

Traditional Herbal Medicines As a Complementary Treatment for Monkeypox

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ABSTRACT

Background: Since May 2022, that has been largest-ever spread of monkeypox in countries where it is not normally found. Since India is home to about 36% of the world's population, an MPXV outbreak there might have far-reaching consequences. A fuller understanding of the monkeypox virus and the epidemiology of the disease is urgently needed to help clinicians, public health professionals, and politicians be prepared for any eventuality, especially given the speed with which it has spread to non-endemic nations.

Aim: Review provides an overview of the epidemiology, clinical characteristics, treatments, vaccinations, and herbal resources used in the management of infection for the monkeypox disease. Immune-compromised host & group require to be given additional notice as the illness is known to have significant effects on pregnant women; we have also highlighted relevant information about such pathophysiological situations in this work.

Result and conclusion: The spread of monkeypox virus (2022) in non-endemic nations could provide India with an opportunity to investigate the Krimighna medications mentioned in Brihatrayee, i.e. Charak Samhita, Sushruta Samhita and Ashtanga Hridaya with antiviral activity and to develop novel and useful antiviral agents to combat the monkeypox menace effectively.

Keywords: Monkeypox, HIV, Pregnancy, COVID-19, Herbals.

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INTRODUCTION

Since May 2022, when the first 25,000 cases were reported, the World Health Organisation has classified monkeypox as a global outbreak. This disease (MSM) impacts bisexual, gay, as well as other men who have sex with other men more than other men who have sex with other men.¹ As of July 8, 2022, 9069 laboratory-confirmed cases had been recorded.² The vast majority of these cases occurred in people who had not visited endemic locations, such as the UK, US, Spain and Portugal. On August 4, 2022,¹ US government proclaimed a monkeypox pandemic monkey pox virus (MPXV) is a member of the orthopox genus and a close relative of smallpox.³ Its DNA is made up of two copies of a molecule with two strands. They can attack many different hosts and can finish their life cycles inside the cytoplasm of cells from invertebrates, vertebrates, and humans.⁴ The most common types of human

MPXV are the West African (WA) and Congo Basin (CB) kinds.^{3,4} The symptoms of monkeypox are like those of small pox but a Resemblance between monkeypox and small pox has facilitated clinicians to find antiviral medications for management of MPXV infection. However, specific medicines for the infection are not available since the smallpox vaccine and a newly derived post-infection vaccine are used against monkeypox infection. Apart from allopathic medicines, clinicians and researchers may look towards the Ayurvedic system of medicines.⁵ As per Ayurveda, Vayu (air), Jala (water), Desh (soil & region), and Kala (time) are the four factors that trigger group infection in public. Acharya Charaka also addressed the general idea. The three main Ayurvedic treatments for epidemic ailments are Panchakarma (five purifying processes), Rasayana Chikitsa (immune-modulators therapy), and Sadvritta (positive conduct). Rasayana Chikitsa

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is widely regarded as the most effective treatment available. Numerous Rasayanadravyas are still recognised for their ability to modulate immune function through changes in cytokine production, immunoglobulin secretion, lymphocyte secretions, phagocytosis, and histamine release, among other mechanisms.⁶

This paper lists some herbal remedies that are highly effective against monkeypox infection.

Epidemiological Characteristics

Early outbreaks mostly affected kids younger than 10 years old, but other trends showed that the median age for fewer cases was higher. The most recent outbreak in Nigeria affected 228 people, with a median age of 30. In 18 of the 26 publications that included data on gender, male cases were recorded more frequently. Monkeypox outbreaks have a tendency to strike communities with a low human-animal interaction rate, such as those in rural areas, townships (with less than a thousand people), or within or near humid deciduous tropical forests. Many outbreaks persist in places where hostility is high and people have been forced to flee their homes. India recorded the first case of MPX in Southeast Asia on July 14, 2022. After four days, a second case arrived from the state of Kerala. The third time it happened was on July 22 in the Malappuram area of Kerala. All three male patients were hospitalised and placed in quarantine immediately upon arrival from the United Arab Emirates (UAE). The fourth case of MPX has been recorded in New Delhi, the capital of India, and the victim has no history of international travel.⁷ The number of cases is steadily increasing. Many countries and experts are very worried about this possible change in epidemiological trends and what it could mean for world health.⁸

