




coma-associated bulla.⁷ However, in our case, thrombi and even fibrinoid necrosis were observed not only in the upper-dermis vessels but also in all the other vessels in the biopsy, even in the dermo–hypodermal junction. This unexpected finding could be related to more extensive endothelial damage secondary to COVID-19 infection, as this has recently been reported after observation of viral inclusion bodies in electron microscopy of the kidney, small bowel and lung of severely affected patients.⁸

To our knowledge, this is the first report of a patient with COVID-19 where the presence of an occlusive vasculopathy at the cutaneous level has been demonstrated. In our case, we also observed a striking sweat gland necrosis, a finding previously reported as being associated with ketoacidosis coma but not with COVID-19 infection. Additional studies are needed to characterize completely the tissue damage associated with the virus, including within the gamut of lesions observed in the skin.

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M. Llamas-Velasco ¹, P. Muñoz-Hernández,² J. Lázaro-González,³ A. Reolid-Pérez ¹, B. Abad-Santamaría,³ J. Fraga² and E. Daudén-Tello ¹

¹Department of Dermatology, Fundación de Investigación Biomédica de la Princesa; ²Department of Pathology and ³Intensive Care Unit; Hospital Universitario de la Princesa, Madrid, Spain
Email: mar.llamasvelasco@gmail.com

M.L-V., P.M-H. and J.L-G. contributed equally to the manuscript. J.F. and E.D-T. contributed equally to the manuscript.

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Absence of images of skin of colour in publications of COVID-19 skin manifestations

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DEAR EDITOR, There are now over 1 million confirmed cases of COVID-19 globally, with more than 270 000 recorded deaths to date.¹ COVID-19 has been shown to impact people of colour disproportionately, both in the UK and in the USA, where black people make up 13.4% of the population but 30% of cases of COVID-19.^{2,3} Mounting evidence shows that COVID-19 impacts several organ systems, including the skin.⁴ Knowledge of cutaneous manifestations of COVID-19 and the ability to identify them in patients of all skin types is important for dermatologists and other healthcare providers who may be evaluating patients who are otherwise asymptomatic. In order to provide optimal care to all patients, it is therefore important that we are able to identify cutaneous manifestations of COVID-19 in patients with darker skin.

We completed a systematic literature review, using the PRISMA guidelines, of all articles describing cases of cutaneous manifestations associated with COVID-19. We included English-language articles published between 31 December 2019 and 3 May 2020. We extracted patient case numbers, race and ethnicity descriptors when available, photographs, and descriptions of cutaneous manifestations. In order to assess background skin colour, a board-certified dermatologist with expertise in diagnosing and treating patients with skin of colour (Fitzpatrick type IV–VI) evaluated each of the images and categorized them based on Fitzpatrick type I–VI.

We collated these images, ordered by skin type (Figure 1a). We then manually selected a pixel of background skin, unaffected by the rash, from each image. In order to adjust for lighting conditions, we then standardized the lightness portion of the hue–saturation–lightness scale of this pixel within each coded Fitzpatrick category, thus approximating true skin colour (Figure 1b).

Forty-six articles met our inclusion criteria. Of those, 36 articles included clinical photos of COVID-19-related skin lesions for a total of 130 images. We obtained permission to use 116 of these images in this publication, and they are shown in Figure 1. In total, 92% (120 of 130) showed skin types I–III, 6% (seven of 130) showed patients with type IV skin and 2% (three of 130) could not be classified because they depicted only acral skin. There were no clinical images representing Fitzpatrick type V or VI skin. Photographed eruptions among skin of Fitzpatrick phototypes I–III included chilblain-like, urticarial, maculopapular and vesicular lesions. The images among patients with Fitzpatrick phototype IV included

