Management of Urticaria in COVID-19 Patients: A Systematic Review

Eyad Abuelgasim BSc1*, Ann Christine Modaragamage Dona BSc1††*, Rajan Singh Sondh BSc2, Amer Harky MSc3,4,5

Running Head: Management of Urticaria in COVID-19 Patients

1. Faculty of Medicine, Imperial College London, London, United Kingdom
2. St George’s Hospital Medical School, University of London, London, United Kingdom
3. Department of Cardiothoracic Surgery, Liverpool Heart and Chest Hospital, Liverpool, United Kingdom
4. Department of Integrative Biology, Faculty of Life Sciences, University of Liverpool, Liverpool, UK
5. Liverpool Centre for Cardiovascular Science, Liverpool Heart and Chest Hospital, Liverpool, UK

*authors contributed equally to the work.

Corresponding Author:
Amer Harky
MRCS, MSc
Department of Cardiothoracic Surgery
Liverpool Heart and Chest Hospital
Liverpool, UK
e-mail: aaharky@gmail.com
Phone: +44-151-600-1616

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/dth.14328

This article is protected by copyright. All rights reserved.
Conflict of Interest: none to be declared
Funding: none obtained
Key words: COVID-19, SARS-CoV-2, Urticaria, Angioedema, Antihistamines, Steroids

Abstract

Objectives
The global pandemic COVID-19 has resulted in significant global morbidity, mortality and increased healthcare demands. There is now emerging evidence of patients experiencing urticaria. We sought to systematically review current evidence, critique the literature and present our findings.

Methods
Allowing PRISMA guidelines, a comprehensive literature search was carried out with Medline, EMBASE, Scopus, Cochrane, and Google Scholar, using key MeSH words, which include “COVID-19,” “Coronavirus”, “SARS-CoV-2”, “Urticaria,” “Angioedema,” “Skin rash” up to August, 01 2020. The key inclusion criteria were articles that reported on urticaria and/or angioedema due to COVID-19 infection and reported management and outcome. Studies were excluded if no case or cohort outcomes were observed.

Results
Our search returned 169 articles, 25 of which met inclusion criteria. All studies were case reports, reporting 26 patients with urticaria and/or angioedema and COVID-19...
infection and their management and/or response. Majority of patients (n=16, 69%) were over 50 years old. However, urticaria in the younger ages was not uncommon, with reported case of 2 months old infant. Skin lesions resolved from less than 24 hours to up to 2 weeks following treatment with antihistamines and/or steroids. There have been no cases of recurrent urticaria or cases non-responsive to steroids.

Conclusions

Management of urticarial in COVID-19 patients should involve antihistamines. Low dose prednisolone should be considered on an individualised basis. Further research is required in understanding urticarial pathogenesis in COVID-19. This will aid early diagnostic assessment in patients with high index of suspicion and subsequent management in the acute phase.

Key words: COVID-19, SARS-CoV-2, Urticaria, Angioedema, Antihistamines, Steroids
1. Introduction

The global pandemic COVID-19 is caused by severe acute respiratory syndrome coronavirus-2 (SARS-COV2). It has resulted in global morbidity, mortality and significantly increased healthcare demands.\textsuperscript{1} It was originally reported that the main symptoms of COVID-19 to be a cough and fever. However, as the pandemic progressed, our understanding of COVID-19 increased, leading to anosmia and/or hyposmia established as a third symptom. As our understanding of this disease increases, it is reported that SARS-COV2 can present with clinical manifestations beyond the respiratory system. We are now aware that neurological manifestation can develop which encompasses acute skeletal muscle injury as well as an impaired consciousness.\textsuperscript{2} Additionally, severe infections can have an impact on renal and cardiac function.\textsuperscript{3}
More recently, there has been a growing interest regarding the dermatological manifestations in patients with COVID-19. Skin manifestations during the course of a COVID-19 infection was first reported in China, however the prevalence was low at 0.2% cases out of 1099 cases. There is now emerging evidence in literature making reference to some patients experiencing urticaria. Urticaria manifests itself as urticarial plaques that affect the upper dermis which can cover the skin and mucous membranes. It is described as erythematous and pruritic, and can sometimes present with angioedema, a type of swelling of the dermis subcutaneous tissue, the mucosa, and submucosal tissues.