Mode of Transmission

Monkeypox can spread from animal to animal and from person to person.⁹ The most common ways for people to get sick are through coming into contact with respiratory secretions or body fluids, blood, damaged skin or mucus membranes, or contaminated skin or things within 21 days of a person-to-person transmission. Close sexual contact or exchange of respiratory droplets (kissing; oral, anal, or vaginal intercourse) is additional routes of transmission for monkeypox. MPXV is also transmitted when a person touches something or a surface that is affected.⁸ Zoonotic transmission can also occur through inoculation through bullous lesions and contact with infected animal blood or body fluids.¹⁰ On May 6, 2022, a British citizen became the first person diagnosed with the monkeypox outbreak that year. This individual had recently returned from a trip to Nigeria. The results show that the MPXV isolates brought into the UK in 2018–2019 are genetically similar to the Nigerian MPXV genome, which is part of the West African group of monkeypox virus. On May 4, 2022,^{11,12} the patient's initial samples was deciphered.

Manifestation of Monkeypox

Patients frequently have symptoms like fever, cold, fatigue, headache, muscle pain, hoarseness, lymphadenitis, and skin lesions. Skin lesions develop from blisters and nodules to

cysts and pus-filled. They then ulcerate and crust over for several weeks before recovering. The early lesions are often at the site of inoculation or around the sexual organs or anus. Infections with monkeypox frequently self-regulate and last for 2 to 4 weeks. The most frequent potential side are bronchitis, encephalopathy, and eye problems. The monkeypox virus typically takes 7 to 17 days to incubate, and its symptomatic stage lasts 1 to 4 days, and the rash's duration (from the start of lesions to mucous secretion) ranges from 14 to 28 days.¹³ According to reports on the current outbreak, clinical symptoms and transmission patterns may differ from the typical presentation of monkeypox. Transmission of monkeypox is possible between any two people due to the close skin-to-skin contact that occurs during sex, however epidemiological data reveal that it is now most common among networks of sexually active men who have sex with men (MSM). The rash may or may not be preceded by systemic symptoms known as the prodrome. Mucosal involvement happens in about 40% of cases and includes tumors in the vagina, periumbilical area, and oropharynx. Proctitis, urethritis, phimosis, and balanitis can all cause extremely painful symptoms as well as genital and perianal lesions. Pain or trouble swallowing can be a symptom of oropharyngeal conditions, such as epiglottitis and tonsillitis.¹

Monkeypox Outbreaks During Several Disease Conditions

Monkeypox Associated With HIV

Many people who have had monkeypox are also HIV positive, however the exact connection between the two diseases is poorly understood. In prior trials in Africa,¹⁴ those with untreated HIV had worse outcomes, such as more widespread and persistent lesions, more comorbidities, and numerous deaths. However, there have been no deaths or obviously increased hospitalizations of people with HIV and monkeypox to date, according to recent data from European nations where the majority of patients are receiving effective ART. The importance of completing these tests whenever monkeypox is suspected or confirmed can be shown in the fact that acute HIV infection and other STIs have been diagnosed with cases of monkeypox. Even in people with HIV, tecovirimat is the best drug for treating monkeypox. When planning a course of treatment, you should think about how tecovirimat, cidofovir, and brincidofovir might combine with some ARTs in a way that is clinically important. Due to nephrotoxicity, cidofovir shouldn't be given to people whose blood creatinine is more than 1.5 mg/dL. Injectable vaccinia immune globulin (VIGIV) is not contraindicated for usage in HIV-positive individuals.¹ Treatment options for monkeypox should be considered for HIV-positive people when you think about how bad the sickness is, the level of immunosuppression, and any particularly vulnerable infection sites (such as the genital or anus).

Monkeypox associated with pregnancy

There are very few facts about monkeypox infection during pregnancy. Khalil and co-workers (2022) reported the possibly

infectious characteristics in pregnant woman like premature baby with a skin rash, foetal mortality, and miscarriage in the first and third trimester due to a moderately severe illness. The foetus displayed signs of monkeypox infection, and data from virology, histology, and serology recommended upright transmission. However, there are limitations and potential reporting biases in these numbers. Increased danger of maternal and foetal illness and death, as well as the risks of premature delivery, preterm birth, and miscarriage, are all increased when a woman is infected with smallpox or another orthopox virus. The MVA-BN vaccine is a third-generation live vaccination that offers protection from many orthopox viruses. To far, no monkeypox vaccine is approved for use during pregnancy. Current recommendations state that MVA-BN should be avoided in pregnancy unless reimbursement of protecting the unborn child from monkeypox outweigh the unknown dangers. It has been hypothesised that MVA-BN is safe for nursing mothers. The question of whether MVA-BN passes into breast milk or not remains open.¹⁵

