

Atlas of mpox lesions

A tool for clinical researchers

Version 1.0

28 April 2023



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Atlas of mpox lesions: a tool for clinical researchers, version 1.0, 28 April 2023

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General disclaimers. The Atlas of mpox lesions: a tool for clinical researchers is intended for use by the international clinical trialists to aid the uniformity of data collection and clinical evidence which will inform the global effort to inform clinical severity characterization of mpox disease.

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Abbreviations

WHE Health Emergencies Programme (WHO)
WHO World Health Organization

Background

Introduction

Global understanding of the natural history of monkeypox (now recognised as mpox), its clinical features, risk factors for severe disease and outcomes remains incomplete, and the multicountry outbreak identified in May 2022 (caused by clade 2 virus) has affected new populations across new geographical areas of the world.

In July 2022, WHO convened a working group of international clinical trialists and clinical experts in an effort to improve characterization and assessment of mpox skin lesions. Three preliminary meetings took place (18 and 25 August and 8 September 2022). The outcome of these meetings is the *Atlas of mpox lesions*, which aims to aid the uniformity of data collection and clinical evidence generation by researchers to further inform the characterization of mpox disease.

Rationale

The *Atlas of mpox lesions* underpins a common understanding of the stages of disease, including the appearances of both archetypal mpox lesions, and those with less typical features.

The *Atlas of mpox lesions* will be revised as more medical photography becomes available and/or should further characterization of lesions evolve.

Collation of the images

The images have been collated from global experts (see medical photography contributor list in the acknowledgements). These images have been collected as part of routine care or clinical trials with full informed consent for medical photography and use of images for teaching, educational and medical publication purposes.

Rights of the medical photography remains with the contributing institutions and they should be contacted directly for attribution or reuse. For contact details write to CMTM@WHO.int

Classification of the images

An expert group classified each available image into categories of:

1. Active lesions.
2. Crusted and scabbed lesions.
3. Resolved and healed lesions.

Presentation of the images

For each lesion category group, between 3 and 5 archetypal images are highlighted. Additional extra images aim to display the variation of appearance between individuals, skin colours and sites of lesion.

Future plans

This first version of the atlas is intended to be a basis for future expansion. Specifically, as images become more available, we expect to include more representing severe disease, and lesions affecting skin of colour.

1. Active lesions

Active cutaneous

The active category of lesions includes most of the variable morphologies described of cutaneous MPX.

Early lesions	Typically 1–3 mm that appear solid, are known as papules . Other lesions may develop a clear fluid-filled appearance known as a vesicle or, more often, will appear to contain white material (pustule/pseudo-pustule).
Progression	As lesions progress, central involution of the lesion may lead to a torus (doughnut) shape (umbilicated pseudo-pustule). A scale crust often develops first in the umbilicated central area of evolving skin lesions.
Late stage	Erosions and ulcers may also occur, which are also considered active. Superficial loss of a portion of the epidermis is an erosion , whereas full-thickness loss of the entire epidermis is an ulcer .

Active mucosal

There are three morphologies typically seen in the mouth: ulcerations/erosions without surrounding induration; papules and nodules resembling chancres; and pseudomembranous (sloughy) plaques mimicking candidiasis. All these lesions heal quickly without crust formation or dyspigmentation.

Main images (active lesions)



Fig. 1. Umbilicated pseudopustules (doughnut-shaped) lesions

Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)