The objective of this systematic review is to review the current literature on urticaria in COVID-19 patients. Furthermore, we aim to provide insight into urticarial pathogenesis and management in such patients.

2. Methods

2.1 Literature Search

This study was done according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method identifying published literature on urticaria and/or angioedema due to COVID-19 infection and its management and outcomes. The comprehensive literature search was carried out with Medline, EMBASE, Scopus, Cochrane database, and Google Scholar, using key MeSH words, which
include “COVID-19,” “Coronavirus”, “SARS-Cov-2”, “Urticaria,” “Angioedema,” “Skin rash”. Manual cross checking of reference lists of relevant articles was performed. All published articles have been reviewed, and the findings have been included in this study. The relevant articles have been cited and referenced within this study. The limits included studies in English and articles published after December 2019 until August 01, 2020. All the relevant articles identified were analysed by two authors, and the results were appropriately summarised and reported.

2.2 Inclusion and Exclusion Criteria

The key inclusion criteria were articles that reported on urticaria and/or angioedema due to COVID-19 infection and reported management and outcome, and studies were excluded if no case or cohort outcomes were observed. Other exclusion criteria were consensus documents, editorials, commentaries, and narrative reviews.

2.3 Data Extraction

All studies were screened by 2 authors independently (E.A. and A.D); disagreement was resolved by consensus or involvement of other authors (R.S. and A.H.). The extracted data then were crosschecked by a third author to validate their accuracy (A.H.).

3. Results
Following an extensive database search, 169 articles were identified. Of these, 34 were selected for full text review based on their title and abstract. Full text screening resulted in the final selection of 25 articles (Figure 1), reporting 26 patients with urticaria and/or angioedema and COVID-19 infection and their management plan and/or response to management. Table 1 includes the summarised key findings of the studies included in this review. All included articles were case reports.

The majority of patients (n=16, 69%) were over 50 years old. However, urticaria in the younger ages was not uncommon, with reported case of 2 months old girl. Skin lesions were reported resolve from less than 24 hours to up to 2 weeks following treatment with antihistamines and/or steroids. There have been no cases of recurrent urticaria or cases non-responsive to steroids.

4. Discussion

4.1 Demographic of COVID-19 patients with urticaria development.

The review population revealed that the majority of patients (18 patients) affected by urticaria were over 50 years old. However, urticaria in the younger ages was not uncommon. Typically, urticaria has a peak onset of 20-40 years and affects females more than males, which was found to be the case in this review. Lifetime incidence of urticaria is reported to be 15%. It has been reported that urticaria may be a rare
manifestation of COVID-19, which has been observed in just under 4% of COVID-19 patients.32

Of note, most case reports have found skin manifestations to not be associated with disease severity32,28 Conversely, a prospective Spanish cohort study reported that the presentation of urticaria and maculopapular skin lesions were associated with higher morbidity (severe COVID-19 illness) and higher mortality rate (2%).33 Further observational studies will aid further understanding of the association of COVID-19 disease progression and dermatological manifestations.

4.2 Pathophysiology of urticaria in COVID-19

The pathophysiology was previously hypothesised to be attributed to drug-induced urticaria. Urticaria is a well-known cutaneous manifestation of a drug eruption [34], however urticaria has been debated in COVID-19 patients as to whether the virus directly results in urticaria, or if urticaria is caused by a drug eruption. There have been reports of COVID-19 positive cases with urticaria, where there had been no changes in their medication regime.25,32 This may suggest that urticaria could be directly related to the pathogenesis of the SARS-CoV2. However, individual case reports have reported urticaria manifestation prior to commencement of therapy for COVID-19 as well as reports of remission from urticaria despite continuation of drug therapy.28 This suggests that urticaria in COVID-19 is likely multifactorial and drug-associated skin manifestations to not account for all cases.
SARS-CoV-2 entry into a cell is mediated through binding to angiotensin-converting enzyme-2 (ACE2) protein and subsequent endocytosis in epithelial targets in the lung. Of note, systemic response may be owed to the presentation of ACE2 on other tissues, including kidney, brain and importantly, the vasculature. Angiotensin (Ang) I and Ang II are deactivated by ACE2 Ang I and Ang II are associated with inflammation, oxidative stress and fibrotic scarring. In the instance of coronavirus infection, the binding of SARS-CoV-2 with ACE2 disrupts normal ACE2 activity. This may result in increased activity of Ang II, leading to formation of reactive oxygen species, disrupt antioxidant and vasodilatory molecules and result in complement activation. Such disrupted physiological processes were observed in a rat model with aberrant expression of Ang II.

