As per UGC guidelines an electronic bar code is provided to seure your paper

International Journal for Modern Trends in Science and Technology, 8(07): 292-301, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0807043
Available online at: http://www.ijmtst.com/vol8issue07.html

Epidemiology, Pathology, Diagnosis, Treatment and Control of Monkeypox Disease: A Systemic Research

Ashwin Singh Chouhan* | Nayan Soni | Bharat Parihar | Ram Prasad Prajapat | Chitrance | Lakshey Rawal | Mahendra Nath Chandel

Jai Narain Vyas University (New Campus), Jodhpur (Rajasthan) India

To Cite this Article
Ashwin Singh Chouhan, Nayan Soni, Bharat Parihar, Ram Prasad Prajapat, Chitrance, Lakshey Rawal and Mahendra Nath Chandel. Epidemiology, Pathology, Diagnosis, Treatment and Control of Monkeypox Disease: A Systemic Research. International Journal for Modern Trends in Science and Technology 2022, 8(07), pp. 292-301 https://doi.org/10.46501/IJMTST0807043

Article Info
Received: 19 June 2022; Accepted: 21 July 2022; Published: 26 July 2022.

ABSTRACT

Background: *Monkeypox is a viral infection generated by monkey pox Virus. It is identical to smallpox which belongs to the genus Orthopoxvirus, family Poxviridae, and sub-family Chordopoxvirinae.*

Method and material: *We conducted this research paper by observing the different types of reviews, as well as conducting and evaluating literature review papers.*

Result: *Monkeypox are identical to small pox but milder than the indications ofsmallpox. The virus has mostly affected populations in rural and rain forest regions in Central and Western Africa, with human cases reported in 11 African countries. As of May 21, 2022, the World Health Organization (WHO) reports 92 confirmed cases and 28 suspected cases of monkeypox infection from 12 non-endemic countries.*

Conclusions: *Human monkeypox is an emerging viral zoonotic disease, which is caused by monkey pox virus. Primarily, monkey pox transmission to humans is believed to occur through direct contact with infected animals or possibly by ingestion of inadequately cooked flesh.*

Keywords: *Virus, Monkeypox, Disease, Etiology, Pathology, Diagnosis, Treatment etc*

1. Introduction

Monkeypox is a viral infection generated by monkey pox Virus. It is identical to smallpox which belongs to the genus Orthopoxvirus, family Poxviridae, and sub-family Chordopoxvirinae. The illness is distinctly developed in the distant areas of Central and West Africa. Initially it was identified in 1958 in animals like macaque monkeys and was first reported in Humans in 1970 in a 9-month Old boy developed illness, which was ultimately approved as human monkey pox by the World Health Organization from Zaire.

Monkeypox is a rodent virus which can mostly disseminate among certain rodents in Africa. The viruses are oval brick in appearance and have a lipoprotein layer that envelope the viral DNA. The recognition of monkeypox virus is based on biological feature and end nuclease sequence of viral DNA. Monkeypox has a clinical presentation equivalent to smallpox like fever, malaise, back pain, Headache,

muscle pains but only the dissimilarity is presenting lymphadenopathy. Besides monkeys, reservoirs for the virus are developed in Gambian pouched rats, dormice and squirrels. Currently, there is no validate, secure treatment for monkeypox.

2. History

Monkeypox was initially detected in monkeys in 1958; howevera "vesicular illness in monkeys" was traced in the1860s.Ultimately the disease, and the causative virus, was named as monkeypox because the lesions seen in Monkeys are similar to other pox-forming diseases. Subsequently some studies showed that the "monkeypox" virus was really sustained endemically in African rodents. This large outburst is thought to be triggered by river that produced polluted wild animals to more close with humans, so increasing this zoonotic illness.

Monkeypox is a viral zoonotic disease caused by infection with monkeypox virus. Monkeypox virus is an enveloped double-stranded DNA virus from the Ortho-poxvirus genus in the family Poxviridae. It shares the same genus with the variola virus which causes smallpox, the vaccinia virus which was used for the development of smallpox vaccine, cowpox virus, and camel pox virus. Known as a less lethal and infectious relative of the smallpox virus, monkeypox has developed into two strains, namely the Central African strain, and the West African strain. Although infections with Central African strain have been known to be more severe and transmissible, the spread of monkeypox virus had been limited to tropical rainforest regions of Central and West Africa until 2003. Since then, although the virus was occasionally exported to other areas, it was quickly contained.

The recent outbreak of the monkeypox virus in several non-endemic countries has caused major concern. As of July 17, 2022, 92 confirmed cases and 28 suspected cases of monkeypox infection were reported from 13 non-endemic countries including Australia, Belgium, Canada, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, the UK,US and the India. Read along to find out more about monkeypox virus, its transmission routes, its symptoms, and preventive measures.

