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# Cutaneous manifestations of COVID-19

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## Abstract

The severe acute respiratory syndrome coronavirus two (SARS-CoV-2), which causes the 2019 coronavirus disease (COVID-19), has infected patients worldwide. Physicians have increasingly identified cutaneous findings as a significant clinical manifestation of COVID-19. In this review, we describe the clinical presentation, onset, duration, associated symptoms, treatment, and outcome of cutaneous manifestations thus far reported to be related to COVID-19. We have included data from 63 studies and subdivided reported cutaneous manifestations into the categories of viral exanthem, urticarial, vesicular, chilblains/chilblains-like, non-chilblains vasculopathy-related, pityriasis rosea-like, erythema multiforme-like, Kawasaki/Kawasaki-like disease, and others. Physicians should be aware of the known common cutaneous manifestations of COVID-19 and future research is required to better understand the pathophysiology and prognosis of each COVID-19-related skin manifestation.

*Keywords: COVID-19, SARS-CoV-2, cutaneous manifestations*

## Introduction

The 2019 coronavirus disease (COVID-19), caused by the severe acute respiratory syndrome coronavirus two (SARS-CoV-2), has infected patients worldwide. On March 11, 2020, the World Health Organization (WHO) declared a pandemic. As physicians and scientists work towards learning more about this disease, the literature on cutaneous manifestations associated with COVID-19 continues to grow. Guan et al. reported an early discussion of the topic of cutaneous manifestations in COVID-19 and noted a

skin rash in two of 1,099 (0.2%) COVID-19 patients [1]. Since then, the frequency of cutaneous manifestations amongst patients with COVID-19 continues to rise, as does the morphology types of lesions. In reviewing the global literature, there are patterns that emerge—reports now range from nonspecific morbilliform eruptions to urticaria to vasculopathy-related lesions, amongst others. In this review, we aim to describe the clinical presentation, onset, duration, associated symptoms, treatment, and outcome of cutaneous manifestations thus far reported to be related to COVID-19.

## Methods

In PubMed, we performed a search with the following terms: “(COVID-19 OR SARS-CoV-2) AND (dermatologic OR cutaneous OR skin OR rash OR urticaria OR acral OR pernio OR chilblain OR vesicle OR vesicular OR Kawasaki)” from November 1, 2019 to May 13, 2020. We also manually searched references of relevant articles for studies not initially identified. Data extracted included patient age, sex, COVID-19 status, cutaneous manifestations, timing of cutaneous manifestation, COVID-19 systemic symptoms, treatment for cutaneous manifestation of COVID-19 infection, duration of cutaneous manifestation, and clinical outcome.

## Results

From our literature search, we ultimately included data from 63 studies and reports in this review. We have subdivided reported cutaneous manifestations into the following categories: viral exanthem, urticarial, vesicular, chilblains/chilblains-like, non-chilblains vasculopathy-related, pityriasis rosea-like,

erythema multiforme-like, Kawasaki/Kawasaki-like disease, and other ([Table 1](#)).

### **Viral exanthem**

Eighteen studies reported on viral exanthems or nonspecific rashes associated with SARS-CoV-2 [1-18]. Onset of rash varied between studies, with a majority of patients presenting with rash after COVID-19 systemic symptoms (range: -2 to 30 days). Some studies simply reported "rash" [6], "skin rash" [1], "exanthema" [9], or "faint rash" [14], whereas others reported specific morphologic findings with the eruption, including maculopapular/morbilliform appearance [3,8,10,11,13,15-18] and erythematous plaques [5,7]. Rash was commonly located on the trunk and extremities and pruritus was often reported as an associated symptom. In one report [2], 15.9% of patients with COVID-19 developed an erythematous rash. Most patients had spontaneous resolution of their eruption, although one study reported treatment with IV corticosteroids and antihistamines [8]. Improvement or resolution of rash ranged from 1-10 days and a few patients developed worsening rash [3] or secondary changes such as scale [8].

