthcare providers play in addressing these challenges, the **Centre for One Health** has developed a **Comprehensive Learning Guide for Priority Zoonotic Diseases**. This guide is designed to build capacity across the health sector, equipping professionals with the essential knowledge and skills needed to identify, manage, and prevent these diseases effectively. By enhancing surveillance systems, fostering rapid and accurate diagnostics, and implementing targeted prevention and control measures, healthcare providers can play a transformative role in mitigating the impact of zoonotic diseases.

The guide emphasizes the importance of building a resilient health workforce capable of responding to outbreaks, engaging communities, and collaborating across disciplines. Through these efforts, we aim to reduce the burden of zoonotic diseases, improve health outcomes, and contribute to the creation of a safer and healthier future.

I encourage all healthcare professionals to utilize this guide as a resource for improving their understanding and response to zoonotic diseases. Together, let us strengthen our health systems and work towards a future free from the threats posed by zoonotic diseases.

Dr. Simmi Tiwari
Joint Director and Head
Centre for One Health



Antibiotic Resistance Containment Stewardship: Our Role, Our Responsibility
Judicious Use of Antibiotic: Key to Contain Antibiotic Resistance



Acknowledgement

The **Comprehensive Learning Guide** for Mpox (Monkeypox) has been developed to address the significant public health challenges posed by zoonotic diseases, which have serious health, economic, and social implications, particularly for vulnerable populations. The priority zoonotic diseases necessitate robust surveillance, timely diagnosis, and effective prevention and control measures. This guide aims to strengthen the capacity of healthcare professionals by equipping them with the requisite knowledge and skills to mitigate these public health threats and improve health outcomes.

We acknowledge with deep appreciation the valuable contributions of the **subject matter experts** from leading medical institutions and research organizations, whose guidance and technical expertise has been critical in shaping this **Comprehensive Learning Guide**.

The Centre for One Health, NCDC, expresses its sincere gratitude to Ms. Punya Salila Srivastava, Secretary, Health and Family Welfare, Government of India; Ms. L.S. Changsan, Additional Secretary, Ministry of Health and Family Welfare, Government of India; Prof. (Dr.) Atul Goel, Director General of Health Services (DGHS), Government of India; Ms. Latha Ganapathy, Joint Secretary, Department of Health & Family Welfare, Government of India for their leadership, guidance, and support.

Lastly, we acknowledge the USAID-funded RISE project team, implemented by Jhpiego, for their technical support in drafting and finalizing this guide. Their collaboration has been pivotal in ensuring the quality and relevance of this resource.

Dr. Simmi Tiwari
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Preface

Mpox, more commonly known as **Mpox** and abbreviated as **MPOXV**, is a viral zoonosis with symptoms similar to those seen in smallpox in the past, although clinically less severe (a virus transmitted to humans from animals). With the proclamation of the eradication of smallpox in 1980 and the cessation of smallpox vaccination, Mpox has become a rare disease, especially in Central and West Africa. Mpox is seen in Central and West Africa, usually in rural areas close to tropical rainforests, but in recent years there have been case reports from urban areas as well.

Mpox is a self-limiting illness with symptoms that usually last 2-4 weeks. Severe cases may occur. Recently, the fatality rate has been highest in cases in Central Africa, 10%, in West Africa 1%, where the disease is rare in other geographical areas it is below 1%.

Animal hosts that play a role in the spread of the virus are rodents and primates. Various animal species have been identified as susceptible to Mpox virus. This includes rope squirrels, tree squirrels, Gambian pouched rats, dormice, non-human primates and other species. Uncertainty remains on the natural history of Mpox virus and further studies are needed to identify the exact reservoir(s) and how virus circulation is maintained in nature. Vaccines used against smallpox also provide protection against Mpox. An antiviral agent developed for the treatment of smallpox is also licensed for the treatment of Mpox.

There are two distinct genetic clades of the Mpox virus: the central African (Congo Basin) clade and the West African clade. The Congo Basin clade has historically caused more severe disease and was thought to be more transmissible. The Clade I b was found predominantly during the recent outbreak in 2024.

This scientific module aims to equip learners with the knowledge and tools necessary to educate and train individuals involved in various aspects of Mpox management. It provides a comprehensive overview of the disease, covering its epidemiology, clinical presentation, laboratory diagnosis, treatment options, and preventive measures.

The module is structured in a user-friendly manner, allowing learners to effectively communicate complex scientific concepts to their audience. It contains detailed explanations to enhance understanding and engagement. The content is supported by the latest scientific research and public health guidelines, ensuring the information presented is accurate and up to date.

It is our sincere hope that this module will serve as a valuable resource for learners and educators, enabling them to grasp essential knowledge and skills. By equipping professionals and individuals at risk with the necessary information, we can enhance our collective ability to detect, prevent, and respond to Mpox outbreaks, thereby safeguarding public health.

We hope you find this module informative, engaging, and ultimately, empowering. Together, let us work towards building a safer and healthier future by combating Mpox through knowledge and preparedness.

Abbreviations

ACMS	Awareness, Communication, and Social Mobilization
AST	Aspartate Aminotransferase
CBC	Complete Blood Count
CDC	Centers for Disease Control and Prevention
CSO	Civil Society Organization
CSU	Central Surveillance Unit
DADF	Department of Animal Husbandry, Dairying and Fisheries
DGI	Disseminated Gonococcal Infection
DRC	Democratic Republic of Congo
DSU	District Surveillance Unit
EDTA	Ethylenediaminetetraacetic Acid
ELISA	Enzyme-Linked Immunosorbent Assay
ESR	Erythrocyte Sedimentation Rate
GOI	Government of India
HIV	Human Immunodeficiency Virus
HSV	Herpes Simplex Virus
ICMR	Indian Council of Medical Research
ICAR	Indian Council of Agricultural Research
IGG	Immunoglobulin G
IGM	Immunoglobulin M
IDSP	Integrated Disease Surveillance Programme
IPC	Infection Prevention and Control
KFT	Kidney Function Test
LFT	Liver Function Test
MOA	Ministry of Agriculture
MOEF	Ministry of Environment, Forest and Climate Change
MOHFW	Ministry of Health and Family Welfare
MPXV	Monkeypox Virus (same as MPOX)
MPOX	Monkeypox Virus (MPOXV)
NAAT	Nucleic Acid Amplification Test
NACO	National AIDS Control Organization
NIAB	National Institute of Animal Biotechnology
NIV	National Institute of Virology
OPD	Outpatient Department
OPXV	Orthopoxvirus
PCR	Polymerase Chain Reaction
PHIEC	Public Health Emergency Operations Centre
PHO	Public Health Officer
PHEIC	Public Health Emergency of International Concern
POE	Points of Entry
PPE	Personal Protective Equipment
RPR	Rapid Plasma Reagin (syphilis test)
RC	Research Centre

RTI	Reproductive Tract Infection
SSGT	Senior Scientific Assistant
SSU	State Surveillance Unit
STI	Sexually Transmitted Infection
TPHA	Treponema Pallidum Hemagglutination Assay (syphilis test)
USA	United States of America
UAE	United Arab Emirates
UKHSA	UK Health Security Agency
VDRL	Venereal Disease Research Laboratory (syphilis test)
VTM	Viral Transport Medium
VZV	Varicella Zoster Virus
WHO	World Health Organization

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Introduction to Learning Guide for Mpox

Historically, zoonotic diseases have had a significant impact on human evolution, particularly on cultures and societies that domesticated and raised animals for food and clothing. Zoonoses pose a frequent and feared risk to humanity, transcending natural boundaries and occurring worldwide. Their profound effect on the global economy and health is well recognized, ranging from the international movement of animals and the importation of diseases to bans on animal product imports and restrictions on other international trade practices. Thus, zoonoses are no longer confined to national borders, and global surveillance is necessary for effective control.

Controlling zoonoses remains a priority for international agencies, addressing the specific health and economic challenges of each region. Despite being poorly documented, zoonotic diseases pose a significant public health problem in India. They equally impact animal, human, and environmental sectors, causing substantial damage to the nation's economy. To protect all sectors, it is essential for India to rapidly identify, diagnose, and manage these diseases. The One Health approach plays a crucial role in this endeavor, as we have learned valuable lessons from the COVID-19 pandemic regarding the need for strong surveillance and diagnostic preparedness to handle future pandemic situations.

To provide comprehensive training, the Center for One Health, NCDC has developed Learning Resource Guide. The guide serve as both trainers' guide and self-directed learning resources. The training focuses on zoonoses and zoonotic diseases of public health importance in India (ZPHI) and emphasizes the One Health approach to responding to zoonotic diseases. By the end of the training, participants should have a solid understanding of the core principles of Mpox, its outbreak potential, health emergencies, risk communication, diagnostic procedures, laboratory safety, surveillance, data reporting, and their applications.

The guide is based on national and international guidelines and serve as a comprehensive training guide for individuals involved in zoonotic disease diagnosis and surveillance activities. They provide a deeper insight into the understanding of Mpox. The curriculum is designed to enable facilitators and learners to undergo step-by-step learning within a specified time frame, ensuring a thorough understanding of each module. The guide caters to various audiences, including medical professionals including doctors, veterinarians, paramedical staff and laboratory personnel who are expected to acquire knowledge and competencies beyond their regular field of work.

The guide consists of a Facilitators' Guide (FG). The FG provides instructional processes and supports educators in facilitating and assessing learning. Each module follows a standardized structure, including a session outline, detailed session plans, slide decks, and a wide range of references and resources for further reading. These resources offer comprehensive information on the respective topics.

The learning guide aims to provide a comprehensive education for medical professionals including doctors, veterinarians, paramedical staff and laboratory personnel. It helps them understand, identify, and differentiate between zoonotic diseases and equips them with the necessary knowledge and orientation for diagnostics procedures and surveillance systems.

COURSE DESCRIPTION

Course Design

This comprehensive Mpox training resource guide is tailored for medical professionals including doctors, veterinarians, paramedical staff and laboratory personnel. The course is designed to enhance their understanding and expertise in dealing with Mpox cases, spanning various aspects of prevention, diagnosis, and treatment. The training approach emphasizes practical application, aiming to equip participants with knowledge to enhance the skills and competencies that can be directly applied in their professional roles.

Evaluation Approach

The evaluation approach for the Mpox preparedness and response training guide includes a comprehensive pre and post-training quiz questionnaire designed to assess participants' knowledge and learning progression. The questionnaire utilizes multiple-choice questions (MCQs) to gauge participants' understanding of Mpox-related concepts before and after the training. This approach allows for a clear measurement of knowledge enhancement and provides valuable insights into the effectiveness of the training program.

- ***Pre-Training Quiz:***

Before the training begins, participants will be administered a pre-training questionnaire. This questionnaire serves as a baseline assessment of participants' existing knowledge and awareness of Mpox. The pre-training quiz will consist of MCQs that cover various aspects of Mpox, including its etiology, modes of transmission, clinical manifestations, prevention measures, risk assessment and response strategies. The purpose of the pre-training quiz is to establish a starting point and identify areas where participants may require more focused training.

- ***Post-Training Quiz:***

Upon completion of the Mpox preparedness and response training guide, participants will be given a post-training quiz questionnaire. This questionnaire will contain a similar set of MCQs as the pre-training quiz, covering the same topics related to Mpox. The aim of the post-training quiz is to evaluate participants' knowledge advancement and to measure the effectiveness of the training in enhancing their understanding of Mpox-related concepts and procedures.

COURSE SYLLABUS

Course Goals

Foster an in-depth comprehension of Mpox and its diverse forms.

- Equip participants with knowledge for Mpox diagnosis, management, and prevention.
- Emphasize the importance of the One Health approach in addressing zoonotic diseases.
- Develop proficiency in risk communication, laboratory safety, and surveillance strategies.

Participant's Learning Objectives

By the course's conclusion, participants will be able to:

- To identify Mpox disease and know about the clinical characteristics.
- Apply diagnostic and treatment protocols for Mpox management.
- Implement preventive strategies and outbreak management tactics.

Participant Selection Criteria

Participants for this Mpox response and preparedness training should be professionals from various fields involved in emergency response and public health at the time of emergencies and outbreak scenarios:

- Emergency Responders: Including public health experts, medical personnel, and first responders, veterinarians, port authorities
- Laboratory and Biosafety Staff: Those experienced in handling biohazards.
- Government and Decision-Makers: Officials with authority in emergency coordination.
- Community Leaders and Experts: Community influencers, researchers, representatives from the high risk communities and mental health experts

Using the Resource Guide

All training activities in this course will be conducted in an interactive, participatory manner using the training guide appropriately as suggested in the course outline in the facilitators' guide. To accomplish this, the trainer will have to change roles throughout the course. For example, the trainer is a facilitator when conducting small group discussions and finally, when objectively assessing performance, the trainer serves as an evaluator.

Composition of participants

The training is intended for 15-20 participants hailing from various state and healthcare fraternities. There can be a single facilitator as an expert of the disease.

COURSE SCHEDULE

Morning Session

Introduce and welcome participants

- Discuss participant expectations and prior knowledge
- Outline the objectives of the course and learning outcomes

Review the course schedule and its components

- Provide an overview of the training guide materials
- Conduct a pre-course knowledge assessment to gauge participants' baseline understanding
- Distribute course materials, including handouts and resources

Interactive presentations

- Take Sessions 1-4 and discuss in detail about basics of Mpox, its epidemiology, clinical disease and its significant features in humans and animals.
- Interactive discussion and Q&A session after the lecture

Afternoon Session

Interactive presentations

- Take Sessions 5-10 and discuss in detail about frequently asked questions, diagnosis of Mpox, it's treatment, prevention & control, outbreak management and surveillance.

Debriefing and group discussions on simulation outcomes

- Interactive discussion and Q&A session after the lecture

Review, Assessment, and Closing

- Comprehensive review of key concepts covered during the training
- Interactive quiz to reinforce learning
- Final assessment to measure participants' understanding of course material
- Reflection session: Participants share insights and takeaways from the course
- Closing remarks, thanking participants for their engagement

COURSE OUTLINE

The course outline presented here follows a model structure for the training curriculum. It delineates the enabling objectives necessary to achieve the participant learning goals outlined in the course syllabus. The outline offers recommendations for suitable learning activities and essential resources and materials for each enabling objective. Depending on specific participant requirements, the trainer has the option to introduce supplementary practice activities, devise case studies, role-play scenarios, or tailor learning situations accordingly.

The course outline comprises four columns:

- **Duration:** This column specifies the estimated time allocated for each learning activity. This allocation ensures an equitable distribution of time across the diverse training components.
- **Learning Objectives:** This column lays out the enabling objectives and their alignment with corresponding learning activities. The objectives are sequenced to provide guidance on the training structure. The interplay of objectives and activities—ranging from icebreakers and interactive group tasks to practical exercises and breaks—constitutes the overall training progression.
- **Pre-requisite Knowledge/Skill:** This column addresses the foundational knowledge or skills that participants should possess prior to the session. It underscores the importance of existing competencies for effective engagement in the training.
- **Competencies to be Achieved:** The fourth column enumerates the competencies participants are expected to acquire by the conclusion of the session. It underscores the practical outcomes that participants will attain through engagement in the training.

AGENDA

S. No	Topic	Duration
1.	Welcome & Introduction of the training setting ground rules	15 mins
2.	Ice Breaker: Talk about yourself - Contribution to the management & control of zoonoses - Expectations from the training	30 mins
3.	Training objectives	15 mins
4.	Pre-Test Quiz	15 mins
5.	Session 1: Introduction to Mpox	15 mins
6.	Session 2: Epidemiology	30 mins
7.	Session 3: Mpox in Humans	20 mins
8.	Session 4: Mpox in Animals	15 mins
9.	Session 5: Surveillance	20 mins
10.	Session 6: Diagnosis	20 mins
11.	Session 7: Treatment, Management & Prevention	15 mins
12.	Summary	05 mins
13.	Post - Test Quiz	15 mins
14.	Q/A session, review, and discussion	15 mins
15.	Closing remarks	05 mins

Session-1

Introduction to Mpox

Course No. 001	Session 1: Introduction to Mpox
Duration	15 minutes
Learning Objective	• Describe disease overview • Understand causative agent and its characteristics
Pre-requisite knowledge/skill	• Basic understanding of virology, especially orthopoxviruses and their structure. • Familiarity with clinical features and transmission modes of viral zoonotic diseases. • Awareness of the global and regional public health significance of Mpox.
Competencies to be achieved	• Learners would gain knowledge of the basic characteristics and features of Mpox and its overview • Understanding of the characteristics of the causative agent – Mpox virus, host characteristics and transmission dynamics

OVERVIEW

Mpox is an infectious zoonotic viral disease caused by the Mpox virus. It can cause a painful rash, enlarged lymph nodes and fever. Most people fully recover, but some get very sick. It is usually a self-limited disease, with symptoms lasting from 2-4 weeks.

Mpox is transmitted from animals to humans, with cases often found close to tropical rainforests where there are animals that carry the virus. Evidence of Mpox virus infection has been found in animals including squirrels, Gambian pouched rats, dormice, different species of monkeys and others.

The disease can also spread from humans to humans. It can be transmitted through contact with body fluids of someone who has Mpox, lesions on the skin or on internal mucosal surfaces, such as in the mouth or throat, respiratory droplets and contaminated objects.

The symptoms of Mpox usually comprise of a fever, lymphadenopathy, headache, muscle aches, chills and/or sweats and a painful rash.

Viral DNA detection by PCR is a preferred laboratory test for the Mpox.

GENOME

The Mpox virus is an enveloped double-stranded DNA virus that belongs to the *Orthopoxvirus* genus of the Poxviridae family. Other members of the *Orthopoxvirus* genus such as Camelpox, Cowpox and *Variola* are zoonotic viruses that can also be seen in other living species. *Variola*, commonly known as smallpox, was eradicated in 1980 across the globe with effective vaccination. On electron microscopy, the Mpox virus is relatively large (200 to 250 nanometers). Poxviruses are brick-shaped, surrounded by a lipoprotein envelope with a linear double-stranded DNA genome.

The virions of Mpox have large oval shaped envelopes. Within each virion there is a core which holds the genome along with the enzymes that assist in dissolving the protein coat and replication. The center of the genome codes for genes involved in key functions such as viral transcription and assembly; genes located on the extremities of the viral genome are associated more towards interactions between the virus and the host cell such as spike protein characteristics.

Mpox virus is relatively large compared to other viruses. This makes it harder for the virus to breach the host defenses, such as crossing past gap junctions. Furthermore, the large size makes it harder for the virus to quickly replicate and evade immune response. To evade host immune systems, and buy more time for replication, the Mpox and other Orthopox viruses have evolved mechanisms to evade host immune cells.

The Mpox virus has two primary genetic clades:

1. **Clade I (Central African/Congo Basin):** This clade is generally associated with more severe disease manifestations.
2. **Clade II (West African):** This clade includes **Clade IIa** and **Clade IIb**,
The Clade I b was responsible for the 2024 global outbreak.

