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Review

Monkeypox Virus review

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Abstract

In 1958, the first case human infected by Poxivirus was detected in Democratic Republic of the Congo. This virus can produce after an incubation period of 5 to 21 a large spectrum of symptoms which can be severe, and, in many cases, medical care is necessary. The research of Monkeypox requires special laboratory conditions. Different tests can help to identify this virus in human specimens, like PCR and ELISA. Vaccinia vaccines prepared from viral variants can offer protection against monkeypox.

Keywords Monkeypox Virus, Poxivirus, Democratic Republic of the Congo, ELISA, PCR,Vaccinia Virus Smallpox

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Introduction

The Monkeypox Virus was discovered in 1958 during an outbreak in an animal facility in Copenhagen, Denmark (AABB, 1). The first human case was diagnosed in 1970 in a 9-month-old baby boy in Zaire (now the Democratic Republic of the Congo, DRC), and the infection has since then been reported in a number of central and western African countries(WHO, 2). The first monkeypox cases outside of Africa were reported in 2003 in the US when an outbreak occurred following importation of rodents from Africa, with all people infected becoming ill after contact with pet prairie dogs. Over the past 5 decades, monkeypox outbreaks have been reported in 10 African countries and 4 countries outside Africa. In total, 219 confirmed cases have been reported world wide from countries where the disease is not considered to be endemic (BENVENUTO et al. 3).

Surveillance for human monkeypox infections in endemic areas is a real challenge. Poor infrastructure, scarce resources, inappropriate diagnostic specimens and/or lack of specimen collection, and clinical difficulties in recognizing monkeypox illness are some of the many problems encountered by surveillance systems. As more information is gained from contemporary monkeypox cases, together with the data from past efforts, it will be important to re-assess the characteristics of the disease that help differentiate monkeypox from other rash illnesses (MCCOLLUM & DAMON, 4).

In 2022, 6027 laboratory confirmed cases of monkeypox and three deaths have been reported from 59 countries/territories/areas in five WHO Regions (African, Americas, Eastern Mediterranean, European, Western Pacific) (WHO, 5).

Characteristics of Poxvirus

The family Poxviridae consists of complex double stranded DNA viruses that are distinguished by their replication in the cytoplasm of vertebrate or invertebrate cells (SHCHELKUNOV et al. 6). Eight genera of Poxvirus are discovered in vertebrate: *Orthopoxvirus*, *Parapoxvirus*, *Avipoxvirus*, *Capripoxvirus*, *Leporipoxvirus*, *Suipoxvirus*, *Molluscipoxvirus* and *Yatapoxvirus*. They all share a similar DNA sequence with very similar antigens that have cross-reactivity. Poxviruses include human smallpox virus (Variola)(PHLN, 7), which was declared eradicated by the WHO in 1980. Other poxviruses that can affect humans include Cowpox, the virus used in the smallpox vaccine preparation , Akhmeta virus and monkeypox virus (MPVX), as well as other zoonotic species with epidemic potential (MARTÍN-DELGADO et al. 8). The reference Monkeypox virus, available on NCBI with accession code NC_003010.1 and derived from the sample Zaire-96-I-16, carries a 196,858 nucleotide-long double-stranded DNA linear genome, containing 191 non-overlapping genes, and is a representative of the CentralAfrican clade (GIORGI et al. 9).

Transmission of Monkeypox Virus

Aerosol transmission has been demonstrated in animals and may explain a nosocomial outbreak in the Central African Republic (PETERSEN et al. 10). Indirect or direct contact with live or dead animals is assumed to be the driver of human monkeypox infections in humans (LI et al. 11). Poverty and continued civil unrest force people to hunt small mammals (bushmeat) to obtain protein-richfood, thus increasing exposure to wild rodents, which may carry monkeypox (PETERSEN et al. 10).