COVID-19 associated skin manifestations may be mediated by the systemic inflammatory response that follows the human body’s response to an acute infection. This includes activation of the complement system and adjustment of the cytokine-chemokine milieu. Consequently, this progresses to aberrant activation and sequential degranulation of mast cells. It is hypothesised that mast cell degranulation is the principal pathophysiology associated with subsequent systemic organ damage in COVID-19. Of note, most patients with COVID-19 were reported to have elevated levels of circulating interleukin-6 (IL-6). Furthermore, colocalization of SARS-CoV-2 glycoproteins and respective complement mediators have been reported in peripheral cutaneous blood vessels. Therefore, it is possible that these mediators may be attributed to urticarial pathogenesis.
Urticaria has sometimes been associated with eosinophilia (>500 eosinophils/mm³), which has been observed in a number of COVID-19 cases [43]. Moreover, eosinophilia seems to have a protective mechanism and has been associated with a better prognosis.⁴⁴ There have also been some cases where patients initially presented with urticaria only before experiencing the typical COVID-19 symptoms and testing positive. What was evident in these cases was that they had been taking some form of prescribed medication prior to testing positive to COVID-19.⁴⁵, ⁴⁶ Despite some patients having no medication changes, they still were taking medication at the time of onset of urticaria, suggesting that COVID-19 may cause eosinophilia, resulting in drug hypersensitivity and thus urticaria. However, more research is needed to formally establish this relation.

### 4.3 Diagnosis assessment

It is important to ensure that urticaria is correctly diagnosed so that appropriate treatment can be administered. A diagnostic characteristic of urticaria is that the cutaneous lesions must be evanescent. Multiple case reports have not detailed this characteristic in their studies, so it is important this is taken into consideration. Furthermore, some case reports have mentioned how a skin biopsy for histopathological studies may aid in a diagnosis of urticaria.⁴⁷ One case report has discussed that a skin biopsy of a COVID-19 patient with urticaria revealed perivascular infiltrate of lymphocytes, some eosinophils and upper dermal oedema.⁴⁸ A skin biopsy and awareness of evanescent lesions may allow for the differentiation to be made
between urticaria and other cutaneous manifestations, limiting the chance of a misdiagnosis.

On clinical assessment clinicians should consider the possibility of glucose-6-pyruvate dehydrogenase (G6PD) deficiency in COVID-19 patients as this group of patients may have a dominance of high-producing IL-6 allele. In one study group, this correlation has been reported in 71% of patients.

4.4 Patient management

Classically, the recommended algorithm for treating urticaria includes the use of second-generation antihistamines, and if inadequate control within 2-4 weeks, the dose can be increased up to four times the original dose. If this is still inadequate control after a further 2-4 weeks, specialist referral should be considered, where specialists can consider prescribing omalizumab and ciclosporin to help alleviate symptoms. However, in most patients, second generation oral antihistamines provide adequate control of urticaria. The pathophysiology of COVID-19 related urticaria demonstrates that antihistamines alone will not stop mast cell histamine degranulation but will only act to reduce the severity of urticaria.

Low systemic steroids, on the other hand, targets the COVID-19 inflammatory storm, which prevents mast cell activation, and thus histamine release. Therefore, low dose systemic steroids may be able to effectively manage urticaria in COVID-19 through
their proposed mechanism of action. Combining this with antihistamines can improve patients’ clinical response to urticaria\textsuperscript{9}. A further benefit of low dose steroids, shown through a randomised control trial, has demonstrated an increase in survival rate in COVID-19 patients (Randomised Evaluation of COVID-19 Therapy (RECOVERY), ClinicalTrials.gov Identifier: NCT04381936). Although corticosteroids are promising, it may increase the risk of prolonged viral replication, so it may be best to use them for the shortest duration possible until symptoms are controlled. After this, consideration should be made to promptly switch to omalizumab. Ciclosporin is currently not recommended in COVID-19 patients.\textsuperscript{51}