HOSTS

The Mpox virus, first discovered in 1958 in monkeys, does not have a clearly identified primary host or natural reservoir. However, certain rodents, such as rope squirrels, tree squirrels, Gambian pouched rats, and dormice, along with non-human primates, are known to be naturally susceptible to infection. Monkeys and humans, however, are considered incidental hosts, meaning they are not the natural carriers of the virus but can become infected under certain conditions.

The transmission of Mpox occurs through several pathways. Animal-to-animal transmission takes place within wildlife populations, particularly among rodents and non-human primates. Animal-to-human transmission is typically a result of direct contact with infected animals or their products. Human-to-human transmission is facilitated by close contact, particularly through exposure to bodily fluids, respiratory droplets, or skin lesions from an infected person.

Introduction

Mpox is a viral illness caused by the monkeypox virus, a species of the genus Orthopoxvirus

Mpox occurs primarily in a tropical rainforest areas of Central and West Africa and is occasionally exported to other regions

Monkeypox is usually a self-limited disease with the symptoms lasting from 2 – 4 weeks

Transmitted from one person to another by close contact with lesions, body fluids, respiratory droplets & contaminated materials such as bedding

Clinical presentation of monkeypox resembles that of smallpox, a related orthopoxvirus infection which was declared eradicated worldwide in 1980.

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MPOX (MONKEYPOX)

Overview

A viral disease that is caused by monkey pox virus

Human to human transmission also reported – through close contact with someone who has Mpox

A zoonotic disease that is transmitted from animals to humans

Detection of viral DNA by PCR is a preferred laboratory test for monkeypox

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MPOX (MONKEYPOX)

Agent

- Enveloped double stranded DNA virus
- Belongs to the *Orthopoxvirus* genus of the Poxviridae family.
- Similar to smallpox (variola virus)
- Other members of the *Orthopoxvirus* genus are zoonotic viruses such as Camelpox, Cowpox, etc.
- Monkeypox virus is relatively large compared to other viruses
- Two genetic clades:
 - 1. **Clade I - Central African (Congo Basin)**
 - 2. **Clade II - West African**
 - Clade IIa and Clade IIb
 - Clade I b - 2024 global outbreak.

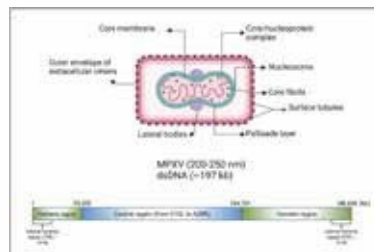


Image Source: Karagoz, A., et al. (2023). ScienceDirect. <https://doi.org/10.1016/j.sbs.2023.01.034>

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MPOX (MONKEYPOX)

Host

- First discovered in 1958 in a monkey
- No identified primary host or natural reservoir
- Certain rodents (including rope squirrels, tree squirrels, Gambian pouched rats, dormice) and non-human primates are known to be naturally susceptible to infection of Mpox virus.
- Monkeys and Humans are incidental hosts



Image Source: Lu, L. et al. (2023). *Signal Transduction and Targeted Therapy*, 8, 458. <https://doi.org/10.1038/s41392-023-01675-2>

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MPOX (MONKEYPOX)

Notes

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Session-2

Epidemiology of Mpox

Course No. 002	Session 2: Epidemiology of Mpox
Duration	30 minutes
Learning Objective	• Understand history and epidemic potential of Mpox • Understand geographical distribution of Mpox globally • Understand geographical distribution of Mpox in India
Pre-requisite knowledge/skill	• Basic knowledge of historical outbreaks and trends of emerging viral diseases. • Familiarity with global health surveillance systems and disease reporting. • Awareness of Mpox occurrence and distribution patterns both globally and within India.
Competencies to be achieved	• Epidemic potential assessment of Mpox • Analysis of seasonality and understanding its implications • Assessment of geographical distribution and prevalence of Mpox disease

GEOGRAPHICAL DISTRIBUTION OF MPOX

Global

Mpox virus was first seen in monkeys kept in a research laboratory in Copenhagen, Denmark in 1958. For this reason, it was initially named as monkey pox. However, the natural reservoir of Mpox is not monkey. But following a series of consultations the name of the disease was suggested as “Mpox” by WHO in a statement released on 28th November, 2022.

Human Mpox was first identified in humans in 1970 in the Democratic Republic of the Congo in a 9 months-old boy in a region where smallpox had been eliminated in 1968. Since then, most cases have been reported from rural, rainforest regions of the Congo Basin, particularly in the Democratic Republic of the Congo and human cases have increasingly been reported from across central and west Africa.

Since 1970, human cases of Mpox have been reported in 11 African countries: Benin, Cameroon, the Central African Republic, the Democratic Republic of the Congo, Gabon, Cote d'Ivoire, Liberia, Nigeria, the Republic of Congo, Sierra Leone and South Sudan.

Between 1970 and 1980, 59 human cases of Mpox were reported and fatality rate has been reported as 17%. All of these cases occurred among individuals exposed to small wild animals (eg, rodents, squirrels and monkeys) in the rainforests of West and Central Africa. The disease burden of Mpox is not fully known. For example, in 1996–97, an outbreak was reported in the Democratic Republic of the Congo with a lower-case fatality rate and a higher attack rate than usual. Despite the high attack rate, the low fatality rate in this outbreak was attributed to a simultaneous outbreak of chickenpox (caused by the chickenpox virus, which is not the orthopox virus) and Mpox. Since 2017, Nigeria has experienced a large outbreak, with over 500 suspected cases and over 200 confirmed cases and a case fatality ratio of approximately 3%.

Mpox can be considered a disease of global importance, as it affects not only West and Central African countries, but also the rest of the world, albeit rare and in small numbers.

In 2003, the first Mpox outbreak outside of Africa was in the United States of America. This outbreak led to over 70 cases of Mpox in the USA. Mpox has also been reported in travelers from Nigeria to Israel in September 2018, to the United Kingdom in September 2018, December 2019, May 2021 and May 2022, to Singapore in May 2019, and to the United States of America in July and November 2021. In May 2022, multiple cases of Mpox were identified in several non-endemic countries.

Given that clusters of cases are also occurring in Europe, the case seen in May 2022 in Massachusetts, USA, which had recently traveled to Canada by private transport but not to Africa, could possibly be related to the multi-country Mpox epidemic.

In May 2022, multiple cases of Mpox were reported in Europe, including Portugal, Spain and the United Kingdom, Canada, Australia, Israel and the UAE. Most cases have been detected in men who have had sex with men, and there may be spread between certain communities, possibly due to close contact during sexual activity.

WHO declared global outbreak of Mpox as a public health emergency of international concern (PHEIC) on 23 of July 2022. An upsurge of Mpox (formerly known as monkeypox) in the Democratic Republic of the Congo and its spread to neighboring countries was declared a public health emergency of international concern on 14 August 2024. Over 20 000 Mpox cases, including over 600 deaths (confirmed and suspected), due to MPOXV clade I and clade II have been reported from Africa Union Member States, including over 5000 confirmed cases, according to the Africa CDC Epidemic Intelligence Report issued on 31 August 2024 and the WHO AFRO weekly report of 30 August. The reporting countries are Burundi, Cameroon, the Central African Republic, the Republic of the Congo, Côte d'Ivoire, the Democratic Republic of Congo (DRC), Gabon, Liberia, Kenya, Nigeria, Rwanda, South Africa, and Uganda.

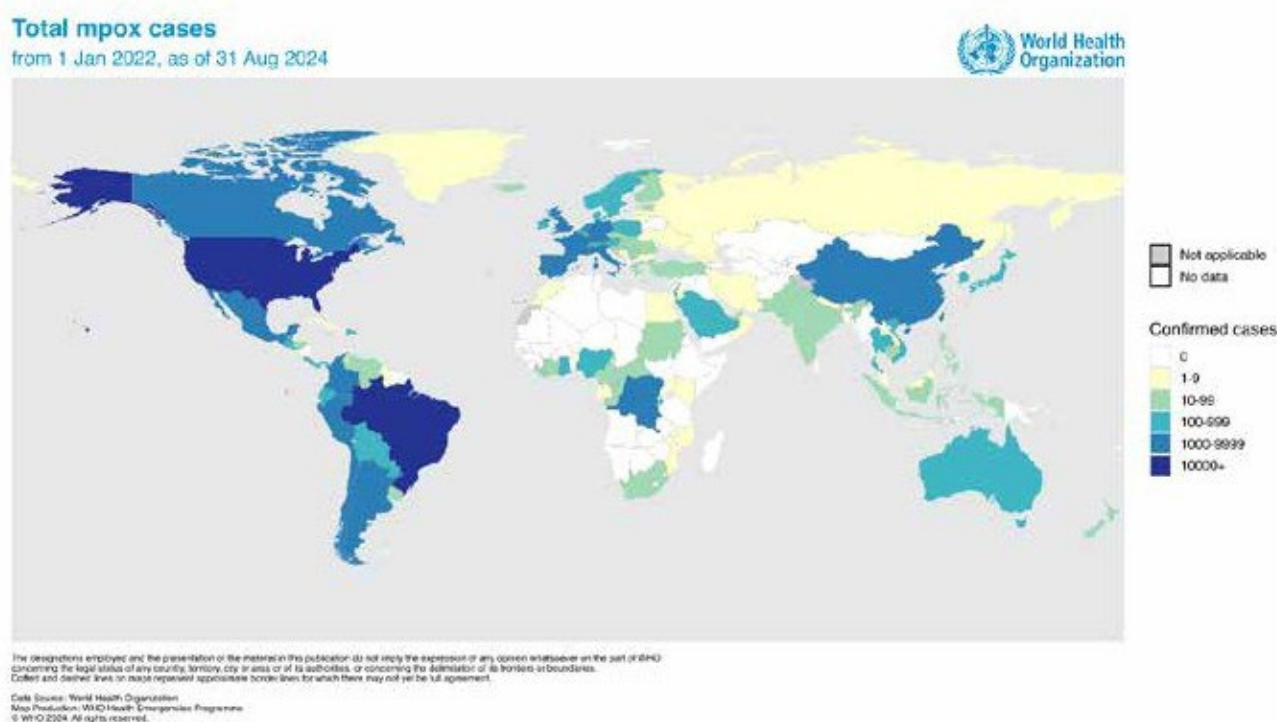
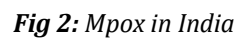


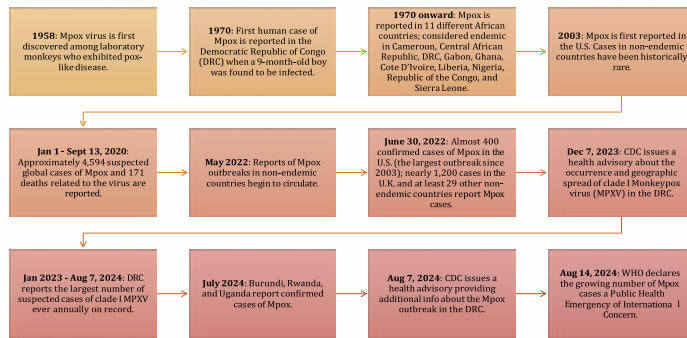
Fig 1: Total Mpox cases from Jan 2022 to Aug 2024 (WHO)

India

In India, the first case of Mpox was reported in Kollam, Kerala on 14th July 2022. On 27th March 2024, the last case was also reported from Kerala. Total 30 laboratory confirmed cases were reported from Kerala (15 cases) and Delhi (15 cases). Self-reporting to the health care provider has been the modality for case detection in India. There are no reported cases of Mpox in India as of now.



Epidemiology: Historical timeline of Mpox Outbreaks



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MPXV (MONKEYPOX)

Global Trends

- 2003**
 - MPOX (clade II) outbreak in the United States of America
- 2005**
 - 1000's of MPX suspected cases reported in the DRC every year since 2005
- 2017**
 - MPOX re-emerged in Nigeria and continues to spread between people across the country.
- 2022**
 - Sudden and rapid MPOX outbreak in 110 nations including Europe, and America. 87,000 cases and 112 deaths reported across globe. WHO declared it a public health emergency of international concern (PHEIC) on 23 of July 2022.
- 2023**
 - CDC issues health advisory about the occurrence and geographic spread of clade I Monkeypox virus (MPXV) in the Democratic Republic of the Congo (DRC).
- July 2024**
 - Burundi, Rwanda, and Uganda report confirmed cases of mpox.
- Aug 7, 2024**
 - CDC issue health advisory to provide additional info about the mpox outbreak in the DRC.
- Aug 14, 2024**
 - WHO determines that the growing number of mpox cases constitutes a public health emergency of international concern.

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MPXV (MONKEYPOX)

Overview of Global totals*



*Data representative from 01 January 2022 to 31 August 2024, Source: World Health Organization. (n.d.). Monkeypox Global Dashboard. Retrieved from https://worldhealth.org/en/mpox/global/#23_Mpx

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MPXV (MONKEYPOX)

Epidemiology: Genetic clades

- Two clades: **Congo Basin** (or Central African or I) and **West African** (II)
- Geographic ranges overlap in Cameroon

	West African clade	Central African clade
Countries which reported cases	Sierra Leone, Liberia, Cote d'Ivoire, Nigeria, Cameroon	Sierra Leone, Liberia, Cote d'Ivoire, Nigeria, Cameroon, Central African Republic, DRC
Infectiousness	Limited	Up to 7 generations
Case fatality ratio	Up to 6%	Up to 11%

Image Source: WHO Monkeypox Health Topics Website

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MPXV (MONKEYPOX)

Burden of Mpox in India

- The first case of Mpox in India was reported in Kollam, Kerala on 14th July 2022.
- The last case of Mpox was reported from Kerala on 27th March 2024.
- A total of 30 laboratory-confirmed cases were reported: 15 cases from Kerala and 15 cases from Delhi.
- Self-reporting to healthcare providers was the primary method for case detection in India.
- There are no reported cases of Mpox in India as of now



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MPXV (MONKEYPOX)

Notes

Session-3

Mpox in Humans

Course No. 003	Session 3: Mpox in Humans
Duration	20 minutes
Learning Objective	• Identify symptoms, and transmission • Identify of individuals at risk • Understand Disease Progression • Understand and knows about the Differential diagnosis • Know about the Case definitions
Pre-requisite knowledge/skill	• Basic understanding of viral disease symptoms and transmission routes. • Familiarity with clinical assessment, risk factors, and differential diagnosis. • Awareness of standard case definitions used in disease surveillance and reporting
Competencies to be achieved	• Understanding and identifying symptoms of Mpox • Understanding of the case study and general understanding of handling of Mpox cases • Explaining high risk/zoonotic individuals and the transmission routes

TRANSMISSION

Mpox virus can be transmitted animal-to-human (i.e., zoonotic transmission) or human-to-human, or direct contact with the blood, bodily fluids, or skin or mucous membranes of infected animals. Recent evidence of human to animal transmission of the disease in geographical regions like Africa has started emerging.

The natural reservoir of Mpox has not yet been identified, though rodents are the most likely. Eating inadequately cooked meat and other animal products of infected animals is a possible risk factor. Being bitten by an infected animal carries a risk in terms of injury and contamination, such that the integrity of the skin will be impaired. People living in or near forested areas in West and Central Africa, where the infection is relatively more intense, may also be indirectly exposed to infected animals.

Human-to-human transmission can result from prolonged close contact with the secretions of an infected person, direct contact with skin lesions or mucous membranes (such as eyes, nose, mouth mucous membranes) or close contact with objects (bed linen, towels, etc.) that have recently been contaminated by skin lesions. This type of contact generally poses a risk to people who share the same house, those who are in proximity for a very long time in closed environments, and health workers who come into contact with an infected person.

Sexual practices such as having multiple and frequent unsafe sexual practices may increase risk of infection transmission. Sexual contact may include intimate contact or oral mucosa contact such as kissing, anal sex, oral sex, or vaginal sex, as well as exposure to genital secretions.

Transmission can also occur via the placenta from mother to fetus. In this case, it may lead to congenital Mpox symptoms in the newborn at birth and immediately after birth. In the presence of active infection in the mother, it can also be transmitted by close contact with the newborn baby.

The potential for airborne transmission has been suggested given the respiratory system involvement during infection, possible transmission during the prodromal period, and similarities to smallpox. Therefore, precautionary public health measures (i.e., consistently, and reliably wearing a well-fitted medical mask) are essential. There is a greater risk of infection for people who closely interact with someone who is infectious, including household members, sexual partners, and health care workers.

Further, pets in close contact with infected humans may contract the virus, leading to potential outbreaks among domestic animals. Similarly, wildlife, particularly those in rehabilitation centers or sanctuaries, are at risk when handled by infected individuals. This not only threatens animal health but also creates a reservoir for the virus, potentially complicating efforts to control outbreaks in human populations. Currently there are no effective vaccines which are approved for use in animals.

