Journal of Community & Public Health Nursing

Research Article Open Access

Community Awareness Strategies: Keys to Prevention of Epidemics of Monkeypox in Nigeria

Oparanma Florence Uche[1]* and GoodLuck Azuonwu[2]

[1]*Department of Nursing Sciences, Rivers State University, Port Harcourt, Nigeria*
[2]*Department of nursing sciences, University of Port Harcourt, Nigeria*

Abstract

This paper examines community awareness strategies keys to prevention of epidemics of monkey pox in Nigeria. Monkeypox infection is a zoonotic infection transmitted by direct or indirect contact with blood, body fluids and lesions of an infected animal. Human to human spread of Monkey pox has been described and infection is usually self-limiting, with an incubation period of 6-16 days. In Nigeria, according to information provided by the Nigeria Centre for Disease Control, between 1971 and 1978, 10 human monkey pox infections were reported in the country. In September 2017, human monkeypox re-emerged in Nigeria, after 39 years when it was last reported. The 2017 human monkeypox outbreak in the country was large. Laboratory diagnosis, as well as management and prevention of monkey pox infection in Nigeria, remain challenging as Nigeria is a resource-poor country with limited infrastructure, technical skill and training which is required in making a diagnosis. Therefore, this paper examines strategies to preventing the epidemics of monkeypox in Nigeria.

Keywords: Monkeypox; Emerging virus; Nigeria; Rash; Zoonosis; Orthopox

Introduction

Monkeypox is a relatively rare viral zoonotic infection which occurs primarily in remote parts of Central and West Africa, especially in the rural rainforest regions of Congo Basin and Democratic Republic of Congo, where it is considered to be endemic. It was first identified in 1958 during an investigation of a pox-like disease among monkeys in the State Serum Institute in Copenhagen, Denmark hence its name. For decades, Monkeypox has mostly been seen in Africa. However, it is occasionally found in other countries, including the United States. In the spring of 2003, the first outbreak of monkeypox outside of Africa occurred in the United States. A shipment of infected animals from Ghana was imported into Texas. The infected rodents spread the virus to pet prairie dogs, which then infected 47 people in the Midwest. As international travel becomes more common, viruses that were once fairly confined to certain locations can more easily spread around the world. In the summer of 2021, a case of monkeypox was found in a U.S. resident who had travelled from Nigeria to the United States. Then, 2022 brought outbreaks to regions outside of Africa, including Europe, the Americas and Australia.

Opines that the first case of human monkeypox infection was first described in a 9-year-old boy from Equateur province of Zaire, Democratic Republic of Congo [1], Central Africa, who developed a smallpox-like illness which was later confirmed as human monkeypox by World Health Organization. Monkeypox virus is an oval brick-shaped virus with double-stranded DNA, which belongs to the Poxviridae family, the sub family; Chordopoxvirinae and genus Orthopoxvirus. Other members of the family include Variola virus, Vaccinia virus (the virus used in smallpox vaccine), Cowpox virus, Camelpox virus and Ectromelia virus. Since the eradication of smallpox, monkeypox is the foremost Orthopoxvirus affecting man. There are two distinct clades of Monkeypox virus namely the Congo Basin and the West African clades; The Congo Basin clade is more virulent and has a higher rate of human-to-human transmission. The recent outbreak of monkeypox in Nigeria which spanned October 2017 to February 2018 was a source of public health concern. There was an initial diagnostic dilemma as many individuals; physicians inclusive had no knowledge of the aetiology of the disease condition [2]. The Centre for Disease Control and Prevention (CDC) played a vital role in diagnosis, as well as implementation of treatment plan, prevention and control. Monkeypox virus is a potential agent of bioterrorism as it is second to Variola virus, the agent of smallpox in terms of orthopoxvirus virulence with a mortality rate of 10%. Hence, there is an urgent need to educate physicians and the general public on the diagnosis, management and control of this disease (Figure1).

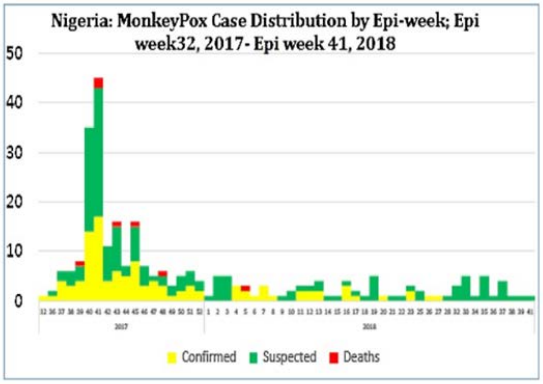

Figure1: Nigeria: Monkeypox case distribution.

