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Review Article

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Review on Monkeypox: Aetology, Epidemiology, Transmission, Clinical sign, Pathogenesis, Zoonotic importance, Risk factor, Prevention and Control.

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Abstract

Monkeypox (Mpox) is a viral novel zoonotic disease that infects both humans and animals. Its causative agent is the Mpox virus (MPXV), which belongs to the genus *Orthopoxvirus* in the Poxviridae family. The disease primarily found in African countries with two genetically distinct clades of MPXV: Clade I (formerly Central African, Congo Basin clade) and Clade II (formerly West African clade). MPXV is notably prevalent among primates and small rodents in Africa, where monkeypox is endemic, particularly in the Democratic Republic of Congo in which regularly outbreaks were reported. Transmission in endemic countries occurs mainly from animals to humans through direct contact with infected animals during hunting, capturing, and processing. Before 2022, rare cases reported in non-endemic countries were usually imported, with human-to-human transmission being limited, but from 2022onward, Monkeypox declared by WHO as public health event of international concern. The clinical presentation of monkeypox is similar to smallpox and includes symptoms such as fever, headache, muscle aches, backache and a rash that appears on the face, inside the mouth, and other parts of the body. Currently, there is no specific antiviral treatment for monkeypox, highlighting the importance of preventive measures. Strategies include vaccination, a one Health approach, isolating and quarantining affected human and animals, using personal protective equipment in healthcare settings, and raising public awareness are important to control the disease.

Keywords

MPXV,
Endemic,
Viral,
Public health,
Zoonotic

1. Introduction

Mpox (formerly known as monkeypox),viral zoonotic disease that may infect both humans and animals caused by the monkeypox virus (MPXV).It was first described in captive monkeys in 1958,but the first human case was diagnosed much later in 1970 in a 9-month-old boy in a village in Democratic Republic of Congo(Ogoina *et al*., 2023).According to the World Health Organization, it is the most important *orthopoxvirus* infection in human(Oladoye, 2021).Other viruses in this family, including the vaccinia and smallpox viruses, exhibit similar clinical features (Meng *et al.*, 2023). Monkey Pox Virus(MPV) has two major clades: West African and Central African clades. The disease historically made sporadic endemics mostly in the Democratic Republic of Congo (DRC) and Nigeria and was extremely rare outside of Africa(Bunge *et al*., 2022).However, in the current epidemic we are facing, there are nearly a hundred confirmed Monkeypox cases in the USA, UK, and many other European countries as of May 21, 2022(Okyay *et al.*, 2022).

While this disease is known to be endemic in certain parts of Africa, it has also emerged as a serious global health concern. Following an outbreak between January and June 2022, the World Health Organization noted that cases were reported in various countries throughout Europe. A month later, in July 2022, the World Health Organization (WHO) classified the disease as a public health event of international concern (PHEIC). This prompted nations to incorporate the disease into their surveillance systems, especially those with direct ties to endemic countries or neighboring regions. Since the disease was not considered by the existing surveillance systems, its inclusion will be challenging for some countries. The surveillance system is already compromised and facing problems, including staff shortages, a lack of training, difficulties in communication, and a lack of supportive equipment and tools (Izzoddeen *et al*., 2024).

In endemic regions, the virus is typically transmitted to humans through direct contact with infected animals during hunting, handling, or consumption of animal meat or fluids. Infected small mammals may appear healthy while still carrying the virus, whereas primates often display symptoms similar to humans. Human-to-human transmission occurs mainly through close, prolonged contact with symptomatic individuals. This includes face-to-face interactions (through talking or breathing), direct skin contact (such as touching lesions or during sexual activity), and through contaminated materials like clothing, linens, or towels. Such intimate contact, especially sexual, has been identified as a key factor in triggering wider outbreaks(Branda *et al*., 2024).

Several factors have contributed to past outbreaks, including greater human intrusion into habitats where animals live, the surge in international trade and travel, rapid population growth, and ongoing deforestation. Monkeypox case fatality rates in DRC were about 10% in non-vaccinated individuals. Individuals vaccinated against smallpox were noted to have fewer lesions and generally less severe disease (Likos *et al*., 2005).

MPXV can also affect wildlife, with examples including large outbreaks in chimpanzee. Gaining a deeper insight into how MPXV interacts with its reservoir hosts such as how ecosystem changes affect infection rates in these animals and how the virus impacts vulnerable wildlife species could lead to better health for wildlife and improved conservation results (Patrono *et al*., 2020). Such mitigation measures could be simultaneously beneficial for human and wildlife health and for the environment. Unless these approaches are taken, zoonotic transmission and subsequent outbreaks will continue(Hayman *et al*., 2025).This review presents an overview of the etiology, epidemiology, and modes of transmission, clinical manifestations, pathogenesis, zoonotic relevance, risk factors, and approaches for prevention and control of Monkeypox infection.