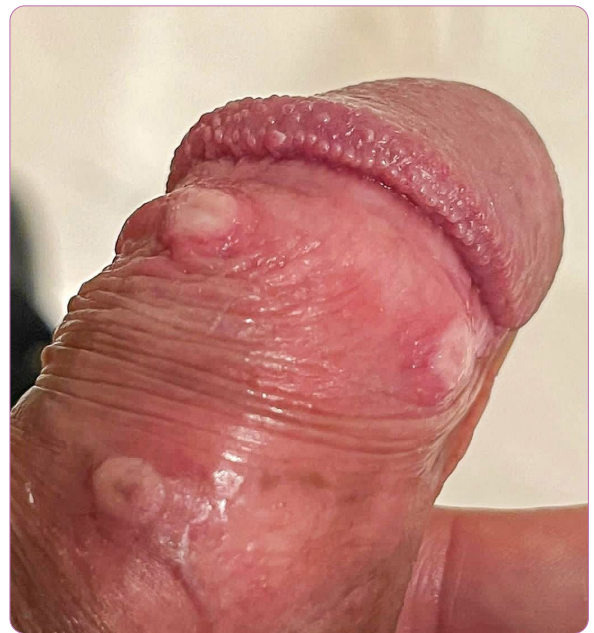


Fig. 2. Genital pseudopustules

Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 3. Umbilicated pseudopustules (doughnut-shaped) lesions

Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 4. Pseudopustules on arm mimicking target lesions

Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 5. Ulcer with purulent base

Source: Zuckerberg San Francisco General Hospital (USA)

Extra images (genital /mucosal – active lesions)



Fig. 6.
Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 7.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 8.
Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 9.
Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 10.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 11.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 12.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 13.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 14.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 15.
Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)

Extra images (non-genital – active lesions)



Fig. 16.
Source: Hospital Clinic de Barcelona (Spain)



Fig. 17.
Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 18.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 19.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 20.
Source: University of Toronto (Canada)

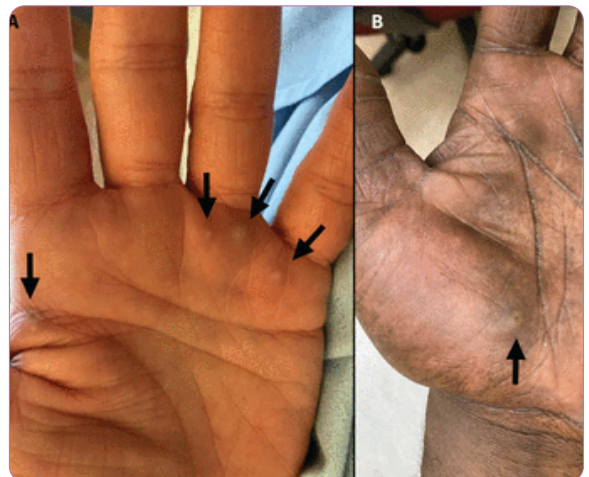


Fig. 21.
Source: University of Toronto (Canada)



Fig. 22.
Source: Hospital Clínic de Barcelona (Spain)



Fig. 23.
Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 24.
Source: Lagos State University Teaching Hospital (Nigeria)



Fig.25.
Source: Fundación Lucha contra las Infecciones (Spain)



Fig. 26.
Source: Fundación Lucha contra las Infecciones (Spain)

2. Crusted and scabbed lesions

Evolving lesions may develop a surface of **thick surface scale (stratum corneum)**, **yellow serous crust**, **haemorrhagic crust or scab (eschar)**. Crusted lesions are considered infectious until the underlying lesion has completely resolved and the surface crust has been replaced by a full layer of epidermis. At this stage, most of the lesion should have crust without surrounding skin thickening (induration).

Main images (crusted and scabbed lesions)

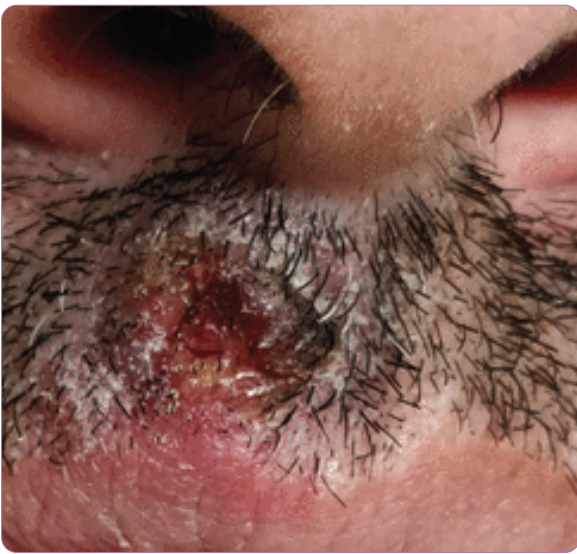


Fig. 27. Crust on upper lip
Source: University of Toronto (Canada)



Fig. 28. Crust on scalp
Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 29. Eschar on penis
Source: Irrua Specialist Teaching Hospital (Nigeria)

3. Resolved and healed lesions

Lesions are considered resolved once the lesion is no longer raised above the skin, any residual crust has resolved (desquamation) and any underlying erosion or ulcer has healed with intact skin (re-epithelialization).