Natural host of monkeypox virus

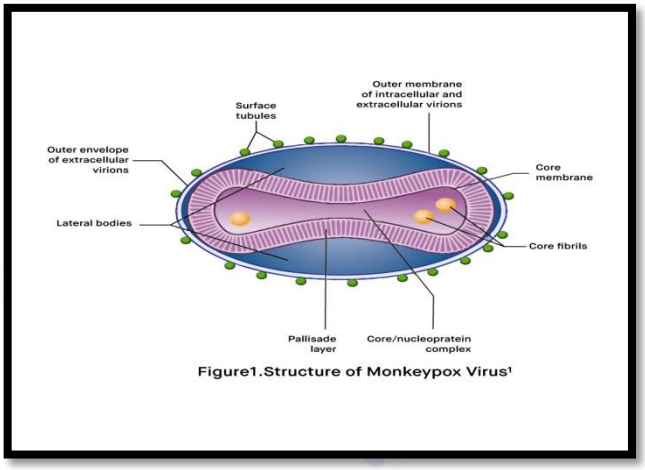

Figure 1: Structure of Monkeypox Virus

Monkeypox virus is a zoonotic pathogen, meaning that it spreads between non-human animals and humans. Although monkeypox was named after its initial discovery in monkeys in a Danish laboratory in 1958, various animal species have identified as susceptible to monkeypox virus, such as rope squirrels, tree squirrels, Gambian pouched rats, and dormice. Still, further research is required to determine the exact reservoirs of the virus.

3. Monkeypox virus Transmission

Infection of register cases outcome from absolute connectionwith the blood, bodily fluids, or cutaneous or mucosal lesions of contaminated animals. In Africa human infections have been recorded by the grasping of polluted monkeys, Gambian giant rats and squirrels, with rodents being the prime pool of the virus. Consuming poor cooked meat of polluted animals is a feasible risk factor. Secondary, or human-to-human, circulation can mark from nearcontact with polluted respiratory tract discharge, skin lesions of anpolluted person or objects newly polluted by patient fluids or lesion materials. Communication occurs predominantly via droplet respiratory molecules typically involving extended face-to-face touch, which puts household members of mobile cases at extensive threat of infection. Circulation can also occur by inoculation or via the placenta.

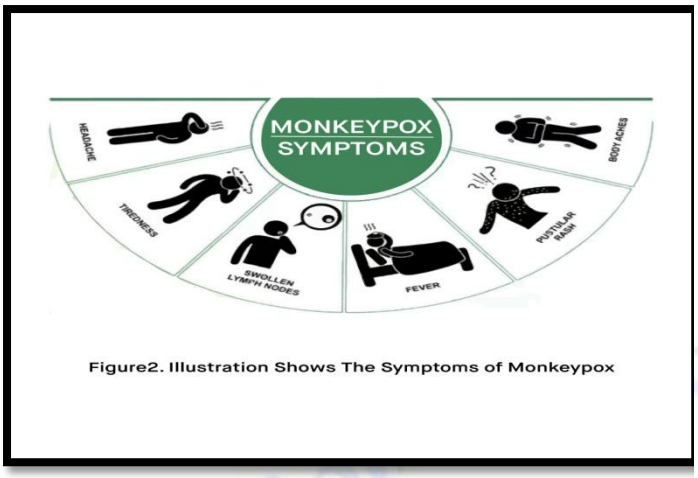

Figure 2: The symptoms of monkeypox

Monkeypox virus spreads through close contact with infected animals and humans, or contaminated materials. The virus may enter through broken skin, respiratory tract, and mucous membranes such as the eyes, nose, or mouth.

Animal to human transmission of monkeypox may be through contact with blood, bodily fluids, and lesion material of an infected animal, including wounds such as bites and scratches. Consuming inadequately cooked meat and other products from infected animals is also considered a potential route for contamination.

Human to human transmission is possible through contact with respiratory secretions, bodily fluids, and skin lesions of an infected person. Again, contact with recently contaminated objects can also cause transmission. Apart from close contact, monkeypox can also transmit from mother to fetus through the placenta. While close physical contact has been identified as a transmission route, data remains insufficient to determine whether monkeypox spreads directly through sexual intercourse.

4. Epidemiology

Monkeypox is an illness in humans was first integrated in the Democratic Republic of the Congo, in the town of Basankusu, in 1970. A second sudden appearance of human illness was distinguished in DRC/Zaire in 1996–1997. In 2003, a small explosion of human monkeypox in the United States appeared among holders of pet prairie dogs. In 2005, a Monkeypox outburst happened in Unity, Sudan and sporadic Cases have been reported. In 2009, an Outreach campaign among refugees from the Democratic Republic of Congo into the Republic of Congo recognized and confirmed two cases of Monkeypox. A monkeypox outbreak in the Central African Republic was carried with 26 cases and two Deaths between August and October 2016.Normally, the prediction involves the proportion of exposure to the virus, host immune response, co morbidities, vaccination status, and extremity of complications. Poxvirus infections have no ethnic preference and the prevalence is uniform in males and females. Roughly one third of the infections were evaluated to be Sub-clinical. The increase in instances was imputed to the effect of the civil war whichhad led to increased hunting for forest animals that carry monkey pox, especially Squirrels. Improvement in lifestyle due to increasing urbanization, and intensified Agricultural activities replacing hunting and trapping, the chances of reducing monkey pox, either from the primary reservoir or intermediate hosts, then it will become a disappearingdisease.

