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The Etiology of Monkeypox virus disease on the human ,treatments and side effects

Research Project

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requirements for the degree of BSc. In chemistry

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Supervisor recommendation

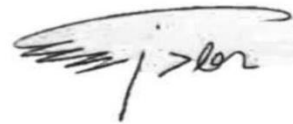
I am the student's supervisor, **Suhaiba Fazil Aziz**. I support that the student has completed all the requirements for submitting the research drawn entitled (**The Etiology of Monkeypox virus disease on the human, treatments and side effects**) according to the numbered administrative order 31/5/1972 on 9th Oct. 2022 in accordance with the instruction of Salahaddin University quality assurance and it is ready for discussion.

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Abstract: -Monkey pox, a viral zoonosis (virus transmitted to humans from animals), has symptoms similar to smallpox but is less severe. After smallpox was eradicated in 1980 and vaccination stopped, monkeypox became the most important orthopoxvirus for public health. Monkeypox is found in central and west Africa, often near tropical rainforests, and is spreading to cities. Rodents and primates are hosts. The World Health Organization (WHO) lists monkeypox, Crimean-Congo hemorrhagic fever, Ebola virus disease, Hendra virus infection, influenza, Lassa fever, Nipah virus infection, smallpox, and yellow fever as infectious diseases caused by viruses that could become endemic or pandemic. These pathogens cause neurological symptoms and are spreading worldwide.

Symptoms: Fever, headache, muscle aches, backache Chills, swelling, and exhaustion

Diagnosis: Chickenpox, measles, bacterial skin infections, scabies, syphilis, and medication-associated allergies are among the clinical differential diagnoses. Monkeypox is distinguished from chickenpox and smallpox by prodromal lymphadenopathy.

Keywords: Monkey pox , viruses, Smallpox, Orthopox viruses, Chickenpox, Lymphadenopathy

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LIST OF ABBREVIATIONS

Symbol	Description
COVID-19	Corona virus disease 2019
MPV	Monkey pox virus
DRC	Democratic republic of Congo
UK	United Kingdom
MSM	Men sex men
DNA	Deoxyribonucleic acid
WHO	World health organization
hMPXV	High monkey pox virus
CFR	Case fatality rate
MTCT	Mother-to-child-transmission
PCR	Polymerase chain reaction
CDC	Centers for Disease Control and prevention
FDA	Food and Drug Administration
VIGIV	Vaccinia immune Globulin Intravenous
EA-IND	Expanded Access Investigational New Drug
CMX-001	Chimerix
TPOXX	Tecovirimat
SEP	Smallpox Eradication Programme
MVA-BN	Modified Vaccinia Ankara-Bavarian Nordic
HIV	Human immunodeficiency virus

1 -Introduction

The name monkeypox comes from the initial discovery of the virus in monkeys in a Danish laboratory in 1958, Concerns about the occurrence of one viral pandemic after another have reached a fever pitch. COVID-19 will soon likely enter an endemic stage (Parvin, Ali et al. 2022). After more than two years of substantive global economic and healthcare impact of COVID-19, unfortunately, we will likely be facing a second new viral outbreak. The second etiological agent is the “monkeypox virus” (MPV). MPV is not new, and it was first discovered in Copenhagen (Cho and Wenner 1973). The earliest animal–human zoonotic transmission was described in 1970 in a 9-month-old male infant in the Democratic Republic of Congo (DRC). In 1970, five more human cases of monkeypox were reported in Liberia and Sierra Leone (four in children aged 4–9 years and a fifth in a 24-year-old adult). A total of 59 cases in other sporadic outbreaks of monkeypox were reported between the 1970 and 1980s in Central and West African countries, mostly associated with wildlife contact (Pastula and Tyler 2022). Since 7 May 2022, when the UK Department of Health reported an initial case in a traveller returning from Nigeria, unusually high and increasing numbers of cases are now being reported across Europe and other regions. Initial publications suggest that, to date, the disease has almost exclusively affected men who have sex with men (MSM) (Likos, Sammons et al. 2005). The MPV belongs to the *Orthopoxvirus* genus of the *Poxviridae* family. MPV is a double-stranded DNA virus. The poxviruses are known to have a brick-shaped or oval structure measuring 200–400 nm (Thornhill, Barkati et al. 2022).