Histopathological examination [5,7,11,12,16] of tissue samples of patients with viral exanthem/rash commonly demonstrated superficial perivascular lymphocytic infiltrate, papillary dermal edema, and epidermal spongiosis. A few specimens contained aggregates of Langerhans cells [5,16] or lymphocytic exocytosis [5,7]. One study with biopsies from three patients observed swollen vessels in the dermis, some with thrombosis or lymphocytic infiltrate [5].

### **Urticarial eruptions**

Sixteen studies reported urticaria or urticaria-like lesions associated with COVID-19 [2,4,6,9,10,13,15,17,19-26]. The majority of studies reported urticarial lesions occurring after onset of systemic symptoms. However, two reports [4,10] noted cutaneous manifestations presenting before systemic symptoms and six reported urticaria coinciding with onset of COVID-19 symptoms [2,10,17,20,21,23]. Two reports identified COVID-19-confirmed patients with urticaria and without any COVID-19 systemic symptoms [22,25]. Urticarial lesions involved the face, trunk, extremities and some noted that these

were widespread and generalized. Two studies cited an incidence of urticaria amidst patients diagnosed with COVID-19; one study found an incidence of 3.4% [2] and the other a rate of 1.9% [4]. Urticarial rash was either treated with antihistamines or spontaneously improved and/or resolved without treatment. Biopsy of a COVID-19-positive patient with an urticarial rash revealed perivascular lymphocytic infiltrate with eosinophils and upper dermal edema [19].

### **Vesicular eruptions**

Nine reports noted vesicular lesions as cutaneous manifestations of COVID-19 [2,4,6,9,10,15,27-29]. Lesions were categorized as varicella-like or chickenpox-like vesicles [2,6,9,15,27], herpes simplex virus (HSV)-1 reactivation [4], isolated herpetiform lesions [28], oral vesiculobullae [29], or vesicular eruptions [10]. One report noted the vesicular lesions to be small and monomorphic, unlike true varicella [10]. The location of these eruptions included the trunk, less frequently the extremities, and occasionally the oral mucosa. Five reports noted mild pruritus to be associated with the vesicular rash [2,4,10,27,28]. In one study, the incidence of vesicular lesions in COVID-19 patients was 1.1% [2]. Most reports identified that vesicular lesions occurred at the same time or after onset of systemic symptoms; one report described four of 34 patients with cutaneous findings before onset of systemic symptoms [10]. Duration of cutaneous lesions ranged between one and 15 days. One description noted lesions to resolve without scarring [27]. Most often there was spontaneous resolution of vesicular lesions and one series reported treating three patients with vesicular lesions on the oral mucosa with antiseptic mouthwash, hyaluronic acid, or valacyclovir [29].

One report described the results of biopsies from seven of 22 patients who presented with vesicular lesions who had presumed COVID-19 infection. COVID-19 status could not be confirmed owing to primer unavailability. Histopathologic examination seemed consistent with viral infection [27] and showed basket-weave hyperkeratosis, a mildly atrophic epidermis, vacuolization of the basal layer, and multinucleate keratinocytes and dyskeratotic

cells. On higher magnification, the atrophic epidermis contained vacuolar alteration and disorganized keratinocytes, some enlarged and multinucleated, and dyskeratotic cells.

