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Editorial

Monkeypox in children: what evidence do we have so far?

Monkeypox virus (MPX) is a double-stranded DNA virus that belongs to the Orthopoxviral genera of the Poxviridae family, which is endemic in Central and West Africa. MPX appeared in 1970, since eradication of smallpox. Apparently, smallpox provides a significant cross-protection (>85%) with monkeypox, but probably most important in individuals with recent vaccination (<10 years). It has been suggested that older population (>60 years), vaccinated with smallpox would be partially protected. Nevertheless, this needs further careful assessment. Animal-to-human transmission (zoonotic infection) can occur through contact with blood, body fluids and skin lesions of infected animals such as arboreal and terrestrial rodents (which include squirrels). Long-term exposure to MPX results in human-to-human transmission through droplet infection, contact with an infected lesion or a contaminated object [1]. As per the recent World Health Organization (WHO) declaration, MPX is now treated as a public health emergency of international concern, affecting over 60 000 cases in more than 95 non-endemic countries worldwide, up to 15 September 2022 [2–10]. MPX has currently three clades [11], clade 1 (formerly 'Congo Basin clade' or Central Africa clade), clade 2 (formerly West African clade), and clade 3, the new one that contains most genomes from the 2017, 2018 and 2022 human outbreaks. At the clade 3 is included the lineage B.1, the most prevalent among the sequenced genomes of MPX virus in the 2022 outbreak [12]. The clade 1 has been classically related to be the most pathogenic and lethal, leading case fatalities rates up to 10% [13].

The clinical presentation of MPX starts with fever, chills, muscle pain, lymph node swellings and headache [1]. It is also characterized by developing a rash involving a contagious lesion. The skin rash progresses through several phases, beginning with macules, papules, vesicles and pustules and ending with crusts and scabs that fall off during recovery. Different stages of the rash may appear at the same time. Erythema and hyperpigmentation of the skin are frequently seen around discrete lesions. There may also be inflammation of the pharyngeal, conjunctival and genital mucosa [1, 3–10].

The recent reports from the USA Centers for Disease Control and Prevention (CDC) confirm that children, especially under 8 years of age, are considered one of the most susceptible groups to severe disease presentations [5–9]. As of 28 July 2022, the CDC has confirmed the first two cases of MPX in children [7]. Both the children are symptomatic but are stable. Although both cases are not related to one another, the occurrence of the disease is thought to be mediated through household transmission. In Europe, 12 monkeypox cases have been found among children aged <18 years. That is a warning sign that the disease is spreading, and we need to be aware of it and take measures that can break the chain of transmission. As MPX is a self-limiting disease, the management depends mainly on preventing dehydration, a healthy diet, antibiotics for secondary bacterial infection, if present, and the approved antiviral agents for smallpox like tecovirimat [5, 6]. Recently, in the Netherlands, a case in a male child younger than 10 years without relevant medical history presented at a paediatric emergency room in Amsterdam, with sore throat was reported. In this case, a day later, the patient travelled to Turkey for a 1-week holiday. After his return, he noticed two small round skin lesions on his left lower jaw and cheek. Samples for MPXV PCR testing were taken from blood, throat, anal region, skin vesicles and urine. All of them except for the urine tested positive for MPXV [10]. Also, a child has been admitted to the intensive care unit in London, the UK, with monkeypox. Although severity criteria in children have not yet been developed by WHO or any other globe authoritative organization, the WHO guideline on monkeypox [14] describes complications and

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risk factor assessment in children, indicating that children should be considered a group at higher risk of severe disease or complications, which may include in general nausea and vomiting, painful cervical lymphadenopathy causing dysphagia, poor oral intake, eye pain, vision abnormalities, hepatomegaly, sepsis, dehydration, respiratory distress and pneumonia, and confusion [14].

According to the WHO, the virus is considered a risk of household transmission. Hence, we should monitor the contacts for any symptoms, including rash, fever and other possible symptoms, for 21 days. Symptomatic contacts should be isolated to receive appropriate management and screened for the virus; however, asymptomatic contacts need regular temperature monitoring [8]. We should also consider the vaccination strategy for people who contact infected patients. In addition, we need to assess the risk level and duration of exposure to determine if an individual is a good candidate for different types of vaccines in post-exposure prophylaxis (PEP) [9]. There is currently no monkeypox vaccine available for administration to children, except the possible use of the JYNNEOS vaccine (subcutaneously) for children for PEP under expanded use authorization issued by the FDA [15]. The American Academy of Pediatrics recommends that children avoid contact with other persons for 2–4 weeks, until the rash is fully resolved (scabs fall off and new skin has formed) (Table 1) [15].

While it is important to emphasize that most confirmed cases have been attributed to close sexual contact, the transmission route remains unclear in a few cases. According to WHO, 72 confirmed cases in children have been reported worldwide, one-third (24) of whom are below 4 years of age. This discovery of MPX in children has completely changed the transmission dynamics. A similar situation was seen during the second wave of coronavirus disease 2019 (COVID-19), when children were the most affected, mainly due to the contagious nature of the virus and efficient household transmission. Monkeypox is now witnessing the same with children getting infected due to household transmission [7]. Children form a vulnerable group and are more likely to contract the virus from an infected adult household member. That cannot be avoided in most households as children are naïve and are always in contact with family members. Infected children can extend this chain of transmission to their daycare centres and schools, leading to a considerable increase in cases.

Infected patients with MPX should be isolated in a single-personal room in a hospital setting with minimal motion outside this room. The essential protective measure should also be taken, including wearing a face mask and covering the skin lesions. In addition, healthcare professionals should follow all the personal protective equipment instructions. Finally, isolation of confirmed or suspected animals that are the primary reservoir for MPX could further limit the transmission of the disease [1]. The COVID-19 pandemic has taught us a valuable lesson in how to prepare for a pandemic, how to properly contain it before it has affected many cases, both physical and psychological, and how to prepare for specific vaccination programs. As a result, we must pay close attention to the early control of MPX infection, particularly in children, through adequate monitoring and population awareness to limit this multi-country outbreak.

Table 1. Recommendations for family and caregivers regarding children with monkeypox [15]

- Children with monkeypox should cover their skin lesions
- Parents/caregivers should encourage children not to scratch skin lesions or touch their eyes.
- Children with monkeypox should avoid contact with other people and pets. If possible, one person should be the caregiver of a child with monkeypox and should avoid skin-to-skin contact with the rash.
- Children who are at least 2 years of age who have monkeypox should wear a well-fitting mask when interacting with a caregiver, and the caregiver should wear a respirator or well-fitting mask and gloves when skin contact with the child may occur, and when handling bandages or clothing.
- Children should not return to school or childcare while contagious. The decision to end isolation and return to school or childcare should be made in collaboration with local or state public health authorities.

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