Centers for Disease Control and Prevention

Clinical Considerations for Monkeypox in Children and Adolescents

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Who this is for: Healthcare providers caring for children and adolescents less than ages 18 years in clinics, emergency departments, and hospitals in the United States.

What this is for: Considerations on clinical management of children and adolescents less than ages 18 years with exposure to monkeypox or concern for *Monkeypox virus* infection.

How to use: These considerations are intended to help U.S. clinicians and health systems develop a plan for managing children and adolescents with exposure to monkeypox, suspected monkeypox, or confirmed monkeypox.

Key points

- Monkeypox should be considered when children or adolescents present with a rash that could be consistent with the disease, especially if epidemiologic criteria are present.
- Young children, children with eczema and other skin conditions, and children with immunocompromising conditions may be at increased risk of severe disease.
- Treatment should be considered on a case-by-case basis for children and adolescents with suspected or confirmed monkeypox who are at risk of severe disease or who develop complications of monkeypox. Tecovirimat is the first-line medication to treat monkeypox, including in children and adolescents.
- Children and adolescents with exposure to people with suspected or confirmed monkeypox may be eligible for post-exposure prophylaxis (PEP) with vaccination, immune globulin, or antiviral medication.

Monkeypox in children and adolescents

Historically, monkeypox has been documented in children and adolescents living in endemic regions. Once illness occurs, the clinical presentation is expected to be similar to that in adults. However, it is not known whether children are more susceptible to monkeypox than adults or whether clinical outcomes differ from those in adults. Monkeypox can spread through contact with the fluids (e.g., lesion exudates and respiratory secretions) of people or animals with monkeypox or through contact with fomites (e.g., shared clothing, towels, toiletries, and bedding). Monkeypox also can be transmitted to the fetus during pregnancy or to the newborn by close contact during and after birth.

While data about monkeypox in children are limited, there is evidence from patients infected with Clade I of *Monkeypox virus* that the disease is more likely to be severe in children under 8 years of age. Additionally, anyone with immunocompromising conditions or certain skin conditions, such as eczema, is at risk of severe monkeypox disease. The 2022 Multinational Monkeypox Outbreak is caused by the Clade IIb virus, which typically causes less severe disease than Clade I. Data on potential complications of infections with Clade II in children are lacking. Rarely, monkeypox can result in complications including encephalitis, cellulitis, pneumonia, sepsis, abscess, airway obstruction due to severe lymphadenopathy, keratitis, and corneal scarring. CDC continues to monitor for these outcomes and will update this considerations document as more information becomes available.

Signs and symptoms

Similar to infections in adults, the most common sign of monkeypox in children and adolescents is a rash that progresses from maculopapular lesions to vesicles, pustules, and finally scabs. Before the 2022 Multinational Monkeypox Outbreak, fever and lymphadenopathy were commonly associated with monkeypox; however, during the current outbreak, these have not always occurred. Other symptoms may include fatigue and headache. Difficulty swallowing or cough may occur when oropharyngeal lesions are present. Intraocular lesions, eyelid swelling, or eyelid crusting may occur when there are lesions near or in a patient's eye, which can occur when a patient touches these sites with their hand after touching a lesion. (See Clinical Recognition.)

Monkeypox rash can be confused with other rash illnesses that are commonly considered in children, including varicella (chickenpox); hand, foot, and mouth disease; measles; scabies; molluscum contagiosum; herpes; syphilis (including congenital syphilis); allergic skin rashes; and drug eruptions. Co-infections with monkeypox are possible. Clinical judgment should be used in determining etiologies that are tested; children and adolescents presenting with signs and symptoms suspicious for monkeypox should be tested for monkeypox, particularly if the children meet epidemiologic criteria for monkeypox. Patients with suspected monkeypox should be assessed for contact with people or animals with a rash or with monkeypox. Cases should be promptly evaluated by healthcare personnel and, when indicated, be considered for treatment.

Clinicians should contact their jurisdictional health department (Jurisdictional Contacts) as soon as monkeypox is suspected.

Management of monkeypox

As with adults, children and adolescents with monkeypox should be closely monitored throughout their illness. Decisions about treatment for children closely align with those for adults (see Interim Clinical Guidance for the Treatment of Monkeypox). For the pediatric population, particular attention should be paid to keeping skin lesions covered and preventing children from scratching lesions or touching their eyes; these may result in auto-inoculation and more severe illness. Optimal fluid intake should be encouraged, particularly in persons with extensive skin involvement who may have additional fluid losses.

