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Frontline Practices in Response to Monkeypox Outbreak in New York City

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The United States declared the ongoing spread of the monkeypox virus outbreak a public health emergency on August 4, 2022 [1]. New York City was once the outbreak's epicenter, with 95 daily new cases at its peak in late July [2]. The number of new cases continues to decline across the United States, and the outbreak appears to have slowed down in the past several weeks as of this writing [3].

Monkeypox virus is a member of the *Orthopoxvirus* genus, which includes other pox viruses such as smallpox and cowpox [4]. The first human monkeypox infection was reported in the Democratic Republic of Congo in 1970, involving a 9-month-old child who presented with a smallpox-like disease [5]. Cases since then have occurred primarily in Africa [6]. In 2003, an outbreak of 47 patients in the United States was attributed to direct contact with prairie dogs in the Midwest that had exposure to infected animals imported from Ghana [6].

PRESENTATION AND EPIDEMIOLOGY

Common presentations in recent decades include nonspecific features, such as prodrome symptoms of fever, fatigue, and headaches followed by a rash that followed a centrifugal pattern and involved the palm and soles [7]. Lesions are typically papular,

vesiculopustular, and ulcerative, affecting the face and body and associated with lymphadenopathy [8]. The virus enters the body through the oropharynx, nasopharynx, and intradermal routes and usually replicates at the inoculation site before spreading to lymph nodes [6]. The incubation period usually lasts 7 to 14 days but has been reported to last up to 21 days [6]. Historically, transmission has primarily been through contact with skin lesions of infected animals, but it is also attributed potentially to exposure to body fluids or respiratory droplets [6].

With the recent worldwide outbreak, demographics and epidemiology appear to have shifted. A recent study reported 528 infections from 16 countries, with 98% of the cases occurring in gay or bisexual men or other men who have sex with men [8]. As anogenital lesions were the most common anatomic site, sexual activity has been implicated in 95% of the cases, due to close skin-to-skin and mucosal contact [8]. Fifty-four of 500 of these patients (11%) presented with a single genital monkeypox lesion, although concomitant sexually transmitted infections were reported as well [8]. Admission to the hospital was mainly for pain management and treatment of superinfection, and no deaths were reported [8]. The diagnosis is made from a swab collection of skin lesions, and later viral

deoxyribonucleic acid is used for polymerase chain reaction testing [6,8].

As of September 20, 2022, one case fatality has been reported so far in the United States among the West African clade that is causing the current global outbreak [3].

INSTITUTIONAL RESPONSE

At our major New York City hospital, we have treated dozens of patients since the first reported case of monkeypox. Here we share the infection prevention policies implemented for this outbreak in a hospital setting, with dedicated guidelines created on the basis of the latest available evidence and Centers for Disease Control and Prevention guidelines [9,10]. Information is available to the staff for reference at any time, and town hall meetings have been held to provide information and clarify questions.

Specific infection prevention guidelines were developed for radiology facilities and distributed to department staff members. Providers at all levels were made aware of the signs and symptoms of monkeypox, with typical skin lesion diagrams in the guidelines, which have been posted in each imaging room. Staff members have been receiving daily e-mails regarding the cases scheduled for the day, with relevant infection precautions for each patient.

Departmental Response and Management of Imaging Equipment

Safe interactions with monkeypox-infected individuals require both contact precautions and special droplet precautions [9]. We are advising any providers who will be in contact with patients who have confirmed or suspected monkeypox infection to wear N95 masks, eye shields, gowns, and gloves. Patients should be masked and their skin lesions covered during transport. Hand hygiene with either alcohol rub or soap is practiced throughout the procedure. We have designated a fluoroscopy room for these patients, which has been used for patients with coronavirus disease 2019 (COVID-19). We follow the hospital infection prevention protocol for bedside imaging services (eg, radiography). When imaging such as CT or ultrasound is required at our radiology facility, we communicate with the hospital infection prevention team and coordinate with in-house environmental services for appropriate postprocedural disinfection and cleaning. We have two infection prevention liaison personnel at our hospital. Infection prevention personnel inspect the disinfected room afterward. We cannot accommodate patients who require MRI at this point because of the equipment-specific disinfection challenges. A standard protocol, timely communication, and closed interdepartmental relations are crucial for our organizational success.

Personal protective equipment (PPE) must be discarded in the designated red biohazard bin in the isolation room. The linen must be bagged when half full, and the bag must be double-knotted. All surfaces are cleaned with US Environmental Protection Agency–registered and hospital-approved disinfectants after the procedure [11]. We use hydrogen peroxide disinfectant to clean hard

surfaces and ammonium chloride disinfectant to disinfect and protect sensitive equipment to avoid the caustic effects of bleach and hydrogen peroxide [12]. Terminal cleaning is performed after the completion of the imaging procedure. Our radiology facilities have been equipped for patients with COVID-19. Prior broad experience with COVID-19 has eased the preparation for patients with monkeypox, as staff members are already very familiar with the existing infection prevention protocol to combat the transmission of COVID-19.

The risk for monkeypox virus transmission in health care facilities in nonendemic settings remains low, with a few cases reported from 2000 to 2022 [13]. The exposure risk to radiology staff members of monkeypox is currently low, according to existing Centers for Disease Control and Prevention guidelines and a recent study conducted by the Colorado Department of Public Health and Environment [14], because of the limited procedure time and lack of possible direct physical contact when wearing the appropriate PPE [9,14].