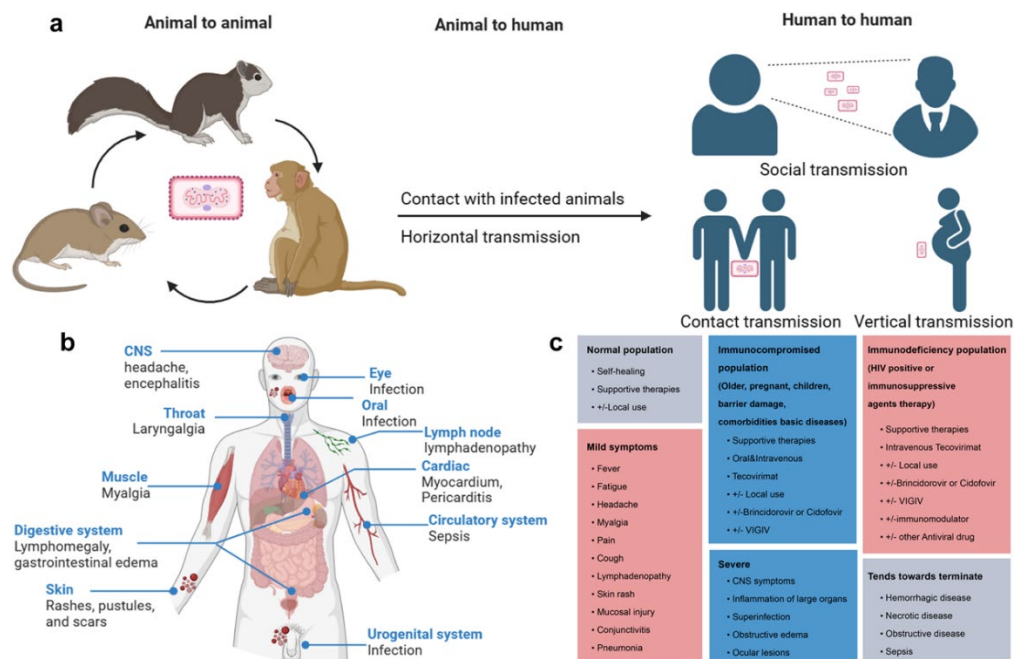


Fig 3: The epidemiological characteristics, pathogenesis, clinical diagnosis, and treatment of Mpox. A) The transmission of Mpox occurs through animal-to-animal, animal-to-human, and human-to-human routes. B) Clinical symptoms typically manifest after Mpox infection. C) Symptoms of Mpox infection may vary based on the immune status and clinical treatment options and clinical treatment options are listed

(Image Source: Lu, J., et al. (2023). Signal Transduction and Targeted Therapy, 8, 458. <https://doi.org/10.1038/s41392-023-01675->)

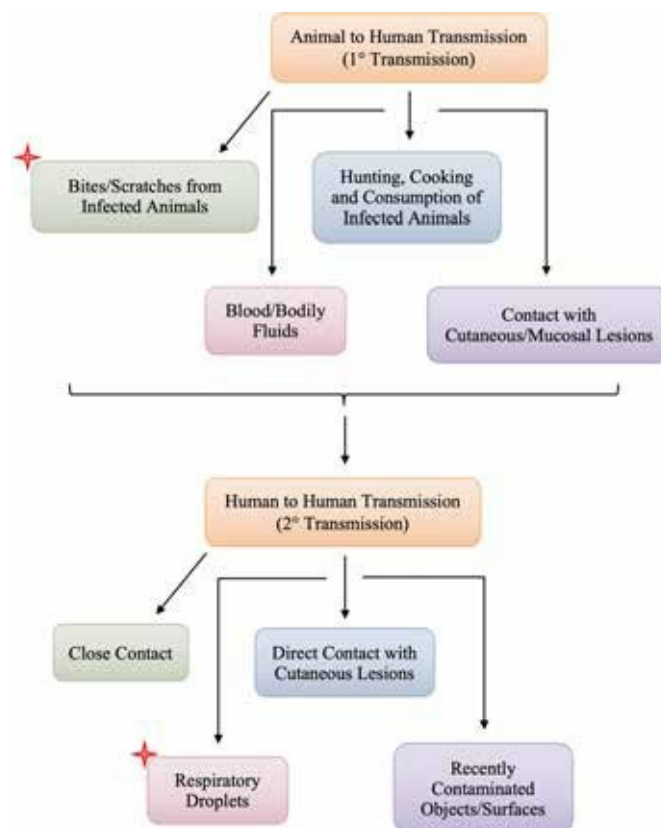


Fig 4: Suspected Modes of Transmission of Monkeypox to Humans

(Image Source: Kaler J, Hussain A, Flores G, et al. (July 03, 2022) Monkeypox: A Comprehensive Review of Transmission, Pathogenesis, and Manifestation. Cureus 14(7): e26531. doi:10.7759/cureus.26531)

WHO IS AT RISK?

People in close contact with infected individuals are at higher risk, particularly those engaging in skin-to-skin contact, including sexual activity, mouth-to-mouth or mouth-to-skin contact, and those in prolonged face-to-face interactions where respiratory droplets may spread. Additionally, individuals handling contaminated items such as clothing, bedding, and towels used by an infected person are also at risk due to the virus remaining on surfaces. Sexual partners with multiple or new partners are especially vulnerable because of the intimate nature of physical contact, which facilitates viral transmission. Pregnant women face the risk of passing the virus to their fetus during pregnancy or to their newborn during and after birth.

Health workers are at higher risk if they do not adhere to strict infection prevention and control measures, such as wearing appropriate personal protective equipment (PPE) while caring for Mpox patients. People with compromised immune systems are also more susceptible to severe outcomes if infected, as their bodies may struggle to fight off the virus. Furthermore, individuals exposed to infected animals, such as rodents or primates, either through handling or via bites and scratches, are at risk. Close contact with infected pets, such as petting or cuddling, can also result in transmission. Finally, children in endemic areas are more vulnerable to Mpox due to their lack of immunity, unlike adults who may have developed resistance over time through previous exposure to similar pathogens. Understanding these risk groups is essential for implementing effective prevention and intervention strategies to curb the spread of Mpox.

CASE DEFINITION

Timely recognition, appropriate case definitions, and targeted interventions play a vital role in mitigating the impact of Mpox on human health.

Suspected Case: A person of any age having history of travel to affected countries within last 21 days presenting with an unexplained acute rash AND one or more of the following signs or symptoms:

- Swollen lymph nodes
- Fever
- Headache
- Body aches
- profound weakness

Probable Case: A person meeting the case definition for a suspected case, clinically compatible illness and has an epidemiological link (face-to-face exposure, including health care workers without appropriate PPE; direct physical contact with skin or skin lesions, including sexual contact; or contact with contaminated materials such as clothing, bedding or utensils is suggestive of a strong epidemiological link).

Confirmed Case: A case which is laboratory confirmed for Mpox virus (by detection of unique sequences of viral DNA either by polymerase chain reaction (PCR) and/or sequencing).

SYMPTOMS

The incubation period (interval from infection to onset of symptoms) of Mpox is usually from 6 to 14 days but can range from 5 to 21 days. Severe cases occur more commonly among children and are related to the extent of virus exposure, patient health status and nature of complications.

Underlying immune deficiencies like HIV, or patient receiving immunosuppressants may lead to worse outcomes. Although vaccination against smallpox was protective in the past, today persons younger than 40 to 50 years of age (depending on the country) may be more susceptible to Mpox due to cessation of smallpox vaccination campaigns globally after eradication of the disease.

Persons with a history of an animal bite or scratch may have a shorter incubation period (13 versus 9 days) than those with tactile/contact exposure.

Clinical course: Intense headache, lymphadenopathy (swelling of the lymph nodes), back pain, myalgia (muscle aches) and intense asthenia (lack of energy). (lasts between 0–5 days)

Lymphadenopathy is a distinctive feature of Mpox compared to other diseases that may initially appear similar (chickenpox, measles, smallpox)

The skin eruption usually begins within 1–3 days of appearance of fever. The rash tends to be more concentrated on the face and extremities rather than on the trunk. It affects the face (in 95% of cases), and palms of the hands and soles of the feet (in 75% of cases). Also affected are oral mucous membranes (in 70% of cases), genitalia (30%), and conjunctivae (20%), as well as the cornea. The rash evolves sequentially from macules (lesions with a flat base) to papules (slightly raised firm lesions), vesicles (lesions filled with clear fluid), pustules (lesions filled with yellowish fluid), and crusts which dry up and fall off. The number of lesions varies from a few to several thousand. In severe cases, lesions can coalesce until large sections of skin slough off.

Complications of Mpox can include secondary infections, bronchopneumonia, sepsis, encephalitis, and infection of the cornea with ensuing loss of vision. The extent to which asymptomatic infection may occur is unknown.

DISEASE PROGRESSION

Initial symptoms include fever, headache, myalgia, fatigue, and lymphadenopathy, a key differentiating feature of Mpox from smallpox. After 1 to 2 days, mucosal lesions develop in the mouth, closely followed by skin lesions of the face and extremities (including palms and soles), and are centrifugally concentrated. The rash may or may not spread to the rest of the body, and the total number of lesions may vary from a small amount to thousands.

Over the following 2 to 4 weeks, the lesions evolve in 1 to 2-day increments through macular, papular, vesicular, and pustular phases. Lesions change synchronously and are characterized as a firm, deep-seated, and 2 to 10 mm in size. Lesions remain in the pustular phase for 5 to 7 days before crusts begin to form. Crusts form and desquamate over the subsequent 7 to 14 days, and the condition resolves around 3 to 4 weeks after symptom onset in most cases. Patients are no longer considered infectious after all crusts fall off.



Fig 5: Disease Progression

(Image Source: WHO Monkeypox Health Topics)



Fig 5: Stages of Rash

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

DIFFERENTIAL DIAGNOSIS

Various infections and skin diseases should be considered. Both clinical and epidemiological data and specific laboratory studies can lead to different diagnoses. In the current outbreak, cases of both Mpox and other sexually transmitted infections have been reported. Therefore, diagnosis of an infection should not rule out infection with the Mpox virus.

The rash which develops in MPOX may resemble other infectious diseases or other conditions, including varicella zoster virus (VZV, chickenpox), herpes simplex virus (HSV), primary or secondary syphilis, disseminated gonococcal infection (DGI), foot and mouth disease, chancroid, lymphogranuloma venereum (LGV), granuloma inguinale, molluscum contagiosum, measles, scabies, rickettsia pox, chikungunya, zika virus, dengue fever, vasculitis and other bacterial skin and soft tissue infections.

Often, the rash caused by VZV can be confused with MPOX but can be distinguished as the rash in varicella generally progresses quicker, is more centrally located than the centrifugal distribution of MPOX, is in multiple stages of development (rather than the same stage as seen in MPOX) and patients usually do not have lesions on their palms and soles. Additionally, patients with VZV typically do not have lymphadenopathy, which is a hallmark of MPOX. Despite the clinical differences between these two diseases, a study from the Democratic Republic of the Congo reported co-infection with MPOX/VZV with an incidence of 10–13%. Patients with co-infection reported fatigue, chills, headache and myalgias. These individuals were less likely to report signs/symptoms of oral sores, axillary lymphadenopathy, cough or sore throat. Patients with co-infection had a higher lesion burden than seen with VZV alone but a lower rash burden than seen with MPOX alone raising the suggestion that co-infection with these two viruses could modulate severity of the overall infection – an area for further investigation.

Differential Diagnosis for Mpox (Monkeypox)

Disease	Epidemiological Clue	Key Clinical Features	Key Distinguishing Features	Biochemistry and Laboratory Tests	Key Findings
Disseminated Zoster	Immunocompromised individuals, elderly	Generalized painful vesicular rash, dermatomal distribution	History of prior varicella infection, painful lesions	PCR for VZV, Tzanck smear (multinucleated giant cells)	VZV DNA detected, positive Tzanck smear
Chickenpox	Children, unvaccinated individuals	Vesicular rash in different stages, fever, pruritus	Lesions appear in crops at different stages	PCR for VZV, serology (IgM, IgG)	IgM positive in acute infection
Molluscum Contagiosum	Children, sexually active adults, immunocompromised	Umbilicated pearly papules, localized or widespread	Painless, firm, umbilicated lesions	Skin biopsy (inclusion bodies), PCR for poxvirus	Henderson-Patterson bodies on histology
Syphilis	Sexually active individuals, congenital cases	Painless genital ulcer (primary), widespread rash (secondary)	Involves palms/soles, condylomata lata in secondary stage	Serology (RPR, VDRL, TPHA, FTA-ABS)	Positive treponemal/non-treponemal tests
Eczema Herpeticum	Patients with atopic dermatitis	Painful, clustered vesicles on eczematous skin, fever	Rapid progression, systemic symptoms, history of eczema	HSV PCR, Tzanck smear (multinucleated giant cells)	HSV DNA detected, positive Tzanck smear
Disseminated Herpes Simplex	Immunocompromised individuals, neonates	Widespread vesicular lesions, systemic involvement	Extensive lesions with systemic symptoms (fever, hepatitis)	HSV PCR, viral culture	HSV DNA detected, elevated liver enzymes
Yaws	Tropical regions, poor hygiene	Papillomatous skin lesions, bone pain	Treponema pertenue infection, endemic in certain regions	Dark-field microscopy, serology (VDRL, RPR, TPHA)	Positive treponemal tests
Scabies	Crowded living conditions, close contact spread	Intense pruritus, burrows in web spaces	Severe itching, especially at night, burrows visible	Skin scraping, microscopy for mites/eggs	Mites, eggs, or fecal pellets on microscopy
Rickettsialpox	Exposure to mites, urban settings	Fever, eschar, papulovesicular rash	Eschar at bite site, history of mite exposure	Weil-Felix test, IFA, PCR for Rickettsia	Positive serology for Rickettsia

Disease	Epidemiological Clue	Key Clinical Features	Key Distinguishing Features	Biochemistry and Laboratory Tests	Key Findings
Measles	Unvaccinated children, outbreaks	Fever, cough, coryza, conjunctivitis, maculopapular rash	Koplik spots (enanthem before rash), descending rash	Serology (IgM, IgG), RT-PCR for measles RNA	Measles IgM positive, RT-PCR detects virus
Bacterial Skin Infections	Trauma, poor hygiene, immunosuppression	Erythema, warmth, purulence, fever	Rapidly progressive, localized or systemic signs	Gram stain, culture of lesion exudate	Bacterial growth on culture
Drug-Associated Eruption	Recent medication history	Widespread maculopapular rash, pruritus, systemic symptoms	Temporal association with drug intake	Eosinophilia, biopsy (if needed)	Drug reaction confirmed with challenge test

Notes on Key Biochemistry Findings:

- Mpox:** Elevated liver enzymes (mild) and lymphocytosis are key findings.
- Syphilis:** Minimal lab abnormalities in early stages; ESR may rise in secondary syphilis.
- Rickettsial Diseases:** Thrombocytopenia and transaminitis help differentiate from other febrile illnesses.
- Measles:** Lymphopenia is characteristic.
- Scabies:** Eosinophilia can suggest parasitic involvement.

SAMPLING WINDOW

The **Sampling Window** for Mpox (Monkeypox) diagnostic testing corresponds with the disease timeline, ensuring accurate detection and monitoring.

During the **Acute Phase (Day 1-5)**, diagnostic efforts focus on collecting **blood, lesion swabs, and urine** to detect active viral infection using **RT-PCR**, the gold standard for Monkeypox DNA detection, along with viral culture and direct microscopy for identifying virus particles.

In the **Viral Replication Phase (Day 5-10)**, **blood, lesion swabs, and serum** are analyzed to detect the immune response through **IgM/IgG ELISA**, while **RT-PCR** is used to continue monitoring viral DNA.

The **Recovery Phase (Day 10-21)** involves sampling of **blood, serum, and lesion swabs** to confirm viral clearance using **RT-PCR**, evaluate antibody development through serology for IgM and IgG, and isolate the virus if feasible.

In **post-mortem cases**, **tissue samples** from the skin and lymph nodes are analyzed with **PCR** for viral DNA and histopathology to detect viral inclusions.

For those monitored **beyond 21 days**, **blood and serum** are tested using serology to detect **IgG antibodies** and PCR for persistent viral DNA. This comprehensive sampling window ensures accurate diagnosis and effective management throughout and beyond the disease course.

Time Frame	Sample	Diagnostic Tests
Day 1-5 (Acute Phase)	Blood, Lesion swab, Urine	RT-PCR (Mpox virus detection), Viral culture, Direct microscopy (for virus particles)
Day 5-10 (Viral Replication Phase)	Blood, Lesion swab, Serum	IgM/IgG ELISA (serological response), RT-PCR (detection of viral DNA)
Day 10-21 (Recovery Phase)	Blood, Serum, Lesion swab	RT-PCR, Serology (for IgM and IgG), Virus isolation (if possible)
Post-Mortem	Tissue samples (e.g., skin, lymph nodes)	PCR (Mpox virus), Histopathology (detection of viral inclusions in tissue)
Beyond 21 Days	Blood, Serum	Serology (IgG antibodies), PCR (for detection of persistent viral DNA)

CASE SCENARIOS

Case Study-1

This case study examines a travel-related Mpox infection in Saudi Arabia.

Case Presentation:

A 24-year-old male presented to the emergency room with worsening skin lesions and a low-grade fever. His symptoms began in the genital area, later spreading to the face and entire body over five days.

Clinical Findings:

- Symptoms: Rash progression from vesicular to umbilicated pustules, fever, lymphadenopathy.
- Physical Exam:
 - ◇ Multiple umbilicated pustules on the face and genital area.
 - ◇ Vesicular lesions on the trunk, soles, and dorsum of the hands.
 - ◇ Palpable cervical and inguinal lymphadenopathy.
- Initial Misdiagnosis: Suspected varicella (chickenpox).



Fig 7: Clinical Findings

(Source: AlBahrani S, AlGarzai R, Aljunaid TO, Al-Tawfiq JA. A case report of Mpox (Monkeypox) in male traveler. *New Microbes New Infect.* 2023 Jun;53:101132. doi: 10.1016/j.nmni.2023.101132.)

Diagnostic Tests:

- PCR Testing: Four skin samples sent to the national laboratory tested positive for Mpox.
- Chest X-ray: Normal.
- Liver Enzymes: Elevated.
- STI Panel: Negative.

Epidemiological Factors:

- Travel History: Visited three neighboring countries in the preceding three weeks.
- Potential Exposure: Reported receiving a massage in an unlicensed center, likely source of infection.
- Sexual History: Denied any sexual activity.

Management and Outcome:

- Treatment: Supportive care, symptomatic management.
- Hospital Course: Mild disease course, full recovery without antiviral therapy.
- Public Health Response: Case was reported to health authorities to aid in epidemiological surveillance.

Discussion:

- Atypical Presentation: Lesions initially appeared in the genital region before spreading centrifugally, differing from classic Mpox progression.
- Transmission Risks: While sexual transmission was suspected in many 2022 cases, non-sexual close contact remains a significant risk.
- Public Health Implications: The case highlights the importance of travel history in diagnosing Mpox in non-endemic regions.

Conclusion:

This case underscores the evolving presentation of Mpox in the 2022 outbreak and the importance of accurate diagnostic tools, epidemiological awareness, and public health interventions in managing emerging infectious diseases.

Case Study-2

This case scenario explores the diagnostic approach, clinical course, and public health response.

Patient Presentation:

A 34-year-old male, residing in the United Arab Emirates (UAE), returned to India after a business trip to Europe. He presented with fever, myalgia, and skin lesions.

Chief Complaint: Fever, malaise, painful vesicular rash.

- **History:** The patient had traveled to multiple European cities, attending conferences and social gatherings.



Fig 7: Clinical Presentation

(Source:] *Infect.* 2022 Nov;85(5):e145-e148. doi: 10.1016/j.jinf.2022.08.007. Epub 2022 Aug 10. PMID: 35963550; PMCID: PMC9556606.)

- **Symptoms Timeline:**

- ◇ **Day 1-3:** Low-grade fever, headache, body aches.
- ◇ **Day 4-5:** Rash progression—starting as maculopapular lesions, becoming pustular and umbilicated.
- ◇ **Day 6-7:** Lesions spread to oral cavity, genital area, and extremities.
- ◇ **Day 8:** Sore throat and lymphadenopathy.
- ◇ **Day 9:** Consulted a clinic in UAE, prescribed symptomatic treatment.
- ◇ **Day 12:** Traveled back to India.
- ◇ **Day 14:** Visited a hospital in Kerala due to worsening symptoms.

- **Clinical Examination:**

- **Vitals:** Stable, no respiratory distress.
- **Skin:** Multiple umbilicated pustules, erythematous borders on face, trunk, and extremities.
- **Lymph Nodes:** Enlarged cervical and inguinal lymphadenopathy.
- **Genital Exam:** Non-tender vesicular lesion on the penile shaft.

Diagnostic Tests:

- **Real-Time PCR:** Positive for Mpox (Clade II, B.1 lineage).
- **Skin Biopsy:** Epidermal necrosis, perivascular inflammation.
- **Serology:** Negative for Varicella, HSV, and Syphilis.
- **HIV Test:** Negative.