Etiology

Monkeypox is originated by Monkeypox virus, which belongs to the genus orthopoxvirus, and is also generated by a class of viruses that include chicken pox and small pox belonging to the same genus. The reservoir for monkeypox virus is unknown, but is thought to be squirrels or rodents in central Africa. In addition to African species, Studies have shown that there are multiple potential hosts for monkeypox virus encompasses primates, rabbits and rodents. Since Monkeypox virus has an animal reservoir, complete elimination of the disease is not feasible.

5. Signs and Symptoms

In individuals, the manifestations of monkeypox are identical to small pox but milder than the indications of smallpox. Monkeypox initiate with fever, headache, muscle aches, and fatigue. The principal dissimilarity between indications of smallpox and monkeypox is that monkeypox produces lymphadenopathy while smallpox does not. The incubation time for monkeypox is generally 7−14 days but can range from 5−21 days.

- The infection can be divided into two periods:
- The invasion period (0-5 days)
- The skin eruption period (within 1-3 days after appearance of fever)
- The invasion period:

- The illness starts with Fever, Headache, Muscle aches, Backache, Swollen lymph nodes, Chills, Exhaustion.

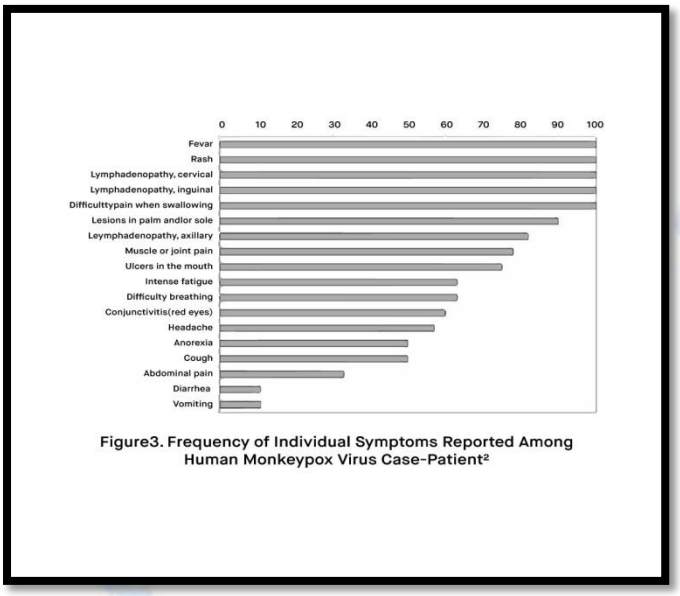

Figure 3: Frequency of individual symptoms reported among human monkeypox virus case-patient

The skin eruption period:

Within 1 to 3 days after the arrival of fever, the patient appears a rash, often developing on the face then extending to other parts of the body. The face and palms of the hands and soles of the feet are most affected. Three weeks might be necessary before the complete withdrawal of the crusts.

Lesions progress through the following stages:

- Rash
- Macules
- Papules
- Vesicles
- Pustules
- Scabs

The illness usually lasts for 2–4 weeks. In Africa, monkeypox has been shown to cause death in as many as 1 in 10 persons who had the disease.

Pathophysiology

Exposure to the polluted animal by a bite or through extreme contact with skin lesions or body fluids shows to be the predominant mechanism of infection in the US monkeypox outburst. Circulation through touch with contaminated bedding or cages is feasible, however it not approved. In African instances, person-to-person transmission through direct contact and respiratory droplets. However there is no confirmation of human-to- human communication in the US. Airborne transference of the monkeypox virus is theoretically feasible, mainly in patients with cough. In Africa, contamination may also occur by consumption of polluted animal for food. The duration of communicability, equivalent for both humans and animals, range from 1 day prior to the onset of the rash until 3 weeks, after rash onset all of the lesions have developed crusts.

Stage	Specification	Representation	Stage duration
Rash	It is more widespread skin involvement, which can be composed of several lesionswith primary and Secondary morphologies		1-2 days
Macules	Flat lesion < 1cm in diameter		1-2 days

Papules	Elevated lesion that is <1 cm in diameter		1-2 days
Vesicles	Small fluid containing lesion that is <0.5 cm		1-2 days
Pustules	Vesicle containingpurulent material May be whiteor yellow Is not always infected		5-7 days
Scabs	A hard coatingon the skin formed during the wound healing Reconstructionphase		7-14 days

7. Monkeypox outbreaks

Source: WHO

Figure4.Geographical Distribution of Confirmed and Suspected Cases of Monkeypox in Non-Endemic between 13 to 21 May 2022

Figure 4: geographical distribution of confirmed and suspected cases of monkeypox in non-endemic between 17 April 2022

Although monkeypox is a relatively rare disease, it is not a novel occurrence. The first human case of monkeypox was detected in 1970 in the Democratic Republic of the Congo (DRC). Since then, the virus has mostly affected populations in rural and rain forest regions in Central and Western Africa, with human cases reported in 11 African countries including the Democratic Republic of the Congo, Nigeria, Cameroon, the Central African Republic, Benin, Liberia, Gabon, Sierra Leone, Cote d'Ivoire, South Sudan, and the Republic of the Congo.

The first monkeypox outbreak outside of Africa occurred in 2003 in the US. Linked to pets imported from Ghana, the outbreak led to more than 70 human cases in total. More recently, monkeypox cases linked to international travel have been reported in Israel (2018), Singapore (2019), the UK (2018 and 2019), and the US (2021).