Monkeypox associated with COVID-19

Although recent rapid outbreaks in a number of countries raise worries that putative genotypic changes could not only change the phenotypic of the virus, but also make it more contagious, it is generally believed that monkeypox rarely transmits asymptotically, unlike SARSCoV-2. A hypothetical SARS-CoV with unique properties Convergence of these two viruses would strain the healthcare system as a whole, making it more difficult to implement existing pandemic management techniques.¹⁶ Additional- respiratory and bronchial problems are just some of the many clinical symptoms SARS-CoV-2 infections can produce. It is infrequently possible to have COVID-19's cutaneous manifestations, such as itchy red papules, erythematousmercutio, membranous pruritus, vascular livedoreticularis, figurate dermatitis, or a flexion rash. It is crucial to take into account the probability of a combined infection with the monkeypox and SARS-CoV-2 virus. Yet, it is uncertain if the pathogenic characteristics, aggressiveness, treatment, or susceptibility to vaccination of one or both of the diseases have changed.

Prevention and Treatment of MPX

There are no specific monkeypox treatments that have yet received FDA approval. Cidofovir, brincidofovir (a lipid-conjugate prodrug of cidofovir), and tecovirimat are just a few of the antiviral medications that have been shown to be effective against MPXV (Table 1). Vaccine-related complications including progressive vaccinia and severe widespread vaccinia can be treated with vaccinia immune globulin intravenous (VIGIV), which has been approved by the Food and Drug Administration (FDA). Several potential courses of treatment are depicted in Figure 1.¹⁷ The CDC now has tecovirimat, cidofovir, and VIGIV in the Strategic National Supply under Expanded Access Investigational New Drug protocols for the treatment of OPXV infections in an epidemic scenario.¹⁸

Any specific immunizations cannot prevent monkeypox infections and illnesses. The vaccinations (Vaccinia virus-based vaccines) developed for smallpox is being evaluated for use to prevent MPXV. Until 2019, the United States' only OPXV vaccine option was ACAM2000. The OPXV family of viruses is the foundation for ACAM2000, which is based on a recombinant strain of the Vaccinia virus that is both alive and homologous. ACAM2000 has been associated with serious side effects (including progressive vaccinia, eczema vaccinatum, and myopericarditis) because of the virus's ability to replicate. Another vaccination for use after exposure, JYNNEOS is a live, nonreplicating form.

Monkeypox survivors must be examined for 21 days after their last exposure for symptoms like chills, fever, rash, and lymphadenopathy. Post-exposure prophylaxis (PEP) immunisation is also recommended if the person has been exposed to the disease. Patients with monkeypox should be isolated from their families and any pets they may have at the ER, in their hospital room, or wherever they are staying at home. Since they are contagious, they should also stay away from other people. The healing process of the lesions and the formation of the new skin layer necessitate continued isolation. Even though smallpox immunisation is not recommended, those with severe T cell function impairments who have been exposed to the virus may benefit from prophylactic therapy.¹⁷

Role of Herbals Against Monkeypox Virus

Herbs have been a boon for humanity since the beginning of time, and Ayurveda is regarded as one of the best collections of herbs that used to prevent and treat a wide range of harmful conditions. Instead of being so old, reported herbal medicines are still very effective against emerging, existing, and re-emerging infectious diseases. The key to battling viral illnesses is developing strong immunity. A variety of ayurvedic medications can strengthen the body's natural defence systems. It is possible to strengthen our resistance by reducing the toxins (ama) in the body when a new virus encounters with the human immune system so that the virus won't look for a weak body to spread through.¹⁸⁻²⁰ We have included a few herbs in Table 2 that may be viable choices for treating MPXV infection.²¹⁻²³

This connection is also manifested when we compare the pathology and symptoms of both monkeypox and smallpox.