4.5 Limitations

All included articles were case. Only three case reports detailed pathological study results.\textsuperscript{8,12,27} A diagnostic characteristic of urticaria is that the cutaneous lesions must be evanescent (no one lesion should last more than 24 hours), however this was only noted by Falkenhain-López et al.\textsuperscript{13}

5. Conclusion

Urticaria is a significant manifestation of COVID-19, notably affecting patient morbidity. As such the clinical presentation of urticaria can aid diagnostic assessment, whilst considering risk factors, such as G6PD deficiency and aberrant IL-6 expression. Management of COVID-19 patients should involve antihistamines. Low dose
prednisolone should be considered on an individualised basis. Further research is required in understanding urticarial pathogenesis in COVID-19. This will aid early diagnostic assessment in patients with high index of suspicion and subsequent management in the acute phase.

References


This article is protected by copyright. All rights reserved.


This article is protected by copyright. All rights reserved.

doi:10.1111/ced.14290


doi:10.1111/dth.13575


doi:10.1111/bjd.19168

24. Quintana-Castanedo L, Feito-Rodríguez M, Valero-López I, Chiloeches-Fernández C, Sendagorta-Cudós E, Herranz-Pinto P. Urticarial exanthem as early diagnostic clue for COVID-19 infection [published online ahead of print,


Definition, Classification, Diagnosis and Management of Urticaria. The 2017 Revision and Update. *Allergy.* 2018;73(5):1145-1146. doi:10.1111/all.13414

