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Vaccination Strategies for Monkey Pox: An Update

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Dear Editor,
The monkeypox virus is the causative agent in the very uncommon illness known as monkeypox [1]. The virus that causes monkeypox is a member of the same family of viruses as the *variola virus*, which is responsible for smallpox. The symptoms of monkeypox are comparable to those of smallpox, although they are less severe, and death from monkeypox is uncommon.

In 1958, two outbreaks of a disease that was similar to pox occurred in colonies of monkeys that were maintained for scientific purposes. This led to the discovery of monkeypox. Even though it is often referred to as "monkeypox," the cause of the illness is still unclear. On the other hand, rodents and non-human primates native to Africa, such as monkeys, may be infected with the virus and transmit it to humans.

In 1970, the first known incidence of monkeypox in a person was documented. Prior to the epidemic in 2022, cases of monkeypox had already been documented in persons in numerous countries located in central and western Africa. In the past, practically all instances of monkeypox in humans who lived outside of Africa could be traced back to international travel to places where the illness is prevalent or to animals that were brought in from other nations. These incidents have place on a number of different continents.

Contact with the blood, body fluids, cutaneous, or mucosal lesions of an infected animal may result in zoonotic transmission to humans. Evidence of infection with the monkeypox virus has been detected in a wide variety of animals throughout Africa, including rope squirrels, tree squirrels, Gambian pouched rats, dormice, and several kinds of monkeys. Even though rodents are probably the natural reservoir of monkeypox, this fact is yet unknown.

Direct contact with an infected person's respiratory secretions, skin sores, or recently contaminated items may cause transmission to occur[2]. Health care providers, family members, and those in close proximity to an active case are at a higher risk since transmission by droplet respiratory particles often needs prolonged face-to-face contact. The longest reported chain of transmission within a community, however, has increased from six to nine cases of transmission from one individual to another. This may be a reflection of the general decline in community immunity after smallpox immunization was discontinued. Furthermore, congenital monkeypox may be passed from mother to child through the placenta or via prolonged, intimate contact after delivery[3]. While it is well-known that close physical contact is a risk factor for transmission, whether or not monkeypox may be transferred particularly via sexual transmission channels is not understood at this time[4]. Sexual health clinics among homosexual, bisexual, and other groups of men who have sex with men have helped to identify some of the instances. It's vital to remember that any man may have monkeypox by having intercourse with another man. If you or a loved one have been in close quarters with someone who is contagious, you should take precautions. More research is required to fully comprehend this danger.

There are a variety of laboratory tests that may be performed to confirm monkeypox, and they vary in terms of the kind of specimen and the quality of the sample. As a result, it is imperative that specimens be packed and sent in conformity with all applicable local, state, and federal regulations. Because of its reliability and sensitivity, polymerase chain reaction [PCR] has become the standard laboratory test of choice. The fluid or ceiling of a vesicle or pustule, as well as a dry crust from a pustule or vesicle, is the best sample type for diagnosing monkeypox. Whenever it's safe and practical to do so, a biopsy may be performed. A viral transport medium

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should not be used to keep lesion samples, and instead they should be maintained cool and dry.

Because of the serological cross-reactivity of orthopoxviruses, antigen and antibody detection techniques cannot be used to confirm a case of monkeypox. Therefore, in situations when resources are few, serology and antigen detection procedures are not advised for diagnosis or case investigation. False positives might also be caused by recent or distant immunization with a vaccinia-based vaccine [e.g., anybody immunized before smallpox eradication, or more recently vaccinated owing to heightened risk, such orthopoxvirus laboratory employees]. Protecting against monkeypox is best done with the two-dose JYNNEOS vaccination. Immune protection from JYNNEOS is at its peak 14 days following the second injection.

The Modified Vaccinia Ankara [MVA] vaccine, known as JYNNEOS, was given the green light in 2019 for use in vaccinating people aged 18 and above who are at high risk of contracting smallpox or monkeypox. Subcutaneous [under the skin] administration of JYNNEOS is split into two doses given four weeks [28 days] apart. The EUA now permits subcutaneous administration of a portion of the JYNNEOS dosage to those aged 18 and above who are at high risk of monkeypox infection [intradermally]. The vaccination still requires two injections, four weeks [28 days] apart. To contain the present monkeypox epidemic, a vaccine like JYNNEOS is desperately required, but there is currently no evidence that a single dosage can give the necessary level of protection. Incase of Post-Exposure Prophylaxis, the individuals who are in close contact with the positive tested subjects can be vaccinated irrespective of their testing status. On the other hand, Expanded Post-Exposure Prophylaxis, involves vaccination for individuals, who had attended any social gathering where monkeypox infected subjected was present can be administered with vaccine and in case of individuals who are having multiple sexual intercourse with monkeypox infected partners in past 14days. The another category Pre-exposure Prophylaxis involves the primary occupational hazard in individuals handling the monkeypox infected individuals [5].

