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AN OVERVIEW OF THE MONKEYPOX VIRUS OUTBREAK: A NEW GLOBAL THREAT

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ABSTRACT

The virus that causes monkey pox is a double-stranded DNA enveloped virus that can spread from human to person or from animal to animal. It is a viral zoonotic illness. As a result, it became the most significant orthopoxvirus in terms of public health. This study examined most of the material pertaining to the monkeypox outbreak, diagnosis, treatment, and prevention based on the literature that was readily available online.

One of the most prevalent illnesses between people and animals is monkeypox (MPX), which is brought on by a virus that is a member of the orthopoxvirus genus. A worldwide emergency, the monkeypox virus (MPXV) outbreak was brought on by environmental elements (virus, wastewater, surface, and air) and intensified by community and governmental decisions. This systematic review's objective is to outline MPXV's environmental aspects, with a focus on risk assessment in order to stop and manage the spread of a new pandemic. Following screening, four studies out of 120 records were included in the systematic review. According to the systematic study, there is a chance that MPXV could spread through the air, wastewater.

KEY WORDS monkey pox, transmission, Tecovirimat, Vaccinia immune globulin

INTRODUCTION

Public health experts are concerned about whether the recent epidemic of monkeypox virus poses a new hazard, even though the coronavirus disease 2019 (COVID-19) pandemic continues to pose a threat to the world. The genus orthopox viruses, which also contains the variola, cowpox (CPX), and vaccines viruses, is home to the double-stranded DNA virus known as the monkeypox virus. Although the monkeypox virus was initially identified in monkeys, rope squirrels, tree squirrels, Gambian pouched rats, and dormice are also among the virus's natural hosts .[1]Thus far, the monkeypox virus has been found in two main clades in Central

and West Africa, the former of which is linked to a more severe form of sickness. [2] The current outbreak's numerous instances have been linked to sexual transmission, particularly

According to the Centres for Disease Control and Prevention (CDC), supportive care is usually enough for individuals with a monkeypox virus infection, and there are no specific medications available as of this writing. On the other hand, smallpox vaccinations, antivirals, and vaccinia immune globulin (VIG) have been used to contain smaller outbreaks; these treatments can be obtained by consulting the CDC. Other orthopoxvirus infections; until proven otherwise, all confirmed orthopoxvirus cases should be treated as though they are cases of monkey pox. [3]

Although the world is challenged by the coronavirus disease 2019 (COVID-19), the emergence of a new outbreak caused by a monkey virus has raised concerns among health officials about a new threat.[4]Monkeypox disease is secondary stranded DNA- viruses of the orthopoxvirus genus, which also include variola, cowpox (CPX) and vaccinia viruses [5]. The monkey virus was first isolated from monkeys. However, the hosts of the monkey virus include chipmunks, wood squirrels, Gambian mice and dormouse [6]. After smallpox was eradicated in 1980, monkeypox (MPX) was identified in 1987 as the dominant orthopoxvirus (OPXV) occurring in humans at that time. There are currently 10 known species in the OPXV genus, including variola (smallpox) .With a mortality rate of 30% (CFR) and high morbidity, smallpox is considered one of the most feared diseases known to man. Monkeypox virus (MPXV) is highly pathogenic and causes smallpox-like clinical manifestations. Vaccination can provide up to 85% protection against infection

MPXV was first discovered in 1958 when it broke out in monkeys in a Danish laboratory .However, it was not recognized as a human disease until 1970, when a nine-month-old child was infected in the Democratic Republic of the Congo (DRC), formerly known as Zaire. MPX is found in the tropical rainforests of the Congo Basin (CB) and West Africa (WA), and the DRC continues to report the highest number of cases annually, most of the children are under 10 years old. The latest outbreak in the Central African Republic (CAR) in October 2016, resulted in 26 cases, three of which were laboratory confirmed [7, 8, and 9].

How is the virus transmitted to humans?

The monkeypox virus (MPXV) can infect anyone through intimate, personal contact, frequently on the skin, and can spread in a variety of ways. This can involve coming into direct contact with a person who has the disease, touching items, materials (such as clothes, beds, or towels), or surfaces that have been touched by a person who has the disease. It can also involve coming into contact with respiratory secretions. Through the placenta, a pregnant individual can transmit the virus to their fetus. Additionally, humans may contract monkeypox from animals if they are bitten or scratched, if they prepare or consume meat, or if they use goods derived from an affected animal [10-20].