<table>
<thead>
<tr>
<th>Study</th>
<th>Case characteristics</th>
<th>Cutaneous manifestation</th>
<th>Involvement site</th>
<th>Accompanied by COVID-19 symptoms</th>
<th>Skin biopsy</th>
<th>Medical and drug History</th>
<th>Management</th>
<th>Response to management</th>
<th>Duration of skin lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proietti et al.⁶</td>
<td>6-month-old, male infant</td>
<td>Giant urticaria, with multiple lesion</td>
<td>Mainly affecting the trunk and limbs</td>
<td>Asymptomatic. 2 weeks after covid-19 confirmed by RT-PCR</td>
<td>Not reported</td>
<td>Not correlated with drugs (topical or systemic), bacterial or parasitic infections, inhalant exposure, or insect bites. Allergies such as allergic rhinitis, atopic dermatitis, and food allergy were not reported.</td>
<td>Laboratory findings were within the normal ranges. Betamethasone (soluble tablets, 0.5 mg/day for 7 days)</td>
<td>Clinical improvement following treatment</td>
<td>&lt; 7 days</td>
</tr>
<tr>
<td>Sousa Gonçalves et al.⁷</td>
<td>57-year-old Caucasian man.</td>
<td>Urticarial rash (an erythematous papular rash with irregular contours)</td>
<td>Elbows</td>
<td>6 days after first reporting covid-19 symptoms</td>
<td>Not reported</td>
<td>No newly initiated drugs, Patient did not have atopy or a clinical history of allergy or other conditions</td>
<td>Not reported</td>
<td>Not reported</td>
<td>Not reported</td>
</tr>
<tr>
<td>Rolfo et al.⁸</td>
<td>62-year-old current smoker man with diagnosed</td>
<td>Urticarial papular lesions, with marked itching</td>
<td>Lower dorsal, lumbar and gluteal region</td>
<td>2 days after first reporting covid-19 symptoms. Vasculitis involving the superficial and deep dermis, with signs of</td>
<td>2 days after the last immunotherapy dose - ipilimumab (1 mg/kg every 6 months)</td>
<td>Serial ferritin, D-Dimer (DD), and IL6 in addition to ANAS and C4, to discard</td>
<td>Within 14 days, dominant skin lesions disappeared,</td>
<td>14 days</td>
<td></td>
</tr>
<tr>
<td>Shansh al(^{\text{d}})</td>
<td>31-year-old lady with a 5-year history of well-controlled</td>
<td>Extensive, severely itching urticarial lesions</td>
<td>Mainly concentrated on the trunk and extremities</td>
<td>5 days after first reporting covid-19 symptoms.</td>
<td>Not reported</td>
<td>Non-sedating antihistamines</td>
<td>Low-dose systemic steroid and non-sedating antihistamine</td>
<td>Rash controlled within 5 days</td>
<td>5 days</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>T4N2M1b G3 stage IV squamous cell lung carcinoma with pleuro-pulmonary involvement and minimal erythema</td>
<td>2 days before covid-19 confirmed by RT-PCR</td>
<td>microangi thrombosis, showing fibrinoid changes of vessel wall with some granulomas, neutrophilic infiltrate, and nuclear debris.</td>
<td>weeks) plus nivolumab (3 mg/kg every 2 weeks)</td>
<td>differential diagnoses, were evaluated.</td>
<td>Elevation of ferritin (940 ng/mL) and DD (2,600 ng/dL) was documented</td>
<td>Hydroxychloroquine (400 mg BID on day 1200 mg BID for 14 days)</td>
<td>Azithromycin (500 mg day 1250 mg days 2-5)</td>
<td>Methylprednisolone 1 mg/kg</td>
<td>Enoxaparin 40 mg SC/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>cough and chest CT-scan normalised. ANAS and complement C4 normalised, as were clotting times and fibrinogen. Serial evaluation of IL6 levels by ELISA only had a slightly elevated value of 246 pg/mL (range 6.25-200 pg/ml,) and throughout the 18-day follow-up period there was lymphopenia that became less evident.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Age/Gender</td>
<td>History</td>
<td>Symptoms</td>
<td>Medications</td>
<td>Outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hassan</td>
<td>46-year-old female nurse</td>
<td>with history of hayfever and mild asthma</td>
<td>Widespread urticarial eruption; red-raised blanching and itchy rash with angioedema of lips and hands</td>
<td>3 days before COVID-19 confirmed by RT-PCR</td>
<td>Not carried out</td>
<td>Started fexofenadine hydrochloride 180mg, two to four times per day. Rash worsened following day and was associated with angioedema. Advised to continue taking fexofenadine hydrochloride 180 mg four times per day and she was commenced on prednisolone 40mg once daily for 3 days. Prednisolone helped lip and hand swelling, but rash remained itchy. Chlorphenamine maleate 4mg four times/day was subsequently added. The rash resolved completely over next few days. The patient made a full clinical recovery. Around 14 days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Najafza deh et al.</td>
<td>Elderly man</td>
<td>Pruritic hives 1.5 to 8.0 cm in diameter</td>
<td>Generalised urticaria with angioedema</td>
<td>At same time as COVID-19 symptoms</td>
<td>Not reported</td>
<td>Initial biochemical tests showed low numbers of white blood cells (WBC)</td>
<td>Not reported</td>
<td>Not reported</td>
<td></td>
</tr>
<tr>
<td>de Perosa nz-Lobo et al.¹²</td>
<td>Elderly woman admitted to the hospital with bilateral pneumonia testing positive for COVID-19</td>
<td>Painful erythematous patches which left residual purpura when fading</td>
<td>Trunk, buttocks and hips</td>
<td>&gt; 5 days after first reporting COVID-19 symptoms</td>
<td>Histologic changes characteristic of small-vessel urticarial Vasculitis: blood extravasation and neutrophilic perivascular inflammation with prominent karyorrhexis. There are some macrophages</td>
<td>Treatment with hydroxychloroquine, lopinavir/ritonavir and azithromycin for 5 days</td>
<td>A sudden worsening of respiratory condition led to the patient’s death, and therefore, no treatment could be prescribed.</td>
<td>Mortality</td>
<td>N/A</td>
</tr>
<tr>
<td>Falkenhan-López et al.(^{13})</td>
<td>51-year-old otherwise healthy woman with a 3-day history of dry cough and arthralgias</td>
<td>Widespread pruritic evanescent skin lesions (lasting &lt;24 hours). Multiple well-demarcated erythematous edematous papules and</td>
<td>Trunk, thighs, upper limbs, and predominantly on the facial area and dorsal aspects of bilateral hands</td>
<td>3 days after first reported COVID-19 symptoms and confirmation of COVID-19 by RT-PCR</td>
<td>The patient had not taken any medication before the onset of the symptoms. No recent contact with plants, chemicals, or topical products. No urticarial</td>
<td>Blood test showed lymphopenia and elevated C-reactive protein (5.4 mg/l) and LDH (388 U/l). Chest radiography revealed bilateral pulmonary infiltrates. Early improvement of pruritus and resolution of skin lesions within 2 days. The patient did not experience recurrent episodes of</td>
<td>7 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle-aged man with a 14-day history of fever, cough and anosmia</td>
<td>Erythematous and oedematous plaques with active border and purpuric centre</td>
<td>Buttocks</td>
<td>14 days after first reporting covid-19 symptoms</td>
<td>Evidence of small-vessel damage: preserved epidermis with moderate perivascular neutrophilic inflammation and blood extravasation in the dermis. Endothelial swelling, necrosis and fibrin deposition</td>
<td>Not reported</td>
<td>Therapy with hydroxychloroquine and azithromycin was started as treatment for COVID-19. Prednisone and antihistamines were administered for his skin condition.</td>
<td>14 days later, the patient was asymptomatic.</td>
<td>14 days</td>
<td></td>
</tr>
</tbody>
</table>