### **Chilblains/chilblains-like eruptions**

Twenty reports described chilblains or chilblains-like lesions during the COVID-19 era [4,6,9,10,15,30-44]. Lesions were described as erythematous-to-violaceous papules or plaques on acral regions, some associated with pruritus or pain. Vesicles, pustules, and bullae could also accompany chilblains-like lesions [10,32]. One series found an incidence rate of 2.9% amongst COVID-19 patients [4], whereas another described the incidence of chilblains-like lesion to be 27.5% [34]. However, the latter also included many patients not confirmed for SARS-CoV-2 infection. Several reports indicated that lesions appeared after patients presented with systemic symptoms. There was a latency range of one to three weeks between general symptoms and chilblains/chilblains-like lesion appearance [30,32,34,35]. However, many also observed that patients were asymptomatic or having mild symptoms when cutaneous lesions appeared [4,10,32,34,35,38,39,41,43]. Two patients presented with chilblains-like lesions before onset of systemic symptoms [36,37]. Many reports did not mention treatment specifically for skin lesions—three reported using topical corticosteroids owing to associated pruritus or progression to firm plaques [30,39,42], whereas another reportedly treated acral lesions with emollients [35]. Chilblains/chilblains-like lesions typically resolved spontaneously; the duration of lesions was generally between a couple of days [37,39] and 2-4 weeks [10,32,38,40,42,44]. Interestingly, patients with chilblains-like lesions were generally younger patients [4] and 12 reports described chilblains-like lesions in pediatric patients [4,32,33,35-43].

Common histological features included vacuolar changes in the epidermis, lymphocytic infiltrate in the superficial and deep dermis in a perivascular or periadnexal pattern, and dermal edema [15,32,37,40-44]. Three reports noted features of vasculitis or vasculopathy in biopsy specimens [37,41,42]. There were mixed findings of thrombosis

in chilblains-like lesions. Two reports noted vascular microthrombi or thrombosis in dermal capillaries [15,42] and two found no evidence of thrombosis or microthrombi [41,44].

### **Non-chilblains vasculopathy-related eruptions**

Fourteen reports presented non-chilblains vasculopathy-related cutaneous findings during the COVID-19 pandemic [9,10,15,26,32,35,45-52]. These cutaneous findings included petechiae, purpura, livedo, acrocyanosis, thrombosis/ischemia, and dry gangrene/necrosis. Location of cutaneous findings varied with the rash morphology. Livedo often occurred on the trunk, arms, or legs; acrocyanosis occurred on the toes; ischemia or necrosis occurred on the fingers or toes; purpura was often located on the buttocks. Most skin findings occurred after the onset of COVID-19 systemic symptoms, but two reports noted a few cases in which lesions appeared before general symptoms [10,45]. Several publications associated patients presenting with purpura, ischemia, or necrosis/dry gangrene with respiratory failure [26] and/or concomitantly requiring mechanical ventilation for significant hypoxia [47,50-52]. Most did not describe specific treatments for cutaneous findings. Topical corticosteroids for skin manifestations were reported twice [26,48]. Duration of lesions ranged between one day and four weeks. Two reports noted patients with positive antiphospholipid antibodies after COVID-19 infection was confirmed [51,52].

Two reports included results from biopsies on patients with non-chilblains vasculopathy-related cutaneous findings. A biopsy from a patient who presented with petechiae revealed superficial perivascular infiltrate of lymphocytes with significant red cell extravasation and dermal papillary edema, parakeratosis, and dyskeratotic cells, without thrombotic vasculopathy [48]. Skin biopsies from three different patients requiring ventilation who had purpura were also performed. One biopsy showed thrombogenic vasculopathy with necrosis of the epidermis and adnexal structures, interstitial neutrophils, and leukocytoclasia [47]. The other two biopsies showed thrombotic vessels in the deep dermis. Immunohistochemistry for all three patients revealed extensive vascular deposits of C5b-9.

### **Pityriasis rosea-like eruptions**

Four reports described patients who developed cutaneous manifestations resembling pityriasis rosea [6,10,53,54]. The rash appeared between 3-7 days after onset of general COVID-19 symptoms [53,54]. Biopsy in one patient demonstrated epidermal spongiosis and parakeratosis, nests of Langerhans cells and lymphocytes, papillary dermal edema, and a dermal infiltrate of lymphocytes and histiocytes [53].