From the moment symptoms appear until the rash has completely healed and a new layer of skin has developed, a person with monkeypox can infect others. It usually lasts between two and four weeks. Researchers continue to find and deepen our understanding of: (i) Whether the virus can spread in the absence of symptoms; (ii) the frequency of respiratory secretion transmission or the circumstances under which a person exhibiting symptoms may be more susceptible to transmission through respiratory secretions; and (iii)

the possibility of transmission through semen, vaginal fluids, urine, or feces. In contrast to COVID-19, this virus is less effective at spreading from person to person and is much easier to contain once it has infected someone.

During pregnancy or childbirth, the virus can be transferred to the fetus. Exposure to mpox during pregnancy can be harmful to the fetus or new baby, and may cause pregnancy loss, birth defects. Transmission of mpox from animals to humans occurs from infected animals to humans through bites or scratches, activities such as hunting, skinning, hunting, cooking, playing with the body or eating animals. The Animal source of the monkey virus is unknown and research is ongoing. Further research is needed on the spread of mpox during outbreaks in different locations and under different condition.[21]

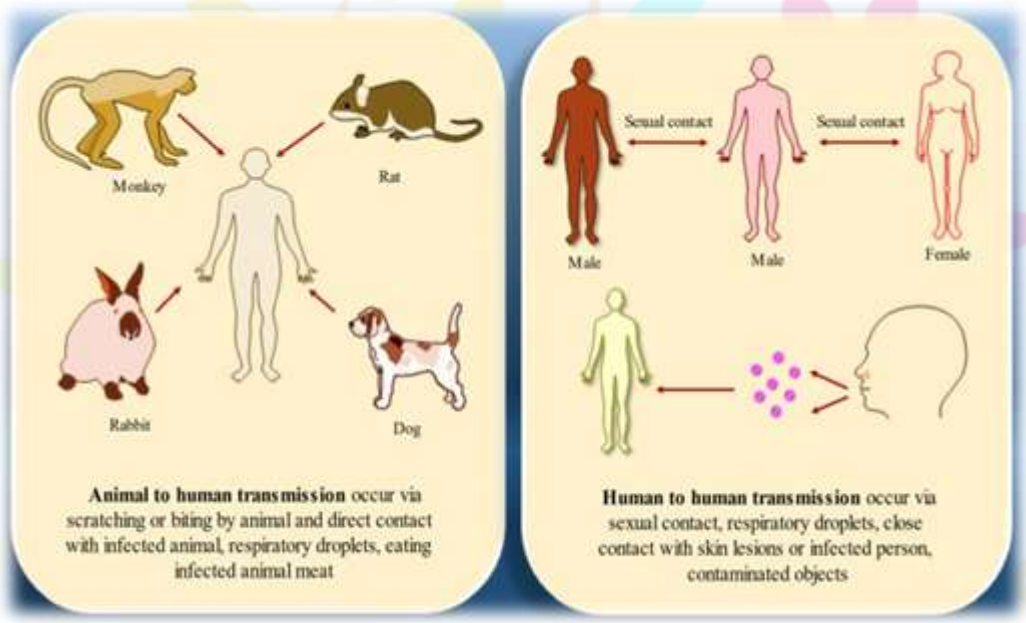

FIG.1.transmisson of mpxv virus

FIG.2. monkeypox infection

PATHOGENESIS

Since mpox is a self-limiting illness, a number of factors, including the particular virus strain, a person's immune system, and associated consequences, can affect how severe an infection is Pain, fever, exhaustion, and lymphadenectasis are typical early signs of an Mpox virus infection. Severe inguinal lymphadenectasis is frequently seen. One useful tool for differentiating Mpox virus infection from other orthopoxvirus infections is lymphadenectasis. Moreover, developing successful defences against Mpox requires an understanding of the transmission mode. After coming into contact with the respiratory secretions or bodily fluids of Mpox patients, the virus spreads to surrounding tissues by breaking the skin or mucous membranes such the ocular, respiratory, oral, urethral, and rectal. Afterwards, it travels throughout the body through draining lymph nodes and immune cells that reside in the tissue [22].

MECHANISM OF ACTION

The monkeypox virus (MPXV) infects the body through mucous membranes or broken skin, and then spreads in a series of stages:

Entry: The virus enters the body through the oropharynx, nasopharynx, or intradermally.

Replication: The virus replicates at the site of entry and spreads to the local lymph nodes.

Viremia: The virus spreads to other organs through the blood.