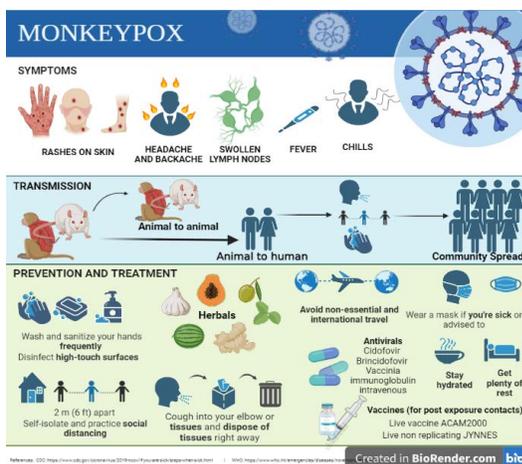


Figure 1: Symptoms, transmission, prevention and treatment of MPXV

Traditional medicines for monkeypox's treatment

Table 1: Potential antiviral management options for MPX infection

<i>Antivirals</i>	<i>Mode of action</i>	<i>FDA Approval</i>	<i>Adverse reactions and side effects</i>
Cidofovir	Competes with DNA polymerase, preventing the synthesis of viral DNA.	AIDS patients who have CMV retinitis (1996)	Nephrotoxicity; nephrotoxicity; nausea; vomiting; reduced intrinsic corneal pressure
Brincidofovir	Lipid conjugate cidofovirprodrug	Smallpox (2021)	Abdominal pain; increased liver transaminases and bilirubin; nausea; vomiting; diarrhoea
Tecovirimat	Restricts replication and dissemination within the host by interfering with the protein VP37's activity, preventing the production of virions that can be released from an infected host cell.	Smallpox (2018)	IV route: Extravasation at the infusion site, discomfort and edoema, and headache Oral route: headache, abdominal pain, nausea, vomiting
VIGI (vaccinia immunoglobulin intravenous)	Passive defence through OPXV-specific antibodies collected from a human population pool plasma of persons immunized with smallpox vaccine	Complications of vaccinia vaccination (progressive vaccinia, severe generalized vaccinia, etc) (2005)	Local injection-site reaction; infusion reaction (not recommended in people with IgA deficiency and possible IgA hypersensitivity)

Table 2: Medicinal plants used in treatment of MPX

<i>S.N.</i>	<i>Medicinal Plants</i>	<i>Parts used</i>	<i>Uses</i>
1	Garlic (<i>Allium sativum</i> L.)	Whole plant	COVID-19, MPX, encephalitis, hepatitis, poliomyelitis
2	Scented thorn (<i>Acacia nilotica</i> (L.) Delile)	Leaf/stem	Poliomyelitis, COVID-19, smallpox, MPX, meningitis, and liver disease
3	Baobab (<i>Adansonia digitata</i> L)	Stem bark	Smallpox, yellow fever, meningitis, MPX, poliomyelitis, and hepatitis
4	African Birch (<i>Anogeissus leiocarpus</i> (DC.) Guill. & Perr)	Stem bark	MPX, poliomyelitis
5	Neem (<i>Azadirachta indica</i> A. Juss)	Leaf	Poliomyelitis, COVID-19, smallpox, MPX, yellow fever, and meningitis
6	Desert date (<i>Balanites aegyptiaca</i> (L.) Delile)	Stem bark	Poliomyelitis, smallpox, MPX, meningitis, and hepatitis.
7	Aizen (<i>Boscia senegalensis</i> (Pers.) Lam. ex Pior)	Root	MPX
8	Sodom apple (<i>Calotropis procera</i> (Aiton) Dryand)	Leaf	COVID-19, MPX, Smallpox,
9	Pawpaw (<i>Carica papaya</i> L)	Leaf	yellow fever, Smallpox, MPX, COVID-19, meningitis, poliomyelitis, and hepatitis
10	Sticky pod (<i>Cassia singueana</i> Delile)	Leaf	MPX
11	Loda (<i>Cissus populnea</i> Guill. & Perr.)	Stem bark	Poliomyelitis, meningitis, MPX
12	Water melon (<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai)	Seed	Smallpox, MPX, Yellow fever, COVID-19, poliomyelitis and hepatitis
13	Pumpkin (<i>Cucurbita maxima</i> Duchesne)	Leaf and seed	MPX, smallpox
14	Jackalberry (<i>Diospyros mespiliformis</i> Hochst. ex A. DC)	Stem bark	COVID-19, yellow fever, poliomyelitis, smallpox, meningitis, hepatitis, MPX and meningitis
15	Broad leaf Fig (<i>Ficus platyphylla</i> Delile)	Stem bark powder	Smallpox, meningitis, poliomyelitis, yellow fever, and MPX
16	Heart leaved fig (<i>Ficus polita</i> Vahl)	Leaf	Smallpox, yellow fever, meningitis, and poliomyelitis
17	Henna (<i>Lawsonia inermis</i> L)	Leaf	Meningitis, yellow fever, COVID-19, MPX
18	Mango (<i>Mangifera indica</i> L)	Leaf	Yellow fever, poliomyelitis, COVID-19, MPX, meningitis, meningitis, and smallpox