2. Literature Review

2.1. Historical background of MPOX

The name "Monkeypox" comes from the fact that the virus was first identified in monkeys in a Danish laboratory in 1958.Mpox is native to the rainforests of Central and West Africa(Hutin *et al*., 2001). People residing near these forested areas are at increased risk due to potential indirect exposure, which may result in asymptomatic or subclinical infections allowing the disease to spread silently within communities. Magnus *et al*.(1959) first identified the Monkeypox virus, which is closely related to the variola virus as the causal agent in two outbreaks of pox infection in cynomolgus monkeys that had recently been received from Singapore at the Statens Serum institute, Copenhagen, Denmark (Srivastava *et al*., 2025). During the next ten years, eight more outbreaks in the USA and the Netherlands were identified among groups of captive monkeys imported from India, Malaysia, and the Philippines. However, no naturally occurring outbreaks of Monkeypox were identified and no human infections were detected. On 1 September 1970 a 9-month-old child suspected of having smallpox was admitted to Basan kusu Hospital, Equatorial Province, Democratic Republic of the Congo (DRC)(Zhang *et al*., 2025).

Specimens from the patient were sent to the WHO Smallpox Reference Centre, Moscow, and a virus similar to, Monkeypox virus was isolated. Since this was the first recognized case of human infection caused by Monkeypox virus, it was decided to undertake special epidemiological investigations in Basankusu Territory. The investigations were carried out by the authors during January 1971(Ladnyj *et al*., 1972). Discontinuation of vaccination after eradication of smallpox, inadequate health infrastructure and bush meat consumption has given rise to increasing susceptibility to MPXV infection in the African population (Schmitt *et al*., 2014).

2.2. Aetology

Monkeypox is caused by the Monkeypox virus, a member of the Poxviridae family, within the Chordopoxvirinae subfamily and the *Orthopoxvirus* genus(Jiang *et al*., 2025).Poxviruses are large, linear, double-stranded DNA viruses with a genome size ranging from 130 to 360 kbp that replicate in the cytoplasm of vertebrate or invertebrate cells. DNA viruses usually replicate and express their genetic material within the nucleus of the host cell, relying heavily on cellular proteins. However, poxviruses operate differently. Poxviruses are different in the sense that they rely heavily on virus-encoded proteins that enable them to replicate in the cytoplasm (Moss, 2013). The central part of the genome contains genes involved in key functions, such as transcription and virus assembly, whereas those located at the termini are involved in virus-host interactions (Kaler *et al*., 2022). Because Poxviruses are larger, it's more challenging for them, including Monkeypox, to get pass the host's defenses through gap junctions. This bigger size also means the virus can't replicate as quickly, so Orthopoxviruses must employ a more complex strategy to thrive within their host. The larger size of the *Orthopoxviruses* alerts the immune system of the individual very early on and thus, generates an immune response very easily(Smith & Kotwal, 2002).

To evade the host immune response, *Orthopoxviruses* possess a range of virulence geneencoded molecules that function as immune modulators by specifically targeting and interfering with components of the host immune system(Kaler *et al*., 2022).The virion consists of five distinct structures: core, membrane, lateral body, surface tubules, and nucleocapsid. The core has a bilobed shape and is surrounded by a double lipoprotein layer. The MPXV genome consists of double-stranded DNA comparable to smallpox. Its central region is 101 kb and shares 96.3% of the identity with the same Vaccinia Virus area. The MPXV genome also has two variable terminal regions containing a 64 kb inverted terminal repeat (ITR) with some Open reading

frame(ORFs), hairpin loops, and short tandem repeats (Kugelman *et al*., 2014).It has a length of 197 kb and encodes for at least 190 proteins, with 30 of them being structural proteins.Out of 190 proteins encoded by the MPXV genome, approximately 20 to 30 have been explored for potential use in vaccines(La Frazia *et al*., 2025).

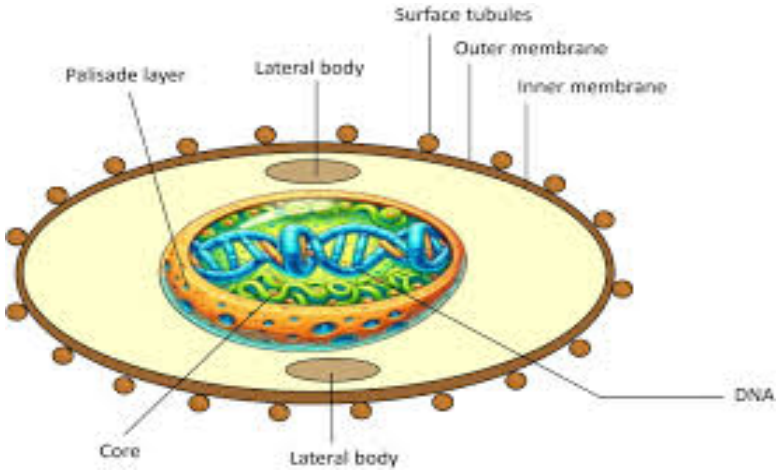

Figure 1*:Structure of MPXV*(Garcia-atutxa *et al.*, 2024).