Management and Outcome:

- **Hospitalization:** Isolated in an infectious disease unit.
- **Treatment:** Supportive care, pain management, hydration, and lesion care.
- **Recovery:** Symptoms resolved by Day 24, with no complications.
- **Contact Tracing:** No secondary cases detected among household contacts.

Public Health Response:

- **Notification:** Case reported to local health authorities.
- **Surveillance:** Screening at airports for travelers with rash illnesses.
- **Education:** Awareness campaigns on Mpox symptoms and prevention.

Discussion:

This case highlights the importance of recognizing imported Mpox infections in non-endemic regions. The atypical presentation with genital and oral lesions necessitated advanced molecular diagnostics. Rapid isolation, proper diagnosis, and public health interventions were key in preventing local transmission.

Transmission Dynamics

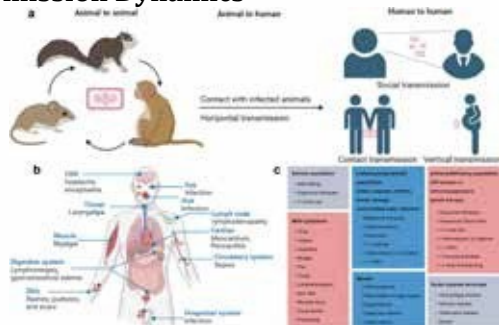


Image Source: Lu, J., et al. (2022). Signal Transduction and Targeted Therapy, 8, 458. <https://doi.org/10.1039/s41292-022-01675-2>

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MPOX (MONKEYPOX)

Notes

Transmission

Transmission

- Human to Human Transmission**
 - Contact - Body fluids, lesions, also intact skin and mucous membranes
 - Respiratory droplet-acquired
 - Sexually Transmitted
 - Mother to Fetus (Vertical Transmission)
- Animal to Human Transmission (Horizontal Transmission)**
 - Infected animal bite or scratch
 - Butchering and/or Consumption of bush meat
 - Direct contact with body fluids or lesions, or contaminated materials
- Fomite Transmission**
 - Contaminated clothing or bed sheets



Image Source: WHO Monkeypox Health Topics Website

Image Source: Kuter J, Housh A, Flores G, et al. (July 01, 2022) Monkeypox: A Comprehensive Review of Transmission, Pathogenesis, and Manifestations. *Clinics* 14(7):e6331. doi:10.7759/curea.6331

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Who is at Risk?

- People in close contact with infected individuals:** Through skin-to-skin contact (e.g., touching, sex), mouth-to-mouth or mouth-to-skin contact (e.g., kissing), or prolonged face-to-face interactions.
- People handling contaminated items:** Risk from exposure to clothing, bedding, towels, or other surfaces touched by an infected person.
- Sexual partners with multiple or new partners:** Increased risk due to intimate physical contact.
- Pregnant women:** Risk of transmitting the virus to the foetus during pregnancy or to the newborn during or after birth.
- Health workers:** Higher risk when caring for Mpox patients if not following infection prevention protocols.
- People with compromised immunity:** More vulnerable to severe outcomes if infected.
- People interacting with infected animals:** Those handling or exposed to rodents, primates, or infected pets through bites, scratches, or close contact.
- Children in endemic areas:** Higher susceptibility due to lack of immunity compared to adults.

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Case Definition

Suspected Case	Probable Case	Confirmed Case
- A person of any age with a history of travel to affected countries within the last 21 days - Presenting with an unexplained acute rash AND one or more of the following symptoms: - Swollen lymph nodes - Fever - Headache - Body aches - Profound weakness	- A person meeting the case definition of a suspected case with clinically compatible illness - Epidemiological link to a confirmed case, such as: - Face-to-face exposure (including healthcare workers without appropriate PPE) - Direct physical contact with skin or skin lesions (including sexual contact) - Contact with contaminated materials (e.g., clothing, bedding, utensils)	- A case that has been laboratory confirmed for Mpox virus through: - Polymerase chain reaction (PCR) testing - Detection of viral DNA in clinical samples

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Signs and Symptoms



Image Source: CDC.com

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Notes

Disease Progression



Image Source: WHO Monkeypox Health Topics

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Detailed disease progression

Incubation period	- Duration: 5-21 days - No symptoms - Virus present in bloodstream (viremia) at the end of the incubation period	No symptoms
Febrile Stage	- Duration: 1-4 days - Fever + other symptoms: swollen lymph nodes (lymphadenopathy), headache, chills, sore throat, malaise, fatigue - Virus in the blood - Small lesions in the mouth (enanthem) appear towards the end	
Rash Stage	- Duration: 2-4 weeks - Virus is present in skin lesions - Virus may be in the blood early in this stage - Antibodies are produced and become detectable	
Recovery	- Duration: Days to weeks - The patient has recovered - Specific antibodies are present in the blood - Scars may remain	No symptoms

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Skin Involvement : Rash Stage

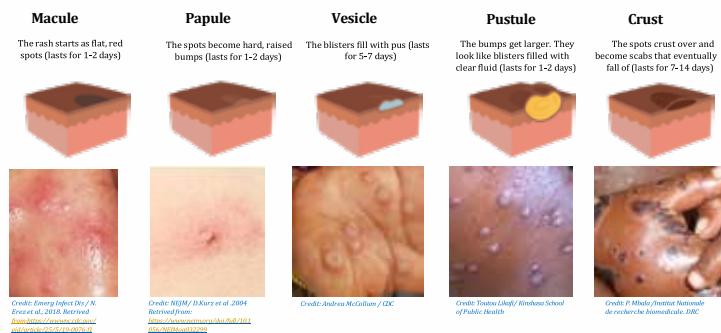


Image Source: Monkeypox Preparedness and response, OpenWHO.org

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Factors influencing the course of monkeypox

- Asymptomatic infection can occur
- Risk factors for severe illness
 - children
 - immunodeficiency
 - invasive route of infection
 - Congo Basin clade variant
- Protective factors
 - prior smallpox vaccination
- Case-fatality ratio
 - Congo Basin clade: about 10%



Image Source: Medically Speaking: <https://www.medicallyspeaking.in/wp-content/uploads/2022/06/Monkeypox-and-its-impact-on-Children-101.jpg>

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Notes

Mpox: Complications and Long-Term Consequences

Complications

- Bacterial infection of eyes (4%)
- Bacterial infection of skin (20%)
- Diarrhea and vomiting leading to dehydration (7%)
- Abscess with airway obstruction
- Bronchopneumonia (10%)
- Encephalitis (<1%)
- Sepsis (<1%)
- Miscarriage
- Death

Long Term Consequences

- Scarring
- Reduced skin pigmentation
- Corneal Ulcer and Blindness



Photo Credit: Spectrum Center for Emerging Diseases (SCED)

Danger

- Loss of vision
- Delirium
- Loss of consciousness, convulsions
- Respiratory distress
- Bleeding
- Inability to produce urine
- Signs of Sepsis



Photo Credit: CDC / Brian R. Mah

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Differential diagnosis

Disseminated zoster	Chickenpox	Molluscum Contagiosum	Syphilis
Eczema herpeticum	Disseminated herpes simplex	Yaws	Scabies
Rickettsialpox	Measles	Bacterial skin infections	Drug-associated eruption

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Differential diagnosis with key distinguishing features

Disease	Epidemiological Cue	Key Clinical Features	Key Distinguishing Features	Biochemistry and Laboratory Tests	Key Findings
Disseminated Zoster	Immunocompromised individuals, elderly	Generalized painful vesicular rash, dermatomal distribution	History of prior varicella infection, painful lesions	PCR for VZV, Tzanck smear (multinucleated giant cells)	VZV DNA detected, positive Tzanck smear
Chickenpox	Children, unvaccinated individuals	Vesicular rash in different stages, fever, pruritus	Lesions appear in crops at different stages	PCR for VZV, serology (IgM, IgG)	IgM positive in acute infection
Molluscum Contagiosum	Children, sexually active adults, immunocompromised	Umbilicated pearly papules, localized or widespread	Painless, firm, umbilicated lesions	Skin biopsy (inclusion bodies), PCR for poxvirus	Henderson-Patterson bodies on histology
Syphilis	Sexually active individuals, congenital cases	Painless genital ulcer (primary), widespread rash (secondary)	Involves palms/soles, condylomata lata in secondary stage	Serology (RPR, VDRL, TPHA, FTA-ABS)	Positive treponemal/non-treponemal tests
Eczema Herpeticum	Patients with atopic dermatitis	Painful, clustered vesicles on eczematous skin, fever	Rapid progression, systemic symptoms, history of eczema	HSV PCR, Tzanck smear (multinucleated giant cells)	HSV DNA detected, positive Tzanck smear
Disseminated Herpes Simplex	Immunocompromised individuals, neonates	Widespread vesicular lesions, systemic involvement	Extensive lesions with systemic symptoms (fever, hepatitis)	HSV PCR, viral culture	HSV DNA detected, elevated liver enzymes

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Notes

Disease	Epidemiological Cue	Key Clinical Features	Key Distinguishing Features	Biochemistry and Laboratory Tests	Key Findings
Yaws	Tropical regions, poor hygiene	Papillomatous skin lesions, bone pain	Treponema pertenuis infection, endemic in certain regions	Dark-field microscopy, serology (VDRL, RPR, TPHA)	Positive treponemal tests
Scabies	Crowded living conditions, close contact spread	Intense pruritus, burrows in web spaces	Severe itching, especially at night, burrows visible	Skin scraping, microscopy for mites/eggs	Mites, eggs, or fecal pellets on microscopy
Rickettsialpox	Exposure to mites, urban settings	Fever, eschar, papulovesicular rash	Eschar at bite site, history of mite exposure	Weil-Felix test, IFA, PCR for Rickettsia	Positive serology for Rickettsia
Measles	Unvaccinated children, outbreaks	Fever, cough, coryza, conjunctivitis, maculopapular rash	Koplik spots (enanthem before rash), descending rash	Serology (IgM, IgG), RT-PCR for measles RNA	Measles IgM positive, RT-PCR detects virus
Bacterial Skin Infections	Trauma, poor hygiene, immunosuppression	Erythema, warmth, purulence, fever	Rapidly progressive, localized or systemic signs	Gram stain, culture of lesion exudate	Bacterial growth on culture
Drug-Associated Eruption	Recent medication history	Widespread maculopapular rash, pruritus, systemic symptoms	Temporal association with drug intake	Eosinophilia, biopsy (if needed)	Drug reaction confirmed with challenge test

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Comparison of Mpox, Small-pox and Chicken pox

Criteria	Mpox	Smallpox (eradicated)	Chickenpox
Pathogen	Mpox virus, ortho-pox virus family	Variola virus, orthopoxvirus family	Varicella zoster virus
Incubation period (days)	5 to 21	7 to 17	12 to 14
Prodrome period (days)	1 to 4	2 to 4	0 to 2
Symptom: Fever severity	Moderate	Severe	Mild or none
Symptom: Malaise severity	Moderate	Moderate	Mild
Symptom: Headache severity	Moderate	Severe	Mild
Symptom: Lymphadenopathy severity	Moderate	None	None
Lesions: Depth (diameter in mm)	Superficial to deep (4 to 6)	Deep (4 to 6)	Superficial (2 to 4)
Lesions: Distribution	Prior outbreaks: centrifugal 2022 outbreak: penile, anorectal, oral-pharyngeal lesions	Centrifugal	Centripetal
Lesions: Evaluation	2022 outbreak: Polymorphic rash	Monomorphic rash	Polymorphic rash
Desquamation (days)	14 to 21	14 to 21	6 to 14
Lesions on palms/soles	Prior outbreaks: common 2022 outbreak: less common	Common	Rare
Death rate	1 to 10% (depends on strain)	~ 30% (depends on type)	Rare

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MPOX (MONKEYPOX)

Sampling window

Time Frame	Sample	Diagnostic Tests
Day 1-5 (Acute Phase)	Blood, Lesion swab, Urine	RT-PCR (Mpox virus detection), Viral culture, Direct microscopy (for virus particles)
Day 5-10 (Viral Replication Phase)	Blood, Lesion swab, Serum	IgM/IgG ELISA (serological response), RT-PCR (detection of viral DNA)
Day 10-21 (Recovery Phase)	Blood, Serum, Lesion swab	RT-PCR, Serology (for IgM and IgG), Virus isolation (if possible)
Post-Mortem	Tissue samples (e.g., skin, lymph nodes)	PCR (Mpox virus), Histopathology (detection of viral inclusions in tissue)
Beyond 21 Days	Blood, Serum	Serology (IgG antibodies), PCR (for detection of persistent viral DNA)

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MPOX (MONKEYPOX)

Case Study-1

Case Presentation: A 24-year-old male presented to the emergency room with worsening skin lesions and a low-grade fever. His symptoms began in the genital area, later spreading to the face and entire body over five days.

Clinical Findings:

• **Symptoms:** Rash progression from vesicular to umbilicated pustules, fever, lymphadenopathy.

Physical Exam:

- Multiple umbilicated pustules on the face and genital area.
- Vesicular lesions on the trunk, soles, and dorsum of the hands.
- Palpable cervical and inguinal lymphadenopathy.



• **Initial Diagnosis:** Suspected varicella (chickenpox).

AlBahrani S, AlGarni R, Aljoudi TD, Al-Toufiq JA. A case report of Mpox (Monkeypox) in male traveller. New Microbes New Infect. 2023 Jan;53:101132. doi: 10.1016/j.nmni.2023.101132.

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Diagnostic Workup	Epidemiological Factors	Management and Outcome
• PCR Testing: Four skin samples sent to the national laboratory tested positive for Mpox. • Chest X-ray: Normal. • Liver Enzymes: Elevated. • STI Panel: Negative.	• Travel History: Visited three neighboring countries in the preceding three weeks. • Potential Exposure: Reported receiving a massage in an unlicensed center, likely source of infection. • Sexual History: Denied any sexual activity.	• Treatment: Supportive care, symptomatic management. • Hospital Course: Mild disease course, full recovery without antiviral therapy. • Public Health Response: Case was reported to health authorities to aid in epidemiological surveillance.

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MPXV (MONKEYPOX)

Discussion: • Atypical Presentation: Lesions initially appeared in the genital region before spreading centrifugally, differing from classic Mpox progression. • Transmission Risks: While sexual transmission was suspected in many 2022 cases, non-sexual close contact remains a significant risk. • Public Health Implications: The case highlights the importance of travel history in diagnosing Mpox in non-endemic regions. Conclusion: This case underscores the evolving presentation of Mpox in the 2022 outbreak and the importance of accurate diagnostic tools, epidemiological awareness, and public health interventions in managing emerging infectious diseases.
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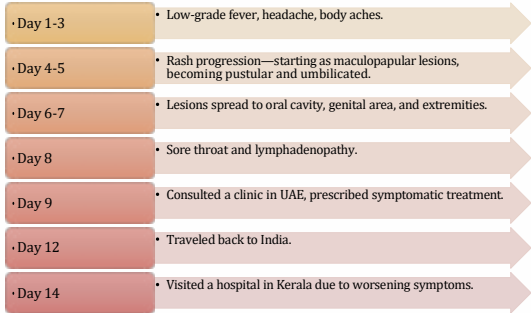
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MPXV (MONKEYPOX)

Case Study-2 A 34-year-old male, residing in the United Arab Emirates (UAE), returned to India after a business trip to Europe. He presented with fever, myalgia, and skin lesions, raising concerns of an emerging infectious disease. This case scenario explores the diagnostic approach, clinical course, and public health response. Patient Presentation: • Chief Complaint: Fever, malaise, painful vesicular rash. • History: The patient had traveled to multiple European cities, attending conferences and social gatherings.	 Yadav PD, Baghelkumar A, Sahay BK, K S, Shrivastava A, Kumar R, Son S, Mohandas S, Patel DV, Kumar A, Gupta N, George AE, Vijay N, D A, Saravali M, A R, Sathish G, Ravindranath M, Srinivasan S, James P. M.S. First two cases of Monkeypox virus infection in travellers returned from UAE to India, July 2022. J Indian J Public Health. 2022; 56(2):145-148. doi: 10.4103/jipph.2022.080007. Epub 2022 Aug 24. PMID: 35945555. PMCID: PMC9355066.
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MPXV (MONKEYPOX)

Symptoms Timeline	
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- Vitals: Stable, no respiratory distress.
- Skin: Multiple umbilicated pustules, erythematous borders on face, trunk, and extremities.
- Lymph Nodes: Enlarged cervical and inguinal lymphadenopathy.
- Genital Exam: Non-tender vesicular lesion on the penile shaft.

- Real-Time PCR: Positive for Mpox (Clade II, B.1 lineage).
- Skin Biopsy: Epidermal necrosis, perivascular inflammation.
- Serology: Negative for Varicella, HSV, and Syphilis.
- HIV Test: Negative.

- Hospitalization: Isolated in an infectious disease unit.
- Treatment: Supportive care, pain management, hydration, and lesion care.
- Recovery: Symptoms resolved by Day 24, with no complications.
- Contact Tracing: No secondary cases detected among household contacts.

- **Notification:** Case reported to local health authorities.
- **Surveillance:** Screening at airports for travelers with rash illnesses.
- **Education:** Awareness campaigns on Mpox symptoms and prevention.

- This case highlights the importance of recognizing imported Mpox infections in non-endemic regions. The atypical presentation with genital and oral lesions necessitated advanced molecular diagnostics. Rapid isolation, proper diagnosis, and public health interventions were key in preventing local transmission.

Session-4

Mpox in Animals

Course No. 004	Session 4: Mpox in Animals
Duration	15 minutes
Learning Objective	• To understand host range and reservoirs for Mpox in animals • Describe clinical signs and symptoms • Understand disease transmission in animals
Pre-requisite knowledge/skill	• Basic knowledge of zoonotic diseases and animal reservoir hosts. • Familiarity with signs of illness in wild and domestic animals. • Understanding of interspecies transmission dynamics and risk to humans.
Competencies to be achieved	• Capability to explain the signs and symptoms in different animals • Comprehension disease progression • Understanding disease transmission • Defining case of Mpox • Understanding Post-Mortem risks and lesions

ANIMALS AFFECTED

Various animal species have been identified as susceptible to Mpox virus. This includes rope squirrels, tree squirrels, Gambian pouched rats, dormice, non-human primates and other species. In areas where Mpox (Mpox) is endemic in animals, the virus that causes Mpox is thought to be maintained in nature through circulation among a number of susceptible mammals, namely wild rodents (including squirrels and rats), with occasional spill-over to non-human primates and humans.

The virus that causes Mpox (Mpox) has been reported in animals outside of endemic areas, in imported primates, and in pet prairie dogs (rodents of the genus *Cynomys*) where infection was initially introduced to North America through imported rodents.

The Mpox virus has been reported in a pet domestic dog (genus *Canis*) found in proximity to infected humans.