### **Erythema multiforme (EM)-like eruptions**

Targetoid lesions or erythema multiforme (EM)-like eruption in patients with COVID-19 were noted in 8 reports [10,29,32,34,42,55-57]. One large series reported 37 patients with erythema multiforme (EM)-like lesions that were smaller than classic EM, less widespread, and not typical targetoid [34]. Lesions typically appeared two to three weeks after onset of systemic symptoms [55-57] and treatment options included systemic corticosteroids [55]. Histopathologic examination of EM-like lesions in four patients demonstrated epidermal spongiosis, dilated vessels in the dermis with neutrophilic infiltrate, perivascular lymphocytic infiltrate, and red blood cell extravasation [55].

### **Kawasaki/Kawasaki-like disease (multisystem inflammatory syndrome in children)**

Three reports presented children with COVID-19 who developed clinical manifestations of Kawasaki disease or Kawasaki-like disease [58-60]. One 6-month-old presented with a blotchy, erythematous rash and later developed conjunctivitis, prominent tongue papillae, and swelling of the hands and legs, consistent with Kawasaki disease [58]. The patient subsequently tested positive for COVID-19 on the evening of hospital discharge. Another publication observed a 30-fold increase in the incidence of Kawasaki-like disease during the COVID-19 era as compared to pre-COVID-19 [60]. Patients with COVID-19 and Kawasaki-like disease were also typically older than children with Kawasaki disease before the COVID-19 era, had more cardiac involvement, and more often required adjunctive steroid treatment, suggesting that patients infected with SARS-CoV-2 may have developed a more severe course of Kawasaki-like disease.

### **Other**

Other cutaneous manifestations associated with COVID-19 reported in the literature include conjunctivitis with eyelid dermatitis [61], symmetrical drug-related intertriginous and flexural exanthem (SDRIFE), [62], periorbital dyschromia [63], eczema-like rashes [15], angiomatic lesions [15], and annular lesions [15]. Interestingly, two patients who developed periorbital dyschromia developed the cutaneous manifestations two days before developing general COVID-19 symptoms. After complete resolution, both patients had recurrence of both periorbital lesions and COVID-19 general symptoms [63]. During the second phase, the periorbital dyschromia again preceded each patient's systemic symptoms.

### **Discussion**

Cutaneous lesions are quickly becoming recognized by physicians as a significant clinical manifestation of COVID-19, with the most common presentations being viral exanthem/rash, urticaria, and, in young adults and children, chilblains-like lesions. Vesicles, non-chilblains vasculopathy-related lesions, and Kawasaki-like disease (multisystem inflammatory syndrome) are less commonly reported. Importantly, skin manifestations can occur in the absence of fever or respiratory symptoms. Thus, cutaneous manifestations can serve as an additional sign of COVID-19, prompting physicians to consider testing patients with skin findings for infection. Rapid diagnosis and treatment can help improve outcomes for patients with COVID-19.

Primary viral exanthems can consist of maculopapular/morbilliform or erythematous plaques on the trunk and extremities and are often associated with pruritus. Most of these eruptions spontaneously resolved without additional treatment. Interestingly, one patient with an erythematous maculopapular rash was 10 days postpartum [13]. Postpartum mothers are at increased risk of morbidity and mortality from influenza-like infections [64] and providers should take extra precautions for this vulnerable population during the COVID-19 pandemic.

Acute urticaria has been reported in association with other coronaviruses [65]. Urticaria related to COVID-19 typically resolves spontaneously and patients with associated pruritus often improved on antihistamines.

Eighteen reports discussed pediatric patients with COVID-19-related skin lesions [4,17,32,33,35-43,56,58-61]. The youngest patient with cutaneous manifestations associated with COVID-19 was two months old [17]. Pediatric cutaneous manifestations included conjunctivitis with eyelid dermatitis [61], maculopapular rash [17], urticaria [17], and erythema multiforme-like lesions [42,56]. The most common cutaneous presentation in children and young adults was chilblains or chilblains-like lesions. Patients who presented with chilblains-like lesions were often asymptomatic from COVID-19 symptoms [4]. Interestingly, although classic chilblains often occur during cold weather [66,67], COVID-19 patients presented with lesions during warm periods. It is important for providers to be aware of chilblains-like lesions as a potential presenting symptom of COVID-19 infection to initiate prompt screening, diagnosis, and potential containment measures.