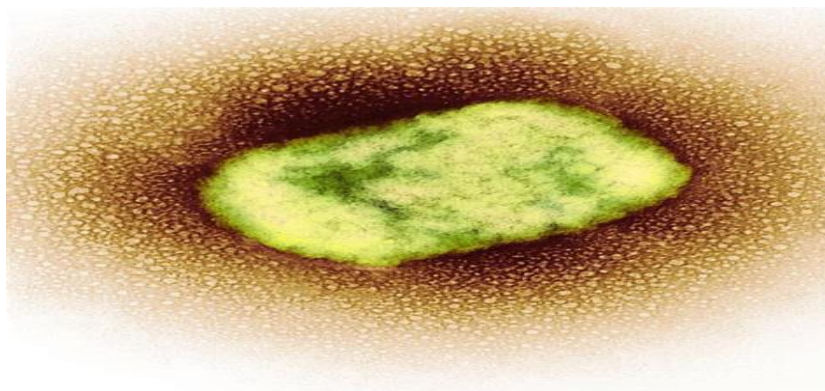


Fig.1 Poxvirus

The name “monkeypox” appears on the World Health Organization (WHO) list of infectious diseases caused by viruses that have the potential to be endemic or pandemic, alongside Crimean-Congo hemorrhagic fever, Ebola virus disease, Hendra virus infection, influenza, Lassa fever, Nipah virus infection, smallpox, yellow fever(Sklenovská 2020). These pathogens are becoming more common worldwide and typically cause neurological symptoms. Monkeypox virus is a re-emerging global health threat that has now posed unique challenges and can be expanded through borders These consequences led to the WHO declaring hMPXV as the highest level of alert and a public health emergency of international concern on July 23, 2022 . The COVID-19 pandemic demonstrated that pathogens with the potential for widespread spread could affect the nervous system(Seang, Burrel et al. 2022). MPV was first isolated from cynomolgus monkeys exhibiting smallpox-like lesions(Girometti, Byrne et al. 2022).



Fig.2 Cynomolgus

1.1Epidemiology

The first documented MPV case was in a nine-month-old child from DRC in 1970 MPV outbreaks have risen since 1970 but are primarily contained within the African continent. Notably, there has been limited viral spread to Europe and North America Up to 48 confirmed cases of monkeypox were reported in six African countries between 1970 to 1979. These included DRC (n = 38), Cameroon (n = 1), Cote d'Ivoire (n = 1), Liberia (n = 4), Nigeria (n = 3), and Sierra Leone (n = 1). By 1986, more than 400 human MPV cases were reported, with mortality approaching 10%.

Small viral outbreaks occur routinely in equatorial Central and West Africa including 500 cases in DRC alone between 1991 to 1999. The Congo basin remains endemic in the DRC and includes a high case fatality rate (CFR). In the DRC, 1000 cases/year were reported (Alakunle, Moens et al. 2020). In 2022-2023 was confirmed in May 2022. The initial cluster of cases was found in the first outbreak: London, United Kingdom; (first ... Suspected cases: 10,739 (since ... Confirmed cases: 86,494 (since January 2022)

1.2 Pathogen:

Monkeypox virus is an enveloped double-stranded DNA Orthopoxviral virus in the Poxviridae family. West African and central African (Congo Basin) monkeypox virus clades exist. The Congo Basin clade caused more severe and transmissible disease. Cameroon is the only nation where both virus clades have been found (Thornhill, Barkati et al. 2022).