CLINICAL SYMPTOMS

Nonhuman primates

The predominant syndrome in nonhuman primates is a self-limited rash, which begins as small cutaneous papules that develop into pustules, then crust over, and may leave small scars when the crusts drop off. A typical Mpox lesion has a red, necrotic, depressed center, surrounded by epidermal hyperplasia. The number of lesions varies from a few individual pocks to extensive, coalescing lesions. They sometimes affect the entire body, but may be more common on the face, limbs, palms, soles and tail. Some animals have only skin lesions, which may be accompanied by a fever or lymphadenopathy, but do not appear to be otherwise ill. In more severe cases, there may also be respiratory signs (coughing, nasal discharge, dyspnea), ocular discharge, anorexia, facial edema or oral ulcers.

Prairie dogs and other species

In prairie dogs, the clinical signs may include fever, depression, anorexia, blepharoconjunctivitis (often the initial sign), respiratory signs (nasal discharge, sneezing and/or coughing, respiratory distress), diarrhea, skin lesions similar to those in nonhuman primates, and oral ulcers. Lymphadenopathy was seen in naturally infected prairie dogs. Similar clinical signs have been reported in other naturally or experimentally infected rodents; however, not all animals developed skin lesions. Some rope squirrels develop skin and oral lesions, respiratory signs and, corneal lesions.

POST MORTEM LESIONS

At necropsy, the skin may contain one or more papules, umbilicated pustules (“pocks”) with central necrosis, or crusts over healing lesions. Ulcers, erosions or lesions with necrotic centers may be found in the mouth of some animals. Peripheral lymphadenopathy is common but not always present. Conjunctivitis or blepharoconjunctivitis may also be noted. Pox lesions (white plaques or small, white, firm, deeply embedded foci with umbilicated necrotic centers) are sometimes detected on internal organs or in the stomach and small intestine. Some animals may have other internal lesions including lung involvement (e.g., pleuritis, consolidation of the lung, pulmonary edema, multifocal necrotizing pneumonitis or bronchoalveolar pneumonia), enlargement and/or mottling of the liver, orchitis, and multifocal necrotizing lesions in various organs and tissues including the spleen, liver, colon, thymus, brown fat, uterus or vagina. Hemorrhages were noted in the upper gastrointestinal tract, nasal cavity, gall bladder and brain of intranasally inoculated dormice, and in the lungs of experimentally infected ground squirrels, together with pulmonary edema.

TRANSMISSION

Transmission of the virus that causes Mpox can occur when a susceptible animal comes into contact with the virus from an animal, human, or materials contaminated with the virus. The virus enters the body through skin lesions (even if not visible to the naked eye), respiratory tract, or mucous membranes. Mpox is transmitted from infected animals to humans or other susceptible animals by direct inoculation via bites, scratches or by direct contact with the body fluids and/or the meat of an infected animal during hunting and other activities involving susceptible animal species.

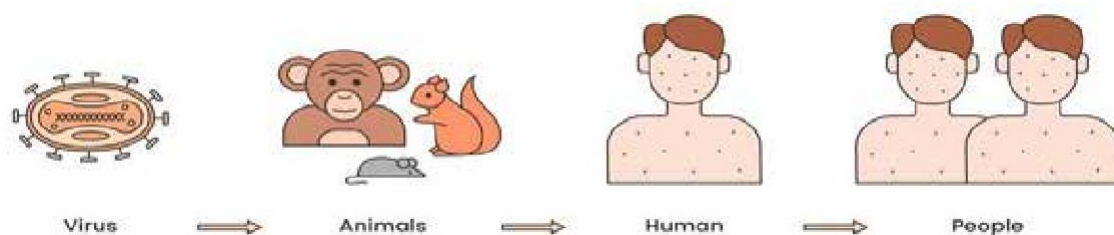


Fig 9: Transmission

Human to animal transmission has been suspected in cases of pet dogs which had close contact with their owners who were symptomatic. The dogs showed mucocutaneous lesions and tested positive on PCR.

CONTROL

Disease reporting

Veterinarians who encounter or suspect Mpox should follow their national and/or local guidelines for disease reporting.

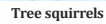
Prevention

As a result of a Mpox outbreak in 2003 that was caused by imported exotic pets, the U.S. banned the importation of six types of African rodents, dormice, Gambian giant pouched rats, brush-tailed porcupines.

Good infection control measures, including the isolation of new animals, help prevent outbreaks in primate facilities and facilities that import exotic pets. Because infections have been reported in Asian monkeys mixed with primates from Africa, these species should not be housed in the same area.

Care should be taken to avoid spreading the virus on fomites. Vaccination with vaccinia virus (smallpox vaccine) is protective in nonhuman primates. Anyone who has been exposed to Mpox should avoid contact with animals that might be susceptible to infection, particularly rodents and nonhuman primates.

Animals affected



MPOX (MONKEYPOX)

Symptoms

- <https://www.woah.org/en/disease/monkeypox/the-1d-2>

MPOX (MONKEYPOX)

Transmission



Abstract

References

Principles

- MPOX (MONKEYPOX)**

Notes

[illegible]

Session-5

Surveillance

Course No. 005	Session 5: Surveillance
Duration	15 minutes
Learning Objectives	• Understand considerations of Mpox surveillance in humans • Describe risk communication and public awareness
Pre-requisite knowledge/skill	• Basic understanding of epidemiological surveillance methods and case monitoring. • Familiarity with effective communication strategies during infectious disease outbreaks. • Awareness of the roles and responsibilities of healthcare and public health systems in coordinated response efforts.
Competencies to be achieved	• Comprehension of the various methods employed for surveillance and monitoring of cases • Description of strategies for risk communication and raising public awareness about Mpox • Understanding the importance of collaboration between healthcare providers and public health authorities in addressing Mpox cases

The overall goal of surveillance, case investigation and contact tracing in this context is to detect new outbreaks and stop human-to-human transmission to control the outbreak and minimize zoonotic transmission. The key objectives of surveillance and case investigation are to rapidly identify cases and clusters in order to provide optimal clinical care; to isolate cases to prevent further transmission; to identify, manage and follow up contacts to recognize early signs of infection; to protect frontline health workers, to identify risk groups; and to tailor effective control and prevention measures.

One case of Mpox is considered an outbreak. Because of the public health risks associated with a single case of Mpox, clinicians should report suspected cases immediately to national or local public health authorities regardless of whether they are also exploring other potential diagnoses, according to the case definitions above or nationally tailored case definitions. Probable and confirmed cases of Mpox should be reported as early as possible, including Clinicians should report suspected cases immediately to local and national public health authorities. Probable and confirmed cases of Mpox should be reported as early as possible, including a minimum dataset of epidemiologically relevant information.

If Mpox is suspected, case investigation should consist of clinical examination of the patient in a well-ventilated room while using appropriate personal protective equipment (PPE), questioning the patient about possible sources of infection, and safe collection and dispatch of specimens for Mpox virus laboratory examination.

As soon as a suspected case is identified, contact identification and forward contact tracing should be initiated. Contacts of probable and confirmed cases should be monitored, or should self-monitor, daily for any sign or symptom for a period of 21 days from last contact. Quarantine or exclusion from work are not necessary as long as no symptoms develop, but known contacts should avoid sexual contact with others during the 21 days monitoring period, regardless of their symptoms.

Countries and clinicians should be on alert for signals related to patients presenting with Mpox. It is important to note that patients may present to various community and other health facility settings including but not limited to primary care, fever clinics, sexual health services, infectious disease units, obstetrics and gynecology, emergency departments, and dermatology clinics. Guidance for clinical management, infection prevention and control, and the safe collection of samples for confirmatory testing should therefore be disseminated widely. In countries detecting cases of Mpox, epidemiological and transmission patterns should be investigated wherever possible in order to inform ongoing response activities to control the outbreak.

At local and national level, countries should systematically document the number of suspected cases reported, the number of suspected cases which are tested, and the number of confirmed cases among those tested.

Surveillance strategies

Aims:

- Rapidly identify cases and clusters of infections and their sources

Key objectives:

- Isolate cases to prevent further transmission
- Provide optimal clinical care
- Identify and manage contacts
- Protect frontline health workers
- Effectively control and take preventive measures based on identified routes of transmission

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Core Surveillance Strategy

Hospital-based Surveillance:

- Health facility-based surveillance and testing in dermatology, STI clinics, medicine, pediatrics OPDs, emergency departments, etc.

Targeted Surveillance:

- Targeted intervention sites identified by NACO for MSM (men who have sex with men) and FSW (female sex workers) populations.
- Measles surveillance by the Immunization division.

Contact Tracing:

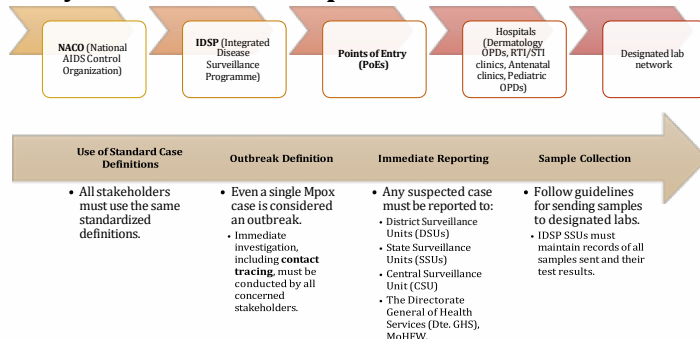
- Initiate contact tracing and testing for symptomatic individuals after the detection of a probable or confirmed Mpox case.



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Key Stakeholders in Mpox Surveillance



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Surveillance for Monkeypox – How? (contd...)

Outline

- Use Standard Case Definitions by all District Surveillance Units (DSUs) under Integrated Disease Surveillance Programme (IDSP) and at Points of Entry (PoEs).
- Even one case of monkeypox is to be considered as an outbreak. A detailed investigation by the Rapid Response Teams need to be initiated through IDSP.
- Report any suspected case immediately to the DSU/State Surveillance Units (SSUs) and CSU (Central Surveillance Unit), which shall report the same to Dte. GHS MoHFW.
- Send the samples as per the guidelines to the designated laboratories.

Salient Features

- Targeted surveillance for probable case or clusters.
- Initiate contact tracing and testing of the symptomatic after the detection of the probable/confirmed case.

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Notes

[illegible]

Indicators for monitoring the quality of mpox surveillance

1

1. Proportion of probable and confirmed cases with complete demographic information

2

1. Proportion of suspected cases with laboratory testing performed.

3

1. Proportion of probable and confirmed cases with complete clinical and risk factor information

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MPOX (MONKEYPOX)

Notes

Session-6

Diagnosis

Course No. 006	Session 6: Surveillance and Diagnosis
Duration	20 minutes
Learning Objectives	• Various methods of sample collection , transport and storage of specimens • Familiarize with various techniques to identify the pathogen • Information about the network of referral laboratories in India
Pre-requisite knowledge/skill	• Basic knowledge of specimen collection techniques and biosafety protocols. • Familiarity with diagnostic methods used for viral pathogen detection. • Awareness of the referral laboratory network and sample transport procedures in India.
Competencies to be achieved	• Understanding the requirements for sample collection • Understand the biosafety measures involved during the sample collection • Understand the process of sample transport to the referral laboratories

SPECIMEN TYPE TO BE COLLECTED

The recommended specimen type for laboratory confirmation of Mpox is skin lesion material, including swabs of lesion surface and/or exudate, roofs from more than one lesion, or lesion crusts. Swab the lesion vigorously, to ensure adequate viral DNA is collected. Both dry swabs and swabs placed in viral transport media (VTM) can be used. Two lesions of the same type should be collected in one single tube, preferably from different locations on the body and which differ in appearance. Lesions, crusts and vesicular fluids should not be mixed in the same tube. If resources permit it, two tubes may be collected to minimize risk of poor sampling or inhibitors, however only one should be tested and the second should only be tested in case the first provides inconclusive results. In the prodromal phase (1-4 days), the collection of an nasopharyngeal/oropharyngeal swab is encouraged. However, data on the accuracy of this specimen type for diagnosis is limited for Mpox, therefore a negative throat swab specimen should be interpreted with caution.

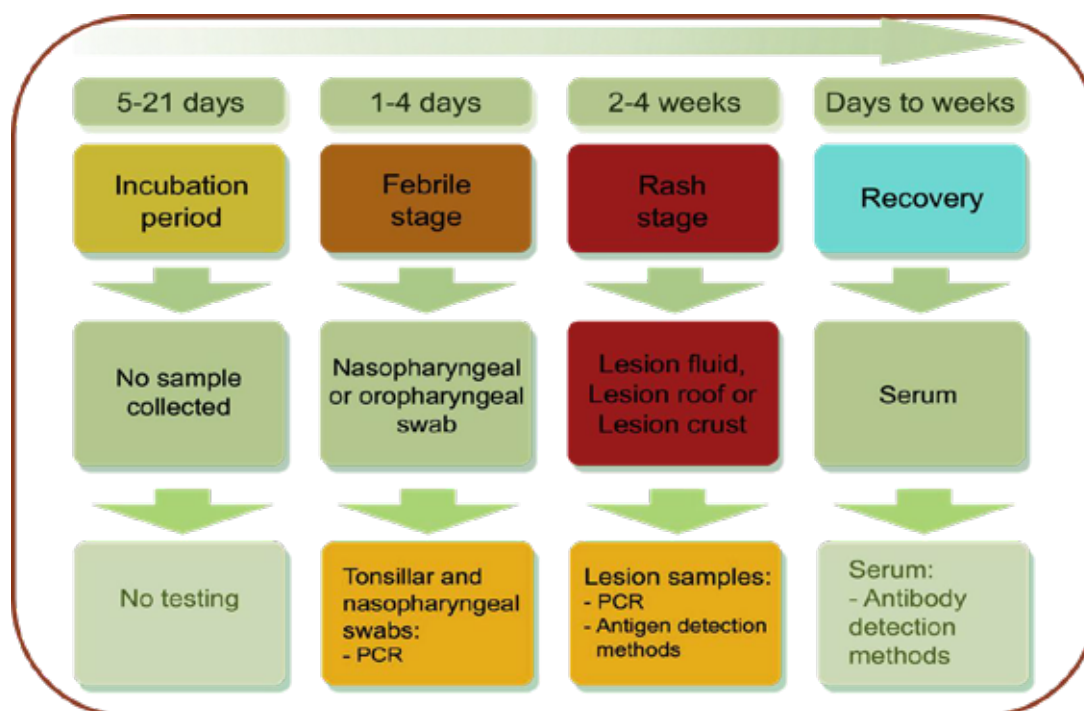


Fig 10: Timelines for sample collection

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

Lesion roof, base scrapping, fluid and crust/scab collection (collect from multiple sites)

- Explain the procedure to the patient
- Sanitize the skin covered with lesion with 80% alcohol wipes to start the collection
- Remove the lesion roof using sterile scalpel or plastic scrapper
- Place the roof in the screw cap plain tube.
- Similarly, use 1ml intradermal syringe to collect the pustule/ vesicular fluids from multiple lesions and collect in fresh screw cap plain tube
- Use the polystyrene swab to collect the scrapings from the base of the lesions by gentle scrapping and put it in fresh screw cap plain tube

The scab/crust if formed using polystyrene swab, should also be collected in fresh screw cap plain tube

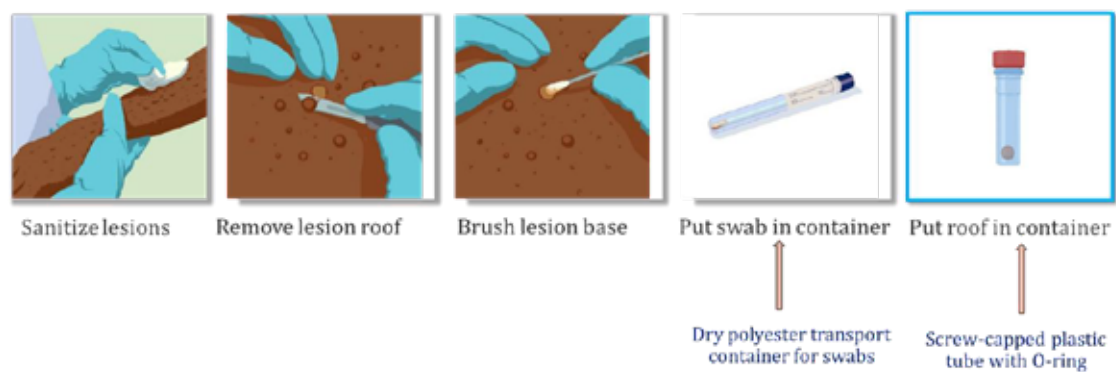


Fig 11: Lesion roofs and fluid collection procedure

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

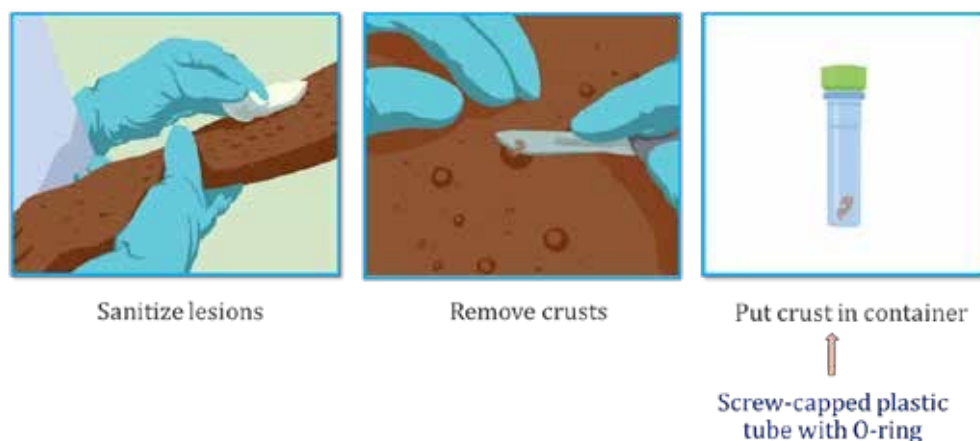
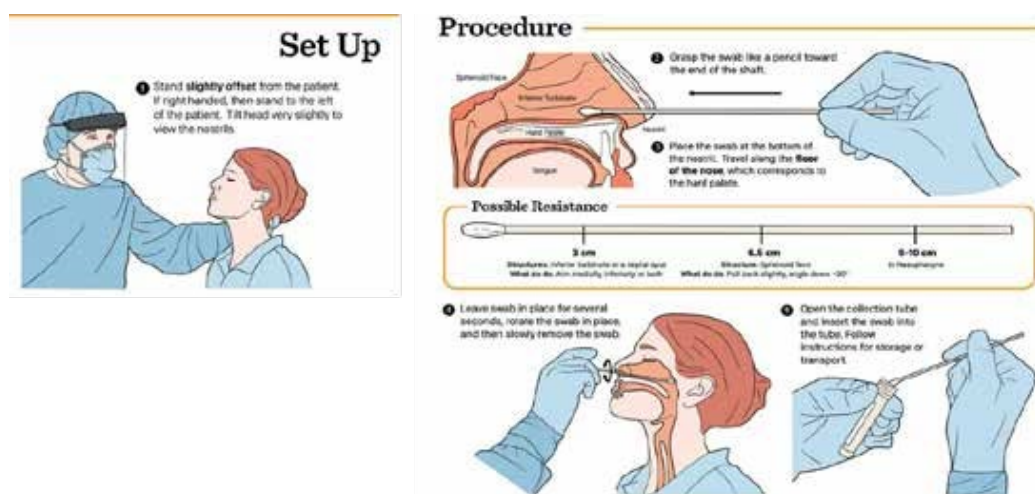