A clinical trial of the MVA vaccine comparing intradermal and subcutaneous administration of a two-dose series was published in 2015. The amount of vaccination given intradermally was one-fifth that given subcutaneously. Immune responses to vaccination were comparable across the two groups, suggesting that intradermal delivery is as effective as subcutaneous treatment. More noticeable but yet tolerable adverse effects were redness, hardness, itching, and edoema at the injection site after intradermal administration. According to the FDA, the advantages of JYNNEOS for the approved applications significantly exceed the hazards[5].

With the available JYNNEOS safety and immune response data in adults and the historical data with use of live vaccinia virus smallpox vaccine in paediatric populations, the FDA authorised two doses of JYNNEOS administered via the subcutaneous route of administration in individuals younger than 18 years of age. In the studies used to get approval, JYNNEOS was shown to be both safe and effective in those with compromised immune systems. At first, it was designed as a backup vaccine in case of a smallpox epidemic in which the immune system of a certain population was impaired[5].

Live Smallpox [Vaccinia] Vaccine [trade name ACAM2000] has been approved by the Food and Drug Administration for use in active vaccination against smallpox illness in those who are at high risk for contracting the disease[6]. Sanofi Pastuer Biologics Co. produces the vaccine. In the event that smallpox is used as a biological weapon, the United States will be better prepared thanks to the approval and inclusion of this second-generation vaccination in the Strategic National Stockpile [SNS]. The vaccinia virus, a "pox"-type virus similar to smallpox but causing lesser illness, is used to manufacture the vaccine. Unlike other vaccinations, which employ inactivated viruses, ACAM2000 uses the "live" vaccinia virus. This means that it cannot induce smallpox. To stop the virus from spreading from the vaccination site to other areas of the body or to other persons, careful aftercare is essential.

With ACAM2000, you won't need to worry about getting a "shot" as you would with other vaccines. Droplets of vaccine are injected under the skin of the upper arm many times using a two-pronged stainless steel [or bifurcated] needle. As the virus multiplies at the injection site, a localized infection [or "pock"] develops. As soon as 3–4 days have passed after vaccination, if there is a red, itchy painful place at the location of the vaccine, this indicates that there is "a take." A blister forms at the vaccine site, which dries into a scab after about three weeks and eventually peels off, leaving a thin scar. If a person is ever exposed to smallpox, the vaccination will have primed their immune system to produce antibodies and cells in the blood and elsewhere that will aid in fighting off the virus. Immune protection from a single dose of the ACAM2000 vaccine peaks at four weeks post-vaccination. On the other hand, it may cause greater discomfort and harm than JYNNEOS. A significantly compromised immune system, among other disorders, should prevent one from using this supplement.

Until the full extent of immunity from vaccinations has been achieved, people should take measures to limit their exposure to monkeypox[7]. The smallpox and Ebola epidemics might be contained with the help of ring vaccination programs. Monkeypox is less difficult to control than COVID-19 because infected people exhibit symptoms [such fever and chills] while they are infectious [8]. This is why it is more practical to vaccinate a small group of individuals in close proximity to the sick person than to inoculate a huge percentage of the population. Vaccination is most effective when given within 14 days of exposure, although it may be given as early as four days after exposure if necessary. The

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World Health Organization recommends expanding immunization programs to include the demographic subset that has had the highest cases so far: males who have sex with other men. The Omicron form of COVID-19 has a much shorter incubation period, at just three days, compared to the monkeypox incubation period, which is normally seven to fourteen days but may vary from five to 21 days. Because of the considerable time between exposure and the onset of symptoms, contact tracing and vaccination campaigns may be more effectively launched before the onset of disease.

Through contrast to earlier recorded outbreaks of monkeypox [outside of Africa], when risk was connected with travel to central or west Africa or other sorts of interaction with persons or animals from those regions, the virus seems to be propagating in sexual networks. While there is no proof of food-borne transmission, environmental sources including bedding may harbor the virus. The control measures involving risk of spread of Monkeypox lies in avoiding direct or indirect contact with the infected individual or animal. Recently human to animal transmission of monkeypox virus has also been reported(9). Also sexual intercourse with infected individual specifically in case of bisexuals or gay individuals should be minimized.

Till date, there is one clinical trials reported in database of Clinicaltrials.gov based on Vaccination of IMVAMUNE in Republic of Congo, which started in the year 2019 [10]. But now as it had become more virulent, there is immediate need to evaluate the effect of Vaccine around the globe and more research is needed for its implementation.

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