***Corresponding author:** Oparanma Florence Uche, Department of Nursing Sciences, Rivers State University, Port Harcourt, Nigeria, E-mail: uche.florence2015@gmail.com

Received: 29- August -2022, Manuscript No: JCPHN-22-72725, **Editor assigned:** 2 - September -2022, PreQC No: JCPHN-22-72725 (PQ), **Reviewed:** 19- September -2022, QC No: JCPHN-22-72725, **Revised:** 24- September -2022, Manuscript No: JCPHN-22-72725 (R), **Published:** 30- September -2022, DOI: 10.4172/2471-9846.1000364

Citation: Uche OF, Azuonwu GL (2022) Community Awareness Strategies: Keys to Prevention of Epidemics of Monkeypox in Nigeria. J Comm Pub Health Nursing, 8: 364.

Conceptual Clarification

Monkeypox

States that monkeypox virus is an enveloped zoonotic virus and a species of the genus Orthopoxvirus in the family Poxviridae [3]. It has a similar morphology, size, and genome to Variola virus; however, it has a very broad host range, making it capable of infecting many species such as rodents, monkeys, and humans. This has allowed the virus to persist in wild host reservoir, causing sporadic human diseases thus avoiding global eradication by vaccination. The monkeypox virus measures about 200-250nm in size, it appears brick shaped, with characteristic surface tubules and a dumb bell shaped core. Like all orthopoxvirus, the central coding region sequence (CRS) at monkeypox virus nucleotide positions 56000–120000 is highly conserved and flanked by variable ends that contain inverted terminal repeats (ITRs). At present, there are virtually no studies of the biology of the monkeypox virus as there have been no animal models in which to study monkeypox.

Epidemiology

Monkeypox is indigenous to the rainforests of Central and West Africa. Between 1970 and 1986, 10 cases of human monkeypox infection were reported in Sierra Leone, Nigeria, Liberia and Côte d'Ivoire all. A total of 338 cases were reported from surveillance reports from 1981 to 1986 in the Democratic Republic of Congo [4]. Another outbreak occurred from 1996-1997 in the Democratic Republic of Congo, with an attack rate of 22 cases per 1000 population, sporadic occurrences in neighbouring countries have also been reported. The first report of human monkeypox infection outside Africa occurred in 2003 in the United States following shipment of rodents imported from Ghana to Texas. Eighty-one (41% laboratory confirmed) cases of monkeypox were reported in this outbreak. In 2003, 11 cases of monkeypox and 1 death were reported from the Democratic Republic of Congo while in 2005, 10 cases were reported in Sudan [5].

Objectives of this paper are to

- examine the epidemiology of monkeypox in Nigeria
- review related literature on monkeypox
- examine the physical features of monkeypox
- examine the signs and symptoms of monkeypox
- examine the mode of transmission of monkeypox
- review the community awareness strategies for the prevention of monkeypox
- identify the management plans for monkeypox in Nigeria

Outbreak of Monkeypox in Nigeria

According to information provided by the Nigeria Centre for Disease Control, between 1971 and 1978, 10 human monkeypox infections were reported in the country. In September 2017, human monkeypox re-emerged in Nigeria, after 39 years when it was last reported. The 2017 human monkeypox outbreak in the country was large. Bayelsa state was the first state in Nigeria to have reported the 2017 outbreak [6]. Unlike previous reports of the West African clade, the outbreak was characterized by infection predominantly among young male adults with significant transmission to others. The Niger Delta University Teaching Hospital reported that a substantial number of its young adult cases had concomitant genital ulcers, syphilis and HIV infection. The CDC has reported cases of American travellers contracting Monkeypox upon return from Lagos and Ibadan. Agam Rao, a medical officer in the Division of Pathogens and High Consequence Pathology at the Centers for Disease Control and Prevention, said that since 2018 all cases reported outside Africa have come from Nigeria [7].