8. Countries have monkeypox disease

In May 2022, several cases of monkeypox were detected in various non-endemic countries. As of May 21, 2022, the World Health Organization (WHO) reports 92 confirmed cases and 28 suspected cases of monkeypox infection from 12 non-endemic countries including Australia, Belgium, Canada, France, Germany, Italy,

Netherlands, Portugal, Spain, Sweden, the UK, and the US.

Dangerous is monkeypox

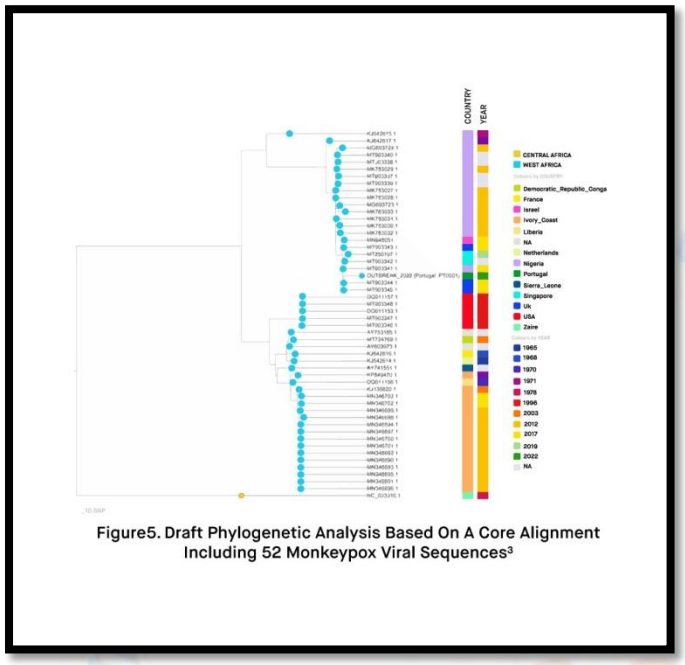

Figure 5: Draft phylogenetic analysis based on a core alignment including 52 monkeypox viral sequences

As mentioned above, infections with the monkeypox virus are not typically as transmissible or severe as smallpox infections. Most people are known to recover on their own within a few weeks. However, some people such as children, pregnant women, and immunocompromised persons can develop more severe illness. The true burden of monkeypox is not clear. Still, the virus has been reported to have caused deaths in Africa, with a fatality rate potentially as high as 1 in 10 infected persons. Future research is required to determine the exact risks and risk groups associated with the monkeypox disease.

9. Vaccine for monkeypox

Due to cross-protection afforded for the immune response to ortho-poxviruses, both monkeypox and smallpox vaccines have been developed in formulations based on the vaccinia virus. Vaccination was demonstrated to be around 85% effective in preventing monkeypox. In 2019, a newer two-dose vaccine based on a modified attenuated vaccinia virus was approved for use against monkeypox. Thanks to cross-protection, prior smallpox vaccination is also thought to reduce symptom severity.

Apart from vaccines, although the data on their effectiveness is scarce, antiviral agents such as cidofovir and tecovirimat may also be used in the treatment of monkeypox, as both agents have proven to be effective against poxviruses. Developed originally for smallpox, tecovirimat was recently licensed by the European Medical Association (EMA) for use against monkeypox based on human and animal studies.

Protect

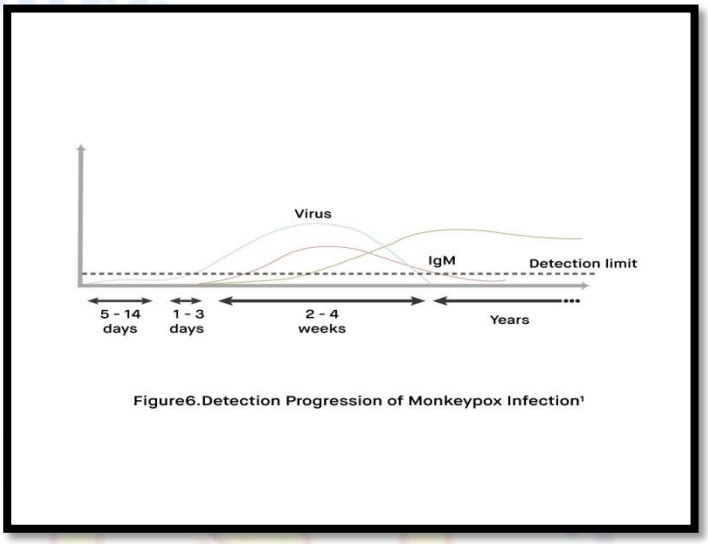

Figure 6: Detection progression of monkeypox infection.

In order to protect yourself and others, you should avoid close contact with wild animals, stray animals, and animals that seem to be unwell in general. Touching or consuming bush meat may also lead to contamination. You should also make sure to not eat inadequately cooked meat. You should also refrain from coming into close contact or sharing belongings such as towels or bedding with people who may have monkeypox. Finally, you should always make sure to apply rules of personal hygiene and wash or sanitize your hands regularly.