19	Spike thorn (<i>Maytenus egalensis</i> (Lam.) Exel)	Stem bark	MPX
20	Balsam pear (<i>Momordica charantia</i> L.)	Leaf	Hepatitis, poliomyelitis, smallpox, yellow fever, MPX, COVID-19, hepatitis, and poliomyelitis.
21	Moringa (<i>Moringa oleifera</i> Lam.)	Leaf	Smallpox, COVID-19, MPX, yellow fever, poliomyelitis, meningitis, hepatitis, and meningitis
22	Black cummin (<i>Nigella sativa</i> L.)	Leaf/seed	MPX, smallpox, COVID-19
23	Olive (<i>Olea europea</i> L)	Leaves/stem	Yellow fever, COVID-19, MPX, and smallpox
24	Ashanti pepper (<i>Piper guineense</i> Schumach. &Thonn)	Seed	Yellow fever, COVID-19, MPX, hepatitis, and poliomyelitis
25	Karaya gum tree (<i>Sterculia setigera</i> Delile)	Stem bark	MPX

Table 3: Name of medicinal plants with potential therapeutic activity against monkeypox symptoms and their corresponding supportive treatment

<i>Symptoms</i>	<i>Supportive Treatment</i>	<i>Herbal medicine</i>
Distress in the lungs/ bronchopneumonia	Nebulizer therapy, preventative ventilation with oral/IV antibiotics	Garlic, Scented thorn, Baobab, Desert date, Sodom apple, Broad leaf fig, Heart leaved fig, Ashanti pepper
Wound infection	Supplementary oxygen, oral/IV antibiotics, corticosteroids, and insulin	Sodom apple, Jackalberry, Black cummin, Olive
Ulceration of the mouth, throat, and digestive tract	Oral/intravenous fluid replenishment, oral/IV antiemetic and antidiarrheal medicines	Garlic, Pawpaw
Pyrexia	Medicines to reduce fever, external cooling	Scented thorn, African birch, Desert date, Sodom apple
Skin super-infection	Antibiotics taken orally or intravenously, excision and discharge, and sophisticated wound care (such as negative pressure wound therapy)	Neem, Watermelon, Henna, Moringa
Lymphadenopathy/Inflammation	oral/IV anti-nociceptive medicines	Scented thorn, Aizen, Watermelon, Karaya gum
Infected cornea	Corticosteroids, ophthalmic antibiotics, and antivirals	Sticky pod, Pumpkin, Mango,
Skin lesions/abscesses/fibrosis	To encourage re epithelization, wet occlusive dressings are applied	Neem, Loda, Henna, Spike thorn, Balsam peer, Moringa,
Headache and backache	Oral/IV anti-inflammatory/analgesic medications	African birch, Black cummin

There are many herbs reported in Ayurveda for their successful utilisation during smallpox, which are supposed to be effective against monkeypox (Table 3). In fact, such herbal remedies are employed in countries like Nigeria, from where the current outbreak is assumed to be spreading around the globe gradually. In Table 3, we have compiled a few examples of medicinal herbs that may be effective in treating monkeypox.²⁴⁻²⁸

CONCLUSION

Monkeypox outbreaks in non-endemic regions serve as a reminder that viruses and infectious illnesses do not respect geographical boundaries. Better readiness is required because monkeypox cases are gradually rising in India. The best course of action is strict oversight at the border and before time detection, isolation and case execution. Main techniques are disease observation, contact tracing, and ring vaccination with smallpox vaccinations that are available and approved for monkeypox off-label use. The bioactivity of plants should be better understood in order to isolate the robust active ingredients. Plants may provide sources for novel antiviral medicines. Therefore, it is crucial to find natural medicines

made from plants. In the current communication, an effort has been made to present data on plants in one location that may offer protection against MPXV infections and assist researchers in their search for plant-based treatments for monkeypox. By creating evidence-based preventative and therapeutic techniques based on Ayurveda, India now has the opportunity to demonstrate the efficacy of its traditional medical system.

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