1.3 Transmission

the reservoir host of MPV remains unknown. However, African rodents are suspected of playing a part in the transmission of infection. MPV transmission occurs through contact with skin lesions of the infected animals, body fluids or respiratory droplets (Fig.1). The virus enters the body through the respiratory tract, broken skin, or mucous membranes (eyes, nose, or mouth) (Gigante, Korber et al. 2022). Transmission from animal to human may occur through scratch, bite, bush meat preparation, or direct or indirect contact with body fluids or lesion material. Human-to-human transmission occurs through large respiratory droplets, sneezing, coughing, etc. Respiratory droplets do not travel more than a few feet; therefore, prolonged face-to-face contact is necessary for transmission to occur. Other transmission methods from human to human are direct contact with the viral lesion and body fluids and indirect contact with infected materials through clothing or infected linens. Mother-to-child transmission (MTCT) may also occur via the placenta (congenital Monkeypox), via close contact during and after birth. Although close physical contact is needed for the transmission of Monkeypox, it is not clear whether the monkeypox virus can be transmitted through sexual routes (Vaughan, Aarons et al. 2020).

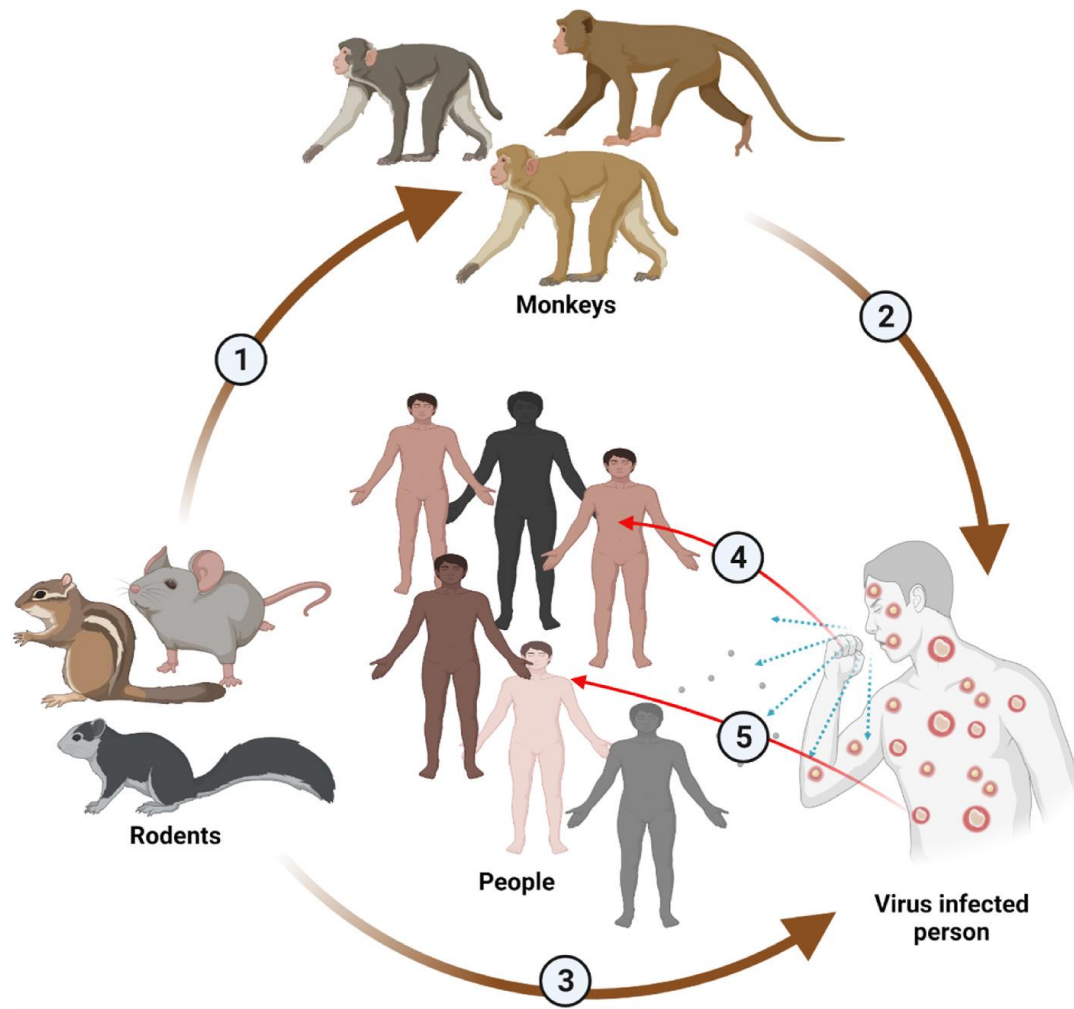


Fig.3MPV transmission. From rodents to monkeys (1). From monkey to human (2). From rodents to humans (3). From infected person to healthy people through cough droplets (4). From infected person to healthy people through direct skin contact (5). (Created using BioRender program).