Prodromal stage: The virus spreads to the skin and other organs, and symptoms like fever and lymphadenopathy appear. This is the most infectious stage.

Lesions: Lesions appear in the oropharynx and then on the skin.

The incubation period, when there are no visible symptoms, is typically 7 to 14 days, but can be up to 21 days. People with monkeypox can pass the disease on to others until all sores have healed and a new layer of skin has formed.

Some people with monkeypox develop serious complications, including:

Bacterial skin infections that lead to abscesses or serious skin damage

Pneumonia

Corneal infection that can lead to vision loss

Infections of the blood, brain, heart, rectum, genital organs, or urinary passages

Children, pregnant people, and people with weakened immune systems are at higher risk for serious illness and death.

SYMPTOMS OF MONKEYPOX

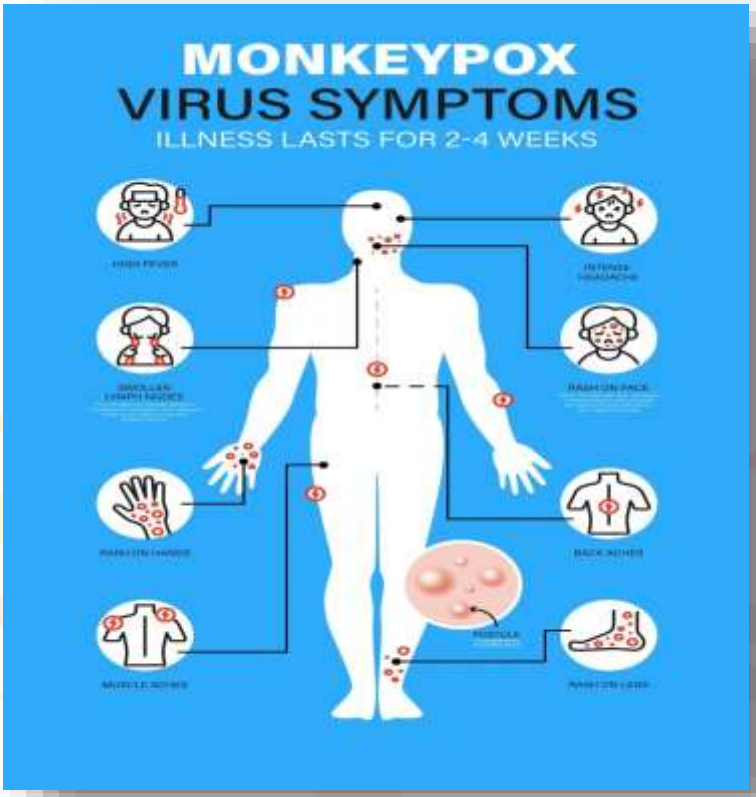

FIG.3.symptoms of monmeypox

COMPLICATIONS

- Bacterial infection of the skin
- Chronic skin scarring
- Hyperpigmentation or hypopigmentation
- Skin scarring (loss of vision)
- Pneumonia
- Dehydration (vomiting, diarrhoea, poor appetite due to pain in the mouth and invisibility of skin fluid due to complications)
- sepsis
- encephalitis
- infection.[23]

MODES OF TRANSMISSION

1 = transmission of carrier rats to monkeys, 2 = transmission of carrier rats to uninfected humans, 3 = transmission of carrier monkeys to uninfected humans, 4 = transmission from carrier monkeys to an infected person, 5 = transmission from an infected person to an uninfected population from the right. Or contact with sores, coughs, etc, 6 = nosocomial transmission, 7 = birth transmission