Fig 12: Lesion crust collection procedure

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

Collection of Nasopharyngeal and Oropharyngeal swabs in screw capped plain tube

- Explain the procedure to the patient
- Remove the polystyrene swab. Don't let anything touch the sterile swab on the end of the stick.
- Ask patient to open mouth and stick their tongue out
- Use tongue spatula to press the tongue downward to the floor of the mouth.
- Use sterile polystyrene swab to swab both of the tonsillar arches and the posterior nasopharynx, without touching the sides of the mouth.
- Reach behind the uvula and swab: a. tonsillar fauces, b. the posterior pharynx, and c. any ulceration, exudate, lesion, or area of inflammation.
- Don't let the sterile swab touch the patient's tongue, gums, or teeth as you gently remove it from his/her mouth
- Place the swab into the screw-capped plain plastic tube [without any medium or VTM]
- Similarly, tilt patient's head back 70 degrees. Gently and slowly insert a polystyrene swab with a flexible shaft through the nostril parallel to the palate until resistance is encountered.
- The distance is equivalent to that from the nostril to the ear of the patient, indicating contact with the nasopharynx
- Gently rub and roll the swab, leaving it in place for several seconds to absorb secretions. If a deviated septum or blockage creates difficulty in obtaining the specimen from one nostril, use the same swab to obtain the specimen from the other nostril
- Slowly remove swab while rotating it. Specimens can be collected from both nostrils
- Place the swab into the same screw-capped plain plastic tube [without any medium or VTM] in which the OPS swab was kept
- Break the excess stick and recap the tube tightly.
- Keep the tube in an upright position in the stand.
- Surface decontaminate the tube using 2% Lysol or 0.5-1% Sodium hypochlorite wipes





Brush tissue



Put swab in container

Fig 13: Nasopharyngeal specimen collection

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

Venous Blood Collection in SSGT and EDTA tube

- Explain the procedure to the patient
- Check the patient's fore-arm/median cubital fossa for a prominent vein of good size. Use the median cubital vein wherever feasible.
- Apply the tourniquet 4-5 fingerbreadths above the site of venipuncture.
- Perform hand hygiene by using an alcohol-based hand rub on the outer pair of gloves
- Disinfect the skin site using a wipe containing 70% alcohol, in a circular motion, from the centre to periphery. Allow the skin to dry.
- Do not re-touch the site of puncture again. In case of accidental touch, repeat the skin disinfection as above.
- Anchor the vein by holding your thumb below the puncture site.
- Ask the patient to make a fist so as to make the veins prominent.
- Insert the needle (vacutainer or syringe needle) into the vein, bevel side up, at an angle of about 30° and advance the needle into the vein.
- Collect 5 mL of blood (into the syringe or into tubes) and aliquot 2 ml in EDTA (Purple top) 3 ml in SSGT (Yellow top) for serum separation.
- Release the tourniquet.
- Withdraw the needle gently and apply a piece of sterile gauze to the puncture site
- Ask the patient to gently press down on the gauze on the puncture site, keeping the arm folded
- If a syringe and needle were used for collection, transfer the blood inside the tube by piercing the stopper of the tubes placed firmly on a rack.
- Invert EDTA tubes gently 4-5 times to ensure proper mixing of the additives
- Keep the tubes in an upright position in the stand.
- Discard the syringe and needle into the sharp's container
- Surface decontaminate the SSGT and the EDTA tube using 2% Lysol or 0.5-1% Sodium hypochlorite wipes

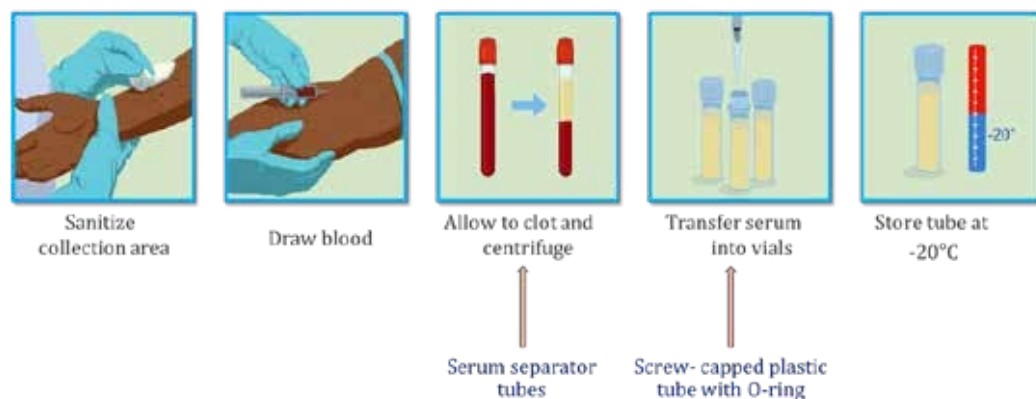


Fig 13: Serum sample collection

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

Urine sample collection in the screw capped sterile urine container

- Explain the procedure to the patient
- Provide privacy to the patient
- First ask patient to wipe/clean the genitals
- Ask patient to urinate a small amount into the toilet bowl, and then stop the flow of urine.
- Then collect a sample of urine into the clean or sterile container provided
- Ask the patient to collect about 3 to 5 mL of mid-stream urine sample into the collection tube provided, taking care not to contaminate the outside of the container
- Ask patient to finish urinating into the toilet bowl
- Close the lid carefully and keep the container standing position
- Surface decontaminate the SSGT and the EDTA tube using 2% Lysol or 0.5-1% Sodium hypochlorite wipes

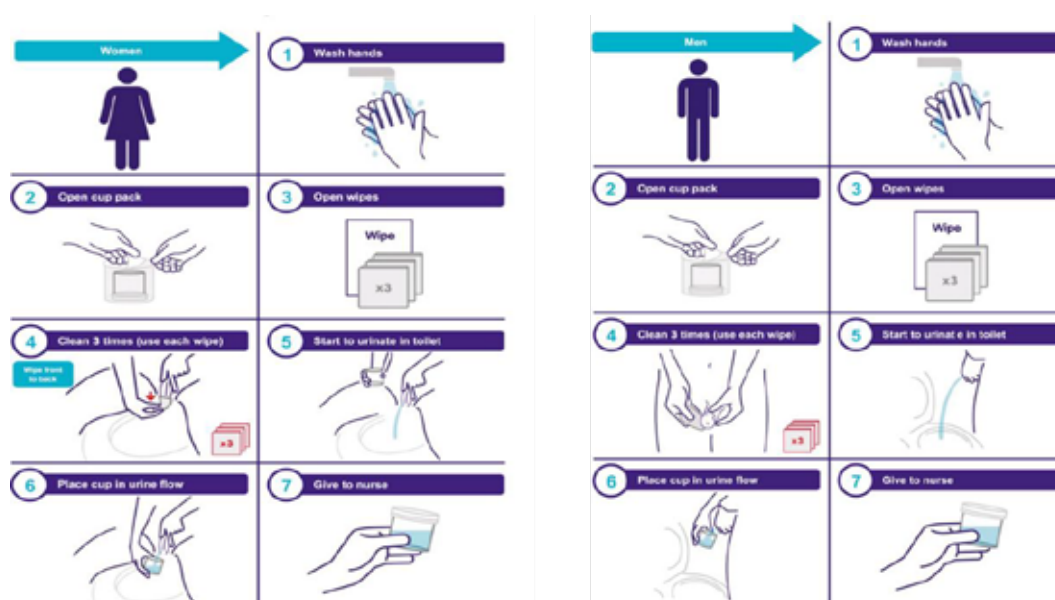


Fig 15: Procedure for urine sample collection

(Image source: <https://www.sciencedirect.com/science/article/pii/S0099176719301308>)

STORING & TRANSPORTING SPECIMENS

Specimens collected for MPOXV investigation should be refrigerated (2– 8 °C) or frozen (-20 °C or lower) within one hour after collection. If transport exceeds 7 days for the sample to be tested, specimens should be stored at -20 °C or lower. Longer term specimen storage (>60 days from collection) is recommended at -70°C. Viral DNA present in skin lesion material is relatively stable if kept in a dark, cool environment, which can be considered when cold chain is not readily available, but room temperature shipment is not recommended until further studies provide evidence that sample quality is not compromised. Repeated freeze-thaw cycles should be avoided because they can reduce the quality of specimens. Aside from specific collection materials indicated in the annex, other requisite materials and equipment may include: transport containers and specimen collection bags and triple packaging, coolers and cold packs or dry ice, sterile blood-drawing equipment (e.g. needles, syringes and tubes), labels and permanent markers, PPE, and materials for decontamination of surfaces.

Specimens should be stored refrigerated or frozen within an hour of collection and transported to the laboratory as soon as possible after collection. Correct handling and storage of specimens during transportation is essential for accurate diagnostic testing. Transport of specimens should comply with any applicable national and/or international regulations. For international transport, specimens from suspected probable or confirmed cases of MPOXV, including clinical samples, viral isolates and cultures should be transported as Category A, UN2814 “infectious substance, affecting humans”. All specimens being transported should have appropriate triple packaging, labelling and documentation. Shipping requires a dangerous goods certified shipper.

Guidelines for triple layer packaging of samples

Clinical specimens pose a health hazard to workers involved in the process of handling and therefore utmost care should be exercised. Diagnostic specimens are classified as hazardous materials (risk groups 2, 3 and 4 under 2004 regulations; or Category B under 2005-2006 regulations) and therefore require packaging that meets International Air Transport Association (IATA).

The packaging of these materials must be of good quality and be strong enough to withstand leakage of contents, shocks, pressure changes, humidity, vibration and manual or mechanical handling considered incident to ordinary transportation. This is interpreted to mean that the contents should not leak to the outside of the shipping container, even if there should be leakage of the primary receptacle(s) during transit. The packaging should be resilient enough to withstand rough handling, passage through cancellation machines, sorters, conveyors and other similar equipment.

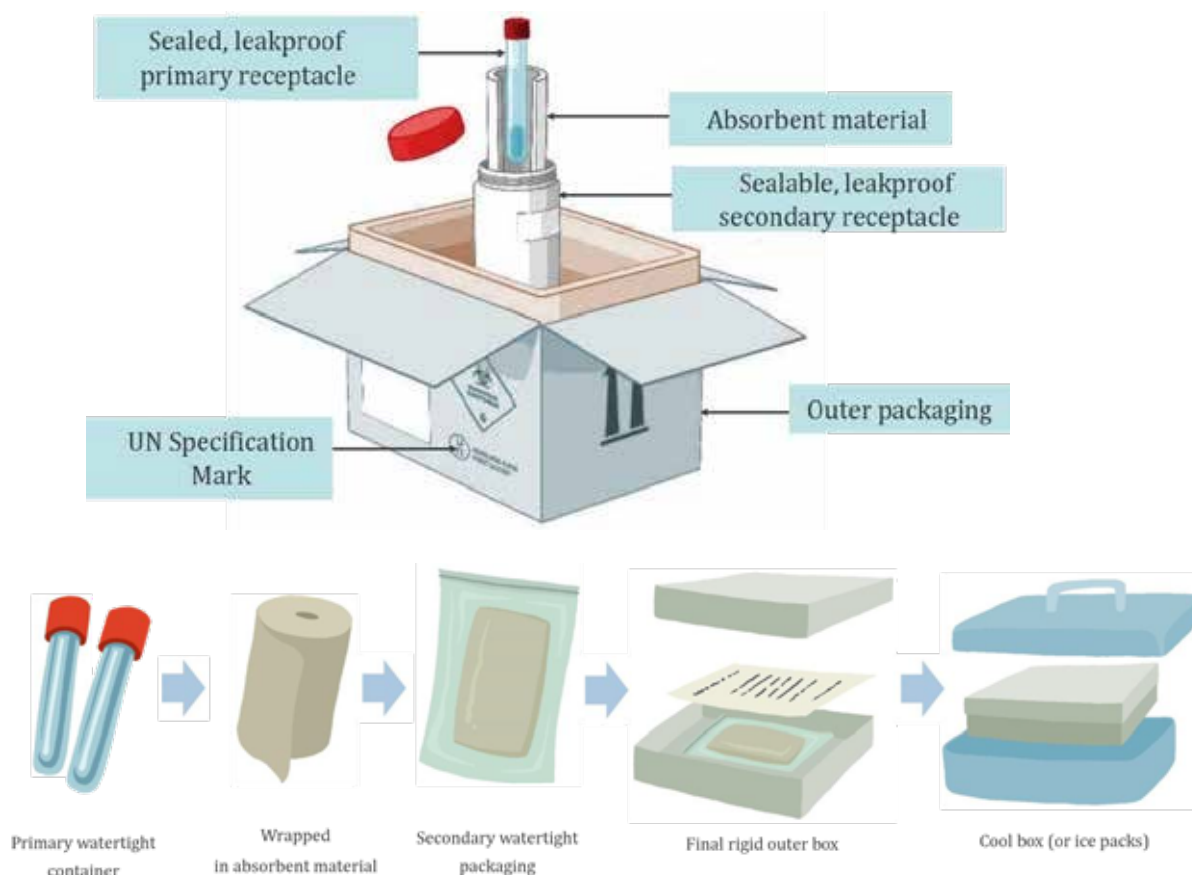


Fig 16: Basic triple packaging system

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

Procedure:

- Arrange a transportation date with the receiving laboratory
- When all the arrangements have been finalized, inform the lab of the time and manner of transportation
- Follow triple Layer packing guidelines
- Transfer the biological sample (VTM, scrapping, Blood, Serum etc.) to properly labelled plastic vial (leak proof) with complete patient identity, date of collection, specimen number
- Seal it tightly with parafilm.
- Make sure the information on form (that accompanies the specimen) and specimen match with each other.
- Put tightly closed plastic sample vial in a self-sealing Ziplock bag (secondary container)
- All secondary containers should be put into a sturdy outer container or packaging/box that has a minimum of one rigid side of 4 inches in width. (insulated thermos box with ice/ vaccine carrier)
- Place adequate cushioning materials inside the box so as to absorb shocks during transport, and adequate absorbing material to absorb any spillage should it occur.
- Place sufficient dry ice/ice packs between the secondary container(s) and the outer container to maintain a cold chain during transportation.

- If using ice packs (should be frozen) and vaccine carrier, place frozen icepacks along the sides and place the samples in the center
- For liquid specimens, the outer container must not contain more than a total of 4 liters (L) (excluding ice or dry ice used to keep specimens cold).
- Place ID form/ test request form in a sealed plastic bag inside the transport box.
- Label the outer container with
 - ◊ Name, addresses and telephone numbers of the sending and receiving laboratories;
 - ◊ Orientation labels on opposite sides of shipping container

Precautions

- Do not ship sample in glass tubes and vials
- Do not ship samples with incomplete labeling;
- Do not allow samples to freeze-thaw before shipping.



Fig 17: Sample packaging

(Image Source: Monkeypox Preparedness and response, OpenWHO.org)

Documentation

Commercial Air Shipments require:

- Airway bill
- Name & telephone number of a responsible person who is knowledgeable and accessible for 24/7hrs.
- Shipping pouch (address window) should be pasted on the top surface of closed guide.

The sending and receiving laboratories should record and document the boxes of specimens that are transferred, with a note indicating the number of boxes sent and received.

All the clinical specimens should be transported to the Apex laboratory of ICMR-NIV Pune routed through the Integrated Disease Surveillance Program network of the respective district/state.

Personal Protective Equipment for handling the clinical specimens

PPE to be donned before collecting the specimens should include- Coveralls/Gowns, N-95 mask, Face shield/safety goggles, double pair of gloves. Donning & doffing of PPE should be carefully performed as per the standard procedure.

Specimen rejection criteria:

The sample is unacceptable and should be rejected in case of any discrepancy which may otherwise lead to erroneous results. The laboratory staff should notify the clinician who has requested the tests.

LABORATORY TECHNIQUES FOR MPOX DIAGNOSIS

Clinical specimens such as lesion samples, EDTA blood, serum, urine, and oropharyngeal/nasopharyngeal swabs (OPS/NPS) are tested using PCR to detect the Orthopoxvirus genus, which includes Cowpox, Buffalopox, Camelpox, and Monkeypox. If the result is positive, further confirmation is performed using either a Monkeypox-specific PCR or real-time PCR for Monkeypox DNA. A confirmed positive result is reported as Monkeypox. If the initial Orthopoxvirus PCR is negative, alternative causes should be investigated.

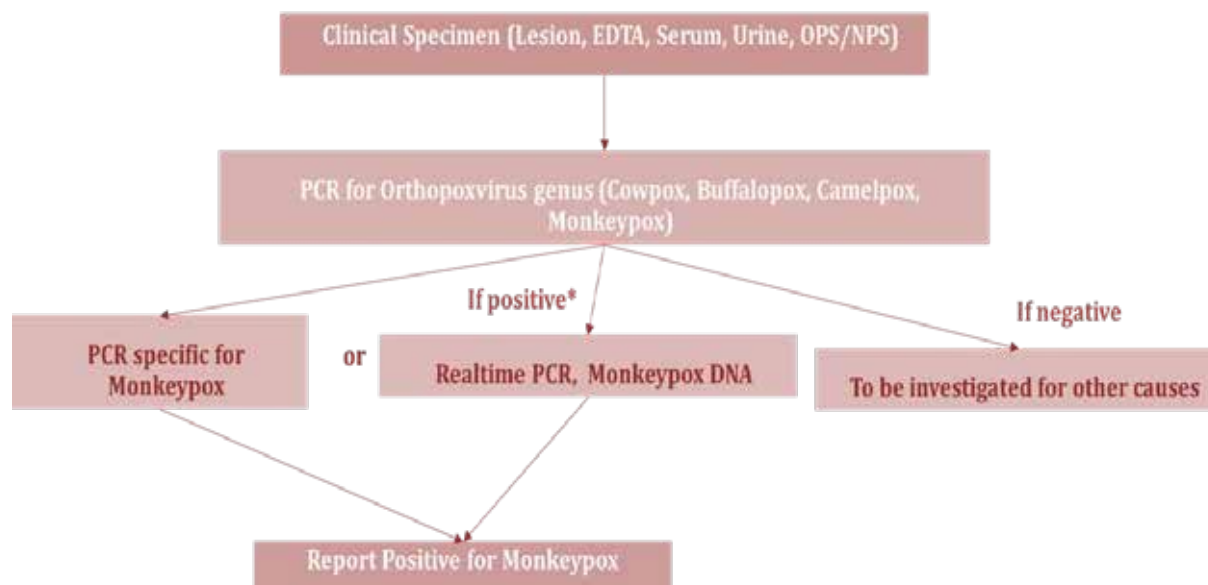


Fig 18: Diagnostic Algorithm

(Source: Reproduced from the Guidelines for Management of Monkeypox Disease, MOHFW, GoI)

Electron microscopy

Electron microscopy can be used to evaluate the specimen for a potential orthopoxvirus. Considering the availability of molecular assays and the high technical skills and facility required for this method, it is not routinely used for the diagnosis of poxviruses and cannot reliably distinguish between orthopoxvirus species.