In an article published by The Conversation, Oyewale Tomori pointed out that the number of Monkeypox infections in Nigeria through 2021 is likely to be under-represented, because much of the Nigerian population has been avoiding healthcare facilities due to fear of contracting COVID-19.

As British health authorities reported the first case of Monkeypox in the UK in May 2022, the Nigerian government has released to the public information and statistics on reported cases and deaths in the country. In a report released on May 9, 2022, the NCDC states that 230 cases were confirmed across 20 states and the Federal Capital Territory between 2017 and 2022. In 2022, NCDC has implemented National Technical Working Group, abbreviated as NTWG, for the purpose of reporting and monitoring infections, in addition to strengthening response capacity. In the NCDC report, Rivers State was the most affected by Monkeypox followed by Bayelsa and Lagos. In the span from 2017 to 2022, the NCDC reported 6 deaths in 6 different states, making for a 3.3% Case Fatality Ratio [8]. Between September and December 2017, Nigeria reported 89 confirmed and 228 suspected cases of monkeypox from 24 out of the 36 states in the country. Studies of monkeypox virus have identified at least 2 different genetic types (clades) of the virus, both of which segregate based upon geographic separation, with one type being found in West Africa and the other in Central Africa. The West African clade was implicated in this outbreak. Most of the confirmed cases were among adults whose ages ranged from 21- 40 years with male to female ratio of 2.5:1. Six deaths were reported among which four reportedly had background immunosuppressive illness. Prior to this, only 3 cases had been previously reported in Nigeria. The first reported case occurred in 1971, in a 4-year-old boy from the South Eastern part of the country while the last reported case occurred in 1978. Prior to the recent outbreak, there had been no reported case of monkeypox in Nigeria since 1978. Another West African country, Liberia has also reported 2 confirmed cases of monkeypox in November 2017 [9].

Review of Related Literature

Nigeria is a sovereign country located in West Africa with a population of over two hundred million. The country is made up of 36 states and federal capital territory. MPX has been reported in some regions or states in Nigeria. As at 27th October 2017, the Nigeria Center for Disease Control (NCDC) reported some cases to WHO, and these cases were confirmed in Abuja, Enugu, Bayelsa, and Akwa Ibom. The suspected cases were from Delta, Nassarawa, Niger, Rivers, Abuja, Lagos, Imo, Enugu, Ekiti, Akwa Ibom, Bayelsa, and Cross River. In January 2019, many suspected cases were reported across 26 states while confirmed cases were recorded in 17 states. Nigeria Centre for Disease Control (NCDC) (2019), reported, as at September 2019, Monekeypox virus (MPXV) cases across nine states which include Oyo, Bayelsa, Lagos, Delta, Rivers, Enugu, Akwa Ibom, Anambra, and Cross River. Meanwhile MPXV cases were reported in six additional states as at December 2019, and this makes the total reported cases to 113 and confirmed cases to 45 between January and December 2019 [10]. Although there are not enough data to suggest that this disease is endemic in any region of Nigeria, some states in the Southern Nigeria (Southwest, South-South, and Southeast) happened to record outbreaks of the disease over the years. [11] Carried out a study on the incidence rate of monkeypox in Democratic Republic of the Congo. The study was reported in only six articles, all peer-reviewed,

three with data from the Democratic Republic of the Congo and three from the CAR. Surveillance data of suspected monkeypox cases in the DRC showed that the incidence increased from 0.64/100,000 in 2001 to 2.82/100,000 in 2013. Even with the removal of cases from areas of active surveillance, including the Sankuru district of the DRC, the investigators found that the increases remained substantial. Between November 2005 and November 2007, the average annual cumulative incidence of confirmed monkeypox from nine health zones in the Sankuru district was 5.53 per 10,000, ranging from 2.18 to 14.42 per 10,000 [12]. An overall attack rate of confirmed or probable monkeypox in a 2015 outbreak in the CAR was calculated to be per 10,000 persons, while an outbreak in 2016 had a reported attack rate of 50 per 10,000 for suspected and confirmed cases.