Studies also less commonly reported a pityriasis rosea-like rash in COVID-19 patients, as well as an EM-like eruption. Physicians should be aware of these two recognizable morphologies as a possible indicator of COVID-19 infection.

Kawasaki disease or Kawasaki-like disease (multisystem inflammatory syndrome) in COVID-19 pediatric patients has recently garnered media attention. However, although some studies suggest that there may be a causal relationship between COVID-19 and Kawasaki-like disease, other authors urge caution in prematurely associating the two [68].

The mechanisms behind COVID-19-associated cutaneous manifestations are not known. Most theories implicate the immune system as the driver of skin findings in COVID-19 patients. One hypothesis is that cutaneous lesions are related to an immunologic reaction to viral particles in blood vessels in the skin, leading to a lymphocytic vasculitis [18]. A second theory suggests that Langerhans cells are activated in response to the virus, thereby

causing spongiosis and vasodilation [18]. Biopsy samples have demonstrated aggregates of Langerhans cells in COVID-19 patients [5,16,53]. Thirdly, complement activation may play a role in mediating tissue damage in COVID-19, leading to microthrombotic disease in the lung and skin [47]. Retiform purpura and livedo are cutaneous manifestations of occlusive microthrombotic disease, as seen in three patients who also demonstrated microvasculature complement deposition in skin biopsies [47]. These patients also had associated elevated d-dimers, consistent with complement-mediated endothelial cell injury and clotting pathway activation [47]. Moreover, C5b-9 vascular deposition is also a feature of antiphospholipid syndrome and two reports identified COVID-19 patients with ischemia and/or necrosis of the skin who were subsequently found to have antiphospholipid antibodies [51,52]. Although antiphospholipid antibodies can transiently arise in critically ill patients with various infections [69], complement activation in COVID-19 patients may also play a role in antiphospholipid antibody positivity. Whether one or all four of these theories are at play remains to be solved.

Whereas few have studied whether cutaneous manifestations in COVID-19 are associated with severity of respiratory symptoms and prognosis, some patterns have been presented. Urticaria and chickenpox-like vesicles were not correlated with COVID-19 disease severity [2]. Results are conflicting from the two series looking at whether morbilliform rash is associated with worse outcomes [2,10]. Chilblains-like lesions often occurred in younger patients, who have a better prognosis than older patients [70]. Elevated levels of prothrombin time and d-dimer have been associated with a worse prognosis in COVID-19 patients and consequently microthrombotic cutaneous findings seemed to indicate a worse prognosis [71].

One limitation of this review is that some studies did not confirm COVID-19 infection in some patients. However, patients with swab negativity could also represent early clearance of the virus after a short asymptomatic course, particularly in otherwise young, healthy patients. Additionally, COVID-19 was

not always confirmed in certain facilities owing to limited or lack of testing resources [27]. Some countries reserved testing for patients with respiratory symptoms or for those who required hospitalization. Thus, patients who were asymptomatic or had mild symptoms were not always tested [4,10]. Another limitation is that many reports cited in this review consisted of case reports. However, many of the case reports described overlapping or similar features.

## Conclusion

Physicians should be aware of common cutaneous manifestations of COVID-19. Skin lesions often self-

resolve between 1-4 weeks. Younger patients may be relatively asymptomatic but present with cutaneous findings of chilblains-like features on acral regions. Patients with severe infection requiring mechanical ventilation can present with microthrombotic morphology (purpura, livedo, or necrosis). Further research is required to better understand the pathophysiology and prognosis of each COVID-19-related skin manifestations, as well as the kinetics of SARS-CoV-2 in association with cutaneous findings.