1.4 Diagnostics of MPV infection

Monkeypox can be tentatively diagnosed if the characteristic skin lesions are present, or if other symptoms consistent with the disease are seen during an outbreak. The diagnosis can be confirmed by histopathology and virus isolation. Polymerase chain reaction (PCR) is the preferred laboratory test given its accuracy and sensitivity. For this, optimal diagnostic samples for monkeypox are from skin lesions or fluid from vesicles and pustules, and dry crusts (Peiró-Mestres, Fuertes et al. 2022).

Chickenpox, measles, bacterial skin infections, scabies, syphilis, and medication-associated allergies are among the clinical differential diagnoses. Monkeypox is distinguished from chickenpox and smallpox by prodromal lymphadenopathy.

1.5 Signs and symptoms of monkeypox

Monkeypox symptoms are similar to smallpox symptoms, but milder; and monkeypox is rarely fatal. MPXV is not related to chickenpox.

Signs and symptoms can include:

- Fever
- Headache
- Muscle aches and backache
- Swollen lymph nodes
- Chills
- Exhaustion

A rash that can look like pimples or blisters that appears on the face, inside the mouth, and on other parts of the body, like the hands, feet, chest, genitals, or anus (figures 4 & 5).

The rash goes through different stages before healing completely. The illness typically lasts 2-4 weeks. Sometimes, people get a rash first, followed by other symptoms. Others only experience a rash (Peiró-Mestres, Fuertes et al. 2022).



Fig.4 Signs and symptom of monkeypox



Fig.5 Pimples and blisters of rash

1.6 Prevention of monkeypox

Prevention Steps

Take the following steps to prevent getting monkeypox:

- ✚ Avoid close, skin-to-skin contact with people who have a rash that looks like monkeypox.
- ✚ Do not touch the rash or scabs of a person with monkeypox.
- ✚ Do not kiss, hug, cuddle or have sex with someone with monkeypox.
- ✚ Do not share eating utensils or cups with a person with monkeypox.
- ✚ Do not handle or touch the bedding, towels, or clothing of a person with MPXV.
- ✚ Wash your hands often with soap and water or use an alcohol-based hand sanitizer (fig.6)(Ramnarayan, Mitting et al. 2022).



Fig.6 Hand washing

1.7 Clinical

infection are quite similar to those of smallpox, but there are some distinguishing features attributed to monkeypox, such as the enlargement of lymph nodes occurring with the onset of fever early in the course of the disease. Pronounced lymphadenopathy is a hallmark of monkeypox. Almost 90% of individuals affected with monkeypox virus show lymphadenopathy. The size of the enlarged lymph nodes was approximately 1 to 4 cm, similar to the size of a pigeon's egg (Abdelaal, Serhan et al. 2023). However, the course of this disease is milder than that of smallpox. The dominant clinical features attributed to monkeypox infection, as seen in patients

after the monkeypox outbreak in the US, included rash, fever, chills, adenopathy, headache, and myalgia. These symptoms were observed during the initial presentation of illness. Some individuals reported symptoms of tonsillitis with or without pharyngitis, and coughing was also common. The average duration of fever was reported to be 8 days, while that of the rash was 12 days. Nausea and vomiting are possible findings in the second week of illness, resulting in severe dehydration. Table 1 shows the differences between the clinical pictures of smallpox and monkeypox (Sklenovská 2020).

Table 1: Clinical features of monkeypox and smallpox.