In 21 peer-reviewed articles conducted by [13] showed information about smallpox vaccination status was reported for confirmed, probable, and/or possible monkeypox cases. In 11 articles, describing outbreaks from 10 different countries, investigators reported that none of the 49 cases were vaccinated. These countries were Cameroon, Liberia, Nigeria, Sierra Leone, CAR, Republic of the Congo, DRC, Coˆte d'Ivoire, South Sudan, and the UK. The outbreaks in these countries were small, with one to six cases per outbreak, except for the Republic of the Congo with 11 cases and South Sudan with 19 cases. In the 10 other articles, which reported data from outbreaks in the DRC [1981–2013] and US [2003], the proportion of monkeypox cases with a history of prior smallpox vaccination ranged from 4–21% , illustrating that the majority of cases (approximately 80–96%) occurred in unvaccinated individuals. The highest percentage of vaccinated cases (21%) was found in the US outbreak. In a study of confirmed and suspected cases in the CAR, 19.2% (5/26) had a smallpox vaccination scar, and the overall attack rate was lower among vaccinated individuals (0.95/ 1000) compared to unvaccinated individuals (3.6/1000). [14] Conducted study on the origins of monkeypox outbreaks. The study pointed out that human-to-human transmission has been reported from primary human cases, secondary cases and serial transmission across four cases has been observed. In the current monkeypox outbreak in Nigeria, genomic studies on monkeypox virus isolates from human cases suggest that the index case was not imported into Nigeria. Current evidence suggests that the outbreak is caused by multiple source emergences into the human population, and not sustained by human to human transmission. The zoonotic source(s) of the outbreak are currently under investigation, and it is unclear what, if any, environmental or ecologic changes might have facilitated its sudden re-emergence in Nigeria. Clustering of cases has been identified within states, although no epidemiological linkages across states have yet been identified [15]. Three family clusters have been identified and this suggests human-to-human transmission. In one family the secondary attack rate was 71%. However, since most cases have no obvious epidemiologic linkage suggestive of person-to-person contact, the hypothesis of a multiple-source outbreak is reinforced, but this does not exclude emergence from contact with humans that are a part of previously unrecognized human endemic disease.

Physical Features of Monkey Pox

The monkeypox virus's full host range is uncertain. Animals known to be susceptible to infection include diverse Old and New World monkeys and apes, and various rodents, shrews and other small mammals. Among nonhuman primates, clinical cases have been described in chimpanzees (*Pan troglodytes*) and an infant sooty mangabey (*Cercocebus atys*) in the wild, as well as captive gorillas (*Gorilla gorilla*), chimpanzees, Asian orangutans (*Pongo pygmaeus*), gibbons (*Hylobates lar*), marmosets (*Hapale jacchus*), and various monkeys in the genera *Cercopithecus*, *Macaca* and *Siamiri*. Antibodies have been found in other wild or captive nonhuman primates. During an outbreak in the U.S. associated with exotic pets, infected animals included Gambian giant pouched rats (*Cricetomys spp*); North American black-tailed prairie dogs (*Cynomys ludovicianus*) rope squirrels (*Funisciurus* spp), dormice (*Graphiurus* sp), a groundhog/ woodchuck (*Marmota monax*), an African hedgehog (*Atelerix* sp), a jerboa (*Jaculus* sp) and two opossums (*Didelphis marsupialis* and *Monodelphis domestica*). Chinchillas (*Chinchilla lanigera*) and coatimundis (*Nasua nasua*) developed antibodies after exposure, but viral DNA or infectious virus was not found. Giant anteaters (*Myrmecophaga tridactyla*) were thought to have been involved in an outbreak among primates at the Rotterdam Zoo in the Netherlands in 1964. Limited early surveillance in sheep, goats and cats in Africa found no evidence of exposure, but antibodies were detected in one pig [16]. A subsequent attempt to infect pigs by rubbing virus into the skin did not result in virus recovery except from the inoculation site. Experimental infections with clinical signs have also been reported in 13-lined ground squirrels (*Spermophilus tridecemlineatus*), the cotton rat (*Sigmodon hispidus*), forest giant squirrel (*Protexerus strangeri*), bobak marmot (*Marmota bobak*), and red squirrels (*Sciurus vulgaris*). Adult white rabbits (with the apparent exception of albino rabbits), guinea pigs, white rats (*Rattus spp*) and wild type laboratory mice (*Mus musculus*) are refractory to experimental infection, though newborn rats and rabbits can be infected. The physical features of monkeypox are listed below;

