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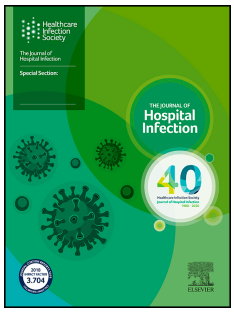

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Fortuitous diagnosis of Monkeypox in a patient hospitalized for several days: risk assessment and follow-up for exposed healthcare workers.

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Running title: Caregivers exposed to unknown monkeypox

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The current monkeypox (MKP) outbreak affects countries where the disease is non-endemic. Atypical presentations, with few skin lesions, have been described [1]. This may lead to delayed diagnosis of the disease, increasing the risk of healthcare workers (HCW) exposure. A recent review identified a single case of transmission to an HCW among 12 publications in high-income countries [2].

Here, we report on the outcomes in a cohort of HCWs who were exposed without appropriate personal protective equipment (PPE) to an inpatient who had a late diagnosis of MKP.

A 41-year-old man was admitted to the emergency room (ER) with keratoconjunctivitis. He remained in the ER for 10 hours before being transferred to a single room in a general surgery ward. He stayed for 48 hours on this ward before an infectious disease consult was requested. MKP infection was then suspected based on the patient's sexual orientation, and vesicular skin lesions on his forearms, forehead, scalp, neck, and eyelid. The skin lesions had appeared on the day of ER admission. The patient was then transferred to the Infectious Disease Unit with appropriate MKP precautions. From this point it was assumed that there was no HCW exposure without appropriate PPE. The diagnosis of MKP was confirmed by PCR on skin lesion swab sampled 1 day later. This triggered contact tracing, 4 days after the patient was admitted to the ER.

All HCW involved in the initial care of the patient were tracked through hospital software, and face to face interviews were conducted by the Infection Control and Prevention team (ICPT) and an occupational physician. Interactions with the patient were then categorized.

Risk exposure was assessed with a tool adapted from CDC exposure risk assessment [3] and UKHSA contact tracing guidance for classification of contacts [4]. It was considered that hand hygiene with hydro-alcoholic products was <100% performed, and multiple unprotected skin contact (not involving lesions) was categorized as medium risk exposure.

For each contact, we assessed the appropriate use of PPE. Universal masking has been mandatory in our hospital since April 2020, and the patient had donned a surgical mask every time an HCW entered his room.

Data regarding age, pregnancy, immunodepression and type of exposure were collected. Information on MKP, including modes of transmission, symptoms and instruction for self-surveillance (including daily temperature), was provided. Follow-up calls were made on days 10 and 21 post-exposure.

A total of 44 HCW were identified for having possibly provided care to the index patient. Seventeen them were excluded from follow-up because they had no direct contact with the patient or fomites and had worn facemasks. Another HCW was on vacation and could not be contacted.

Twenty-six HCW were assessed for vaccination eligibility. None were at risk of severe MKP. Vaccine was offered to 11 of them (4 high-risk and 7 medium-risk), because of close patient contact without adequate PPE; two medium-risk HCW declined vaccination. Type of care, number of cares, and characteristics of HCW involved are summarized in Table I.

Vaccination was administered within a median of 5 days after first contact with the index case.

At the end of the 21-day follow-up period, none of the 26 HCW had developed the disease. This report confirms that exposed HCW are at low risk of contracting MKP in healthcare settings, even without adequate contact and airborne precautions [2].

The index patient was young and self-caring and required nursing care only for administration of iv antibiotics and eye care. He is probably representative of many of the inpatients with MKP during the current outbreak. Whilst this probably reduced the risk of transmission, it can also

add to the difficulty in tracing all HCWs who have had contact (because the contact is likely to have been trivial). The current global outbreak has shown that MKP is spread through close contact. Nevertheless, standard precautions and early suspicion of MKP are paramount to limit HCW exposure, and organisations must be prepared to respond to HCW exposure incidents.

It remains uncertain whether medium-risk contacts in healthcare settings should receive vaccination. Neither of the 2 vaccine refusers in this report developed MKP. Indeed there is only one report of MKP transmission to an exposed HCW, and this was a high-risk contact who had received a single dose of smallpox vaccine 6 days after exposure [5]. The effectiveness of PEP probably decreases if delayed; [6] risk assessment and PEP should be conducted promptly.

In the context of healthcare facility with high hygiene standards, HCW are probably at low risk of contracting MKP. Risk assessment tools for HCW should be developed or improved based on accumulated experience of the 2022 global outbreak.

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Table I: Characteristics of healthcare workers and type of care provided to undetected monkeypox patient

HCW	Age	Ward	Profession	Number of cares	Type of care	PPE	Risk category	Vaccination
1	> 42	GS	Nurse	2	Eye drop, helped with undressing	None	Medium	YES
2	< 42	GS	Nurse	3	Infusion, eye drops	Gloves for eye drop	Medium	YES
3	< 42	GS	Nurse	6	Infusion, eye drops	Gloves for eye drop	Medium	YES
4	> 42	GS	As nurse	Several	Undressing, making bed, temperature and blood pressure, local eye care	Gloves for eye care	Medium	YES
5	< 42	Scanner	RT	1	Contact with skin	None	Weak	NA
6	52	Scanner	RT	1	Contact with skin	None	Weak	NA
7	30	ER	Nurse	5 to 6	Eye drop, delivery of medications	None	Weak	NA
8	51	ER	As nurse	2 to 3	Blood pressure, temperature	None	Medium	Refused
9	36	ER	Nurse	3 to 4	Blood pressure, temperature, infusion	None	Medium	YES
10	< 30	ER	Resident	4 to 5	Clinical examination, fluorescein dye test	Glove for eye test	High	YES
11	21	ER	MS	2 to 3	Clinical examination, fluorescein dye test	Glove for eye test	High	YES
12	Unknown	Transport	Paramedic	2	Skin contact	Gloves	Very weak	NA
13	Unknown	Transport	Paramedic	1	Skin contact	Gloves	Very weak	NA
14	40	Transport	SB	1	Linen contact	None	Weak	NA
15	Unknown	Transport	Paramedic	1	Transport as MKP suspect	Gown, gloves, glasses, FFP2	Very weak	NA
16	Unknown	Transport	Paramedic	1	Linen contact	None	Weak	NA
17	Unknown	Transport	SB	1	Linen contact	None	Weak	NA
18	Unknown	Transport	SB	1	Skin contact	None	Weak	NA
19	> 42	GS	MD	1	Eye examination	None	High	YES
20	Unknown	GS	Resident	4	Eye examination	Gloves	Very weak	NA
21	Unknown	GS	Resident	1	Eye examination	Gloves	Very weak	NA
22	< 42	GS	As nurse	1	Blood pressure	None	Medium	Refused
23	< 42	GS	Nurse	4	Eye drop, eye cleaning	None	High	YES
24	41	GS	Nurse	3 to 4	Infusion, no contact with skin	None	Weak	NA
25	36	GS	As nurse	1	Talk to the patient, no contact	None	Very weak	NA
26	31	GS	As nurse student	2 to 3	Bringing water, food, contact with linen	None	Weak	NA

*GS = general surgery ward ; ER = emergency room ; As nurse = assistant nurse ; RT = radiological technician ; MS = medical student ; SB = stretcher bearer ;