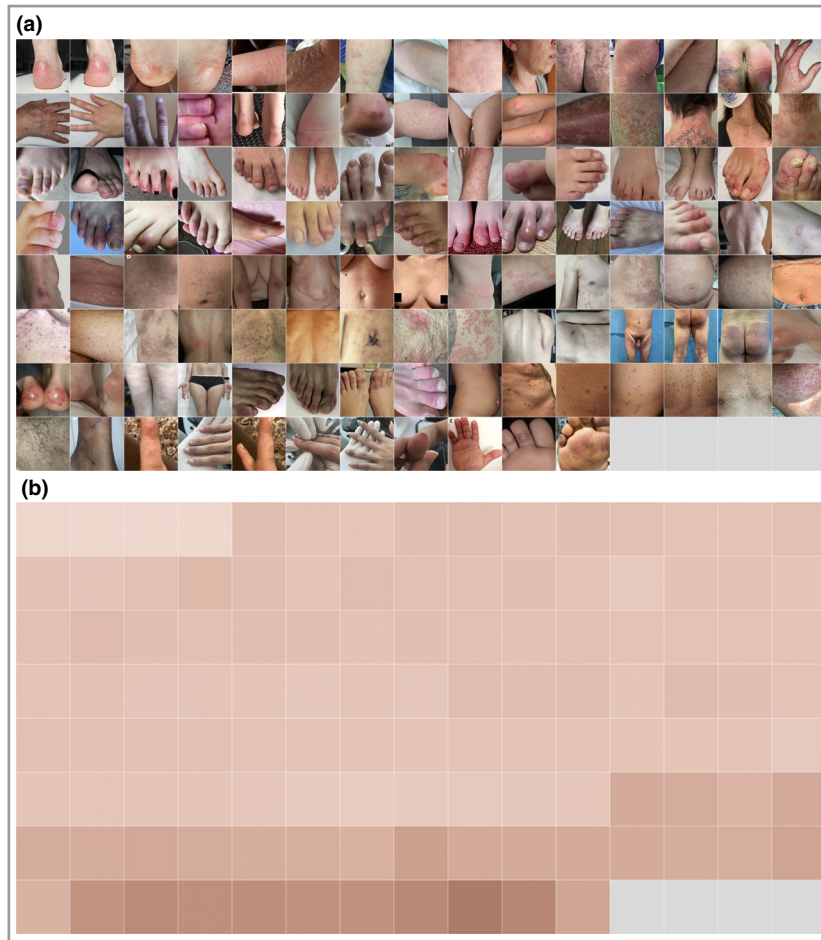


Figure 1 (a) Images of cutaneous manifestations associated with COVID-19. (b) Approximation of the skin colour of the patients in (a). All images are reproduced with permission of the respective copyright owners.

chilblain-like lesions and necrotic purpura only. In the six articles with race and ethnicity information, 91% of the patients mentioned were reported to be white and 9% were Hispanic.

Our analysis demonstrates that articles describing the cutaneous manifestations of COVID-19 almost exclusively show clinical images from patients with lighter skin. Based on our analysis, there are no published photos of the cutaneous manifestations in dark skin (Fitzpatrick type V or VI). This is a problem because skin disease often presents differently in skin of colour.⁵ We have previously reported imbalances in representation of Fitzpatrick skin types in dermatology textbooks⁷ and in dermatology journals.^{6,7} This can lead to cognitive biases that can also impact differential diagnoses and physician–patient relationships.⁶

Forty-seven per cent of dermatologists report insufficient exposure to patients with darker skin during their training, and this directly impacts the quality of patient care.^{6,8} One way to mitigate this deficiency is to increase the availability of images in teaching materials and dermatological journals.⁸ We will not be able to attain this goal without an explicit commitment to documenting, photographing and publishing

the manifestations of this disease in a wide variety of skin tones.

Our study is limited by the subjective assessment of skin type from a photograph. Lighting conditions including over-exposure may have made dark skin look lighter, and this may have led to some misclassification across one or two skin types. However, it is unlikely that lighting issues alone would result in skin types V or VI appearing as skin type I–III.

The paucity of images of skin manifestations of COVID-19 in patients with darker skin is a problem, because it may make identification of COVID-19 presenting with cutaneous manifestations more difficult for both dermatologists and the public. Given the racial disparities in COVID-19 infections and associated deaths, it is important that all manifestations of this disease contain broad representation of people of different races and ethnicities, as any clue, if recognized, could contribute to early diagnosis and potentially better health outcomes.

Dermatologists should prioritize identification of cutaneous manifestations of COVID-19 in patients with darker skin by photographing and disseminating these findings. Journals should prioritize publication of manuscripts depicting the

cutaneous manifestations of COVID-19 in darker skin because exclusion of these patients from the literature may further exacerbate existing health disparities.

J.C. Lester ¹, J.L. Jia,² L. Zhang,³ G.A. Okoye⁴ and E. Linos³

¹Department of Dermatology, University of California San Francisco, San Francisco, CA, USA; ²Stanford University School of Medicine, Stanford, CA, USA; ³Department of Dermatology, Stanford University School of Medicine, Stanford, CA, USA; and ⁴Department of Dermatology, Howard University, Washington, DC, USA

Email: Jenna.Lester@ucsf.edu

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