Features	Monkeypox	Smallpox
Time		
Incubation	7-14 days	7-14 days
Prodrome	Upto 4 days	Upto 4 days
Rash period	14-30 days	14-30 days
Symptoms		
Fever	Yes	Yes
Headache	Yes	Yes
Tiredness	Yes	Yes
Lymphadenopathy	Yes	No
Rash distribution	Centrifugal	Centrifugal
Rash characteristics	Hard, first maculopapular, then vesicular and pustular, well-circumscribed	Hard, first maculopapular, then vesicular and pustular, well-circumscribed
Rash progression	Slow progression from 1 stage to the other; every stage lasting 2–3 days	Slow progression from 1 stage to the other; every stage lasting 2–3 days

1.8 Treatment

Monkeypox disease usually induces mild symptoms, and most patients recover without therapy. Per the CDC guidelines, there is currently no specific treatment for monkeypox virus infections. However, antiviral drugs approved to treat smallpox may be used to treat monkeypox disease. Cidofovir (Vistide) is an antiviral medication that inhibits the viral DNA polymerase and effective against poxviruses in in-vitro and preclinical studies. As per the current CDC guidelines, this drug may be used to treat severely ill monkeypox patients, but the clinical outcome remains unknown (Veintimilla, Catalán et al. 2022). Tecovirimat (ST-246) is an antiviral medication used to treat human smallpox disease in adults and pediatric patients. This antiviral drug is approved by the FDA and can be used to treat Monkeypox during an outbreak. Tecovirimat is given orally (200 mg capsule) as an injectable formulation. Vaccinia Immune Globulin Intravenous (VIGIV) is used to treat complications due to vaccinia vaccination, including eczema vaccinum, severe generalized vaccinia, and infections induced by vaccinia virus. VIGIV can be used for the treatment of Monkeypox during an outbreak. Brincidofovir (Tembexa) is an antiviral drug that the FDA approved to treat human smallpox disease in adult and pediatric patients. CDC is currently developing an Expanded Access Investigational New Drug (EA-IND) to use Brincidofovir as a treatment strategy for Monkeypox. Other antiviral therapeutic drugs have also shown some effects against Orthopoxviruses species as antiviral therapeutics. These include CMX-001, which is a modified cidofovir drug. It lacks the extent of nephrotoxicity seen with cidofovir and has demonstrated antiviral activity against Orthopoxvirus species, including Monkeypox ST-246 (Tecovirimat, also known as TPOXX) is another promising antiviral effect against a variety of Orthopoxviruses species. It blocks the release of the intracellular virus from the cell. The use of these drugs in endemic areas to treat MPV infections can be considered, and physicians are allowed to make these decisions depending on the status of the infected persons (Al-Tawfiq, Barry et al. 2022).

1.9 Vaccines

- Some countries have maintained strategic supplies of smallpox vaccines procured for the Smallpox Eradication Programme (SEP) which concluded in 1980. These first-generation vaccines held in national reserves since that time are not recommended for monkeypox at this time, as they do not meet current safety and manufacturing standards(Vandenbogaert, Kwasiborski et al. 2022).
- Many years of research have led to development of new and safer (second- and in particular third-generation) vaccines for smallpox, some of which may be useful for monkeypox. Two vaccines (MVA-BN and LC16) have been approved in several jurisdictions for prevention of monkeypox.
- The supply of the newer, especially third-generation, vaccines is limited at this time and approaches for enhancing vaccine access are under discussion(Gul, Liu et al. 2022).

2. Review Article

Rajat Goyal 1,2 et all in year 2022 report that Over the past few years, the countries of the world have been afflicted with numerous infectious ailments. As the terror of the COVID-19 disease widespread decreases, nations throughout the world are facing the terror of the epidemic surrounding the pervasiveness of the geographical spread of human monkeypox cases worldwide. Thus, several approaches to decimate the rising spread of the monkeypox virus (MPXV) are warranted. MPXV cases received global attention during the 1970s, emanating from Africa has fully-fledged to be a universal concern with MPXV cases reported in Israel, Singapore, the United Kingdom, and the United States. Monkeypox appears as a zoonotic viral disease that is instigated via the monkeypox virus recognized as the most critical orthopoxviral infection in humans. Transmission of the monkeypox virus to human beings is alleged to occur via direct exposure to infected animals or it can probably be transmitted via consuming infected meat, or blood. The transmission from human to human takes place through the respiratory route (droplets), virus-contaminated material, and direct contact (skin-to-skin or sexual). This disease may be caused several difficulties including, headache, fever, malaise, back pain, rash, and lymphadenopathies.