- Lesions are well circumscribed, deep seated, and often develop umbilication (resembles a dot on the top of the lesion)
- Lesions are relatively the same size and same stage of development on a single site of the body (ex: pustules on face or vesicles on legs)
- Fever before rash
- Lymphadenopathy common
- Disseminated rash is centrifugal (more lesions on extremities, face)
- Lesions on palms, soles
- Lesions are often described as painful until the healing phase when they become itchy (crusts)

The illness typically lasts 2-4 weeks. The severity of illness can depend upon the initial health of the individual, the route of exposure, and the strain of the infecting virus (West African vs. Central African virus genetic groups, or clades). West African monkeypox is associated with milder disease, fewer deaths, and limited human-to-human transmission. Human infections with the Central African monkeypox virus clade are typically more severe compared to those with the West African virus clade and have a higher mortality. Person-to-person spread is well-documented for Central African monkeypox virus.

Signs and Symptoms

Monkeypox is a rare disease caused by infection with the monkeypox virus. Monkeypox virus is part of the same family of viruses as smallpox. Monkeypox symptoms are similar to smallpox symptoms, but milder; and monkeypox is rarely fatal. Monkeypox is not related to chickenpox. Symptoms of monkeypox 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. 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. The rash starts as flat, red bumps, which can be painful. Those bumps turn into blisters, which fill with pus. After a few days, a rash often develops. Eventually, the blisters crust over and fall off — the whole process can last two to four weeks. You can also get sores in your mouth, vagina or anus. Not everyone with monkeypox develops all of the symptoms. In fact, in the current (2022) outbreak, many cases are not following the usual pattern of symptoms. This atypical presentation includes only a few lesions, no swollen lymph nodes, less fever and other signs of illness. You can have it and not know it. However, even if you do not show many signs of infection, you can still spread it to others through prolonged close contact.

Clinical Signs

Most patients develop a rash one to several days after they begin to feel ill, though there have been instances where patients noticed a few skin lesions (e.g., at the site of an animal bite or scratch, or in the groin) shortly before they felt unwell. Skin lesions are usually concentrated on the extremities (including the palms and soles), but they can also be seen on the head and torso, as well as the mucous membranes and genitalia. They vary in number from less than 25 to more than a hundred, and may become confluent in severe cases. As in animals, skin lesions usually begin as macules and papules, which develop into vesicles and pustules ("pocks"), umbilicate form, scabs and are eventually shed. During the outbreak in the U.S., some pustules had prominent erythematous flares. Such flares have not been noted in African cases, possibly because most affected people have darker skin [17]. The skin lesions usually resolve within 14 to 21 days. Residual varioliform scarring, with hypopigmented and/or hyper pigmented skin lesions, may be a sequela in some cases. Severe scarring, as seen in smallpox, is rare. Some patients also have ocular signs including conjunctivitis, or more rarely, keratitis or corneal ulceration. Respiratory complications including bronchopneumonia, coagulation disorders, and rare cases of encephalitis or multiorgan failure have also been reported. Secondary bacterial infections can occur, and may lead to sepsis. Pregnant women may abort or give birth to an infected fetus. One fetus infected in utero was stillborn, with cutaneous maculopapular skin lesions and severe hepatic involvement; another had skin lesions and was born prematurely but alive. At least one mildly affected pregnant woman gave birth to a full-term, healthy child. Most patients recover in 2-4 weeks, but deaths are possible, especially in people infected with the Congo Basin clade or immunosuppressed individuals infected with either clade. Subclinical and very mild cases have also been reported.

Prairie Dogs and Other Rodents

In prairie dogs, the clinical signs may include fever, depression, anorexia, blepharoconjunctivitis (often the initial sign), respiratory signs (nasal discharge, sneezing and/or coughing, respiratory distress), diarrhea, skin lesions similar to those in nonhuman primates, and oral ulcers. Lymphadenopathy was seen in naturally infected prairie dogs, but did not occur in all experimentally infected animals. Elevated serum levels of liver enzymes have also been reported. Some cases are fatal, and experimentally infected prairie dogs sometimes died without developing lesions on the skin or mucous membranes. Similar clinical signs have been reported in other naturally or experimentally infected rodents; however, not all animals developed skin lesions. Intranasally inoculated dormice, which often died, had only nonspecific signs such as lethargy, an unkempt hair coat, a hunched posture, conjunctivitis and dehydration. Some naturally infected Gambian giant pouched rats had asymptomatic infections or mild illnesses, with no respiratory signs and limited skin lesions, but other animals died, and experimentally infected pouched rats sometimes became moderately to severely ill, with skin and oral lesions, ocular lesions and nonspecific signs of illness. Pox lesions were found in a wild Thomas's rope squirrel (*Funisciurus anerythrus*) in Africa that was found infected with a Congo Basin strain. Some rope squirrels (*Funisciurus anerythrus*) inoculated with a Congo Basin strain developed skin and oral lesions, respiratory signs and, in one case, corneal lesions. However, African squirrels administered a high viral dose in an earlier study died with a generalized, nonspecific illness, and skin lesions occurred only in a few animals that received a lower, nonfatal dose.