10. Diagnostic testing for monkeypox

Alongside vaccines and antiviral treatments, diagnostic technology has also been developed for monkeypox virus. Several IVD companies in China have developed monkeypox virus nucleic acid detection kits based on PCR-fluorescent flow method. As these viral detection kits do not currently have a registration certificate, they are used exclusively for research and disease control purposes.

The specific detection that must be evaluated encompasses other rash illnesses, such as, smallpox, chickenpox, measles, bacterial skin infections, scabies, syphilis, and medication-related allergies.

Lymphadenopathy throughout the prodromal stage of illness can be a clinical quality to differentiate it from smallpox. Monkeypox can only be diagnosed absolutely in the laboratory where the virus can be recognized through a number of different tests:

- Polymerase chain reaction (PCR) assay
- Enzyme-linked immunosorbent assay (ELISA)
- Antigen detection tests
- Virus isolation by cell culture
- Cross-adsorbed virus neutralization
- Immunofluorescence or hem agglutination inhibitionassays,
- Immunoblotting or Western blotting

11. Prevention

Averting monkeypox augmentation through restrictions on animal trade or prohibiting the locomotion of small African mammal's and monkeys may be potent in lessening the enlargement of the virus in exterior Africa. Potentially polluted animals might be segregated from other animals and set into immediate quarantine. Evade connection with animals that could harbor the virus. Evade touch with any substances, such as bedding, that has been in contact with a sick animal. Segregate polluted patients from others who could be at danger for infection. Execute good hand hygiene after contact with contaminated animals or humans. For Example, cleaning your hands with soap and water or applying an alcohol-based hand Sanitizer. Use personal protective equipment when caring for patients.

Treatment

There are no authorization therapies for human monkeypox, however, the smallpox vaccine can protect against the disease. The termination of general vaccination in the 1980s has growing sensitivity to monkeypox virus infection in the human population.

Cidofovir

Cidofovir is a powerful antiviral drug utilized in various virally generated cutaneous illnesses. It is applied either topically or intralesional for the remedy of skin diseases developed by DNA Viruses. It has broad-spectrum activity against all DNA viruses encompasses Herpes, adeno, polyoma, papilloma and poxviruses. Among the poxviruses, smallpox, cowpox, monkeypox, camelpox, molluscum contagiosum have proven Susceptible to the inhibitory effects of cidofovir.

Smallpox Vaccine

Smallpox vaccine is successful at safeguarding people against monkeypox when given before subject to monkeypox. CDC suggests that the vaccine should be given within 4 days from the date of exposure to prevent onset of the disease. If given between 4–14 days after the date of exposure, vaccination may mitigate the symptoms of illness, but not avert the disease.

Tecovirimat (ST-246)

ST-246 is efficacious in curing orthopoxvirus-developed illness. Human clinical trials revealed the medicine was safe and endurable with only minimal side effects. Tecovirimatis currently undergoing in clinical trials and has recently been granted permission to conduct Phase II trials by the U.S. Food and Drug Administration. In phase I trials tecovirimat was usually well tolerated with no serious adverse events.

Vaccinia Immune Globulin (VIG)

Vaccinia immune globulin (VIG) is made from the pooled blood of persons who have been administered with the smallpox vaccine. These individuals can develop antibodies in response to the smallpox vaccine are separated and purified.

Method and material

We conducted this research paper by observing the different types of reviews, as well as conducting and evaluating literature review papers.

12. Result & Discussion

Monkeypox are identical to small pox but milder than the indications of smallpox. Monkeypox initiate with fever, headache, muscle aches, and fatigue. The principal dissimilarity between indications of smallpox and monkeypox is that monkeypox produces lymphadenopathy while smallpox does not. The incubation time for monkeypox is generally 7–14 days but can range from 5–21 days.

Since then, the virus has mostly affected populations in rural and rain forest regions in Central and Western Africa, with human cases reported in 11 African countries including the Democratic Republic of the Congo, Nigeria, Cameroon, the Central African Republic, Benin, Liberia, Gabon, Sierra Leone, Cote d`Ivoire, South Sudan, and the Republic of the Congo.

Linked to pets imported from Ghana, the outbreak led to more than 70 human cases in total. More recently, monkeypox cases linked to international travel have been reported in Israel (2018), Singapore (2019), the UK (2018 and 2019), and the US (2021). Countries have monkeypox disease In May 2022, several cases of monkeypox were detected in various non-endemic countries.

As of May 21, 2022, the World Health Organization (WHO) reports 92 confirmed cases and 28 suspected cases of monkeypox infection from 12 non-endemic countries including Australia, Belgium, Canada, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, the UK, US and the India. However, some people such as children, pregnant women, and immunocompromised persons can develop more severe illness. Still, the virus has been reported to have caused deaths in Africa, with a fatality rate potentially as high as 1 in 10 infected persons. You should also refrain from coming into close contact or sharing belongings such as towels or bedding with people who may have monkeypox.

13. Conclusion & Future Aspect

Human monkeypox is an emerging viral zoonotic disease, which is caused by monkey pox virus. Primarily, monkey pox transmission to humans is believed to occur through direct contact with infected animals or possibly by ingestion of inadequately cooked flesh. There are no licensed therapies to treat human monkey pox viral infection; however, the smallpox vaccine can protect against the disease. The discontinuation of general vaccination in the 1980s has given rise to increasing susceptibility to monkey pox virus infection in the human population.