While most cases of monkeypox resolve without treatment, treatment should be considered for the following groups:

- Children and adolescents with severe disease (e.g., hemorrhagic disease, confluent lesions, encephalitis, airway obstruction due to lymphadenopathy, or other conditions requiring hospitalization)
- Children and adolescents with complications from monkeypox (g., pneumonia, sepsis, ocular lesions, cellulitis, or abscess)
- Children and adolescents at risk of severe disease including:
    - Children under 8 years of age
    - Children and adolescents with immunocompromising conditions
    - Children and adolescents with a history or presence of atopic dermatitis, or with other active exfoliative skin conditions (e.g., eczema, burns, impetigo, varicella zoster, herpes simplex, severe acne, severe diaper dermatitis with extensive areas of denuded skin, psoriasis, or Darier disease [keratosis follicularis])
    - Children and adolescents with aberrant infections, such as those involving the eyes, face, or genitals

Treatment

Tecovirimat

Under an investigational protocol, tecovirimat is currently being used as the first-line treatment for infection with *Monkeypox virus*, including for children and adolescents with severe disease or underlying medical conditions that put them at risk for severe disease, and for children and adolescents with complications from monkeypox. Individual risks and benefits must be considered prior to initiating tecovirimat.

Evidence for the efficacy of tecovirimat for monkeypox treatment comes from animal studies that suggest a potential for reduction in mortality and a case study that suggests tecovirimat may limit the duration of illness and viral shedding. Prior to the 2022 Multinational Monkeypox Outbreak, tecovirimat was used in a 28-month-old child with no adverse effects attributed to the drug, but no clinical studies have been done in pediatric populations.

Oral tecovirimat dosing is most practical for children who weigh at least 13 kilograms (approximately 28 pounds), can take capsules or the contents of a capsule mixed with soft food, and are able to eat a fatty meal to ensure optimal drug absorption. Because of the challenge of accurate dosing for children under 13 kilograms, IV therapy is currently recommended for this group when tecovirimat is indicated.

Renal immaturity in pediatric patients less than 2 years of age may result in higher exposure to hydroxypropyl-β-cyclodextrin, an ingredient in IV tecovirimat. Animal studies have shown potential for this ingredient to cause nephrotoxicity at very high doses. Monitoring of renal function at least weekly is recommended during treatment for children and adolescents receiving IV tecovirimat, especially for pediatric patients less than 2 years of age.

Other treatments

Other treatments might be considered in addition to tecovirimat or as an alternative; these should be reserved for unusual circumstances, such as very severe infections, disease progression despite tecovirimat treatment, or when tecovirimat is contraindicated or unavailable. Use of these treatments should be in consultation with infectious disease specialists, pharmacists, state and local health departments, and CDC.

Vaccinia immune globulin , licensed for treatment of vaccinia virus vaccine complications, may be used for treatment of severe monkeypox infection, though it is unknown whether children will benefit from treatment. Vaccinia immune globulin is available from the US Strategic National Stockpile and can be given through an existing expanded access Investigational New Drug (EA IND).

The use of the antiviral medications cidofovir [828KB, 6 Pages] and brincidofovir [670KB, 21 Pages] may also be considered, but these should be used with caution due to potential toxicity.

For additional information on current therapeutic recommendations, see Treatment Information for Healthcare Professionals.

Post-exposure prophylaxis (PEP)

Data on PEP to prevent monkeypox in children are limited, and there are no vaccines or other products currently licensed for monkeypox prevention in children or adolescents. However, PEP should not be withheld from children or adolescents who are otherwise eligible. Decisions about whether to offer PEP should take into account the level of risk from the patient's exposure and the individual patient's risk of severe disease. Prophylactic therapeutics that can be administered include vaccination, immune globulin, and antiviral medication. For almost all patients, vaccination is the therapeutic that should be administered. Immune globulin or antivirals may also be considered for infants under 6 months of age, given their immature immune systems and possible decreased responses to vaccination.

When considering PEP for a child or adolescent, clinicians should first consult their jurisdictional health department (Jurisdictional Contacts). Jurisdictional health departments can facilitate consultation with CDC for guidance regarding pediatric use of JYNNEOS vaccine or other PEP modalities, when needed, and for assistance with the associated EA IND processes.

Vaccines and other options for monkeypox PEP in children and adolescents are reviewed below. For detailed information on vaccines for monkeypox, see Considerations for Monkeypox Vaccination.

Vaccines

JYNNEOS

JYNNEOS contains a non-replicating *Vaccinia virus*. While JYNNEOS has not been studied specifically for children or adolescents, the same non-replicating V*accinia virus* in the JYNNEOS vaccine has been used in studies as part of vaccines against other diseases including tuberculosis, measles, and Ebola. These studies included children as young as 5 months old, and no serious safety concerns were reported. In the United Kingdom in 2018–2019, JYNNEOS was administered to a few young children, including infants, following exposures to monkeypox, with no known adverse events. JYNNEOS has also been administered to some children in the United States during the current outbreak without any adverse events to date.

JYNNEOS can be offered for pediatric cases using a single-patient EA IND authorization from the US Food and Drug Administration, which can be acquired in coordination with state and local health departments and CDC.