This article is protected by copyright. All rights reserved.
<table>
<thead>
<tr>
<th>Goldust et al.14</th>
<th>74-year-old Wuhan man presented with fever (100.4°F), dry cough and fatigue</th>
<th>Diffuse, irregular shaped, partially confluent urticarial weals</th>
<th>Generalized</th>
<th>12 days after admission, first reported COVID-19 symptoms and confirmation of COVID-19 by RT-PCR</th>
<th>Not carried out</th>
<th>Treatment included hydroxychloroquine, lopinavir/ritonavir, thymosin and methylprednisolone. (unclear which medications were started before/after development of urticaria – possible reaction to medication?)</th>
<th>Not reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-year-old subfebrile (98.6°F) Wuhan woman had</td>
<td>Disseminated, variable size, erythematous patches, which fade on</td>
<td>Generalised</td>
<td>1 day after admission</td>
<td>Not carried out</td>
<td>Ruxolitinib</td>
<td>CT scan showed bilateral ground-glass changes.</td>
<td>Not reported</td>
</tr>
</tbody>
</table>

plaques with diffuse underlying erythema

lesions before, and no precipitating factors were found. Review of systems was negative for diarrhea, dysphagia, or other suggestive symptoms of anaphylaxis.

Treatment with loratadine 10 mg every 12 hours

urticaria after 7 days of antihistaminic treatment.

Goldust et al.14 74-year-old Wuhan man presented with fever (100.4°F), dry cough and fatigue

Diffuse, irregular shaped, partially confluent urticarial weals

Generalized

12 days after admission, first reported COVID-19 symptoms and confirmation of COVID-19 by RT-PCR

Not carried out

Treatment included hydroxychloroquine, lopinavir/ritonavir, thymosin and methylprednisolone. (unclear which medications were started before/after development of urticaria – possible reaction to medication?)

Not reported

Not reported
<p>| Aktaş et al.\textsuperscript{15} | 64-year-old female | Severe pink urticarial plaques | Generalised | During course of COVID-19 | Not reported | Metformin and a combination of irbesartan and hydrochlorothiazide treatment for years due to diabetes mellitus and hypertension. No atopy in dermatological examination. Similar reaction occurred 9 years ago lasting a few weeks. | Detailed investigation including thorax computed tomography and testing coronavirus. Treated with hydroxychloroquine, azithromycine, and oseltamivir in intensive care unit for 7 days. As etiology of her diffuse urticaria, viral infection itself, drugs she received, and psychological stress of the clinical condition were considered. Cetirizine 10 mg twice a day. | Urticarial reaction was partially controlled on Cetirizine 10 mg twice a day. | Not reported |
|---|---|---|---|---|---|---|---|---|
| 55-year-old woman | Urticarial skin rash | Generalised | 3 days before admission and | Not reported | No new medication before | High-resolution computed tomography | In the following days urticaria | Not reported |</p>
<table>
<thead>
<tr>
<th>Patient</th>
<th>Skin rash</th>
<th>Skin rash comment</th>
<th>Treatment</th>
<th>Laboratory findings</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>64-year-old patient with acute respiratory distress</td>
<td>Urticarial rash</td>
<td>Generalised</td>
<td>Skin rash was already present at the time of</td>
<td>Treatment with lopinavir/ritonavir and hydroxychloroquine from 1 week,</td>
<td>Blood test revealed abnormal blood count with neutrophil leukocytosis (neutrophil granulocytes)</td>
</tr>
</tbody>
</table>

