Elsevier has created a Monkeypox Information Center in response to the declared public health emergency of international concern, with free information in English on the monkeypox virus. The Monkeypox Information Center is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its monkeypox related research that is available on the Monkeypox Information Center - including this research content - immediately available in publicly funded repositories, with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the Monkeypox Information Center remains active.

Travel Medicine and Infectious Disease 50 (2022) 102412

Contents lists available at ScienceDirect

Travel Medicine and Infectious Disease

journal homepage: www.elsevier.com/locate/tmaid

Monkeypox virus infection and creatine phosphokinase increase: A case from Italy

ARTICLE INFO

Keywords
Monkeypox virus
HIV
Men having sex with men (MSM)
Creatine phosphokinase value (CPK)

Dear Editor

Human monkeypox (MPX) is a zoonotic disease, with possible transmission from person to person, caused by MPX virus (MPXV) a double-stranded DNA virus which belongs to the Poxviridae family genus Orthopoxvirus [1,2]. In the past years some cases have been described in Africa, where the virus is endemic, and rarely sporadic cases outside of Africa [3]. In recent months, more concern has been raised about the growing of monkeypox cases in many Western countries. Over 8000 suspected or confirmed cases of MPXV infections have documented up to July 12, 2022 from European regions by ECDC-WHO [4].

Here, we report a mild monkeypox virus infection in an HIV-positive person who developed a very high blood level of creatine phosphokinase (CPK). A 45-year-old Italian MSM HIV-positive on antiretroviral therapy (ARVT) with elvitegravir/tenofovir/emtricitabine/cobicistat and good viro-immunological response was referred to our institution because of recent onset of pustular lesions. The lesions first appeared on the face (Fig. 1A) and neck, subsequently on the genitals and after a few days they scattered in the limbs and trunk. The patient complained of asthenia, headache, mild myalgia and cold. He denied precedent fever. The physical examination revealed unilateral painful inguinal lymphadenopathy and about 15 disseminated vesicular skin lesions (Ø max 0.5 cm). On the penis one lesion was ulcerated with crusted scab (Fig. 1B). The patient referred only a protected sexual intercourse with a healthy man thirteen days before in London. The patient was afebrile, vital signs were normal and no other clinical abnormalities were observed. Blood tests showed moderate relative lymphocytosis and elevated value of CPK (1414 U/L, normal 39 to 308). MPXV infection was diagnosed by a real time polymerase chain reaction performed at AOUP Paolo Giaccone (University of Palermo, Italy) and confirmed by the National Institute for Infectious Diseases "L. Spallanzani", Rome, Italy. The patient was monitored out-patiently and isolation at home was advised for at least 15 days. Blood tests three days later revealed a further rise in CPK (8168 U/L), increased AST (176 U/L, normal 50), and lactate dehydrogenase (344 U/L, normal 50 to 250); c reactive protein was 3.45 mg/L (normal 5); and protein electrophoresis was also normal. The patient denied intense exercise, recent muscle injury or angina symptoms. The patient denied ever taking statins. A cardiological examination and an ECG did not reveal any pathological data. CPK value decreased to 1136 U/L three days after. CPK and AST values became normal after two weeks and progressive resolution of the skin lesions and symptoms was observed. Recent disease clusters prevalently include high risk groups as MSM [5], our patient referred only a protected sexual intercourse with an apparently healthy partner, revealing a possible transmission related to a close contact, droplets, or fomites rather than sexual intercourse itself [6,7]. The above might suggest that an infected but asymptomatic person could be a source of infection as suggested by Rahimi et al. [6]. This could lead to an exponential increase in the number of cases in the next future. On the basis of a PubMed literature search combining the following terms "(CPK[Title/Abstract]OR creatine phosphokinase [Title/Abstract]OR rhabdomi*[Title/Abstract]) AND virus[Title/Abstract]" CPK increase has been described in the course of many viral infection mostly Influenza, Ebola, Dengue and Crimea-Congo haemorrhagic fever. Other viral agents involved are HIV, Tick-Borne Encephalitis Virus, Measles Virus, Coxsackie B virus, SARS-CoV-2, Herpes Simplex Virus, Epstein Barr Virus, West Nile Virus, Chikungunya Virus and Hepatitis E Virus. In the most of them the increase in CPK was associated to muscular tissue damage, which in some rare cases was complicated by rhabdomyolysis. Rarely, high level of CPK has been associated to cardiac involvement (myocarditis and pericarditis). Up to now no paper has reported an increase in CPK during monkeypox and neither have cases of pericarditis or myocarditis. However, in an experimental study in which a recombinant MPXV containing the firefly luciferase gene was used to experimentally infect black-tailed prairie dogs, MPXV could be visualized using *in vivo* imaging also in the heart as early as day 6 post-infection [8]. In conclusion, we have not been able to determine the cause of the sharp rise in CPK in our patient, and we would like to ask all the physicians caring for patients infected with MPXV to seek the CPK determination and attempt to identify the cause of the rise.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

https://doi.org/10.1016/j.tmaid.2022.102412
Received 19 July 2022; Received in revised form 26 July 2022; Accepted 28 July 2022
Available online 12 August 2022