Presently, there is no proven therapy for its treatment, thus monkeypox virus is considered a major threat to global health security. In this review, we discussed the transmission potential of the monkeypox virus on the healthcare system, its epidemiology, mode of transmission, and different diagnostic, preventive, and treatment approaches.(Chinitz, Goyal et al. 2020)

Heng Li a,1, et all in year 2022 report that Monkeypox, caused by the monkeypox virus (MPXV), is a zoonotic disease endemic mainly in West and Central Africa. As of 27 September 2022, human monkeypox has occurred in more than 100 countries (mostly in non-endemic regions) and caused over 66,000 confirmed cases, which differs from previous epidemics that mainly affected African countries. Due to the increasing number of confirmed cases worldwide, the World Health Organization (WHO) has declared the monkeypox outbreak as a Public Health Emergency of International Concern on July 23, 2022. The international outbreak of human monkeypox represents a novel route of transmission for MPXV, with genital lesions as the primary infection, and the emergence of monkeypox in the current outbreak is also new, as novel variants emerge. Clinical physicians and scientists should be aware of this emerging situation, which presents a different scenario from previous outbreaks. In this review, we will discuss the molecular virology, evasion of antiviral immunity, epidemiology, evolution, and detection of MPXV, as well as prophylaxis and treatment strategies for monkeypox. This review also emphasizes the integration of relevant epidemiological data with genomic surveillance data to obtain real-time data, which could formulate prevention and control measures to curb this outbreak(Zhang, Ru et al. 2022).

Daisuke Akazawa¹, et all in year 2022 report that Monkeypox virus (MPXV) is a zoonotic orthopoxvirus that causes smallpox-like symptoms in humans and caused an outbreak in May 2022 that led the WHO to declare global health emergency. In this study, from a screening of approved-drug libraries using an MPXV infection cell system, atovaquone, mefloquine, and molnupiravir exhibited anti-MPXV activity, with 50% inhibitory concentrations of 0.51-5.2 μM , which is more potent than cidofovir. Whereas mefloquine was suggested to inhibit viral entry, atovaquone and molnupiravir targeted post-entry process to impair intracellular virion accumulation. Inhibitors of dihydroorotate dehydrogenase, an atovaquone's target enzyme, showed conserved anti-MPXV activities. Combining atovaquone with tecovirimat enhanced the anti-MPXV effect of tecovirimat.

Quantitative mathematical simulations predicted that atovaquone can promote viral clearance in patients by seven days at clinically relevant drug concentrations. Moreover, atovaquone and molnupiravir exhibited pan-Orthopoxvirus activity against vaccinia and cowpox viruses. These data suggest that atovaquone would be potential candidates for treating monkeypox (Noguchi, Aizawa et al. 2021).

Rokshana Parvin et al. in year 2022 report that poxviruses as a group have variable levels of host ranges and virulence. For example, smallpox, which is caused by the variola virus, only infects humans with fatal outcomes, whereas related viruses, such as cowpox viruses can infect multiple hosts, but only cause mild disease in humans. Recently, the monkeypox virus (MPXV) re-emerged and infected over 780 human cases in over 20 countries worldwide at the time of writing this review. It has been shown before not only monkeys play a role in the transmission of MPXV to humans, but also rodents (*Cricetomys gambianus*, and *Graphiurus murinus*) and squirrels (*Heliosciurus* spp, *Funisciurus* spp). In addition, anthropogenic actions, such as deforestation, climatic changes, animal-human interfacing, globalization, and the cessation of smallpox vaccination, could contribute to the re-emergence of MPXV. Herein, we review the current nomenclature, epidemiology, genetic diversity of poxviruses, particularly MPXV, and the control regimens, including available antivirals and vaccines. We further highlight the genetic relatedness of the emergent MPXV viruses to know viral lineage using phylogenetic analysis (VIDICAN, PLEŠA et al. 2022).