## Potential conflicts of interest

The authors declare no conflicts of interests.

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**Table 1.** Reports of cutaneous manifestations of COVID-19.

Viral exanthem										
Study	# patients (%)	Age, sex	COVID-19 status	Cutaneous manifestation	Time of onset	Systemic Sx	Cutaneous treatment	COVID-19 treatment	Duration of cutaneous manifestation	Clinical outcome
Guan et al. [1]	2/1,099 (0.2%)	-	Confirmed with PCR	Skin rash	-	-	-	-	-	-
Recalcati [2]*	18/88 (20.4%)	-	Positive	Erythematous rash (n=14), urticaria (n=3), chickenpox-like vesicles (n=1) on trunk, few with mild itching	With (n=8) or after (n=10) onset of Sx		-	-	-	Rash usually resolved within a couple of days
Hunt and Koziatek [3]	1	20, M	Confirmed with PCR	Generalized morbilliform rash on trunk and extremities	Same time as fever	Fever → tachycardia, hypotension, hypoxemia	-	-	-	Rash worsened 6 days later; hospitalized in ICU
Hedou et al. [4]*	5/103 (4.9%)	-	Confirmed with PCR	Erythematous rash (n=2), urticaria (n=2), HSV-1 reactivation (n=1), pruritus (n=5)	Before (n=1 [urticaria]) or after (n=4) onset of Sx	-	-	-	Median: 2 days (range: 1-6 days)	Rash resolved
Gianotti et al. [5]	3	59, F	Confirmed with PCR	Erythematous macules on arms, trunk, lower legs	3 days after admission	Respiratory Sx	-	Lopinavir-ritonavir, heparin, levofloxacin	-	Recovering
		89, F	Confirmed with PCR	Erythematous papules coalescing into plaques on chest and abdomen	~1 week after onset of Sx upon admission to ICU	Fever, cough	-	Ceftriaxone, azithromycin	8 days	Rash resolved

		57, M	Confirmed with PCR	Diffuse, pruritic erythematous macules and papules on trunk	2 days before onset of Sx	Fever, headache, cough, arthralgias	-	HCQ, levofloxacin	-	Improvement of rash 10 days later
Duong et al. [6]*	295	-	Not Confirmed	Chilblains or chilblain-like lesions (n=146), urticaria or rash or chickenpox-like lesions or pityriasis rosea (n=149)	-	-	-	-	-	-
Amatore et al. [7]	1	39, M	Confirmed with PCR	Erythematous-edematous, non-pruritic, annular plaques on upper limbs, chest, neck, abdomen, palms	Same time as onset of Sx	Fever	-	HCQ	7 days	Rash resolved
Avellana Moreno et al. [8]	1	32, F	Confirmed with PCR	Pruritic, morbilliform rash with petechial and maculopapular lesions on an erythematous base and cephalon-caudal progression	6 days after onset of Sx	Fever, myalgia, asthenia → cough, diarrhea	IV corticosteroid and antihistamine	-	-	Scaly reaction 4 days after onset of rash
Bouaziz et al. [9]*	14	-	Confirmed with PCR	Exanthema (n=4), chicken-pox like vesicles (n=2), cold urticaria (n=1), vascular lesions (n=7) including violaceous "porcelain-like" macules, livedo,	After onset of Sx	-	-	-	-	-