Main images (resolved and healed lesions)



Fig. 30. Post-inflammatory changes with pink scars
 Source: Fundación Lucha contra las Infecciones (Spain)

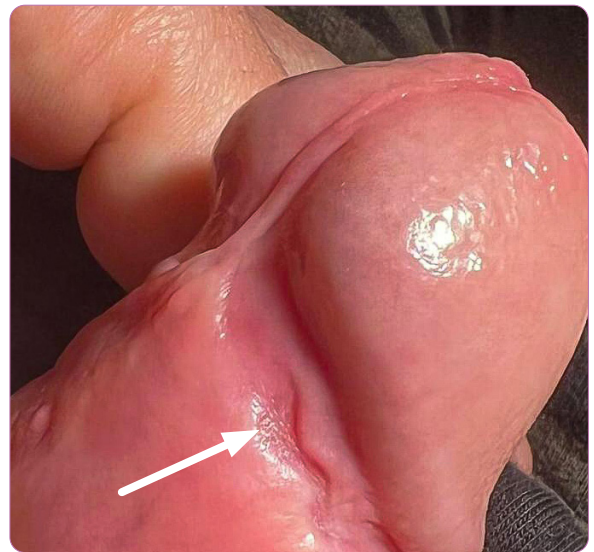


Fig. 31. Depressed scar
 Source: Evandro Chagas National Institute of Infectious Diseases-Fiocruz (Brazil)



Fig. 32. Re-epithelialized lesion with surrounding collarate of scale
 Source: Zuckerberg San Francisco General Hospital (USA)



Fig. 33. Faint post-inflammatory pigmentation
 Source: Zuckerberg San Francisco General Hospital (USA)



Fig. 34. Pink scarring at base of penis
Source: Zuckerberg San Francisco General Hospital (USA)



Fig. 35. Multiple scars with hypo- and hyper-pigmentation
Source: Fundación Lucha contra las Infecciones (Spain)

4. Other clinical findings

Additional clinical manifestations include a skin exanthem and ocular involvement.



Fig. 36.
Source: Bichat Claude Bernard Hospital, APHP (France)



Fig. 37
Source: Bichat Claude Bernard Hospital, APHP (France)



Fig. 38.
Source: Bichat Claude Bernard Hospital, APHP (France)



Fig. 39
Source: Bichat Claude Bernard Hospital, APHP (France)

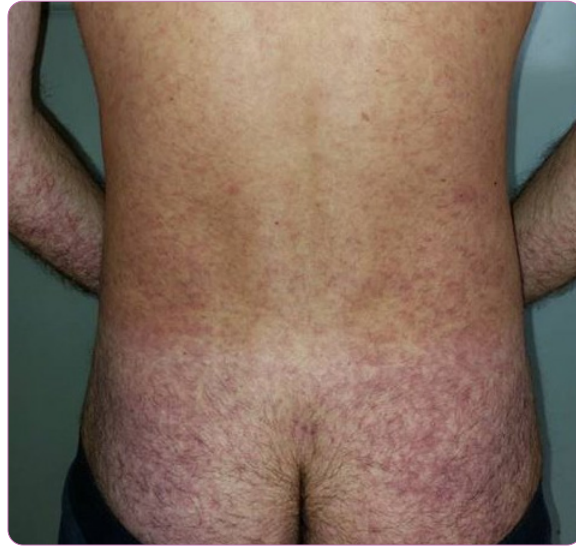


Fig. 40

Source: Bichat Claude Bernard Hospital, APHP (France)

Annex. Conflicts declared in Declaration of Interests forms

All contributors to the mpox atlas have completed declaration of interest statements. These have been reviewed by WHO Secretariat, as below.