Genome of Mpox virus classified into three monophyletic clades based on their analysis: two previously known and characterized clades (Clades I and II) and a novel emerging clade having genomes from the current 2022 multicounty Mpox outbreak(Ogoina *et al*., 2026). There are 286 genomes recognized, which include the hMPXV-1A lineage as well as newly classified lineages: A.1, A.1.1, A.2, and B.1. Notably, lineage B.1 encompasses all Mpox genomes from the outbreaks in 2022.the B.1 sub-group, seems to have originated in Europe on February 3, 2022. This means that the virus might have been spreading quietly in areas where it's not normally found, possibly being mistaken for other sexually transmitted infections. The knowledge about the molecular functions of these genes and their contributions toward pathogenesis needs more elaborative investigations(Aden *et al*., 2023).

2.3.Epidemiology

Monkeypox has remained endemic in the Democratic Republic of the Congo (DRC) and has continued to spread to other countries in Central and West Africa. A significant milestone was reached in 2003, when Mpox was reported outside Africa for the first time (Bunge *et al*., 2022). This outbreak in the United States was linked to the importation of animals from Ghana, which included several rodent species infected with the Monkeypox virus (MPXV).These rodents transmitted the virus to prairie dogs that were sold as pets, resulting in 47 confirmed and probable human cases across six Midwestern state (Harapan *et al*., 2022).Notable changes in the epidemiology of Mpox were observed between 2017 and 2018, characterized by a rise in reported cases and an expansion of the geographic area affected (Gessain *et al*.,2022). However, the onset of the COVID-19 pandemic shifted global public health priorities, leading to a temporary decline in Mpox surveillance and reporting, with most of the documented cases occurring in endemic regions of Africa(Naga *et al.*, 2025).

As both an emerging and re-emerging infectious disease, Mpox has become a global health concern. A worldwide outbreak of MPXV Clade II took place between 2022 and 2023, representing the first sustained transmission of the virus outside Africa since human cases were first reported in 1970. In 2023, Clade Ib cases were

identified in the DRC and subsequently spread to neighboring countries, exacerbating the epidemic(Mukadi-Bamuleka *et al*., 2025).By May 21, 2022, a total of 92 cases of human Mpox had been reported across 13 non-endemic countries, including Australia, Belgium, Canada, France, Germany, Italy, the Netherlands, Portugal, Spain, Sweden, the UK, and the USA. Interestingly, many of those diagnosed with Mpox indicated recent travel to Europe and North America rather than to the West or Central Africa, where the virus is typically more prevalent(Aynalem *et al.*, 2025).

Fast forward to August 14, 2024, the World Health Organization (WHO) once again declared Mpox a Public Health Emergency of International Concern (PHEIC)the second time in two years. Withthe emergency prevention and control measures adopted by countries worldwide, along with the introduction of relevant vaccines, the overall number of Mpox cases is declining globally. However, some areas still struggle with outbreaks or ongoing epidemics(Zhang *et al*., 2025).

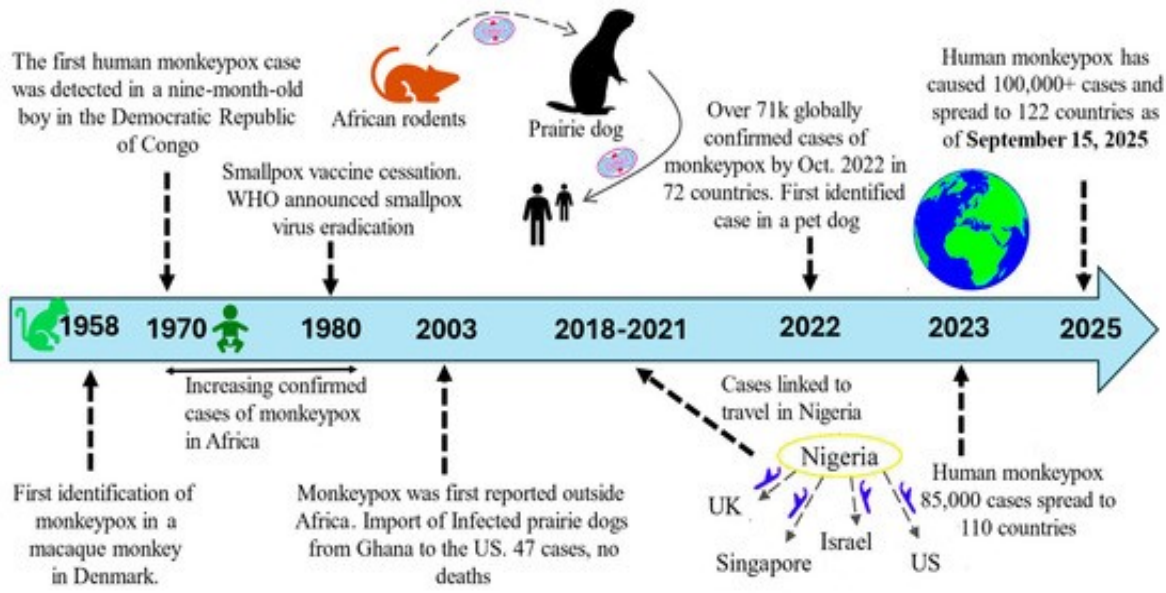

Figure 2: Timeline of MPXV (1958 up to 2025) (Chen *et al*., 2026).