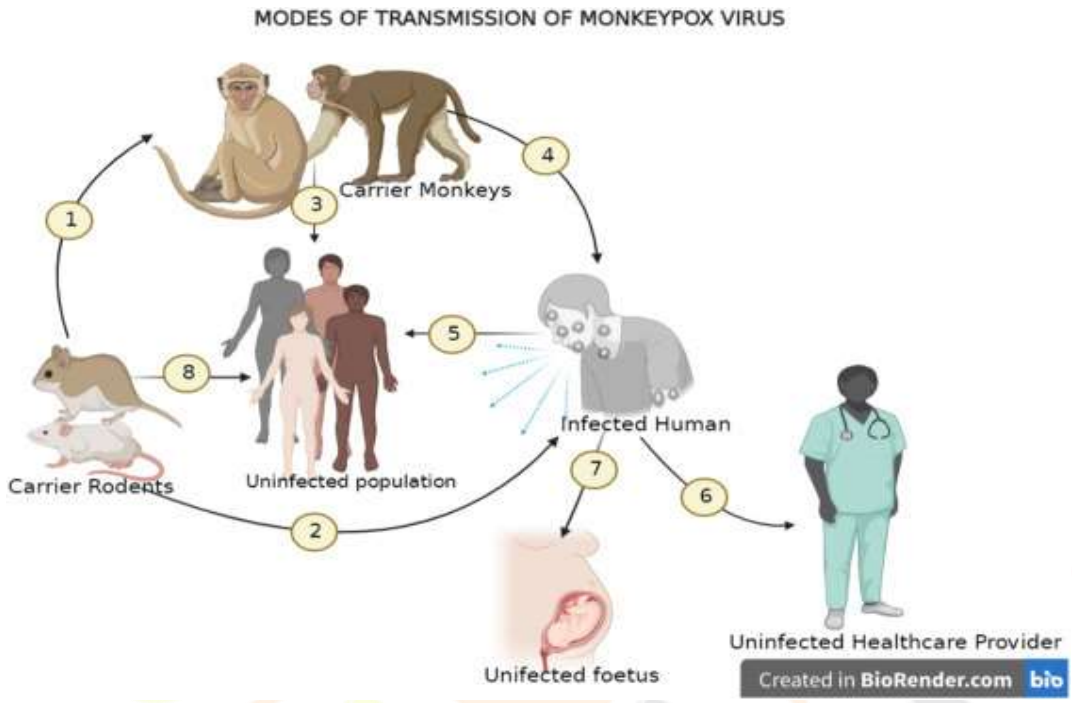

Fig.4 .modes of transmission

TREATMENT

Patients with chronic skin and mucosal problems may benefit less from supportive care. Treatment of gastrointestinal symptoms such as vomiting and diarrhoea to reduce loss of gastric fluids, ensure adequate hydration and nutrition, and protection of the eyes and internal organs in severe cases, only some clinical Support is recommended for patient with epilepsy.fig.5 shows MPX suspicious cases management as an overview. Antiviral medications approved for monkeypox may be effective against monkeypox, although no antiviral treatment is approved for monkeypox. Tequovirat, cidofovir and brincidofovir can be used to treat monkeypox.