ACAM2000

Up until the early 1970s, a precursor to ACAM2000 was administered to children in the United States to prevent smallpox, an infection caused by another orthopoxvirus. That vaccine and ACAM2000 contain a replicating *Vaccinia virus* and are associated with adverse events caused by uncontrolled viral replication, such as progressive vaccinia and eczema vaccinatum. Many adverse events were more common in young children, particularly post-vaccinial encephalitis in those under age 12 months, and immunocompromised individuals.

ACAM2000 is contraindicated in children under 12 months of age and in children and adolescents with the following conditions:

- Congenital or acquired immune deficiency disorders, including those taking immunosuppressive medications and people living with HIV (regardless of immune status)
- Atopic dermatitis/eczema and persons with a history of atopic dermatitis/eczema or other acute or exfoliative skin conditions
- Pregnancy
- Cardiac disease
- Eye disease treated with topical steroids

ACAM2000 is allowed for use against monkeypox under an EA IND. It can be used following risk-benefit discussions and a review of any conditions that could increase the patient's risk for adverse events. Clinicians considering the use of ACAM2000 should also take into account the risk of accidental inoculation, autoinoculation, and myopericarditis, which may be greater among children and adolescents compared to adults. They should also take into consideration whether the child or adolescent resides in a home with immunocompromised persons (both adults and children), pregnant persons, and persons with skin conditions including eczema because these persons are at risk for serious infection with *Vaccinia virus*, which can infect them if the vaccinated person does not keep the vaccination site covered.

Vaccinia immune globulin

Vaccinia immune globulin is approved for treatment of smallpox vaccine complications. Its effectiveness as monkeypox PEP is unknown. However, vaccinia immune globulin is available through an EA IND for potential prevention of monkeypox. Particularly for infants under 6 months of age, vaccinia immune globulin can be offered as an alternative PEP modality.

Antivirals as PEP

Antiviral medications, primarily tecovirimat, can be considered for use as monkeypox PEP in unusual circumstances (e.g., when vaccine is contraindicated due to an allergy to vaccine components). The effectiveness of antiviral medications as monkeypox PEP is unknown.

Infection control

Pediatric inpatient care

For children hospitalized with suspected or confirmed monkeypox or for hospitalized children with monkeypox exposure, isolation and infection control procedures should take into consideration the child's age and caregiving needs, family and caregiver preferences, and individual patient and caregiver factors, including the patient's course of illness, the extent and location of lesions, the ability to cover lesions, and the risk to caregivers (e.g., pregnant or immunocompromised persons). The presence of caregivers in the hospital provides immeasurable benefit to children.

For detailed recommendations on isolation and infection control in healthcare settings, see Infection Control: Healthcare Settings.

In homes

Isolation and infection control measures can prevent the spread of *Monkeypox virus* to others. Extra care should be taken to ensure children with immunocompromising conditions avoid close contact with persons with monkeypox. If unavoidable, then children over 2 years of age should wear a well-fitting mask or respirator when interacting with members of the household who have monkeypox. If a child or adolescent develops monkeypox, they should avoid contact with uninfected people and pets until the rash has resolved, the scabs have fallen off, and a fresh layer of intact skin has formed. When possible, whether in the hospital or at home, limit the number of caregivers to one person. Caregivers should cover areas of broken skin with bandages to the extent possible and avoid direct skin-to-skin contact with the rash. During interactions with caregivers, children over 2 years of age with monkeypox should wear well-fitting source control (e.g., a medical mask) when possible. Caregivers assisting with changing bandages or clothes covering the rash should wear gloves to avoid infection. Gloves should be disposed of after use, followed by handwashing. If any clothing (whether on the caregiver or the child) comes into contact with the rash, it should be immediately laundered.

Additional considerations

Breastfeeding a child who has monkeypox

Decisions about whether or not an infant or child with monkeypox may directly breastfeed from an uninfected caregiver should be considered on a case-by-case basis through weighing the benefits of breast milk with any uncertain risks of the child transmitting infection to the caregiver, particularly to a caregiver who is immunocompromised or at risk for severe infection.

Neonates born to individuals with suspected or confirmed monkeypox

Early bathing is recommended for neonates born to individuals with suspected or confirmed monkeypox. Bathing can be performed using wipes or soap and water and should occur prior to the neonate receiving procedures, vaccines, and medications (e.g., Vitamin K).

PEP should be considered for neonates born to individuals with suspected or confirmed monkeypox. The specific therapeutic that is administered should be determined after consultation with public health authorities.

Caregivers or family members who do not have suspected or confirmed monkeypox can provide routine care to an uninfected neonate who is born to a person with monkeypox.

Neonates born to individuals with suspected or confirmed monkeypox should be closely monitored for the development of signs consistent with monkeypox, including fever, lymphadenopathy, rash, or any new signs or symptoms of illness, for 21 days following birth or the last close contact with a person with monkeypox during their infectious period. Monitoring should include at least daily temperature checks and full skin exams, which can be performed by a caregiver or healthcare provider.

For detailed recommendations, see Clinical Considerations for Monkeypox in People Who are Pregnant or Breastfeeding.

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