Globally, as of 31 August 2024, a total of 106,310 laboratory-confirmed Mpox cases and 234 deaths have been reported. The Region of the Americas accounts for 64 879 cases and 148 deaths. In August 2024, there were 2,082 new cases, representing a 15.6% increase compared to July, which is the highest monthly total since November 2022.The African Region reported 62.3% of these new cases, followed by the European (13.7%) and Western Pacific (13.2%) regions. These numbers highlight significant disparities between regions and emphasize the importance of ongoing global monitoring and focused health interventions (Jadhav *et al.*, 2025).

2.4. Mode of transmission

Monkeypox can spread in various ways, primarily through close contact with infected individuals or animals. The virus can be transmitted from animals to humans through direct contact or exposure to bodily fluids. Common sources of exposure include exudates from skin or mucosal lesions, saliva, or respiratory excretions (Nakoune *et al*.,2017). There's also a possibility of the virus being shed in feces. While human-to-human transmission is less common than animal-to-human, it can still occur when people are in close contact for an extended period or come into contact with an infected person's lesions

(Nakoune *et al.*, 2017). Human infections typically result from interactions with infected animals, whether through bodily fluids, bites, or consuming bush meat from rodents or primates, but its spread in human populations is caused by human-to-human transmission(Al-deeb *et al.*, 2025).

Contaminated objects or fomites thought to increase the probability of viral transmission among household members is sharing a residence or using dishes that have been used by an infected individual. Another finding in the ongoing monkey pox epidemic is that men who have sex with other males are more likely to get the disease (Mehra *et al.*,2023). Prior outbreaks of Mpox have been associated with traveling to endemic areas in Western and Central Africa, zoonotic transfer by bodily fluid contact, and human-to-human via close contact with infectious lesions or bodily fluids, notably men who have sex with men (MSM) transmission mostly reported (Souza *et al*., 2024).Vertical transmission of Mpox to the fetus is possible and may result in congenital Mpox, although the specific risk at various stages of pregnancy remains unclear. During a study period from2007 to 2011 in the DRC, four pregnant women were infected with Mpox. The outcomes included one healthy birth, two miscarriages, and one case of fetal death with widespread maculopapular skin lesions indicative of vertical transmission (Kumar *et al.*, 2023).

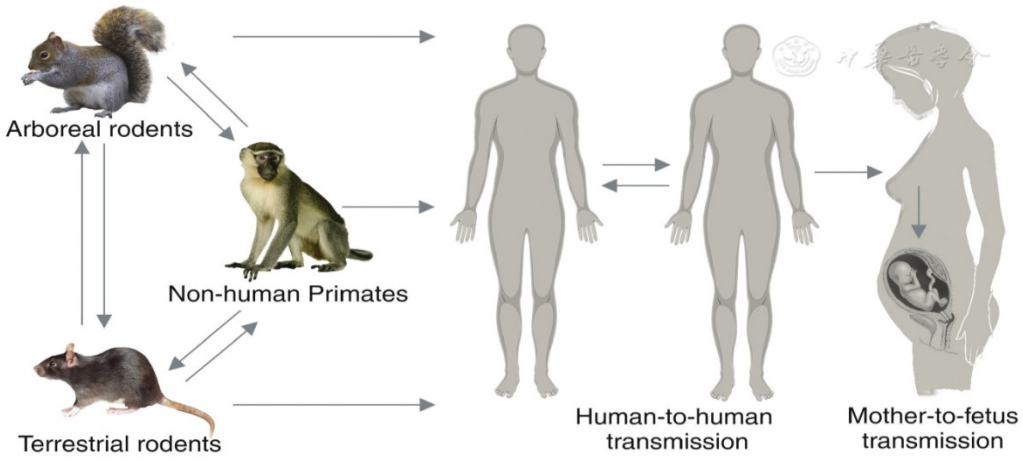

***Figure 3**: Mpox transmission*(Anil *et al*., 2024).

2.5.Risk factor for Mpox

The ongoing global outbreak of the Mpox virus highlights potential shifts in the virus's characteristics and human behaviors. Factors such as declining immunity from smallpox vaccinations, easing of COVID-19 safety measures, increased international travel, and heightened social interactions at large events may all play a role. Notably, the current spread has primarily impacted gay and bisexual men, as well as other men who have sex with men, indicating that sexual networks may be facilitating transmission(Thornhill *et al.*,2022). People living with HIV, particularly those with advanced or untreated infection, face a markedly increased risk of severe Mpox disease and death(Fallah *et al.*, 2026). In addition to sexual contact, certain activities like hunting and consuming bush meat significantly raise the risk of infection. This includes direct or indirect encounters with wild animals, such as coming into contact with sick animals, their rashes, or eye discharges. Activities like cleaning animal cages, handling contaminated bedding, and getting scratched or bitten are common in communities that depend on wildlife for food and livelihood, further increasing the risk of transmission (Quiner *et al*., 2017).