It has been noticed that the newer monkeypox should be similar to smallpox virus which produce a powerful life hazard infection in individuals. So this locomotion of individuals cause concerns for shifting of virus into an area without monkeypox. However the prevalence of human illness requires additional assessment and examinations with further studies to better understand the area of elements involved in disease communication and spread. The cause of concern now is the presence and potential spread of other hither to less known pox viruses, including the monkeypox in humans.

It has been observed that the newer monkeypox could be like the eradicated smallpox virus which causes a potentially life threatening infection in humans. Biological warfare and potential threat of bioterrorism cannot be ruled out; therefore, a 99 American Journal of Infectious Diseases and Microbiology better understanding of monkeypox virus and similar microorganisms could contribute to better management of emergency situations. .

Acknowledgment

We thankful way to all the honest and extraordinarily supporting pals for his or her assist and assist for the finishing touch of work. Last however now no longer the least, we grateful to all folks who cooperated and helped me immediately or circuitously to perform this work.

Ethical Approval: - Ethical approval turned into now no longer required for this letter. All facts used are publicly accessible.

Funding: - There have been no outside reasserts' of investment for this research.

Financial Support and Sponsorship: - Nil.

Declaration of Competing Interest: - All authors are, do now no longer record any conflicts of hobby with inside the writing of this letter.

Authors' Contribution

The first author developed the proposal, undertook the literature search and review, and then collects and analyzes the data under supervision of my respective advisers. The second author gives constructive comments and guidance and work with the main author with respect to the research objective.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

References

[1] Arita I, Jezek Z, Khodakevich L, and Ruti K. 1985. Human monkeypox: a newly emerged orthopoxvirus zoonosis in the Tropical rain forests of Africa. Am J Trop Med Hyg. 34: 781-789.

[2] Jezek Z, Khodakevich LN, and Szczeniowski MV.1988. Human monkey pox: its clinico-epidemiological characteristics. Zh Mikrobiol Epidemiology Immunobiol. 6:23-30.

[3] University of Alabama. "History of Monkeypox." May 25,2005. <http://www.bioterrorism.uab.edu/EI/monkeypox/history.html> (accessedMarch6,2007).https://www.medicinenet.com/monkeypox/article.htm

[4] Breman JG, Kalisa R, Steniowski MV, Zanotto E, Gromyko AI, Arita I. Human monkeypox, 1970–79. Bull World Health Organ 1980; 58: 165–82.

[5] Ladnyj ID, Ziegler P, Kima E. "A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republi of the Congo" "What You Should Know About Monkeypox" (https://www.cdc.gov/ncidod/monkeypox/pdf/factsheet2 .pdf) (PDF). Fact Sheet. Centers for disease control and prevention. 2003-06-12.

[6] Breman, JG., Kalisa, R., Steniowski, MV., Zanotto, E., Gromyko, AI and Arita, L. 1980. Human monkeypox 1970-74. Bull. WHO 58:165-182.

[7] " Breman JG, Kalisa R, Steniowski MV, Zanotto E, Gromyko AI, Arita I. Human monkeypox, 1970–79. Bull World Health Organ 1980; 58:165–82.

[8] Human monkeypox and other poxvirus infections of man. In: Fenner F, Henderson DA, Arita I, Jezek Z, Ladnyi ID, eds. Smallpox and its eradication. Vol.29. Geneva, Switzerland: World Health Organization, 1988:1287–319.

[9] Fine PE, Jezek Z, Grab B, Dixon H. The transmission potential of monkeypox virus in human populations.Int J Epidemiology1988; 17: 643–50.

[10] Monkeypox: Background, Pathophysiology, Epidemiology Mary Beth Graham, MD; Chief Editor: William D James, MD, Dec 09, 2016 Dec 09, 2016 https://emedicine.medscape.com/article/1134714- overview#a3

[11] Ligon BL. Monkeypox: a review of the history and emergence in the Western hemisphere. Semin Pediatr Infect Dis 2004 Oct; 15(4):280-7 http://www.mdedge.com/obgmanagement/dsm/390/dermatology/monkeypox December 18, 2017.

[12] Moore ZS, Seward JF, Lane JM. Smallpox. Lancet 2006 Feb4; 367(9508);425-35. (Review the clinical features, complications and differential diagnosis of smallpox infection. They compare and contrast smallpox with varicellaand monkeypox) http://www.who.int/mediacentre/factsheets/fs161/en/

[13] Olson VA, Laue T, Laker MT, et al. Real-time PCR system for detection of orthopoxviruses and simultaneous identification of smallpox virus. J Clin Microbial2004; 42:1940–6.

[14] Karem, KL, Reynolds, M., Braden, Z., Lou, G., Bernard, N and Patton, J. 2005. Characterization of acute-phase humoral immunity to monkeypox: use of immunoglobulin M enzymelinked immunosorbent assay for detection of monkeypox infection during the 2003 North American outbreak. Clin Diagn Lab Immunol.12: 867-872.