Departmental Staff Safety

Asymptomatic staff members who have been exposed to monkeypox are evaluated by our employee health services, which, in conjunction with the infection prevention team, determine the risk of their exposure. Low-risk exposure is defined as entry into the living space of a person with monkeypox without proper PPE (CDC, n.d.). Intermediate- to high-risk exposure to monkeypox is currently defined as unprotected contact with skin, lesions, bodily fluids, or contaminated materials (eg, linens, clothing) or being inside the same room with an infected person without wearing an N95 or equivalent respirator (or higher), eye protection,

gloves, and/or gown during any procedures that may create aerosols. Staff members who have intermediate- to high-risk exposures can contact employee health services to be evaluated for the US Food and Drug Administration–approved Jynneos vaccine as postexposure prophylaxis [15]. The vaccine is effective at preventing monkeypox if administered within 4 days of the exposure event and can reduce the severity of illness if given within 5 to 14 days after exposure [16].

Staff members who experience acute symptoms or have had positive monkeypox test results may need to isolate for up to 28 days from the time of symptom onset until they are no longer infectious. However, we have no staff members who contracted monkeypox or required quarantine. Education, training, and communication among our staff are paramount to empowering our staff. We recognize the fear and anxiety of contracting monkeypox that patients and staff members may face being at a health care facility. We did not experience any staff shortages or decreased patient volume during this monkeypox outbreak. As of September 20, 2022, we have completed imaging for a total of six patients with suspected or confirmed diagnoses, three with ultrasound and three with CT. Our census of patients with positive diagnoses has been zero for the past several weeks. The number of patients suspected or diagnosed with monkeypox and requiring radiologic imaging remains low at our facility despite the large number of infected individuals citywide.

SUMMARY

Although there are more than 3,400 cases in New York City and 23,800 cases in the United States, there has been only one reported death during

the current outbreak of monkeypox, suggesting decreased virulence compared with historical outbreaks.

Unlike in the 2003 outbreak in the United States, human-to-human transmission has been well documented in the current outbreak. We must remain vigilant and adapt our infection prevention practices, such as using PPE, precautions, and the type of disinfectant products we use to clean surfaces in our departments.

REFERENCES

1. US Department of Health and Human Services. Biden-Harris administration bolsters monkeypox response; HHS secretary Becerra declares public health emergency. Available at: <https://www.hhs.gov/about/news/2022/08/04/biden-harris-administration-bolsters-monkeypox-response-hhs-secretary-becerra-declares-public-health-emergency.html>. Accessed September 20, 2022.
2. NYC Health. Monkeypox (MPV): data. Available at: <https://www1.nyc.gov/site/doh/data/health-tools/monkeypox.page>. Accessed September 20, 2022.
3. Centers for Disease Control and Prevention. 2022 outbreak cases and data. Available at: <https://www.cdc.gov/poxvirus/>

[monkeypox/response/2022/index.html](https://www.cdc.gov/poxvirus/monkeypox/response/2022/index.html). Accessed August 15, 2022.

4. Andrei G, Snoeck R. Cidofovir activity against poxvirus infections. *Viruses* 2010;2: 2803-30.
5. Ziegler P, Kima E. A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo. *Bull World Health Organ* 1972;46:593-7.
6. Kumar N, Acharya A, Gendelman HE, Byrareddy SN. The 2022 outbreak and the pathobiology of the monkeypox virus. *J Autoimmun* 2022;131:102855.
7. McCollum AM, Damon IK. Human monkeypox. *Clin Infect Dis* 2014;58: 260-7.
8. Thornhill JP, Barkati S, Walmsley S, et al. Monkeypox virus infection in humans across 16 countries—April–June 2022. *N Engl J Med* 2022;387:679-91.
9. Centers for Disease Control and Prevention. Information for healthcare professionals: interim clinical considerations for monkeypox vaccination. Available at: <https://www.cdc.gov/poxvirus/monkeypox/clinicians/index.html>. Accessed September 20, 2022.
10. Mount Sinai. Monkeypox staff resources. Available at: <https://www.mountsinai.org/care/infectious-diseases/services/monkeypox/staff-resources>. Accessed September 20, 2022.
11. US Environmental Protection Agency. Disinfectants for emerging viral pathogens (EVPs): list Q. Available at: <https://www.epa.gov/pesticide-registration/disinfectants-emerging-viral-pathogens-evps-list-q>. Accessed September 20, 2022.
12. Brown SA, Merritt K, Woods TO, Busick DN. Effects on instruments of the World Health Organization-recommended protocols for decontamination after possible exposure to transmissible spongiform encephalopathy-contaminated tissue. *J Biomed Mater Res* 2005;72B:186-90.
13. Vaughan A, Aarons E, Astbury J, et al. Human-to-human transmission of monkeypox virus, United Kingdom, October 2018. *Emerg Infect Dis* 2020;26: 782-5.
14. Marshall KE, Barton M, Nichols J, et al. Health care personnel exposures to subsequently laboratory-confirmed monkeypox patients—Colorado, 2022. *MMWR Morb Mortal Wkly Rep* 2022;71.
15. US Food and Drug Administration. Monkeypox update: FDA authorizes emergency use of JYNNEOS vaccine to increase vaccine supply. Available at: <https://www.fda.gov/news-events/press-announcements/monkeypox-update-fda-authorizes-emergency-use-jynneos-vaccine-increase-vaccine-supply>. Accessed September 20, 2022.
16. Centers for Disease Control and Prevention. Vaccination. Available at: <https://www.cdc.gov/poxvirus/monkeypox/interim-considerations/overview.html>. Accessed September 20, 2022.

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Q2 Q3 The authors state that they have no conflict of interest related to the material discussed in this article. Drs XXX are XXX.

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