Inger K. Damon et al. in year 2011 report that monkeypox, a vesiculo-pustular rash illness, was initially discovered to cause human infection in 1970 through the World Health Organization (WHO)-sponsored efforts of the Commission to Certify Smallpox Eradication in Western Africa and the Congo Basin. The virus had been discovered to cause a nonhuman primate rash illness in 1958, and was thus named monkeypox. The causative agents of monkeypox and smallpox diseases both are species of Orthopoxvirus. Orthopoxvirus monkeypox, when it infects humans as an epizootic, produces a similar clinical picture to that of ordinary human smallpox. Since 1970, extensive epidemiology, virology, ecology and public health research has enabled better characterization of monkeypox virus and the associated human disease. This work reviews the

progress in this body of research, and reviews studies of this “newly” emerging zoonotic disease(Choi, Cossaboom et al. 2021).

3.PERSONS WITH INFECTION

Between April 27 and June 24, 2022, 43 sites in 16 countries reported 528infections. 98% were gay or bisexual men, 75% were White, and 41% had HIV. The median agewas 38. Sexual activity caused 95% of infections. None died.

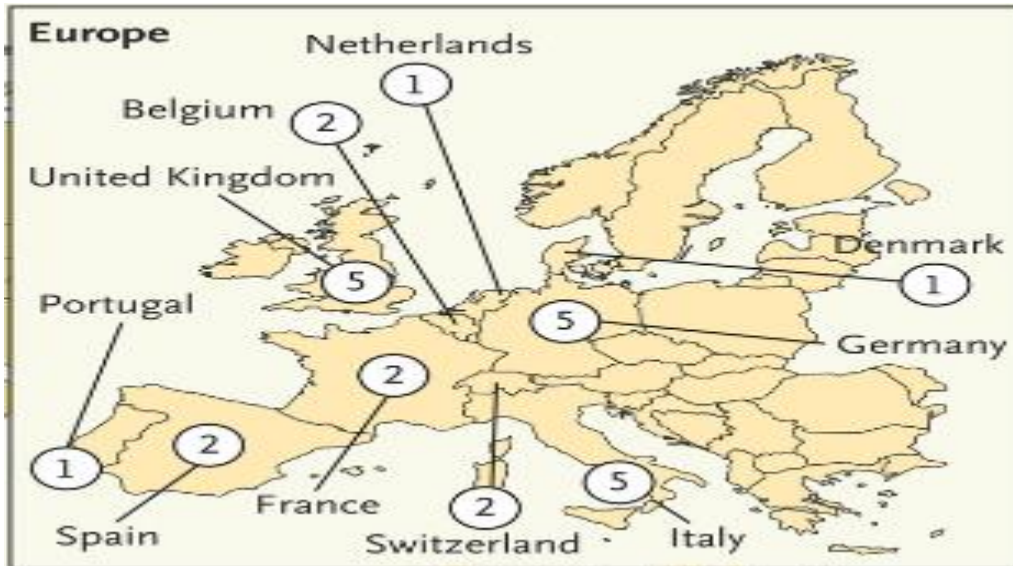


Fig.7Demographic and clinical characteristics of the persons with infection are summarized

Table 2. Demographic and Clinical Characteristics of the Persons with Monkeypox.

Characteristic	All Persons (N=528)
----------------	---------------------

Median age (range) — yr	38
Sex or gender — no. (%)	
Male	527
Female	0
Trans or nonbinary	1
Sexual orientation — no. (%)†	
Heterosexual	9
Homosexual	509
Bisexual	10
Race or ethnic group — no. (%)†	
White	398
Black	25
Mixed race	19
Latinx	66
Other or unknown	20
HIV positive — no. (%)	218
HIV negative or status unknown — no. (%)	310
Use of preexposure prophylaxis against HIV — no./total no. (%)	176/310
Foreign travel in month before diagnosis — no. (%)‡	147
Continent of travel — no./total no. (%)	
Europe	132/147
North America	9/147
Australasia	0/147
Africa and Middle East	2/147
Central and South America	2/147
Not stated	2/147
Known to have undergone STI screening — no. (%)	377
Microbiologically confirmed concomitant STI present — no./total no. screened (%)	109/377