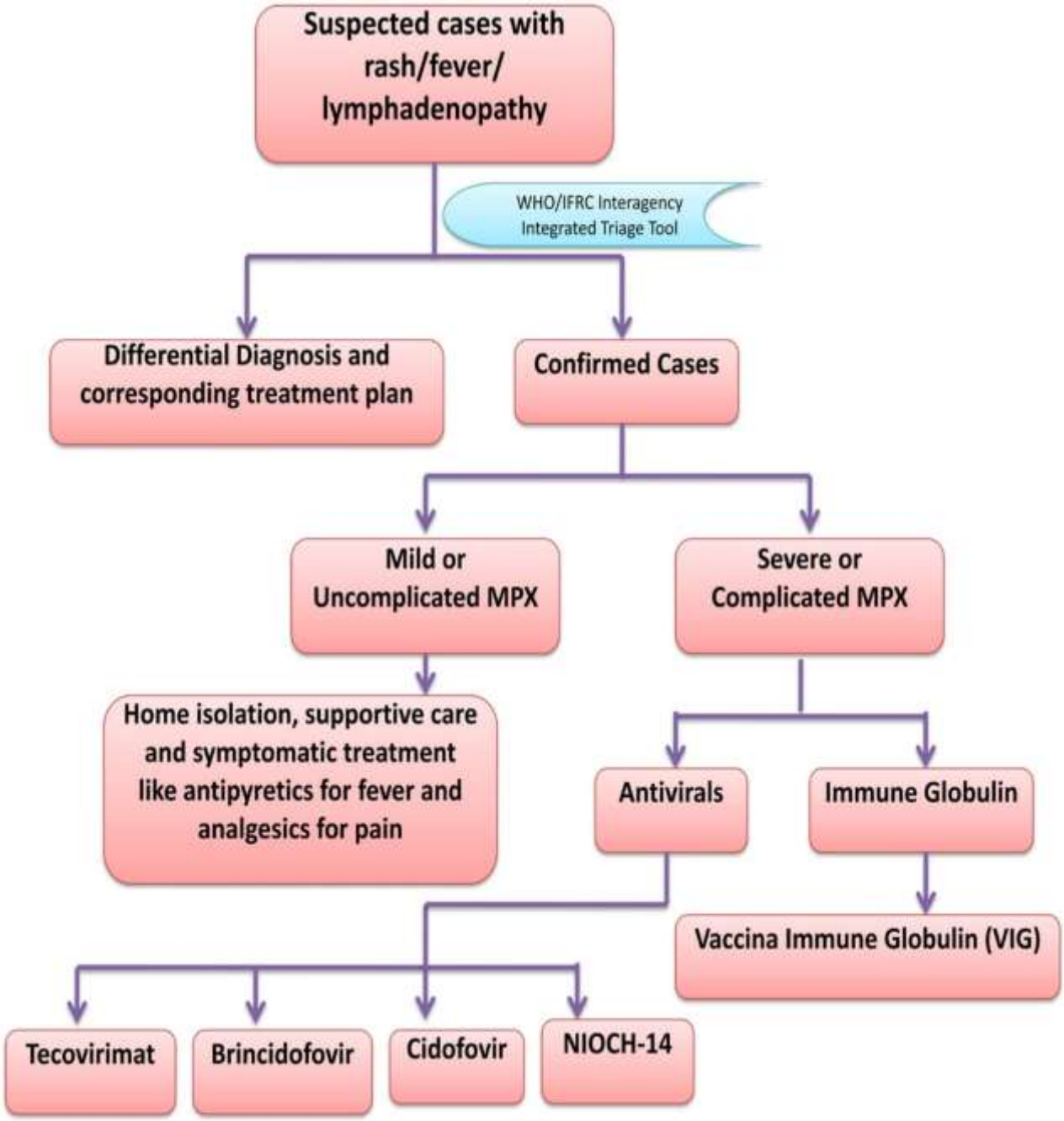

Fig.5.overveiw of management of suspected MPX cases.

TECOVIRIMAT

A small chemical molecule that inhibits entry and exit, Tecovirimat (formerly ST-246), is active against orthopoxviruses such as vaccine, chicken, cattle, ectromelia (mice), variola virus and monkeys in vitro and in vitro[24].

FIG.6. tecovirimat

CIDOFOVIR

AIDS patients with CMV (cytomegalovirus) retinitis should be treated with this drug. This antiviral drug was approved by the FDA in 1965. Currently, cidofovir is not effective in the treatment of herpes in humans. But laboratory and animal studies have shown its effectiveness against deadly diseases of monkeys and orthopoxvirus in animals. A major side effect of cidofovir is severe nephrotoxicity.[25-29]

FIG.7.cidofovir

BRINCIDOFOVIR (BCV)

Brincidofovir is a cidofovir prodrug with a better safety profile and less nephrotoxicity. It was also known under the brand names CMX001 and Tembexa, manufactured by Chimerix Incorporated (Inc). Tembexa received FDA approval on June 4, 2021 after being developed in collaboration with the US Department of Health and Human Services' Biomedical Advanced Research and Development Administration. Brincidofovir, an oral noncyclic fatty acid nucleoside phosphonate, is absorbed from the small intestine and

circulates throughout the body as phospholipids. Comparing brincidofovir and cidofovir, higher cellular absorption and intracellular levels of the active drug are achieved due to efficient conversion to the active form by intracellular enzymes, particularly rapid oral absorption, no renal toxicity and good conversion to active drug appearance [30].

FIG.8. BCV

VACCINIA IMMUNE GLOBULIN (VIG)

Vaccinia immune globulin (VIG) is made from the pooled blood of individuals who have been inoculated with the smallpox vaccine. The antibodies these individuals developed in response to the smallpox vaccine are removed and purified. This results in VIG. It can be administered intravenously. It is used to treat individuals who have developed progressive vaccinia after smallpox vaccination. It was also used along with cidofovir for the 2003 Midwest monkeypox outbreak as concomitant therapy to reduce the serious side effects of smallpox vaccine.

FIG.9.VIG

DIAGNOSIS

MPXV infection is diagnosed using clinical symptoms and laboratory tests. Symptoms of MPXV are similar to smallpox, but less severe .The incubation period for MPX is usually 7 to 14 days, but can be up to three weeks. Common symptoms of this disease include fever, severe headache, back pain, malaise, myalgia and lymphadenopathy. The main difference between the symptoms of MPX and smallpox is that, unlike smallpox, MPX causes lymphadenopathy. The rash usually appears 5 days after the onset of fever and affects the face, palms, soles, oral mucosa, genitals and conjunctiva. The most reliable and accurate laboratory method for MPX diagnosis is PCR (RT-PCR). The best diagnostic examples of MPX are skin lesions, crusts or fluid from vesicles and pustules, and dry crusts. Antigen and antibody detection methods, such as enzyme-linked immunosorbent assay (ELISA) and immunohistochemistry, do not provide a specific diagnosis for MPX because orthopoxvirus can cross-react serologically. Electron examination is not useful for specific diagnosis because MPX virus is indistinguishable from other poxviruses, but there is evidence that the virus belongs to the Poxviridae family [31].