Mode of Transmission

Explained that monkeypox viruses have been found in skin lesions and most or all secretions and excretions (e.g., urine, feces, and oral, nasal and conjunctival exudates) in animals [5]. Likely routes of transmission include inhalation, direct inoculation into breaks in the skin, and the ingestion of infected tissues. The importance of aerosol transmission might differ between species or situations. Experimentally infected prairie dogs can shed monkeypox viruses until 21 days after inoculation, and limited evidence suggests that some small animals, such as dormice and Gambian giant pouched rats, might carry this virus for a few weeks or months. Viral DNA was detected in the tissues, urine and feces of one dormouse for at least 6 months, but no viral antigens were found when this animal was euthanized. Whether such animals can shed infectious virus is not known. Humans can become infected via bites from animals, in aerosols during close contact, or by direct contact with lesions, blood or body fluids. Sexual transmission was suspected in a few cases, when there were lesions on the genitalia, and transplacental transmission has been documented. In Africa, clinical cases have often been linked to handling, preparing and eating wild animals, but person-to-person transmission was also significant in some outbreaks. Monkeypox virus has been isolated from humans for up to 18 days after the onset of the rash, and scabs shed during recovery were found to contain significant amounts of infectious virus. Person-to- person transmission does not seem to be capable of maintaining the virus in human populations.

Medical Management or Intervention of Monkeypox

Monkeypox is self-limiting hence treatment is mainly by bed rest and supportive care. However, hospitalization and possible intensive care may be necessary in severe cases. Preferably, nursing should be done in a negative pressure room while applying airborne and contact precautions to limits its spread. Isolation of infected individuals is also a necessary precaution in preventing the spread of the infection and this must be continued until the last crust is shed as direct contact with skin lesions and fomites are considered infectious. There is no proven treatment for human infection at the moment but cidofovir and brincidofovir (CMX- 001) have been shown to have anti-monkeypox viral activity in vitro and in animal studies. A reduction in mortality was observed with the use of cidofovir than therapeutic use of smallpox vaccine following intratracheal infection of cynomolgus monkeys.

However, CDC recommends consideration of cidofovir in individuals with severe monkeypox infection; brincidofovir has an improved safety profile over cidofovir as it has less renal toxicity during its use in the treatment of cytomegalovirus infection. Tecovirimat (previously known as ST-246) is an oral antiviral agent with activity against orthopoxvirus including monkeypox in vitro and in animal studies but its effectiveness in humans is unknown. Vaccinia Immune Globulin (VIG) is a blood product which is rich in antibodies against Vaccinia virus; it is obtained from pooled blood of individuals who have been inoculated with the smallpox vaccine. There is no available data on the effectiveness of VIG on the prevention and treatment of complications from monkeypox infection, however its use may be considered in patients with severe infection. CDC recommends the prophylactic use of VIG in persons who have been exposed to the virus but have severe cellular immunodeficiency with contraindication to smallpox vaccination.

Prevention and Control of Monkeypox

- Restriction of movement of monkeys and small African mammals may limit the spread of monkeypox virus outside Africa.

- Animals with suspected monkeypox infection which may be demonstrated as rhinorrhea, respiratory distress, mucocutaneous lesions, ocular discharge and/or lymphadenopathy should be quarantined while avoiding contact especially bites and scratches and exposure to body fluids and secretions.

- Animals that might have come in contact with an infected animal must be quarantined and observed for symptoms of monkeypox for 30 days.

- Use of gloves and wearing of protective clothing while handling sick animals or during slaughtering procedures, thorough cooking of all animal products before eating also limits the risk of infection.

- There is need to avoid contact with any material that has been in contact with infected animal, practicing good hand hygiene after contact with infected animals or persons also limits the risk of infection and its spread. There is currently no commercially available vaccine specific for monkeypox.