Viral shedding through feces could be another way the Mpox virus spreads. In regions of Africa where resources and infrastructure are limited, this exposure becomes a significant risk. Many people may sleep outdoors or live close to forests where infected animals are more common(Kaler *et al*., 2022).Additionally, a lack of awareness and training among healthcare workers (HCWs) contributes to the risk. For instance, a study in 2022 at Injibara General Hospital in Ethiopia revealed that only 38.5% of HCWs had sufficient knowledge about Mpox, even though 62% expressed a positive attitude toward learning more(Aynalem *et al.*, 2025).A broader national survey conducted in 2024 showed some improvement, with 56.5% of HCWs demonstrating better knowledge and 51.5% showing a positive attitude. Factors like being male, having a higher level of education, and receiving a COVID-19 vaccination were associated with greater knowledge about the virus. (Fetensa *et al*., 2025).

2.6. Mpox in Animal

Mpox primarily infects animals, especially rodents and non-human primates, but it can also spread to humans through direct contact with infected animals, including bites, scratches, or the consumption of contaminated meat(Yeshiwas *et al*., 2025).As a zoonotic disease, Mpox can be transmitted between animals and humans in multiple directions, including animal-to-human, human-to-human, animal-to-animal, and potentially human-to-animal transmission. Evidence indicates that the 2022 multi-country outbreak was not caused by repeated zoonotic spillover events; instead, ongoing human-to-human transmission has sustained the outbreak. However, in several African countries, animal-to-human transmission continues to occur(Husein *et al*., 2023). To date, these transmission events do not appear to result in long-term sustained spread, although available data are limited. When animal-to-human transmission is suspected, detailed exposure information should be gathered during case investigations, and relevant animal health authorities should be notified to support further investigation and control efforts(World Health Organization, 2022).

The natural animal host of the virus has not yet been definitively identified, but African squirrels and other rodents are considered the most likely reservoirs. To date, the virus has been detected only once in the carcass of a *Funisciurus squirrel* in the Democratic Republic of the Congo(Abdullah *et al.*, 2024). Transmission to humans is thought to occur through the consumption of infected bush meat, contact with saliva or respiratory secretions, or direct contact with lesion crusts, although the exact transmission routes of MPXV remain uncertain.Studies using non-human primates (NHPs) are valuable for improving our understanding of Monkeypox disease. NHP models are also a safer alternative to Variola virus models, as they pose a lower risk to laboratory personnel. Compared with other MPXV-susceptible animals, such as prairie dogs, non-human primates are particularly useful because of their close biological relationship to humans. In addition, they adapt better to laboratory and research environments than other susceptible species, including prairie dogs (Scott Parker and Markbuller, 2014).

Figure 4: *Non-human primate infected* with MPXV(Chapman *et al*., 2010).

In the early stages of rash development, epidermal necrosis occurs at the center of each lesion, with early invasion of the upper dermis. In non-human primates, progressive lesion development has been documented, including ulceration, necrosis, edema, and interstitial hyperplasia. Histopathological findings show cellular debris and fluid accumulation, fissures, sebaceous gland destruction, and loss of hair follicles. These features create what is described as a "partial wound," which is vulnerable to secondary bacterial infections or complications like cellulitis(Madfoon *et al*., 2025).

2.7. Clinical sign and pathogenesis

The incubation period of Mpox typically ranges from 5to 14 days, but in some cases, it can extend up to 21 days, depending on route of exposure(Mishra *et al*., 2025).Mpox is generally a self-limiting illness, and most patients recover on their own within two to four weeks. However, complications can occur, especially in children. Severe disease is more likely in immunocompromised children and in those with underlying skin conditions such as eczema. Most reported deaths have occurred in children under ten years of age and are usually linked to complications rather than the virus itself.The most common complication is secondary bacterial infection, which may present as skin and soft-tissue infections such as boils, abscesses, cellulitis, or swollen, infected lymph nodes. In severe cases, these infections can spread to the bloodstream, leading to sepsis or septic shock(Chauhan, 2023).Respiratory complications, including bronchopneumonia and respiratory distress, have also been reported. Gastrointestinal symptoms like vomiting and diarrhea can occur, leading to serious dehydration and disruptions in electrolyte and acid-base balance. Neurological complications, including encephalitis, may develop and can present with symptoms such as persistent crying, poor feeding, seizures, altered consciousness, or coma. Eye involvement is another serious complication, as infection and corneal scarring can lead to permanent vision loss (Jiang *et al*., 2023).