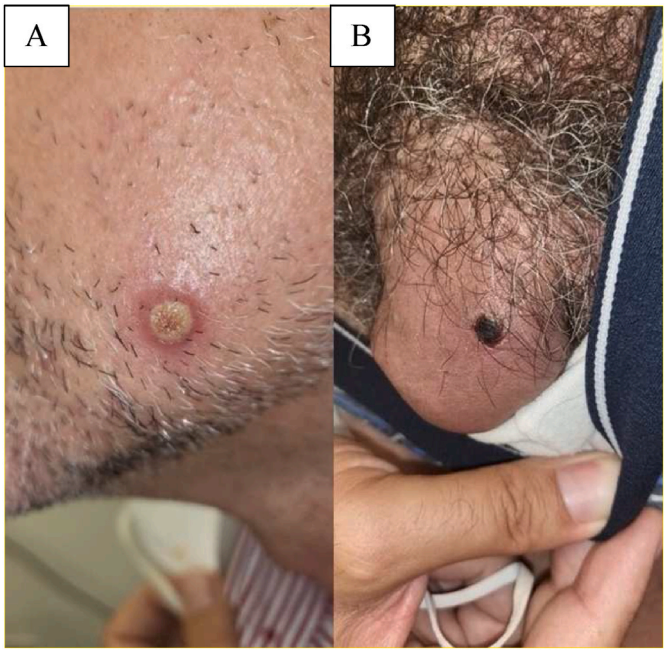

Fig. 1. A Pustular lesion with umbilicate aspect on the face. **B** Ulcerated with crusted scab lesion on the penis.

Declaration of competing interest

Nothing to declare.

Author's contributions

We consider that all authors equally contributed on this manuscript.

References

[1] Chen N, Li G, Liszewski MK, Atkinson JP, Jahrling PB, Feng Z, Schriewer J, Buck C, Wang C, Lefkowitz EJ, Esposito JJ, Harms T, Damon IK, Roper RL, Upton C, Buller RM. Virulence differences between monkeypox virus isolates from West Africa and the Congo basin. Virology 2005 Sep 15;340(1):46–63. https://doi.org/10.1016/j.virol.2005.05.030. PMID: 16023693.

[2] Moore M, Zahra F. Monkeypox [Internet]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022 May 22. 2022 Jan–. PMID: 34662033.

[3] Adegboye OA, Eugenia Castellanos M, Alele FO, Pak A, Ezechukwu HC, Hou K, Emeto TI. Travel-related monkeypox outbreaks in the Era of COVID-19 Pandemic: are We Prepared? Viruses 2022 Jun 13;14(6):1283. https://doi.org/10.3390/v14061283. PMID: 35746754; PMCID: PMC9228578.

[4] Joint ECDC-WHO Regional Office for Europe Monkeypox Surveillance Bulletin. https://monkeypoxreport.ecdc.europa.eu [accessed 13 July 2022].

[5] León-Figueroa DA, Bonilla-Aldana DK, Pachar M, Romaní L, Saldaña-Cumpa HM, Anchay-Zuloeta C, Diaz-Torres M, Franco-Paredes C, Suárez JA, Ramirez JD, Paniz-Mondolfi A, Rodriguez-Morales AJ. The never-ending global emergence of viral zoonoses after COVID-19? The rising concern of monkeypox in Europe, North America and beyond. Trav Med Infect Dis 2022 May 26;49:102362. https://doi.org/10.1016/j.tmaid.2022.102362. Epub ahead of print. PMID: 35643256; PMCID: PMC9132678.

[6] Rahimi F, Talebi Bezmin Abadi A. The 2022 monkeypox outbreak: lessons from the 640 cases in 36 countries. Int J Surg 2022 Jun 14;104:106712. https://doi.org/10.1016/j.ijsu.2022.106712. Epub ahead of print. PMID: 35710067.

[7] Halani S, Mishra S, Bogoch II. The monkeypox virus. CMAJ (Can Med Assoc J) 2022 Jun 20;194(24):E844. https://doi.org/10.1503/cmaj.220795. Epub 2022 Jun 2. PMID: 35654445.

[8] Weiner ZP, Salzer JS, LeMasters E, Ellison JA, Kondas AV, Morgan CN, Doty JB, Martin BE, Satheshkumar PS, Olson VA, Hutson CL. Characterization of Monkeypox virus dissemination in the black-tailed prairie dog (Cynomys ludovicianus) through in vivo bioluminescent imaging. PLoS One 2019 Sep 26;14(9):e0222612. https://doi.org/10.1371/journal.pone.0222612.

Luca Pipitò, Antonio Cascio*
Infectious and Tropical Diseases Unit- Department of Health Promotion, Mother and Child Care, Internal Medicine and Medical Specialties "G D'Alessandro,", University of Palermo, Palermo, Italy

* Corresponding author.
E-mail address: antonio.cascio03@unipa.it (A. Cascio).