Molecular tests

Detection of viral DNA by polymerase chain reaction (PCR) is the preferred laboratory test for Mpox. The best diagnostic specimens are taken directly from the rash – skin, fluid or crusts – collected by vigorous swabbing. In the absence of skin lesions, testing can be done on oropharyngeal, anal or rectal swabs. Testing blood is not recommended. Antibody detection methods may not be useful as they do not distinguish between different orthopoxviruses.

There are numerous variants of PCR-based methods for the detection of Orthopoxvirus/MPOXV genomic targets. Over 90 primer/probe sets are used to target as many as 38 poxvirus genes.

For the confirmation of Mpox on the suspected clinical specimens:

- PCR for Orthopoxvirus genus [Cowpox, Buffalopox, Camelpox, Mpox] will be done
- If specimen will show positivity for the Orthopoxvirus, it would be further confirmed by Mpox specific conventional PCR or real time PCR for Mpox DNA
- Additionally, virus isolation and the Next Generation Sequencing of clinical samples (Miniseq and Nextseq) will be used for characterization of the positive clinical specimens**

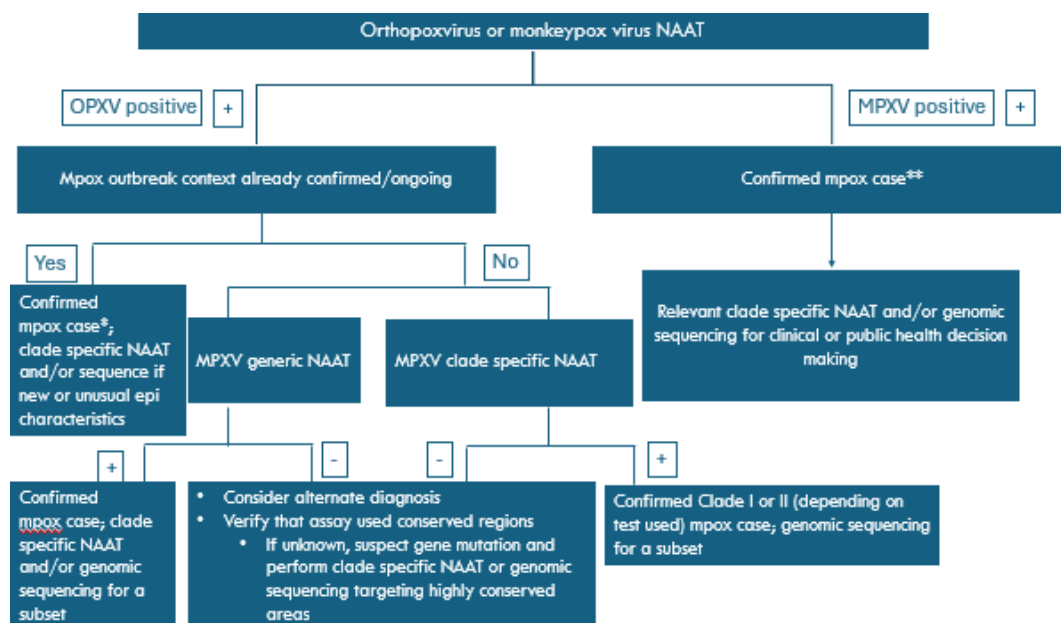


Fig 19: Laboratory testing algorithm for clinical management and surveillance of mpox: Positive results.

(Source: World Health Organization. Clinical management and infection prevention and control for monkeypox: Interim rapid response guidance. 2022 Jun 10; Available from: <https://www.who.int/publications/i/item/WHO-MPX-Clinical-and-IPC-2022.1>)

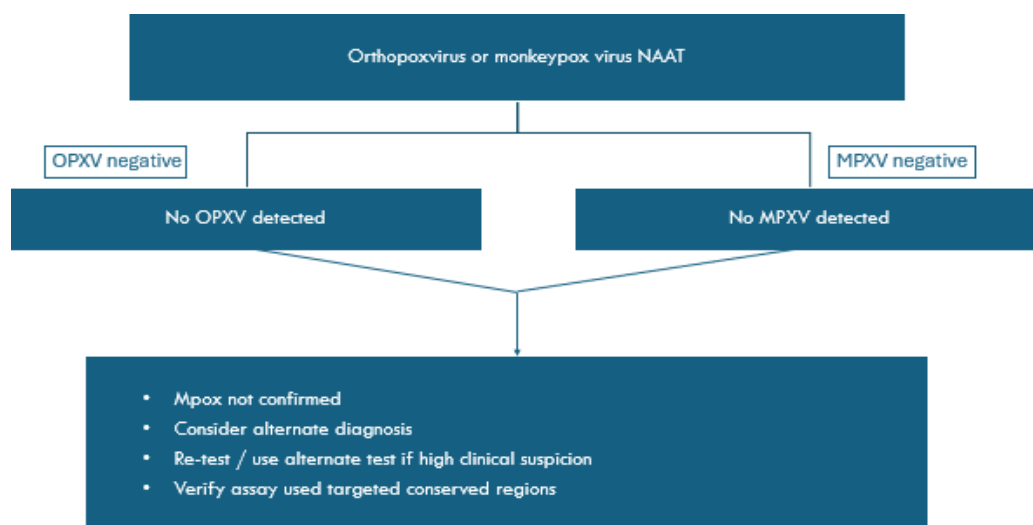


Fig 20: Laboratory testing algorithm for clinical management and surveillance of mpox: Negative results.

(Source: World Health Organization. Clinical management and infection prevention and control for monkeypox: Interim rapid response guidance. 2022 Jun 10; Available from: <https://www.who.int/publications/i/item/WHO-MPX-Clinical-and-IPC-2022.1>)

Diagnostics

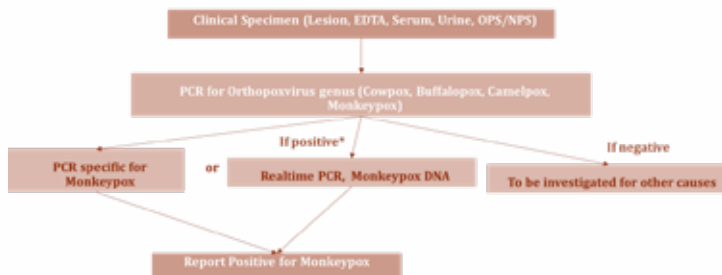


- **Role of Electron Microscopy:**
 - Electron microscopy can be used to examine specimens for the presence of orthopoxvirus.
- **Limitations:**
 - Requires high technical expertise and specialized facilities.
 - Not commonly used for routine poxvirus diagnosis due to the availability of more advanced molecular assays.
 - Cannot reliably differentiate between different orthopoxvirus species.

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MPOX (MONKEYPOX)

Diagnostic Algorithm



* Virus isolation and the Next Generation Sequencing of clinical samples (Miniseq and Nextseq) will be used for characterization of the positive clinical specimens

Source: Reproduced from the Guidelines for Management of Monkeypox Disease, MoHFW, G4

Centre for One Health, NCDC, MoHFW

MPOX (MONKEYPOX)

Laboratory testing algorithm for clinical management and surveillance of mpox: Positive results.

*This applies in resource-limited settings and provided that other orthopoxviruses do not co-circulate in humans; otherwise, a MPXV-specific or MPXV clade-specific test is required for confirmation.

**if resources allow, sample should be further characterized in a reference laboratory

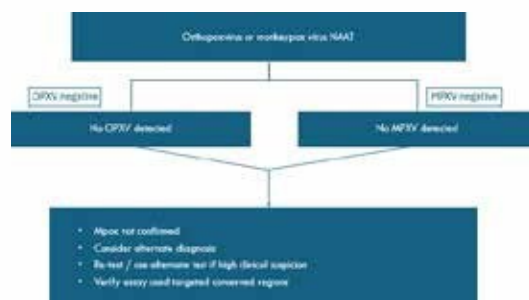


World Health Organization. Clinical management and infection prevention and control for monkeypox: interim rapid response guidance. 2022 Jun 10. Available from: <https://www.who.int/publications/item/WHO-MPX-Clinical-and-IPC-2022.1>

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MPOX (MONKEYPOX)

Laboratory testing algorithm for clinical management and surveillance of mpox: Negative results.



World Health Organization. Clinical management and infection prevention and control for monkeypox: interim rapid response guidance. 2022 Jun 10. Available from: <https://www.who.int/publications/item/WHO-MPX-Clinical-and-IPC-2022.1>

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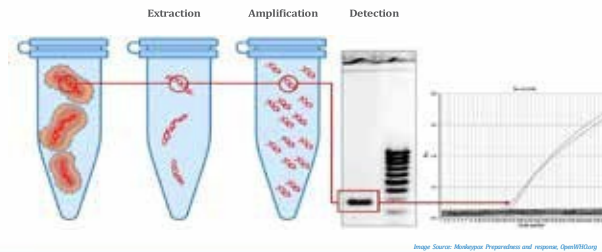
MPOX (MONKEYPOX)

Notes

Nucleic acid detection: PCR

Polymerase chain reaction (PCR) is the technique most commonly used to confirm monkeypox.

- Tests conducted on **lesion material**
- Small amount of DNA is enough
- Detects **monkeypox virus** + identifies the **viral clade**



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MPOX (MONKEYPOX)

Testing for HIV

Individuals living with HIV, especially those immunosuppressed, are at a higher risk of severe mpox disease.

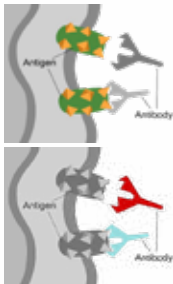
In cases where mpox transmission is linked to sexual contact or immune suppression is suspected, patients should be tested for HIV if their status is unknown.

Follow current WHO guidelines on HIV testing services.

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MPOX (MONKEYPOX)

Antigen and Antibody Detection Explained



Antigen detection

- uses an antibody directed against an orthopoxvirus antigen
- proves the presence of an orthopoxvirus **current infection**
- done on **lesion material**
- **not monkeypox virus specific**

Antibody detection

- uses an antigen directed against the antibody
- **limited diagnostic value**: proves a reaction of the body to the virus **current or past infection/vaccination**
- done on **serum**
- **not monkeypox virus specific**

Antibody and Antigen tests for Mpox have **NOT** been recommended for use by MoHFW owing to the limited diagnostic value

Image Source: Monkeypox Preparedness and response, OpenWHO.org

Centre for One Health, NCDC, MoHFW

MPOX (MONKEYPOX)

Biomedical Waste Management

Correct containment and disposal of contaminated waste (e.g., dressings) in accordance with Biomedical Waste Management guidelines (2016 & subsequent amendments) for infectious waste.



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MPOX (MONKEYPOX)

Notes

Session-7

Treatment, Management & Prevention

Course No. 007	Session 7: Treatment, Prevention & Management
Duration	20 minutes
Learning Objectives	• Understand guidelines for effective Mpox management • Describe preventive measures (vaccination) to protect exposed personnel
Pre-requisite knowledge/skill	• Basic understanding of infectious disease management protocols and public health guidelines. • Familiarity with personal protection measures, disinfection practices, and infection control. • Awareness of available vaccines and vaccination strategies for high-risk groups.
Competencies to be achieved	• Comprehension of current guidelines for Mpox management • Thorough understanding of preventive measures to adopt for at-risk individuals • Ability to describe various disinfection options • Knowledge about available vaccines for humans

TREATMENT

Currently, there are no specific clinically proven treatments for Mpox infection. As with most viral illnesses, the treatment is supportive symptom management. There are, however, prevention measures that can help prevent an outbreak. The infected individual should remain in isolation, wear a surgical mask, and keep lesions covered as much as reasonably possible until all lesion crusts have naturally fallen off and a new skin layer has formed. For severe cases, investigational use can be considered for compounds with demonstrated benefit against orthopoxviruses in animal studies and severe vaccinia vaccine complications.

The goal of treating Mpox is to take care of the rash, manage pain and prevent complications. Early and supportive care is important to help manage symptoms and avoid further problems.

Getting an Mpox vaccine can help prevent infection. The vaccine should be given within 4 days of contact with someone who has Mpox (or within up to 14 days if there are no symptoms).

It is recommended for people at high risk to get vaccinated to prevent infection with Mpox, especially during an outbreak. This includes:

- health workers at risk of exposure
- men who have sex with men
- people with multiple sex partners
- sex workers.

Several antivirals, such as tecovirimat, originally developed to treat smallpox have been used to treat Mpox.

MANAGEMENT

Most people with Mpox recover within 2–4 weeks. Things to do to help the symptoms and prevent infecting others:

Do's

- stay home and in your own room if possible
- wash hands often with soap and water or hand sanitizer, especially before or after touching sores
- wear a mask and cover lesions when around other people until your rash heals
- keep skin dry and uncovered (unless in a room with someone else)
- avoid touching items in shared spaces and disinfect shared spaces frequently
- use saltwater rinses for sores in the mouth
- take sitz baths or warm baths for body sores
- take medications for pain and fever like paracetamol (acetaminophen)

Don't

- pop blisters or scratch sores, which can slow healing, spread the rash to other parts of the body, and cause sores to become infected; or
- shave areas with sores until scabs have healed and you have new skin underneath (this can spread the rash to other parts of the body).

To prevent spread of Mpox to others, persons with Mpox should isolate at home, or in hospital if needed, for the duration of the infectious period (from onset of symptoms until lesions have healed and scabs fall off). Covering lesions and wearing a medical mask when in the presence of others may help prevent spread. Using condoms during sex will help reduce the risk getting Mpox but will not prevent spread from skin-to-skin or mouth-to-skin contact.

Component of management	Symptoms/Signs	Management
Protection of compromised skin and mucous membranes	Skin rash	• Clean with simple antiseptic • Mupirocin Acid/Fucidin • Cover with light dressing if extensive lesion present • Do not touch/ scratch the lesions • In case of secondary infection relevant systematic antibiotics may be considered
	Genital ulcers	• Sitz bath
	Oral ulcers	• Warm saline gargles/ oral topical anti-inflammatory gel
	Conjunctivitis	• Usually, self-limiting • Consult Ophthalmologist if symptoms persist or there are pain/ visual disturbances
Rehydration therapy and nutritional support	Dehydration can occur in association with poor appetite, nausea, vomiting and diarrhoea	• Encourage ORS or oral fluids • Intravenous fluids if indicated • Encourage nutritious and adequate diet
Symptom alleviation	Fever	• Tepid sponging • Paracetamol as required
	Itching/Pruritus	• Topical Calamine lotion • Antihistaminics
	Nausea and vomiting	• Consider anti-emetics
	Headache/ malaise	• Paracetamol and adequate hydration

PREVENTION

Smallpox (vaccinia) vaccination appears to provide some protection from Mpox. Post-exposure vaccination also seems to be helpful, and may be offered to people who are exposed to a Mpox-infected person or animal. This vaccine cannot be used in those who are immunocompromised.

Raising awareness of risk factors and educating people about the measures they can take to reduce exposure to the virus is the main prevention strategy for Mpox.

Reducing the risk of human-to-human transmission

Surveillance and rapid identification of new cases is critical for outbreak containment. During human Mpox outbreaks, close contact with infected persons is the most significant risk factor for Mpox virus infection. Health workers and household members are at a greater risk of infection. Health workers caring for patients with suspected or confirmed Mpox virus infection, or handling specimens from them, should implement standard infection control precautions. Samples taken from people and animals with suspected Mpox virus infection should be handled by trained staff working in suitably equipped laboratories. Patient specimens must be safely prepared for transport with triple packaging in accordance with WHO guidance for transport of infectious substances.

Infection Prevention and Control (IPC)

A combination of standard, contact, and droplet precautions should be applied in all healthcare settings when a patient presents with fever and vesicular/pustular rash. In addition, because of the theoretical risk of airborne transmission of Mpox virus, airborne precautions should be applied as per risk assessment.

Clinical triage includes early recognition and immediate placement of patient in separate area from other patients (source control). All individuals, including family members, visitors and HCWs should apply standard, contact and droplet precautions.

Patient isolation

Patient should be managed in isolation, precautions should be taken to minimize exposure to surrounding persons, which include placing a surgical mask over the patient's nose and mouth—if tolerable to the patient—and covering any of the patient's exposed skin lesions with a sheet or gown.

Ambulance Transfer

- When a case has to be transported, the personnel accompanying the patient should wear PPE (long sleeved gown, N95 mask, gloves, and goggles).
- Give prior information to the hospital of the admission/transfer of a potentially infectious person.
- Request patient to wear a mask (if tolerated) and advise on Respiratory Hygiene and Cough Etiquette.
- If lesions are present, cover them with long sleeved clothing/pant or a clean sheet to minimize contact with others. In the ambulance use disposable linen if available.
- The ambulance should be cleaned and disinfected before using for the other patients. After wearing PPE, surfaces (stretcher, chair, door handles etc.) should be cleaned with a freshly prepared 1% hypochlorite solution or equivalent. Carefully place reusable blankets in a bag without shaking or fluffing them, then put into a laundry bag and send for laundering clearly labelling it so that person in the laundry wears appropriate PPE before handling or autoclaves it before opening. Follow manufacturer's instructions for cleaning/disinfecting reusable equipment in the ambulance. All masks and any waste contaminated with crusts, secretions, serum or body fluids should be disposed of as infectious waste in yellow bag. In the ambulance, if the driver's chamber is not separate, driver should also use PPE.

Additional Precautions

- PPE (Disposable gown, gloves, N95 mask, Eye goggles) should be donned before entering the patient's room and used for all patient contact. All PPE should be disposed of prior to leaving the isolation room where the patient is admitted.
- Hand hygiene (following standard steps of hand hygiene) after all contact with an infected patient and/or their environment during care.
- Correct containment and disposal of contaminated waste (e.g., dressings) in accordance with Biomedical Waste Management guidelines (2016 & subsequent amendments) for infectious waste.
- Care when handling soiled laundry (e.g., bedding, towels, personal clothing) to avoid contact with lesion material.
- Soiled laundry should never be shaken or handled in manner that may disperse infectious particles.
- Care when handling used patient-care equipment in a manner that prevents contamination of skin and clothing.
- Ensure that used equipment has been cleaned and reprocessed appropriately.
- Ensure provisions are in place for cleaning and disinfecting environmental surfaces in the patient care environment.
- Hospital disinfectant currently used for environmental sanitation may be used as per recommendations for concentration, contact time, and care in handling.