Clinical characteristics

The incubation period for monkeypoxcan range from 5-21 days but usually falls within 7-14 days. Clinical presentation of monkeypox infection can be similar to chickenpox, caused by varicella-zoster virus. Symptoms usually begin within 5 days of infection with fever and chills, headache, muscle aches, back pain, fatigue, and swollen lymph nodes, the latter symptom differentiating monkeypox from smallpox (CCFSPH.IASTATE, 12). About 1-3 days, sometimes later, after the initial onset of symptoms, a rash or lesions can appear, usually beginning on the face and spreading throughout the body, often to the extremities rather than the trunk (Fig. 2) (LABORATORY GUIDELINES FOR THE DETECTION OF MONKEYPOX VIRUS, 13). Notably, monkeypox lesions can appear on the palms of the hands and soles of the feet (75% of cases). Most individuals with monkeypox experience rash with 1 to >100 skin lesions, but there are cases when no rush occurs. In most patients, symptoms of monkeypox are usually self-limiting and spontaneously resolve within 14-21 days. However, symptoms can be severe and require medical care (POTTER et al. 14).

Diagnosis

WHO and CDC have put forth case definitions for monkeypox during the 2022 outbreak that combine clinical, epidemiologic, and laboratory data. Diagnostic assays include virus isolation, electronmicroscopy, PCR, ELISA, and immunofluorescent antibody assay. Characteristic brick-shaped poxvirus virions are found on electronmicroscopy. Histopathologic analysis may demonstrate ballooning degeneration of keratinocytes, prominent spongiosis, dermal edema, and acute inflammation. CDC developed an IgM-capture and IgG ELISA that demonstrated recent monkeypox virus infection. Serum IgM and IgG were detected five and eight days after

Figure 1. Images of individual monkeypox lesions (Photo credit: UK Health Security Agency)(LABORATORY GUIDELINES FOR THE DETECTION OF MONKEYPOX VIRUS, 13).

onset of rash, respectively. If the diagnosis of monkeypox is being considered, local and state public health officials, along with the CDC, should be notified so that the samples are quickly processed (Fig. 2)(ISAACS, 15).

Treatment

There is no specific treatment for human monkeypox infection. Nor is there a specific vaccine fully protective against monkeypox virus. Cross-reactivity with vaccinia virus smallpox vaccine can provide cross immunity with partial protection against infection and reduction in disease severity, but with waning vaccine-derived immunity, the strength of this protective effect is decreasing. Earlier vaccinia vaccines have suboptimal safety profiles, but later vaccines derived from viral variants that do not replicate within cells, have been approved for use with human monkeypox infection (HSE, 17).

Conflict of interest

No

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No

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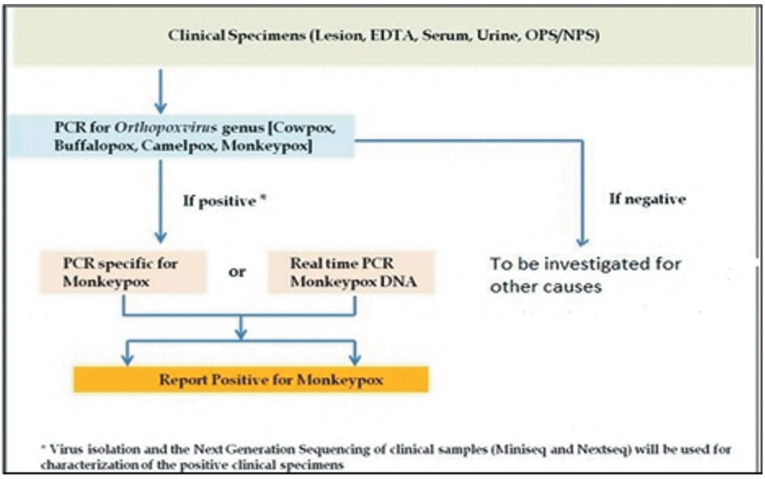

Figure 2. Steps of diagnosis of Monkeypox Virus (MHFWGI, 16).

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