Gonorrhea	32/377
Chlamydia	20/377
Syphilis	33/377
Herpes simplex virus infection	3/377
Lymphogranuloma venereum	2/377
Chlamydia and gonorrhea	5/377
Other or not stated	14/377
HIV test taken — no./total no. with previously unknown or negative HIV status (%)	122/310
New HIV infection diagnosis — no./total no. (%)	3/122
Sexual history not known — no./total no. (%)	122/528
Median no. of sex partners in previous 3 months (IQR)	5
“Chemsex” reported in the previous month — no. (%)	106
Reported attendance at a sex-on-site event in the previous month — no. (%)	169

4. Discussion

The aim of this study is to collect information about pandemic disease which is very dangerous that affected on human life exactly on male also we study the viruses and anti-viruses (vaccine). The nations of the world have experienced a number of infectious diseases over the past few years. Nations around the world are currently dealing with the pandemic surrounding the pervasiveness of the geographical expansion of human monkeypox cases as the horror of the COVID-19 disease's global decline. Consequently, various strategies are necessary to stop the monkeypox virus's (MPXV) growing tide of transmission. When MPXV instances first emerged in Africa in the 1970s, they attracted attention on a global scale. The monkeypox virus is thought to spread to humans either directly through contact with infected animals or maybe

by consumption of infected meat or blood. The respiratory route (droplets), substance contaminated with the virus, and direct touch are the routes through which the virus is transmitted from one human to another (skin-to-skin or sexual). Many problems, such as headaches, fevers, malaise, backaches, rashes, and lymphadenopathies, might be brought on by this disease. Monkeypox virus is regarded as a significant threat to the security of global health because there is now no proven medication for its treatment, and they say the monkeypox virus (MPXV), which causes the disease, is endemic mostly in West and Central Africa. In contrast to earlier epidemics, which mostly afflicted African nations, human monkeypox has already been reported in over 100 countries (largely in non-endemic regions) and has resulted in over 66,000 confirmed cases. The World Health Organization (WHO) has deemed the monkeypox epidemic a Public Health Emergency of Worldwide Concern as of July 23, 2022 due to the rising number of confirmed cases around the world, this evolving predicament, which presents a new picture from prior outbreaks, should be understood by clinical physicians and scientists. The molecular virology, antiviral immune evasion, epidemiology, evolution, and detection of MPXV, as well as prevention and therapy approach for monkeypox, will all be covered in this review. The integration of pertinent epidemiological data with genetic surveillance data to produce real-time data, which may be used to develop prevention and control strategies to stop this outbreak, is another focus of this research. In May 2022, an outbreak of the monkeypox virus (MPXV), a zoonotic orthopoxvirus that mimics smallpox in humans, resulted in a worldwide health emergency being declared by the WHO, the host ranges and pathogenicity of poxviruses vary considerably. For instance, related viruses, like cowpox viruses, can infect various hosts but only cause minor sickness in humans, unlike smallpox, which is caused by the variola virus, which only infects humans and has catastrophic results. During the time this review was being written, in this project, we go understanding viruses, kind of viruses, causes privation and how control measures for poxviruses, specifically MPXV and the available antivirals and vaccines. By employing phylogenetic analysis, we further highlight the genetic similarity of the emerging MPXV viruses to understand viral.

5. Conclusion

In this project, we investigated the monkey virus and talked about that first this disease was found in the monkey and then it was transferred to humans and the first person who was infected with an African child was nine years old and at first the number of infected was low but then in 2022 the number of patients increased first the person has muscle pain but then it becomes a spot on the hand and the whole body of this disease with corona disease is different that this disease makes spots but corona is not like that Also, the difference between this disease and normal pox is that this disease is the swelling of the lymph swelling of the knots with the people and also this disease is transmitted to humans through touching and biting and also by eating animal meat It is also transmitted from human to human through sneezing, cough, and direct and indirect exposure, and this disease is also transmitted among homosexuals of men so far this condition has not been recorded in women and no vaccine has been found for this disease but any normal pox vaccine is used also to understanding viruses, kind of viruses, causes privation and how control measures for poxviruses, specifically MPXV and the available antiviral and vaccines.

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