[15] Prevention [https://www.cdc.gov/poxvirus/monkeypox/prevention. html] (Centers for Disease Control and Prevention)

[16] Zabawski EJ Jr Dermatology Online Journal [01 Sep 2000, 6(1):3] A review of topical and intralesional cidofovir. (PMID: 11328613)

[17] Centers for Disease Control and Prevention [CDC]. Updated interim CDC guidance for use of smallpox vaccine, cidofovir, and vaccinia immune globulin (VIG) for prevention and treatment in the setting of an outbreak of monkeypoxinfections [online]. CDC; 2008 Sept. Available at:http://www.cdc.gov/ncidod/monkeypox/treatmentguidelines.htm. Accessed 2 Feb 2013

[18] Sbrana E, Jordan R, Hruby DE, Mateo RI, Xiao S-Y, Siirin M, et al. (2007) Efficacy of the antipoxvirus compound ST-246for treatment of severe orthopoxvirus infection. The American journal of tropical medicine and hygiene 76(4):768-773

[19] Updated interim CDC guidance for use of smallpox vaccine, cidofovir, and vaccinia immune globin (VIG) for prevention and treatment in the setting of an outbreak of monkeypox infections.

[20] Marennikova SS, Šeluhina EM, Mal'ceva NN, Ladnyj ID. 1972. Poxviruses isolated from clinically ill and asymptomatically infected monkeys and a chimpanzee. Bulletin of the World Health Organ.46:613-620.

[21] Arita I, Jezek Z, Khodakevich L, and Ruti K. 1985. Human monkeypox: a newly emerged orthopoxvirus zoonosis in the tropical rain forests of Africa. Am J Trop Med Hyg. 34: 781-789.

[22] Pal M.2007. Zoonoses.2nd Ed. Satyam Publishers, Jaipur, India.

[23] Landyi, ID., Ziegler, P and Kima, A. 1972. A human infectioun caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo (DRC). Bull World Health Organ. 46: 593-597.

[24] Jezek Z, Khodakevich LN, and Szczeniowski MV.1988. Human monkey pox: its clinico-epidemiological characteristics. Zh Mikrobiol Epidemiol Immunobiol. 6:23-30.

[25] Hutin, YJ., Williams, RJ., Malfait, P., Pebody, R., Loparev, VN and Ropp, SL. 2001. Outbreak of human monkeypox, Democratic Republic of Congo, 1996 to 1997. Emerg Infect Dis. 7: 434-438.

[26] Von Magnus, P., Andersen, EK., Petersen, KB and BirchAndersen, AA. 1959. A pox-like disease in cynomolgus monkeys. Acta Pathol. Microbiol. Immunol. Scand.46, 156-176.

[27] Jezek, Z and Fenner, F. 1988. Human monkeypox. Monographs in Virology, Vol. 17. Karger, Basel.P. 140

[28] Reed, KD., Melski, JW., Graham, MB., Regnery, RL., Sotir, MJ., Wegner, MV., et al. 2004. The detection of monkeypox in humans in the Western Hemisphere. N Engl J Med. 350:342-350.

[29] Likos, AM., Sammons, SA., Olson, VA., Frace, AM and OlsenRasmussen, 2005. A tale of two clades: monkeypox viruses. J Gen Virol. 86: 2661-2672.

[30] Hutson, CL., Carroll, DS and Self, J. 2010. Dosage comparison of Congo Basin and West African strains of monkeypox virus using a prairie dog animal model of systemic orthopoxvirus disease. Virology 402: 72-82.

[31] Fields, BN., Knipe, DM., Howley, PM., Chanock, RM., Melnick, JL., Monath, TP., Roizman, B and Straus, SE. 1995. Fields Virology, 3rd Ed. Lippincott, Williams and Wilkins, Philadelphia, USA.

[32] Esposito, JJ and Knight, JC. 1985. Orthopox virus DNA: a comparison of restriction profiles and maps. Virology 143: 230-251.

[33] Gispen R, and Brand-Saathof B. 1974. Three specific antigens produced in vaccinia, variola, and monkeypox infections. J Infect Dis. 129: 289-95.

[34] Pattyn SR. 2000. Monkeypoxvirus infections. Rev Sci Tech. 19: 92-97.

[35] Morand A, Delaigue S, and Morand JJ. 2017. Review of poxvirus: emergence of monkeypox. Med Sante Trop. 27: 29-39.

[36] Reynolds, MG., Carroll, DS and Olson, VA. 2010. A silent enzootic of an orthopoxvirus in Ghana, West Africa: evidence for multi-species involvement in the absence of widespread human disease. Am J Trop Med Hyg. 82:746-54.

[37] Reynolds, MG and Damon, IK. 2012. Outbreaks of human monkeypox after cessation of smallpox vaccination. Trends Microbiol. 20:80-87.

[38] Centers for Disease Control and Prevention .2003. Update: multistate outbreak of monkeypox – Illinois, Indiana, Kansas, Missouri, Ohio, and Wisconsin. Morb Mortal Wkly Rep 52: 642-646.

[39] Huhn, GD., Bauer, AM., Yorita, K., Graham, MB., Sejvar, J and Likos, A. 2005.

[40] Jezek, Z, Szczeniowski, M., Paluku, KM and Mutombo, M. 1987. Human monkeypox: clinical features of 282 patients. J Infect Dis.156 : 293-298.