IPC at home

- Patients who do not require hospitalization may be managed at home taking following preventive measures:
- Patients should be isolated in a room or area separate from other family members. Healthy household members should limit contact with the patient.
- Patients should not leave the home except for medical care.
- No visitors should be allowed at home.
- Patients, especially those who have respiratory symptoms (e.g., cough, shortness of breath, sore throat) should wear a surgical mask. If this is not feasible, other household members should consider wearing a surgical mask when in the presence of the patient.
- Disposable gloves should be worn for direct contact with lesions and disposed of after use.
- Skin lesions should be covered to the best extent possible (e.g., long sleeves, long pants) to minimize risk of contact with others.
- Contain and dispose of contaminated waste (such as dressings and bandages) in the Biomedical waste disposable bag Do not dispose of waste in landfills or dumps.
- Proper hand washing with soap and water (or use of an alcohol-based hand rub) should be performed by the patient and other household members after touching lesion material, clothing, linens, or environmental surfaces that may have had contact with lesion material.
- Laundry (e.g., bedding, towels, clothing) may be washed with warm water and detergent
- Care should be used when handling soiled laundry to avoid direct contact with contaminated material.
- Soiled laundry should not be shaken or otherwise handled in a manner that may disperse infectious particles.
- Dishes and other eating utensils should not be shared. Soiled dishes and eating utensils should be washed with warm water and dish washing soap.
- Contaminated surfaces should be cleaned and disinfected. Standard household cleaning/disinfectants may be used in accordance with the manufacturer's instructions.
- Pets and domestic animals should be excluded from the patient's environment.

Duration of Isolation Procedures

- Affected individuals should avoid close contact with immunocompromised persons and pregnant women until all crusts are gone. Isolation precautions should be continued until all lesions have resolved and a fresh layer of skin has formed.

RISK COMMUNICATION

This includes providing public health advice through the channels that target audiences use on how the disease transmits, its symptoms, preventive measures and what to do in case of suspect or confirmed infection. This should be combined with targeting community engagement to the population groups who are most at risk, working closely with health care providers, including STD clinics, and civil society organizations.

Risk communication should be informed by insights from social listening detecting public sentiment and should timely address possible rumors and misinformation. Health information and advice should be provided avoiding any form of stigmatization of certain groups such as men who have sex with men (MSM). The key measures that can be taken to prevent infection with Mpox virus:

Isolate infected patients from others who could be at risk for infection.

- Avoid contact with any materials, such as bedding, that has been in contact with a patient of Mpox.
- Practice good hand hygiene after contact with infected persons. For example, washing your hands with soap and water or using an alcohol-based hand sanitizer.
- Use masks and gloves when caring for patients.

Treatment/Management



- No Specific treatment, only supportive management



- Antiviral drugs, such as tecovirimat, cidofovir/brincidofovir, and trifluridine (and vidarabine) eye drops or ointments, may be effective but their efficacy has not been established in clinical trials.



- The monkeypox vaccine should be administered within four days of exposure to prevent the onset of the disease.



- The vaccine can provide some protection or reduce the severity of symptoms if given within the recommended time frame.



- The monkeypox vaccine is not routinely recommended for the general public but may be recommended for specific groups such as laboratory workers, healthcare workers, and individuals working with animals known to carry the virus.

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Supportive management

Component management	Symptoms/Signs	Management
Protection of compromised skin and mucous membranes	Skin rash	• Clean with simple antiseptic • Mupirocin, Acid/Puclidin • Cover with light dressing if extensive lesion present • Do not touch/scratch the lesions • In case of secondary infection relevant systematic antibiotics may be considered
	Genital ulcers	• Sitz bath
	Oral ulcers	• Warm saline gargles/ oral topical anti-inflammatory gel
	Conjunctivitis	• Usually, self-limiting • Consult Ophthalmologist if symptoms persist or there are pain/ visual disturbances
Rehydration therapy and nutritional support	Dehydration can occur in association with poor appetite, nausea, vomiting and diarrhoea	• Encourage ORS or oral fluids • Intravenous fluids if indicated • Encourage nutritious and adequate diet
Symptom alleviation	Fever	• Tepid sponging • Paracetamol as required
	Itching/Pruritus	• Topical Calamine lotion • Antihistamines
	Nausea and vomiting	• Consider anti-emetics
	Headache/ malaise	• Paracetamol and adequate hydration

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Prevention

- ❑ Close contact with infected individuals or contaminated materials should be avoided.
- ❑ Personal protective clothing and equipment, including gloves, should be worn while caring for the sick.
- ❑ For animal-to-human transmission, contact with sick or dead animals should be avoided.
- ❑ Animal meat or parts should be properly cooked before consumption to prevent monkeypox infections.
- ❑ JYNNEOS is an U.S. Food and Drug Administration-licensed vaccine for the prevention of monkeypox disease.
- ❑ MVA-BN vaccine as the first vaccine against mpox to be added to its prequalification list, based on information submitted by the manufacturer, Bavarian Nordic A/S, and review by the European Medicines Agency.

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Recommendations to minimize the mpox infection in clinicians and healthcare professionals



Avoid direct contact with mpox patients



Wear personal protective equipment (gown, gloves, eye protection and fitted N95 mask)



Cover the skin lesions of confirmed mpox patients



Use gloves while handling mpox patients' laundry



If available, place the mpox patient in a negative pressure room in the hospital

Source: Smith, J., & Doe, A. (2023). Human-to-animal transmission of mpox: Risks and implications. *Journal of Infectious Diseases*, 45(3), 123-134. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10126400/>

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Notes

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ANNEXURES

Case Information Form

Annexure 1

Before collecting sample, "Case Information Form" format to be filled by clinical officer reporting the case as advised in Annexure 1 of MOHFW guidelines for Management of Monkeypox disease

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Notes

Overview of GoI strategy – Mpox Response

Annexure 2

Surveillance Strategies

Aim

To rapidly identify cases and clusters of infections and the sources of infections as soon as possible in order to:

- isolate cases to prevent further transmission
- provide optimal clinical care
- identify and manage contacts
- protect frontline health workers
- effective control and preventive measures based on the identified routes of transmission.

Surveillance outline

The Standard Case Definitions by all District Surveillance Units (DSUs) under Integrated Disease Surveillance Programme (IDSP) and at Points of Entry (POEs). Even one case of monkeypox is to be considered as an outbreak. A detailed investigation by the Rapid Response Teams need to be initiated through IDSP. Report any suspected case immediately to the DSU/State Surveillance Units (SSUs) and CSU (Central Surveillance Unit), which shall report the same to Dr. GHS MoHFW. Send the samples as per the guidelines to the designated laboratories.

Core Surveillance Strategy

Two types of surveillance for probable cases or clusters

- Hospital based Surveillance:** Health facility-based surveillance & testing in Dermatology clinics, STD clinics, medicine, pediatrics OPDs etc.
- Targeted Surveillance:** This can be achieved by:
 - Monitor surveillance by immunization division
 - Targeted intervention sites identified by NACO for MSM, FSW population

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Overview of GoI strategy – Mpox Response

Annexure 3

Role of APHOs/PHOs

- Remain in a state of alert, particularly for the passengers arriving from countries reporting monkey pox outbreaks,
- Familiarize with clinical presentation of monkey pox,
- Undertake strict thermal screening and history of travel to affected countries in last 21 days,
- Establish/strengthen referral arrangements from airport/port to identified link hospital.
- Also, familiarize Bureau of Immigration personnel, airline personnel and any State health personnel deployed with them about the disease,
- Inform concerned airlines about detection of a suspect case for the purpose of disinfection procedure to be followed as per standard guidelines.

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Overview of GoI strategy – Mpox Response

Annexure 4

Sample Collection

Clinical samples to be collected from the cases as per the criteria mentioned below

Traveler from outbreak / endemic region or Community Transmission

Asymptomatic	- Observe for the development of any signs and symptoms for 21 days' post exposure - If signs and symptoms develop, collect specimens as per the duration of illness as mentioned below	Recovery phase
Symptomatic	Rash phase** *Lesion roof- with scalpel or plastic scraper collected in plain tube *Lesion fluid with intradermal syringe *Lesion base scrapings with sterile polyester swab collected in plain tube *Lesion crust in plain tube - NPS/OPS in dry plain tube [without any bacterial medium or VTML] - Blood collected in SSGT (4-5 ml) - Blood collected in EDTA (2-3ml) - Urine in sterile urine container (3-5ml)	- Blood collected in SSGT (4-5 ml) - Urine in sterile urine container (3-5ml)

* The specimens from lesion should be collected from multiple sites

** A clear lesion images should be sent along with the case record form (preferably on the email ID mentioned below)

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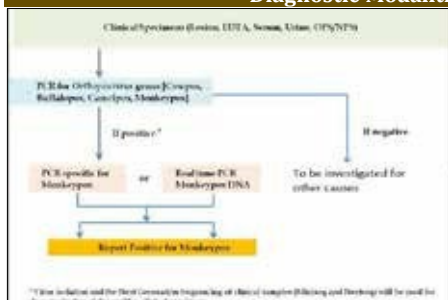
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Notes

Overview of GoI strategy – Mpox Response

Annexure 5

Diagnostic Modalities



All the clinical specimens should be transported to the Apex laboratory of ICMR-NIV Pune routed through the Integrated Disease Surveillance Programme network of the respective district/state

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Overview of GoI strategy – Mpox Response

Annexure 6

Contact Tracing

Definition of a contact

A contact is defined as a person who, in the period beginning with the onset of the source case's first symptoms, and ending when all scabs have fallen off, has had **one or more of the following exposures with a probable or confirmed case of monkey pox:**

- face-to-face exposure** (including health care workers without appropriate PPE)
- direct physical contact**, including sexual contact
- contact with contaminated materials** such as clothing or bedding

Contact monitoring

Contacts should be monitored **at least daily for the onset of signs/symptoms for a period of 21 days from the last contact** with a patient or their contaminated materials during the infectious period. In case of occurrence of fever clinical/lab evaluation is warranted.

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Overview of GoI strategy – Mpox Response

Annexure 7

Prevention

Measures to prevent infection with monkeypox virus:

- Avoid contact with any materials, such as bedding, that has been in contact with a sick person.
- Isolate infected patients from others.
- Practice good hand hygiene after contact with infected animals or humans. For example, washing your hands with soap and water or using an alcohol-based hand sanitizer.
- Use appropriate personal protective equipment (PPE) when caring for patients.

Patient isolation

- Minimize exposure to surrounding persons
 - placing a surgical mask over the patient's nose and mouth—if tolerable to the patient
 - covering any of the patient's exposed skin lesions with a sheet or gown.
- Affected individuals should avoid close contact with immunocompromised persons and pregnant women until all crusts are gone.
- Isolation precautions should be continued until all lesions have resolved and a fresh layer of skin has formed.

Risk Communication

- Providing public health advice through the channels that target audiences use on how the disease transmits, its symptoms, preventive measures and what to do in case of suspect or confirmed infection.
- Targeting community engagement to the population groups who are most at risk, working closely with health care providers, including STD clinics, and civil society organizations.

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National initiatives

Annexure 8

- India initiated its efforts to bring together human health and animal health in 1980s.
- Established the National Committee on Zoonoses, co-chaired by the Director General of Health Services and the Animal Husbandry Commissioner of India. Similar Committees were established at State levels.
- The Department of Biotechnology, Government of India recently established a "Centre of One Health" at NIAB, Hyderabad.
- Centre for One Health being set up by ICMR's NIV, Pune and Maharashtra Animal and Fisheries Science University (MAFSU), Nagpur
- Institutes like the Indian Council of Medical Research (ICMR) and the Indian Council of Agricultural Research (ICAR) have collaborated for joint research priorities
- Constituted a 'National Expert Group on One Health' to promote multi-sectoral, transdisciplinary, collaboration and cooperation to adopt and implement a One Health framework in India.

The Department of Biotechnology launched a One Health Consortium in December 2021, comprising 27 institutions, to study the prevalence of 10 zoonotic diseases nationwide and 5 transboundary animal diseases (mainly in northeastern states), providing risk analysis and early warnings to stakeholders. The consortium aims to establish a network of laboratories, estimate disease prevalence, detect pathogens through serological and molecular tests, and model data for disease forecasting and risk assessment.

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Notes

Role of NCDC in Strengthening Intersectoral Coordination

Annexure 9

1. Acts as nodal agency for "Strengthening of Intersectoral coordination for prevention and control of zoonotic diseases"
2. Policy Decisions: Formulation of Guidelines on Diagnosis, case management, prevention of control of zoonotic disease.
3. Developing trained workforce to combat zoonotic Diseases: Training of Master Trainers for capacity building of medical and Veterinary Professionals on zoonotic diseases in diagnosis treatment and prevention and Control of Zoonotic Diseases.
4. Coordination with the identified Regional Coordinator for strengthening diagnostic in the region for important zoonotic diseases.
5. ACSM: Development of proto type IEC material and formulation of strategy for dissemination of the same.
6. Coordination with the respective State Health Authorities to identify Nodal Officer/Regional Coordinator (RC) for the programme.
7. Coordination with the other stake holders (ICMR, ICAR, IVRI, MoA, MOEF, DADF and wild life institutes etc.)

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NOTE TO FACILITATORS

This resource guide has been meticulously designed to enhance the understanding and expertise doctors, veterinarians, paramedical staff, and laboratory personnel in dealing with Mpox cases. Your role is crucial in ensuring the success of this training, so please follow these instructions carefully:

Familiarize Yourself with the Content:

Thoroughly review all the materials provided in the Mpox training guide. This includes presentations, handouts, case studies and assessment tools.

Tailor the Training to Your Audience:

Understand the professional backgrounds of your participants (doctors, veterinarians, paramedics, and lab personnel). Tailor your examples and discussions to make the training relevant to their specific roles.

Set Clear Objectives:

Begin each session by clearly stating the objectives participants are expected to achieve by the end. This will give them a sense of direction and purpose throughout the training.

Create an Interactive Learning Environment:

Encourage active participation and open discussions. Use real-world scenarios to prompt critical thinking and problem-solving.

Use Multimodal Techniques:

Utilize a mix of teaching methods, such as presentations, group discussions and case based learning. This will cater to different learning styles and keep participants engaged.

Encourage Questions:

Welcome questions and create a safe environment for participants to seek clarifications. This fosters deeper understanding and engagement.

Provide Regular Feedback:

Throughout the training, provide constructive feedback on participants' performance. This will help them identify areas for improvement and enhance their skills.

Summarize and Review:

At the end of each module, summarize key points and takeaways. Conduct a brief review to reinforce learning before moving on to the next topic.

Assessment and Certification:

Develop an assessment mechanism, such as quizzes, practical assessments, or case presentations. Issue certificates of completion to participants who meet the training requirements.

Adapt to Participants' Pace:

Gauge the participants' pace of learning. Adjust the training speed accordingly, ensuring that everyone can follow and grasp the content.

Facilitate Networking:

Create opportunities for participants to interact and network with each other. This can lead to valuable knowledge exchange and collaboration.

Remember, your role as a trainer or facilitator is to guide participants through this comprehensive Mpox training with expertise, enthusiasm, and a dedication to enhancing their professional skills. Your efforts will contribute to building a more capable and knowledgeable medical workforce prepared to handle Mpox cases effectively.

Course Outline

It is imperative to underscore that the course outline harmonizes with the course schedule. Consequently, any modifications or adaptations made to the course schedule should be duly reflected in this course outline. This synergy between the schedule and the outline ensures consistency and alignment between training plans and their actual implementation.

NOTE: Make copies of the schedule, one for each participant and include in the training material bag.

PRE/POST TRAINING QUIZ

Trainee Name:

Date:

Designation:

Test taken before the training (yes/no):

Test taken after the training (yes/no):

Instructions for the trainee:

- The test quiz carries 15 questions
- Attempt all the questions.
- Put a tick mark on the correct option or fill the blanks with True/ False
- Please check whether all questions are answered before submitting

1. What type of microorganism causes Mpox?

- a. Virus
- b. Bacteria
- c. Fungus
- d. Protozoa

2. Which of the following are the common symptoms related to Mpox infection?

- a. High fever, raised skin lesions, swollen lymph nodes
- b. High fever, diarrhea, and vomiting
- c. High fever, flat skin lesions, vomiting
- d. High fever, seizures, and loss of appetite

3. When was the Mpox virus first isolated and identified?

- a. 1938
- b. 2022
- c. 1958
- d. 2005

4. Human to human Mpox virus transmission can occur by which of the following routes?

Select all the correct answers:

- a. Respiratory droplets
- b. Exposure to skin rashes
- c. Mosquito bites
- d. Overuse of drugs

5. What is the typical timeframe for the skin blisters or nodules to start diminishing during Mpox infection?
- 2- 5 days
 - 2- 3 weeks
 - 1 week
 - 3- 5 weeks
6. All of the following are the primary characteristics of the Mpox virus, Except?
- It is a double-stranded DNA virus
 - The infection by the virus is a zoonotic infection
 - Human transmission occurs only through close contact with infected monkeys
7. Which of the following specimen is frequently collected for the diagnosis of the Mpox virus infection?
- Blood specimen
 - Lesion swab specimen
 - Sputum specimen
 - Urine specimen
8. What is the incubation period of Mpox in humans?
- 1-2 days
 - 1-2 weeks
 - 2-4 weeks
 - 4-6 months
9. Mpox ____.
- cannot be transmitted by breathing contaminated air
 - are zoonotic
 - do not affect humans
 - are deadlier than smallpox
10. Which of the following symptoms is NOT associated with Mpox virus?
- Bloody diarrhea.
 - Muscle aches.
 - Swollen glands.
 - Rash lasting 2 to 4 weeks.

- 11. Can Mpox be spread from person to person?**
- a. Yes
 - b. Rarely
 - c. No, never
- 12. Which diagnostic method is commonly used for detecting Mpox in clinical specimens?**
- a. Blood test
 - b. Urine culture
 - c. Stool sample analysis
 - d. Polymerase chain reaction (PCR)
- 13. What is a characteristic feature of Mpox virus under a microscope?**
- a. Oval shape
 - b. Chain-like formation
 - c. Spiral structure
 - d. Cuboidal appearance
- 14. What is the purpose of Mpox surveillance?**
- a. To track international travel patterns
 - b. To monitor population growth
 - c. To detect and respond to Mpox cases
 - d. To study the genetic diversity of Mpox virus
- 15. Mpox infection has been declared a public health emergency in 2022 by the World health organization due to the worldwide spread of the virus. According to health agencies in the USA which of the following age group are at higher risk?**
- a. Children 5 to 10 years old
 - b. Males 18 years and above
 - c. Infants
 - d. Pregnant women

ANSWER KEY

1. **What type of microorganism causes Mpox?**
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- b. **Males 18 years and above**
- c. Infants
- d. Pregnant women

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Developed by
Centre for One Health
National Centre for Disease Control
Ministry of Health and Family Welfare
Government of India