Based on recent evidence, the clinical features of Mpox can be divided into two main stages according to the timing of symptoms: the first one is the invasion (prodromal) period and the second part which is skin manifestation period. The invasion period is characterized by flu-like symptoms, including fever, headache, chills, fatigue, and swollen lymph nodes. These symptoms typically appear first and signal the early phase of infection. Skin manifestations usually develop 1–3 days later and are non-pleomorphic, meaning the lesions appear at the same stage of development. The rash progresses in a predictable sequence, starting as flat spots (macules), then raised bumps (papules), followed by fluid-filled vesicles, pus-filled pustules, crust formation, and finally healing with scarring(Sah *et al.,* 2022).

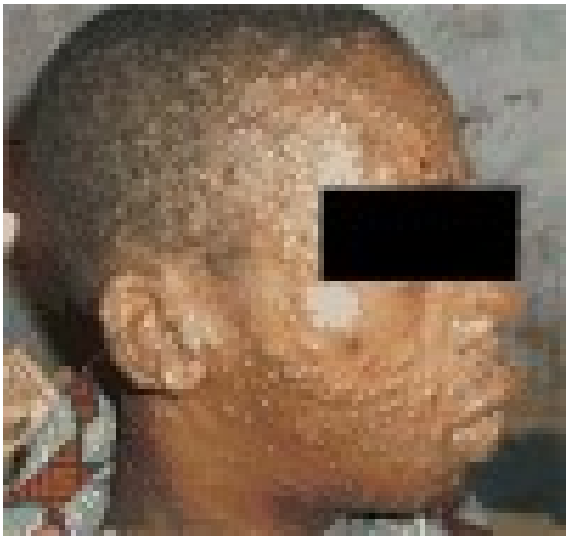

Figure 5:A patient with Monkeypox clinical sign(Mccollum & Damon, 2014).

The lesions are often painful and generally take 2–4 weeks to resolve completely. Mpox rashes commonly appear as firm, deep-seated, well-defined vesicles or pustules, often with a central indentation. These lesions are contagious from the time they appear until the scabs have fully formed and fallen off. Because of their appearance Mpox lesions are frequently mistaken for chickenpox or smallpox. Even after healing, changes in skin pigmentation and permanent scars may(Ogoina *et al*., 2023).Skin lesions were reported in 95% of affected individuals. The most frequently involved area was the anogenital region, seen in 73% of cases. Other commonly affected sites included the trunk, arms, and legs (55%), followed by the face (25%), and the palms and soles (10%). A wide range of lesion types was observed, including flat spots (macules), fluid-filled vesicles, pus-filled pustules, and crusted lesions. In many patients, lesions at different stages of development appeared at the same time. Among those with skin involvement, 58% had lesions described as vesiculopustular (Thornhill *et al.*, 2022).

MPXV employs several mechanisms of pathogenesis to evade the host immune response. One strategy involves the production of viral proteins that inhibit the host's defensive actions, including proteins with antiapoptotic effects(Likos *et al*., 2005). These proteins can either be released to disrupt external signaling or manipulate the cell's own death pathways. Additionally, MPXV encodes proteins that counteract pattern recognition receptors (PRRs), such as BCL-2-like proteins that prevent the detection of double-stranded RNA (dsRNA) by intracellular PRRs. The virus also impairs the ability of T cells and natural killer (NK) cells to exert cytotoxicity. It secretes MHC-class-I-like proteins that bind to the NKG2D receptor, thus inhibiting NK cell lysis of infected cells that do not express MHC I, which diminishes T cell recognition of these cells. Moreover, MPXV may disrupt interferon signaling by blocking the binding of interferon alpha/beta (IFN-α/β) or by suppressing its production. One such mechanism includes the creation of a viral binding protein (vIFN-α/βBP) that sequesters IFN-I before it can interact with its cellular receptors(Branda *et al*., 2024).

The virus also utilizes a complement control protein that acts as a decoy receptor for various cytokines and functions as a secreted immunomodulator, binding to complement proteins like C3b and C4b and attaching to cell surfaces. Furthermore, MPXV releases proteins targeting a wide array of molecules, such as IL-1β, IL-1 receptor antagonist (IL-1RA), and various interleukins and chemokines. Finally, the virus produces an IL-18 binding protein (vIL-

18BP) that inhibits the cytotoxic functions of NK cells and suppresses the IL-18-induced production of interferon and a range of Th1 cytokines, which are crucial for the expansion of cytotoxic T lymphocytes (CTLs) and NK cells(Lucena-Neto *et al.*, 2023).

2.8. Diagnosis and Differential Diagnosis

The diagnosis of Mpox is based on a combination of clinical findings and laboratory confirmation. Clinically, patients often present with early (prodromal) symptoms such as fever, headache, muscle aches, fatigue, and notably enlarged lymph nodes. The presence of lymphadenopathy is a key feature that helps distinguish Mpox from other similar viral illnesses, including chickenpox and smallpox *(*Shang *et al*., 2025).Polymerase chain reaction (PCR) testing is the preferred laboratory method for detecting MPXV because of its high sensitivity and specificity. Gene sequencing can further support diagnosis by identifying viral mutations and assisting with epidemiological tracing. Since viremia is typically short-lived, routine blood sampling for nucleic acid testing is not recommended(Goyal *et al*., 2022) Serological testing may be used when PCR results are inconclusive. In infected individuals, elevated levels of anti-orthopoxvirusIgM antibodies can be detected in acute samples, or a fourfold increase in IgG antibody titers can be observed between acute and convalescent samples. However, recent vaccination against smallpox or Mpox, as well as prior exposure to other Orthopoxviruses, may affect serological test results (Reed *et al.*, 2025).