[41] Breman, JG., Kalisa, R., Steniowski, MV., Zanotto, E., Gromyko, AI and Arita, L. 1980. Human monkeypox 1970-74. Bull. WHO 58:165-182.

[42] Clinical characteristics of human monkeypox, and risk factors for severe disease. Clin Infect Dis.41:1742-1751.

[43] Khodakevich, L., Jezek, Z and Kinzanzka, K. 1986. Isolation of monkeypox virus from wild squirrel infected in nature. Lancet. 1(8472):98-9.

[44] Di Giulio DB, and Eckburg PB.2004. Human monkeypox: an emerging zoonosis. Lancet Infect Dis. 2004 Jan;4 (1):15-25.

[45] Meyer, H., Perrichot, M and Stemmler, M. 2002. Outbreaks of disease suspected of being due to human monkeypox virus infection in the Democratic Republic of Congo in 2001. Clin Microbiol; 40: 2919-2921.

[46] Sejvar, JJ., Chowdary,Y., Schomogyi, M., Stevens, J., Patel, J and Karem, K. 2004. Human monkeypox infection: a family cluster in the midwestern United States. J Infect Dis. 190: 1833-1840.

[47] Monkeypox. http://misc.medscape.com/pi/iphone/medscapeapp/html/A1134714 -business.html Accessed: March 20, 2017.

[48] Karem, KL., Reynolds, M., Braden, Z., Lou, G., Bernard, N and Patton, J. 2005. Characterization of acute-phase humoral immunity to monkeypox: use of immunoglobulin M enzymelinked immunosorbent assay for detection of monkeypox infection during the 2003 North American outbreak. Clin Diagn Lab Immunol.12: 867-872.

[49] Reynolds, MG., Yorita, KL., Kuehnert, MJ., Davidson, WB., Huhn, GD and Holman, R. 2006. Clinical manifestations of human monkeypox influenced by route of infection. J Infect Dis. 194: 773-780.

[50] Cono, J., Casey, CG and Bell, DM. 2003. Smallpox vaccination and adverse reactions. Guidance for clinicians. MMWR Recommend. Rep.52: 1-28.

[51] Quiner CA, Moses C, Monroe BP, et al. Presumptive risk factors for monkeypox in rural communities in the Democratic Republic of the Congo. Yang Y, ed. PLoS ONE. 2017; 12(2): e0168664.

[52] Realegeno S, Puschnik AS, Kumar A, Goldsmith C et al.2017. Monkeypox virus host factor screen in haploid cells identifies essential role of GARP complex in extracellular virus formation. J Virol. Mar 22. pii: JVI.00011-17.

[53] Iizuka I, Ami Y, Suzaki Y, Nagata N et al.2016 A Single Vaccination of Nonhuman Primates with Highly Attenuated Smallpox Vaccine, LC16m8, Provides Long-term Protection against Monkeypox. Jpn. J. Infect. Dis. 2016.

[54] Maksyutov RA, Gavrilova EV, and Shchelkunov SN .2016. Species-specific differentiation of variola, monkeypox, and varicella-zoster viruses by multiplex real-time PCR assay. J Virol Methods. 236: 215-20.

[55] Li D, Wilkins K, McCollum AM, et al.2017. Evaluation of the GeneXpert for Human Monkeypox Diagnosis. The American Journal of Tropical Medicine and Hygiene 96: 405-410.

[56] Stern D, Olson VA, Smith SK, et al.2016. Rapid and sensitive point-of-care detection of Orthopoxviruses by ABICAP immunofiltration. Virology Journal13: 207.

[57] Stern D, Pauly D, Zydek M, et al.2016. Development of a genusspecific antigen capture ELISA for Orthopoxviruses – Target Selection and Optimized Screening. Wang Y, ed. PLoS ONE. 11(3):e0150110.

[58] Sklenovská, N. (2020). Monkeypox Virus. *Livestock Diseases and Management*, 39–68. https://doi.org/10.1007/978-981-15-2651-0_2

[59] Formenty, P., Muntasir, M. O., Damon, I., Chowdhary, V., Opoka, M. L., Monimart, C., Mutasim, E. M., Manuguerra, J. C., Davidson, W. B., Karem, K. L., Cabeza, J., Wang, S., Malik, M. R., Durand, T., Khalid, A., Rioton, T., Kuong-Ruay, A., Babiker, A. A., Karsani, M. E., & Abdalla, M. S. (2010). Human Monkeypox Outbreak Caused by Novel Virus Belonging to Congo Basin Clade, Sudan, 2005. *Emerging Infectious Diseases*, *16*(10), 1539–1545. https://doi.org/10.3201/eid1610.100713

[60] Isidro, J., Borges, V., Pinto, M., Ferreira, R., Sobral, D., Nunes, A., & Santos, J. D. (2022, May 20). *First draft genome sequence of Monkeypox virus associated with the suspected multi-country outbreak, May 2022 (confirmed case in Portugal)*. Virological. Retrieved May 22, 2022, from https://virological.org/t/first-draft-genome-sequence-of-monkeypox-virus-associated-with-the-suspected-multi-country-outbreak-may-2022-confirmed-case-in-portugal/799