This article is protected by copyright. All rights reserved.
| Syndrome (PaO₂/FiO₂ ≤ 100 mm Hg) caused by COVID-19 | Hospital admission | and no new drug introduction had been made in the last 3 weeks before skin rash development. No history of allergy to drugs or foods, nor recent intake of new drugs | 8.600/mm³), and mild lymphopenia (lymphocites 700/mm³), moderate increase of pro-calcitonin serum levels (0.87 ng/mL), marked increase of CRP (10.2 mg/dL), and liver enzymes (GOT, GPT, LDH, GGT fourfold levels) serum levels. Mechanical ventilation for respiratory failure. Intravenous administration of methylprednisolone 40 mg/die and bilastine 20 mg/die. | de Medeiros et al.17 | 55 years old female, intensive care physician | 1st episode: Painful erythematous-edematous plaques. Some lesions evolved into bruises. 2nd episode: Exuberant urticarial lesions. Light 1st episode: Flexor face of forearms and leg extensors 2nd episode: Exuberant urticarial lesions on shoulders and inguinal region. Light | 1st episode: 5 days after contact with covid-19 ICU patient 2nd episode: 2 days after second exposure with covid-19 ICU patient. At same time as | Not reported | 1st episode: lesion resolution in 3 days 2nd episode: Within 48 h, there were no more wheals and erythematous-edematous plaques | 1st episode: 3 days 2nd episode: 4 days |

This article is protected by copyright. All rights reserved.
<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Type of Lesion</th>
<th>Location</th>
<th>Associated Symptoms</th>
<th>Treatment and Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cepeda-Valdes et al. 18</td>
<td>Patient 1: 50y</td>
<td>Bilateral disseminated rash characterised by erythematous annular and irregular weals on the skin that appeared suddenly and disappeared within &lt; 24 hours</td>
<td>Hands, wrists, arms, elbows, knees, and ankles</td>
<td>COVID-19 symptoms</td>
<td>Lesions appeared without itching in the antecubital and popliteal fossae. Lesions regressed after the use of betamethasone</td>
</tr>
<tr>
<td></td>
<td>Patient 2: 20y</td>
<td>Pruritic oedematous plaques</td>
<td>Shoulders, elbows, knees and buttocks</td>
<td>After developing COVID-19 symptoms</td>
<td>Antihistamines and moisturizers; 48 hours after treatment was started the urticaria resolved</td>
</tr>
<tr>
<td>Naziroğlu et al. 19</td>
<td>53-year-old male</td>
<td>Generalised</td>
<td>No respiratory or systemic symptoms</td>
<td>No previous history of atopic conditions including drug or food allergy, chronic urticaria.</td>
<td>Treatment was started with diagnosis of COVID-19; On the fourth day of his admission, his skin lesions regressed and he was discharged on the fifth day of his admission</td>
</tr>
<tr>
<td>Name</td>
<td>Age</td>
<td>Gender</td>
<td>Diagnosis</td>
<td>Onset</td>
<td>History of Symptoms</td>
</tr>
<tr>
<td>--------------</td>
<td>-----</td>
<td>--------</td>
<td>-----------------</td>
<td>-------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Gunawan et al.</td>
<td>51</td>
<td>male</td>
<td>Pruritic urticaria</td>
<td>Day 3</td>
<td>Hypertension, diabetes, dyslipidemia and hyperuricemia</td>
</tr>
<tr>
<td>Adelino et al.</td>
<td>30</td>
<td>female</td>
<td>Rapidly spreading wheals.</td>
<td>Day 11</td>
<td>No relevant past medical history except for pine seeds allergy, following a strict nut-free diet since she was diagnosed.</td>
</tr>
</tbody>
</table>
facial angioedema, with preferential involvement of periocular region and mild edema of the lips, without compromise of the tongue, uvula, vocal cords, or the airway.

