

## **REVIEW ARTICLE**

### **Monkeypox: An Emerging Public Health Threat**

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#### **ABSTRACT**

In last three decades, more than 30 new infectious agents have been detected worldwide and out of which more than 60% have been found to be zoonotic in origin. Monkeypox disease is an infectious zoonotic disease caused by the monkeypox virus belonging to the Orthopoxvirus genus of the Poxviridae family. Human monkeypox was first identified in humans in 1970 in the Democratic Republic of the Congo in a 9-month-old boy in a region where smallpox had been eliminated in 1968. First outbreak of human monkeypox outside Central and Western African region was detected in 2003 in United States of America which was linked to contact with the infected pet prairie dog. The latest Monkeypox outbreak in non-endemic countries started from May 2022 and have been reported from 89 member states across all six WHO regions. India reported first case of Monkeypox on 14<sup>th</sup> July 2022.

#### **Main Text**

Emerging infectious diseases have been classically defined as those diseases which have been newly identified or were previously unknown infections. Emerging infectious diseases have been further classified to include diseases of infectious origin whose incidence in humans has increased within the recent past or threatens to increase in near future including but not limited to previously unknown infectious diseases; known but appearing in new geographic areas; or increasing abruptly; and those which are re-emerging after a period of quiescence.

In last three decades, more than 30 new infectious agents have been detected worldwide and out of which more than 60% have been found to be zoonotic in origin and more than two-thirds of these have originated in the wildlife.<sup>1,2,3</sup> Epidemics and pandemics caused by these emerging and re-emerging diseases often take a heavy toll on life as seen in case of novel coronavirus, SARS-n-CoV-19 which emerged first in November 2019 in the city of Wuhan, China<sup>4</sup> and then spread rapidly across the globe which resulted in concern and panic throughout the world. This disease not only leads to loss of human lives but also poses dire consequences for global economic and developmental activities.

Monkeypox disease is an infectious zoonotic disease caused by the monkeypox virus belonging to the Orthopoxvirus genus of the Poxviridae family, the same genus to which the Smallpox virus belonged.<sup>6,7,8,9</sup>

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Human monkeypox was first identified in humans in 1970 in the Democratic Republic of the Congo in a 9-month-old boy in a region where smallpox had been eliminated in 1968.<sup>10</sup> Since 1970, human cases of monkeypox have been reported in<sup>11</sup> African countries: Benin, Cameroon, the Central African Republic, the Democratic Republic of the Congo, Gabon, Cote d'Ivoire, Liberia, Nigeria, the Republic of the Congo, Sierra Leone and South Sudan. First outbreak of human monkeypox outside Central and Western African region was detected in 2003 in United States of America which was linked to contact with the infected pet prairie dog.<sup>6</sup> Since this, cases of monkeypox disease have been reported from many non-endemic countries such as United Kingdom, Israel, and Singapore with no proven epidemiological linkage.

The latest Monkeypox outbreak in non-endemic countries started from May 2022 and have been reported from 89 member states across all six WHO regions.<sup>11</sup> WHO declared current Monkeypox outbreak as Public Health Emergency of International Concern (PHEIC) on 23<sup>rd</sup> July 2022 as per International Health Regulations (IHR).<sup>12</sup> India reported first case of Monkeypox on 14th July 2022 in Kerala in a 35-year-old male who had a history of travel from United Arab Emirates (UAE).<sup>13</sup> Since then, a total of 9 cases have been reported, 5 from Kerala and 4 from Delhi.<sup>4</sup> Patients in Delhi had no history of foreign travel.<sup>14</sup>

### Epidemiological Perspective

**Agent:** Monkeypox virus (MPXV) is an enveloped double-stranded DNA virus which belongs to the Orthopoxvirus genus and the Poxviridae family, the same genus to which belonged smallpox virus.<sup>6,7,8,9</sup> Virus is found to have two distinct genetic clades – the Central African (Congo Basin) clade and the West African clade. Analysis of clinical and epidemiological data have shown that the West African clade produces less severe disease as compared to the Congo Basin clade.<sup>16</sup>

The current outbreak of monkeypox fever in non-endemic countries have been caused by monkeypox virus belonging to the West African Clade.<sup>11</sup>

**Host:** Natural reservoir is not known till yet. However, certain rodents (including rope squirrels, tree squirrels, Gambian pouched rats, dormice) and non-human primates are known to be naturally susceptible to infection of monkeypox virus.<sup>6</sup>

**Transmission:** Animal to human transmission (zoonotic transmission) can take place from direct contact with the body fluids, blood or muco-cutaneous lesions of infected animals. Eating inadequately cooked meat and other products of infected animal is also one of the possible risk factors for zoonotic transmission.<sup>6</sup> Human to human transmission is said to take place through close contact with respiratory secretions, skin lesions of infected individual or through fomites (such as recently contaminated objects). Since transmission via respiratory droplets require more face-to-face contact between infected individual and susceptible individual, therefore it puts healthcare workers, household members and other close contacts of active case at more risk. The virus can also get transmitted through mother to foetus via placenta or during close contact during or after birth. Transmission through sexual route has not been known yet, however, transmission can take place due to intimate contact at the time of sex through infective lesions.<sup>6</sup>

Recent surge in cases have been attributed to waning immunity against the virus as smallpox vaccination used to provide immunity against MPXV and thus, limiting the disease spread around endemic regions of western and central Africa.