- Immunization of healthcare workers and those exposed to their samples with the smallpox vaccine such as ACAM2000, which contains live Vaccinia virus confers 85% protection from monkeypox infection. Subsequent monkeypox infection may be milder even several years post vaccination with a reduction in the incidence of complications. The investigational vaccines Aventis Pasteur Smallpox Vaccine (APSV) which contains a replication-competent Vaccinia virus and Imvamune (MVA-BN): a replication-deficient smallpox vaccine which contains an attenuated live virus are also available but have restricted use. Imvamune may be used in individuals with certain immune deficiencies. The vaccine, LC16m which also contains attenuated vaccinia virus and has less adverse effects than ACAM2000 has been licensed for used in Japan. Prior vaccination with vaccinia virus is known to provide 85% protection and reduce the severity of the infection but caution is needed in population with high HIV prevalence. The discontinuation of the general smallpox vaccination and the ability of the virus to evolve may have contributed to increased susceptibility of humans to monkeypox infection.

- In the case of significant unprotected exposure to an infected animal or person, CDC recommends preexposure smallpox vaccination to field investigators, laboratory personnel, veterinarians, and healthcare workers investigating or caring for patients with suspected monkeypox. Additionally, post-exposure smallpox vaccination within two weeks of exposure preferably within 4 days of exposure is preferable. Due to the relative rarity of monkeypox infection, vaccination of an entire population is uncommon and caution must be applied when considering vaccination in populations with high prevalence of HIV infection due to the risk of complications.

Addressing Gaps in Knowledge and Strengthening Public Health Preparedness

Most of the currently available data on monkeypox comes from individual case or outbreak reports, and from passive intermittent surveillance, all of which do not portray an accurate overall picture. The rapid response by the Nigerian CDC (Nigeria CDC, 2018) to the ongoing monkeypox outbreak is example of how a locally led integrated Human-Animal Disease Surveillance and Response system can be used effectively to define the outbreak, and points the way forward for other African countries. Nigeria's experience is important for regional training and help build networks to improve surveillance capacity, laboratory diagnostics, best public health and clinical practice, and regional capacities to launch locally led efficient responses. This would contribute to the need to build public health and surveillance capacities across Africa to guide appropriate surveillance, data collection, prevention, preparedness and response activities to monkeypox and other emerging and re-emerging infections with epidemic potential. Advancing public health preparedness and aligning proactive surveillance activities to priority research will require a coordinated, locally-led, multidisciplinary efforts aligned closely with capacity development and training.

Conclusion

In summary, monkeypox is a rare disease caused by the monkeypox virus. It leads to rash and flu-like symptoms. Like the better known virus that causes smallpox, it is a member of the family called orthopoxvirus. Monkeypox was discovered in 1958 when two outbreaks of a pox-like disease occurred in groups of monkeys being used for research. It is spread mainly through human contact with infected rodents, but can sometimes be spread through skin-to-skin contact with an infected person. There are two known types (clades) of monkeypox virus — one that originated in Central Africa and one that originated in West Africa. Monkeypox is usually a self-limited disease with symptoms lasting from two to four weeks. Most people with monkeypox get better on their own without treatment. Following diagnosis, your healthcare provider will monitor your condition and try to relieve your symptoms, prevent dehydration and give you antibiotics to treat secondary bacterial infections if they develop. There is currently not an approved antiviral treatment for monkeypox. Antiviral drugs may help, but they have not been studied as a treatment for monkeypox. Several investigational antivirals with activity against monkeypox are available, but only as part of a research study. The last two years have been incredibly challenging — the COVID-19 pandemic changed so much about the way we lived and worked. Now, just as we are starting to ease back into regular life, we are hearing many media stories about monkeypox as an emerging threat. However, monkeypox is a rare disease. It is spread through close contact like kissing and sex, though we are still learning about how monkeypox spreads in humans. The best way to protect yourself is to avoid contact with people who are infected, wash your hands frequently and wear a facemask in crowded, indoor spaces. Early symptoms of monkeypox are flu-like and include fever, chills and body aches. After a few days, a rash will begin to develop. See

your healthcare provider if you develop symptoms.

Recommendation

The following recommendations are made to avoid and manage monkeypox virus for patients with monkeypox and non-patients.