In clinical practice, obtaining a detailed epidemiological history is essential for the differential diagnosis of Mpox Careful assessment of the distribution and appearance of skin lesions, along with a thorough examination of the entire body, is required once a rash develops. Mpox should be differentiated from other infectious diseases that cause skin lesions, such as smallpox, chickenpox, herpes zoster, herpes simplex, hand-foot-and-mouth disease, herpetic whitlow, syphilis, dengue fever, and scabies(Gupta *et al*., 2023). It should also be distinguished from non-infectious conditions, including allergic reactions (such as contact dermatitis, papular urticaria, and drug eruptions), inflammatory disorders (such as bullous pemphigoid and allergic purpura), and certain neoplastic diseases, including bullous Langerhans cell histiocytosis and cutaneous mast cell hyperplasia(Adelino *et al*., 2024). Historically, some Mpox cases were likely misdiagnosed as smallpox due to the lack of laboratory confirmation. However, the consistent presence of lymphadenopathy in Mpox serves as an important distinguishing feature and may reflect a more effective immune response in infection (Schmitt *et al*., 2014).

2.9. Zoonotic Impact of MPOX

Mpox can be transmitted through both animal-to-human and human-to-human routes. Close contact with infected animals or individuals, as well as living in or traveling to outbreak-affected regions, increases the risk of infection. The clinical symptoms of Mpox resemble those of smallpox and include fever, headache, back pain, muscle aches, and skin rashes. However, Mpox is generally less severe and is distinguished by the presence of swollen lymph nodes, a feature not typically seen in smallpox(La Frazia *et al.*, 2025).In the context of the COVID-19 pandemic, there has been heightened awareness of emerging infectious diseases with the potential to spread widely. With the growing number of Mpox outbreaks reported in Africa and other parts of the world often linked to transmission between humans, rodents, and non-human primates there is an urgent need to better understand the virus. This includes identifying its natural animal reservoirs, clarifying transmission pathways, understanding clinical infection in animals, and improving disease management at the human –animal ecosystem interface (Abdullah *et al.*, 2024).

Surveillance of human Mpox infections in endemic regions remains challenging. Limitations such as weak healthcare infrastructure, limited resources, inadequate diagnostic samples, insufficient specimen collection, and difficulties in clinically recognizing Mpox hinder effective surveillance(Al-deeb *et al.*, 2025). As new data

from recent cases are combined with findings from past outbreaks, it is important to reassess the clinical features that help distinguish Mpox from other rash-causing illnesses. Although current case definitions are sensitive and capture a broad range of rash illnesses, refining them to be more specific would improve accurate case detection, support appropriate patient management, and help prevent further human-to-human transmission(Adelino *et al*., 2024). Ongoing training of healthcare workers is essential to maintain awareness, diagnostic skills, and effective surveillance. Ultimately, expanding laboratory-based surveillance networks will improve understanding of the true burden of Mpox (Mccollum & Damon, 2014).

The introduction of MPXV from animals to humans plays an important role in Mpox outbreaks in some countries with virus circulation in wildlife. Further investigations and studies are needed to understand the relative proportion (compared to human-to-human transmission) and risk factors for zoonotic transmission(Mistry *et al.*, 2025). MPXV infection has been reported in a wide range of mammal species such as monkeys, squirrels, dormice and pouched rats. However, neither the animal reservoir(s), which maintain the virus in nature nor the range of potential intermediate animal hosts which could play a role in animal-to-human transmission, are yet known(Ayoola *et al.*, 2026). When exposure to an infected animal is the suspected route of transmission for a case of Mpox, as part of the case investigation, it is important to collect information on the animal type (preferably the exact species) with which the case came into contact, the time and place of the contact, as well as the type and frequency of contact and the information on whether the animal was alive or dead with or without signs of a disease(World Health Organization, 2022).

2.10. One Health Approach towards Mpox

The One Health approach promotes collaboration across human medicine, veterinary science, environmental studies, and public health to prevent and manage zoonotic diseases like Mpox. Monitoring wildlife for viral outbreaks can act as an early warning system, helping detect diseases like Mpox before they spread to human populations. This kind of surveillance requires close cooperation among wildlife conservationists, veterinarians, and public health authorities(Aribi *et al*., 2026).Environmental changes, including deforestation and climate change, play a major role in the emergence and spread of zoonotic diseases. In the case of Mpox, increased human encroachment into wildlife habitats has led to more frequent contact between humans and animals, creating greater opportunities for viral transmission(Akingbola *et al*., 2025). A One Health response must therefore address these environmental drivers by integrating conservation efforts with public health strategies. Protecting ecosystems is essential, as environmental degradation is a key factor contributing to zoonotic spillover events (Prasad, 2024).