The incubation period (interval from infection to onset of symptoms) of monkeypox is usually from 6 to 13 days but can range from 5 to 21 days while period of communicability is from 1-2 days before the rash to until all the scabs fall off/gets subsided.

The disease is self-limiting in nature and most people will recover completely. Symptomatic treatment should be given to individuals so as to ensure that no complications occur as well as to prevent any long-term sequelae from the disease. Any secondary bacterial infections should be treated as per prevailing guidelines for its management. Apart from this, individuals should be given optimum amount of fluids and food to maintain their nutritional status. Tecovirmat, an antiviral agent has also been approved by European Medical Agency (EMA) to be used for the treatment of this disease. However, the drug is not yet widely available.<sup>6</sup>

### **Surveillance and Containment**

For surveillance purpose, a suspected case of monkeypox disease is defined as “A person of any age having history of travel to affected countries within last 21 days and presenting with an unexplained acute rash and one or more of the following signs or symptoms: swollen lymph nodes, fever, headache, body aches or profound weakness.

Probable case has been defined as “A person meeting the case definition for a suspected case, clinically compatible illness and has an epidemiological link (face-to-face exposure, including healthcare 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 strong epidemiological link. Confirmed case is the one which is laboratory confirmed for monkeypox virus (by detection of unique sequences of viral DNA either by polymerase chain reaction (PCR) and/or sequencing).<sup>17</sup>

Ministry of Health and family welfare has released guidelines for management of monkeypox disease in India on 31<sup>st</sup> May 2022 which pans out surveillance strategy for monkeypox in India. The aims of the surveillance strategy are 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.<sup>18</sup>

### **Challenges in prevention and Management including Immunization and way Forward**

From our experiences and learnings from COVID-19, we know that prevention is the key; there is no need to enforce any lockdown or movement curbs. Disease surveillance in the community should be increased; healthcare workers should be trained to identify and differentiate between chickenpox and monkeypox as both manifests with similar features thus ensuring that no case of monkeypox is missed as possibility of overlooking monkeypox over chickenpox is high. They should also be educated about symptoms, specimen collection, disease detection, acquiring sample collection equipment and maintaining cold storage of specimens. Apart from such enhanced surveillance measures, other measures such as prompt quarantining, contact tracing, testing and ring vaccination for at-risk individuals should be undertaken so that they all will protect occurrence of major outbreaks.

Since vaccination with smallpox vaccine provides protection against monkeypox disease also, the accessibility and availability of smallpox vaccine to at-risk individuals (such as healthcare workers, Men having Sex with Men (MSM), transgenders etc.) should be done as early as possible to limit outbreak within such vulnerable population groups.

India has adequate facility for production of such vaccine and therefore, Government should take proactive steps by incentivizing vaccine manufacturers to produce and manufacture vaccine at home as it had done for COVID-19 vaccines. European Commission had approved smallpox vaccine “Imanvex” to be used against monkeypox disease on 25<sup>th</sup> July 2022.<sup>19</sup> United States have also approved two of the smallpox vaccines to be used against Monkeypox on 28<sup>th</sup> June 2022 and they are: JYNNEOS and ACAM2000.<sup>20</sup> Government of India can also request National Technical Advisory Group on Immunisation (NTAGI) to review the available evidence for vaccines against monkeypox and give recommendations to the government for their use in vulnerable population groups.

Other measures such as information, education and communication (IEC) materials which sensitize public regarding various aspects of disease and to prevent stigma associated with the disease should be made available. Increased surveillance activities and detection of monkeypox cases are critical for undertaking containment measures for preventing disease spread as well as to understand epidemiology of the disease.

Recent outbreak of monkeypox disease comes at a time when already there is transmission of novel coronavirus (SARS-CoV-2) by alteration in its genomic structure and leading to emergence of newer variants of concern (VOC) thus making it unclear whether this outbreak has occurred as a result of interaction between two viruses. Further studies will be required to study the interaction between both viruses and how their co-infection can have influence on evading immune response or increasing transmission abilities or response to vaccination against either or both diseases.

The concept of ‘One Health’ recognised by WHO as health of human beings is connected to health of animals and environment. It can be effectively implemented for reducing incidence of emerging zoonotic threats like COVID-19, monkeypox disease, etc. All countries should recognise zoonotic diseases as a genuine threat as they have potential to disrupt world economies at an unprecedented level as we have seen in case of COVID-19 disease which brought down many countries to implement harsh measures such as lockdown so as to limit the spread of disease. A robust plan for pandemic preparedness should be developed, based on a single health agenda for whole world. Since the implementation of revised International Health Regulations (IHR), 2005, for the first time, public health emergency of international concern (PHEIC) has been declared for three diseases (COVID-19, Poliomyelitis and Monkeypox) at a same time. This should serve as an emergency alarm to whole world and therefore, prioritizing the development of surveillance infrastructure along with training and recruitment of public health professionals and field workers who can participate in outbreak detection and response, thus limiting the impact of such public health crises over whole health system.

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