Name	Conflicts
Oluwatoyin Akinsiku	No conflict declared.
Chloe Bertin	No conflict declared.
Jose Luis Blanco	No conflict declared.
Alba Catala	No conflict declared.
Adrienne Chan	No conflict declared.
Olufolakemi Cole-Adeife	I was a member of the Emergency Operation Command (EOC) for Mpox surveillance and Case management in Lagos State during the 2022 Mpox Outbreak from July to October 2022. This EOC was coordinated the Lagos State Ministry of Health and supported by WHO Nigeria. I was appointed as a medical expert, a physician and dermatologist working for Lagos State. I am also involved in the writing of academic publications (case reports and case series) on some of the Mpox cases managed in Lagos State during the 2022 outbreak. These publications are not funded by any person or organisation. Decision: no action needed.
Edward Cowen	No conflict declared.
Candida Fernandes	I currently run the STD clinic of the Dermato venereology Department at Centro Hospitalar e Universitario de Lisboa Central (2400 euros/month). Decision: no action needed.
Esther Freeman	I am the principal investigator of the Dermatology COVID-19, monkeypox and emerging infections registry, which is a collaboration between the American Academy of Dermatology, the International League of Dermatologic Societies, and the Massachusetts General Hospital. From 2020-2022, Massachusetts General Hospital received research grants from the ILDS to support the registry. I also hold an (unpaid) position as an external advisor to the International League of Dermatologic Societies (2020 to present). I also hold an (unpaid) position on the American Academy of Dermatology Ad Hoc Task Force on Monkeypox (2022 to present). Decision: no action needed.
Irene Fuertes	No conflict declared.
Cristina Galvan	No conflict declared.
Beatriz Grinsztejn	No conflict declared.
Elizabeth Higgs	No conflict declared.
Van Kaway	No conflict declared.
Placide Mbala	No conflict declared.
Kieron Leslie	No conflict declared.
Placide Mbala	No conflict declared.
Emmanuel Nakoune	I have a DOI from him relating to Mpox (guideline) – no conflict declared.
Sebastine Oiwoh	No conflict declared.
Tochi Okwor	No conflict declared.
Nathan Peiffer	No conflict declared.
Josep Riera-Monroig	No conflict declared.
Amanda Rojek	The Pandemic Sciences Institute, and ISARIC, which I have affiliations with, receive funding to conduct clinical research in epidemic diseases, including monkeypox. Decision: no action needed.

Name	Conflicts
Inga Saknite	<p>Since 2022, I am the owner and board member of a limited liability company “Skin Imaging Consulting” based in Latvia. The company is a subcontractor for VUMC on a VUMC/Leidos contract to provide support for the PALM007 mpox study in the Democratic Republic of the Congo (\$60,000). Specifically, I provide study support including photo documentation (developing photography guidelines and providing photography training), and source document development on lesion counting in the field.</p> <p>Decision: no action needed.</p>
Mayara Secco	No conflict declared.
Olivier Segeral	No conflict declared.
Nathalie Strub-Wourgaft	<p>PANTHER – the outcome of this meeting will inform/support the definition of endpoint used in the clinical trial the PANTHER (that I am representing here) will use and how the data will later be interpreted.</p> <p>Decision: no action needed.</p>
Sharon Sukhdeo	No conflict declared.
Eric Tkaczyk	<p>I have received salary, through VUMC, to develop monkeypox AI and support the PALM007 trial via a research contract from the NIH.</p> <p>Decision: no action needed.</p>
Laurence Toutous Trelu	No conflict declared.
Sharon Walmsley	<p>Research grant for RCT of tecovirimat for Mpox, PHAC: \$500,00 (2022).</p> <p>Decision: no action needed.</p>
Yaszdan Yazdanpanah	No conflict declared.
Jason Zucker	No conflict declared.



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