Mitigation strategies may include reducing human–animal contact in areas where forests are increasingly fragmented, implementing community-based interventions, and strengthening land-use planning to prevent further encroachment into natural habitats. However, in many African communities, practices such as hunting and consuming wild animals are deeply embedded in cultural traditions and economic livelihoods. Addressing these realities requires sensitivity to social and cultural contexts, respect for local knowledge systems, and coordinated policies across multiple levels of governance(Fakunle, 2025).Public health education, community engagement, and active involvement of local populations are critical in preventing the spread of Mpox(Obasa *et al*., 2025). Effective public health campaigns should respect cultural and economic practices while incorporating indigenous and informal knowledge systems. At the same time, these initiatives must raise awareness about the risks of MPXV transmission, empowering communities with information that can help reduce the likelihood of zoonotic spillover *(*Hayman *et al.*, 2025).

2.11.Treatment,Prevention and control

Currently, there is no specific antiviral treatment approved solely for monkey pox virus infections(Pourkarim and Entezari-Maleki, 2024). However, due to the genetic similarity between monkey pox and smallpox viruses, treatments and vaccines originally developed for smallpox may offer therapeutic and preventive benefits against monkey pox. The cornerstone of Mpox management is supportive care, which includes controlling symptoms, maintaining proper hydration, providing pain relief, and treating secondary bacterial infections. These measures are particularly important in severe cases and in individuals with weakened immune systems, where the prognosis is generally poorer(Satapathy *et al.*, 2025).

Public awareness and education remain the most important strategies for preventing Mpox. Communities need clear information about how the virus spreads, particularly through direct contact with infected animals, such as rodents and non-human primates, as well as through close human-to-human contact(Lim *et al.*, 2023). Awareness campaigns should focus on avoiding with infected individuals or animals, while promoting safe health practices. Raising community awareness, alongside improved surveillance of current cases and potential exposures, is a critical first step in limiting transmission. Although there is still limited evidence on specific prevention methods for Mpox, valuable lessons can be drawn from the COVID-19 pandemic. These include the importance of early diagnosis, isolation or quarantine of infected individuals, and transparent data sharing. Applying these strategies can support effective community-level interventions and help reduce the spread of viral outbreaks like Mpox(Goyal *et al*., 2022).

Because MPXV-specific vaccines are still not fully developed, smallpox vaccines can be used to prevent Mpox or for emergency use(Jiang *et al*., 2025).JYNNEOS (live attenuated, non-replicating vaccine) known as Imvamune/Imvanex in Europe and ACAM2000 (live-attenuated, replicating vaccine). The effectiveness of these vaccines against the MPXV was tested in clearly defined animal models, specifically *cynomolgus macaques*, which have been used in past research on smallpox vaccines. These vaccines have been approved by the U.S. Food and Drug Administration (FDA) and are recommended for use among high-risk populations, including healthcare workers and close contacts of confirmed cases (Karagoz *et al*., 2023).

2.12. Conclusion and Recommendations

Mpox is a zoonotic viral disease that has raised international concern due to its spread beyond traditionally endemic region. Until 2022, cases in non-endemic countries were rare and typically linked to travel, with limited human-to-human transmission. In 2022, the World Health Organization (WHO) classified Mpox as a public health emergency of international concern, following its swift global spread to over many countries. Virus can spread in various ways, mainly through close contact with infected person or animals. Common sources of exposure include exudates from skin or mucosal lesions, saliva, or respiratory excretions. Skin lesions were reported in most of affected individuals. A wide range of skin lesion reported in affected individual including flat spots (macules), fluid-filled vesicles, pus-filled pustules, and crusted lesions. In many patients, lesions at different stages of development appeared at the same time. There is no specific antiviral treatment for monkey pox virus infections but supportive care like treating secondary bacterial infections are important to manage infected individual. Public awareness and education remain the most important strategies for preventing Mpox. Based on these conclusions, the following recommendations are made:

- Increase public awareness and education on virus transmission.
- Implement isolation and quarantine measures for infected individuals and animals.
- Mitigation of One health approach to prevent future pandemics, and promote overall well-being across all species and environments.

- Promote vaccination in at-risk populations.
- Encourage proper hygiene and sanitation practices.
- Further studies such as epidemiology and transmission dynamics, viral genomics and evolution and vaccine developments needed.

Appendix

List of abbreviation

DNA----------Deoxyribonucleic acid
DRC----------Democratic Republic of Congo
HCWs----------Health Care Workers
HIV----------Human Immune Deficiency Virus
MPXV----------Monkeypox virus
NHP----------Non-Human Primates
PHEIC----------Public Health Emergency of International Concern
PCR---------- Polymerase Chain Reaction
RNA----------Ribonucleic acid

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