PREVENTION AND CONTROL

Epidemiological measures, such as frequent surveillance and isolation of newly infected animals, can be very effective in controlling epidemics (Figure 10). Hygiene measures are important to prevent the virus from spreading to the boil and becoming a new source of infection. Vaccination is another way of protecting animals. Since diseases have been found in Asian monkeys mixed with African primates, these species should be kept separate.. To prevent the spread of the disease, infected people should limit their interactions with animals, especially rats and other mammals.

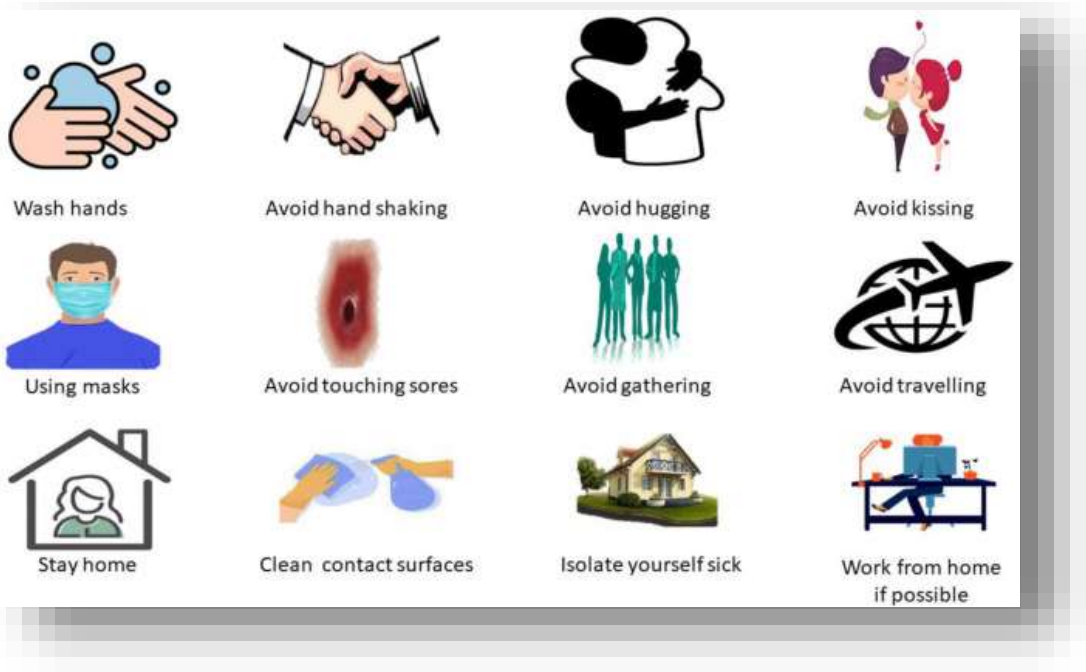

FIG.10.preventive measures to control the mpx

Take the following actions to prevent infection with the MPXV:

1). Avoid animals that may be infected with the virus (animals that are sick or have died in areas where MPX is present).

2). Avoid contact with infected animals and people.

3). When caring for patients, wear personal protective equipment including gowns, masks, respirators, gloves, shoe covers, goggles, eye protection, and eye protection.

4). Isolate the sick from people who may be infected.

5).Vaccination is appropriate for MPX. The FDA has approved ACAM2000, a new vaccine, for the treatment of MPX.

CONCLUSION

It is likely that MPX first arrived thousands of years ago through human contact with infected animals in sub-Saharan Africa. People may have signs and symptoms that are very similar to chicken pox or other vesiculopustular rashes. Cases of MPX in Africa are closely linked to cases of smallpox, and because of the recent ban on smallpox vaccination, the population has weakened antibodies, raising concerns about the use of MPXV as a biological weapon. As a result, MPXV, along with variola virus and many other smallpox viruses, are on the NIH's high-risk list. The CDC has classified it as a "selective agent." Today, human travel is common, there is a risk of MPX spreading, and animals transported across national borders are at risk of infection.

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