1. Develop a standard data collection form for the clinical management of patients and to aid with better documentation and understanding of the natural history of disease.

2. Strengthen clinician awareness of monkeypox and differential diagnosis through training including completing investigation forms and obtaining appropriate specimens for testing.

3. Wash your hands often with soap and water or use an alcohol-based hand sanitizer, especially after contact with sick people.

4. Enhance capacities for infection prevention and control (IPC) and limit nosocomial transmission. Strengthen clinical laboratory capacity for supportive treatment of cases.

5. Conduct operational research to better understand prognostic factors determining severity of illness.

6. Evaluate investigational agents as pathogen-specific treatments such as those under the smallpox research agenda

7. It is important to stay home and rest when you are sick, wear a mask around others and drink plenty of fluids.

8. A person who is sick with monkeypox should isolate at home. If they have an active rash or other symptoms, they should be in a separate room or area from other family members and pets when possible.

References

1. Breman JG, Henderson DA (2002) Diagnosis and management of smallpox. N Engl J Med 346:1300-1308.
2. Damon IK (2011) Status of human monkeypox: clinical disease, epidemiology and research. Vaccine 29: D54-D59.
3. Ladnyj ID, Ziegler P, Kima E (2017) A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo. Bull World Health Organ 46: 593.
4. Olson VA, Laue T, Laker MT, Babkin IV, Drosten C, et al. (2019) Real-time PCR system for detection of orthopoxviruses and simultaneous identification of smallpox virus. J Clin Microbiol 42: 1940-1946.
5. MacNeil A, Reynolds MG, Braden Z , Carroll DS, Bostik V, et al (2009) Transmission of atypical varicella-zoster virus infections involving palm and sole manifestations in an area with monkeypox endemicity. Clin Infect Dis 48: 6-8.
6. Di Giulio DB, Eckburg PB (2004) Human monkeypox: an emerging zoonosis. Lancet Infect Dis 4: 15-25.
7. Ježek Z, Szczeniowski M, Paluku KM, Moomba M (2000) Human monkeypox: clinical features of 282 patients. J Infect Dis 156: 293-298.
8. Kulesh DA, Loveless BM, Norwood D, Garrison J, Whitehouse CA, et al. (2004) Monkeypox virus detection in rodents using real-time 3′-minor groove binder TaqMan assays on the Roche LightCycler. Lab Invest 84: 1200-1208.
9. Breman JG, Steniowski MV, Zanotto E, Gromyko AI, Arita I (1980) Human monkeypox, 1970-79. Bull World Health Organ 58: 165.
10. Karem KL, Reynolds M, Braden Z, Lou G, Bernard N, et al. (2005) Characterization of acute-phase humoral immunity to monkeypox: use of immunoglobulin M enzyme-linked immunosorbent assay for detection of monkeypox infection during the 2003 North American outbreak. Clin Diagn Lab Immunol 12: 867-872.
11. Learned LA, Reynolds MG, Wassa DW, Li Y , Olson VA, et al. (2005) Extended interhuman transmission of monkeypox in a hospital community in the Republic of the Congo, 2003. Am J Trop Med Hyg 73: 428-434.
12. Li Y, Olson VA, Laue T, Laker MT, Damon IK (2006) Detection of monkeypox virus with real-time PCR assays. J Clin Virol 36: 194-203.
13. Seward JF, Galil K, Damon I, Norton SA, Rotz L, et al. (2004) Development and experience with an algorithm to evaluate suspected smallpox cases in the United States, 2002–2004. Clin Infect Dis 39: 1477-1483.
14. Shchelkunov SN, Shcherbakov DN, Maksyutov RA, Gavrilova EV (2011) Species-specific identification of variola, monkeypox, cowpox, and vaccinia viruses by multiplex real-time PCR assay. J Virol Methods 175: 163-169.
15. Von Magnus P, Andersen E, Petersen K, BirchAndersen A (2008) A pox-like disease in cynomolgus monkeys. APMIS 4: 156–176.
16. Weinstein R, Nalca A, Rimoln A, Bavari S, Whitehouse C (2005) Re-emergence of Monkeypox: Prevalence, Diagnostics, and Countermeasures. Clin Infect Dis 41: 176–177.
17. McCollum A, Damon I (2014) Human Monkeypox. Clin Infect Dis 5: 260–267.