Family history of hereditary angioedema, Not on any medication. She had not taken nonsteroidal inflammatory drugs or angiotensin-converting enzyme inhibitors the previous 15 days. She had not exercised, had not drunk alcohol, nor was on menstrual period.

| Paolino et al.22 | 37-year-old Caucasian woman, in her 10th postpartum day | cranio-caudal cutaneous manifestation characterized by erythematous maculopapular lesions | Trunk, neck, and face | 3 days after first reporting covid-19 symptoms | Not reported | Acetaminophen | No signs of dyspnea, and the vital signs (including saturation) were all in normal range. A symptomatic treatment with only acetaminophen was prescribed 7th postpartum day prior development of rash. After 8 days, the cutaneous lesions clearly improved along with improvement of the general symptoms and absence of fever and dry cough. 8 days |
Breastfeeding has not been suspended. The newborn did not show any symptom of the disease and did not develop any cutaneous lesion.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Patient's Age</th>
<th>Description of Rash</th>
<th>Duration of Rash</th>
<th>Management of Rash</th>
<th>Resolution of Rash</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahouac h et al.</td>
<td>57-year-old woman</td>
<td>Diffuse fixed erythematous blanching maculopapular lesions</td>
<td>Asymptomatic 48 hours before COVID-19 symptoms</td>
<td>No drug intake, except paracetamol for fever</td>
<td>Fever and rash resolved within 9 days, dry cough within 2 weeks.</td>
<td>9 days</td>
</tr>
<tr>
<td>Quintana-Castanedo et al.</td>
<td>61-year-old male physician</td>
<td>Progressive, mildly itchy urticarial rash consisting of confluent, edematous and erythematous papules</td>
<td>Thighs, arms and forearms. Palms and soles were spared.</td>
<td>No drug during last 2 months</td>
<td>Oral antihistamines</td>
<td>7 days</td>
</tr>
<tr>
<td>Rivera-Oyola et al.</td>
<td>60-year-old woman</td>
<td>Sudden onset mild hemifacial atrophy and scoliosis, generalized, pruritic rash, large,</td>
<td>Trunk, head, upper and lower extremities</td>
<td>Not reported</td>
<td>Fexofenadine</td>
<td>1 day</td>
</tr>
</tbody>
</table>

This article is protected by copyright. All rights reserved.
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Age</th>
<th>Symptoms</th>
<th>Lesions</th>
<th>Onset</th>
<th>Treatment</th>
<th>Resolution</th>
<th>Comorbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morey-Olivé et al. 26</td>
<td>2-month old girl</td>
<td>Acute urticaria, apparently pruritic</td>
<td>Urticarial plaques</td>
<td>4 days after low fever, at the same time with COVID-19 symptoms</td>
<td>Oral symptomatic treatment</td>
<td>Most lesions healed within 24 h, and the cutaneous manifestations resolved in 5 days in the absence of any other signs and symptoms.</td>
<td></td>
</tr>
<tr>
<td>Amatore et al. 27</td>
<td>39-year old male</td>
<td>Erythematous, rash, oedematous non-pruritic annular fixed plaques of various diameters</td>
<td>Urticarial lesions did not recur on her discontinuation of the fexofenadine 1 week after starting.</td>
<td>Not reported</td>
<td>No relevant medical history</td>
<td>No pulmonary symptoms developed.</td>
<td>Rash fully recovered on day 6 of treatment</td>
</tr>
</tbody>
</table>
**van Damm e et al.**<sup>28</sup>  
39-year-old female nurse  
Pruritic urticarial rash  
Generalised  
At same time as COVID-19 symptoms  
Not reported  
No change in her daily habits or drugs  
Bilastine  
Gradual improvement of rash  
Not reported

**Henry et al.**<sup>29</sup>  
27-year-old woman  
Pruritic rash, large, disseminated, urticarial plaques  
Particular face and acral involvement  
48 hours before covid-19 symptoms  
Not reported  
No triggers except for the viral context were found, and common viral serology was negative.  
Paracetamol and oral antihistamines  
Slow improvement symptoms  
Not reported

**Cohen et al.**<sup>30</sup>  
62-year-old man with a history of hypertension  
12 hours of slightly asymmetric, non-pitting oedema of cheeks and lips  
Lip and facial swelling. He had no other sites of swelling and had no rash.  
12 days before covid-19 symptoms  
N/A  
Lisinopril  
Leukocytosis with relative lymphopenia and elevated high-sensitivity C-reactive protein and D-dimer. Functional C1 inhibitor levels (59.7 mg/dL), C3 levels (206 mg/dL), and C4 levels (46 mg/dL) were all elevated.  
By hospital day 2, swelling markedly improved. Discharged home in stable condition.  
2 days
Intravenous methylprednisolone, famotidine, and diphenhydramine. His lisinopril was held.

Figure Legends

Figure 1. Article selection flowchart (PRISMA)