				non-necrotic purpura, necrotic purpura, chilblain-like with Raynaud chilblain, eruptive cherry angioma						
Galván Casas et al. [10]*	176 of 375 cases	Mean age: 55.3, 56% F	Confirmed (n=122) or suspected (n=54)	Maculopapular lesions: perifollicular distribution, pityriasis rosea-like, purpura may be present, infiltrated papules on extremities, erythema elevatum diutinum or erythema multiforme	Before (n=8), same time (n=108), or after (n=60) as onset of Sx	Cough (n=135), dyspnea (n=100), fever (n=140), asthenia (n=110), headache (n=55), GI disturbance (n=58), anosmia/ageusia (n=40), pneumonia (n=110)	-	Paracetamol (n=82), NSAIDs (n=16), chloroquine/HCQ (n=79), lopinavir/ritonavir (n=54), systemic steroids (n=21), tocilizumab (n=9), azithromycin (n=39), ICU/ventilator (n=21)	Mean: 8.6 days	Associated with more severe COVID-19 disease; patient survival (n=172)
Ahouach et al. [11]	1	57, F	Confirmed with PCR	Diffuse erythematous maculopapular blanching lesions on limbs and trunk with burning sensation on palms	2 days after onset of fever	Fever, dry cough	-	Paracetamol	9 days	Fever and rash resolved in 9 days; dry cough resolved in 2 weeks
Zengarini et al. [12]	1	67, F	Confirmed with PCR	Moderately pruritic, erythematous, confluent rash with diffuse margins on neck, trunk, back, proximal	1 month after hospital admission with fever recurrence	Fever, dyspnea	-	HCQ, piperacillin/tazobactam, remdesivir, enoxaparin	1 week	Intubated before rash; respiratory function improved 1 month later; rash and

				portions of upper and lower extremities						fever resolved
Paolino et al. [13]*	1	37, F	Clinical diagnosis, close contact with positive patient	Erythematous maculopapular lesions on trunk, neck, face; urticarial-like lesions on lower limbs, nonpruritic	3 days after onset of Sx and 10 days postpartum	Fever, dry cough, myalgia, arthralgia	-	Acetaminophen	-	Clear improvement in rash after 8 days
Hoehl et al. [14]	1/2 (50%)		Confirmed with PCR	Faint rash	-	-	-	-	-	Afebrile 7 days after admission
Sachdeva et al. [18]	3	71, F	Confirmed with swab	Pruritic, maculopapular rash on trunk resembling Grover disease	After recovery from systemic Sx	Fever, productive cough, SOB, bilateral pneumonia	-	Lopinavir/ritonavir, HCQ	-	Recovered from general Sx
		77, F	Confirmed with swab	Morbilliform rash on trunk → macular hemorrhagic rash on bilateral legs	Same time as onset of Sx	Fever, cough, lymphadenopathy	-	Lopinavir/ritonavir, HCQ, LMWH	-	Gradual improvement of skin lesions
		72, F	Confirmed with swab	Papulo-vesicular, pruritic rash on sub-mammary folds, trunks, hips	4 days after onset of Sx	Headache, arthralgia, myalgia, fever	-	-	10 days	Remission of rash and general Sx
de Masson et al. [15]*	277	Median age: 27 (range: 2-98); 50% F	Confirmed with PCR (n=25), suspected or close contact (n=115), negative (n=9)	Urticarial (n=26), vesicular (n=41), acral (n=142), morbilliform (n=25) on trunk, limbs, rarely face, petechial (n=7), livedo reticularis (n=4), other (n=41)	-	Fever (n=48), respiratory Sx (n=44), anosmia/ageusia(n=18), GI Sx (n=16)	-	-	-	-

Gianotti, et al. [16]	8	-	Positive	Diffuse maculopapular eruption of trunk suggestive for Grover disease (n=2); papular erythematous exanthem (n=1); severe macular hemorrhagic eruption (n=1)	Same time as systemic Sx (n=2); during hospitalization (n=6)	Fever, sore throat, cough (n=2)	-	Levofloxacin (n=6), HCQ (n=6)	-	ICU (n=1)
Morey-Olivé et al. [17]*	1 of 2 cases	6, M	Confirmed with PCR	Erythematous, nonpruritic, confluent maculopapular rash started on trunk and neck and progressed to cheeks, extremities, palms	2 days after onset of fever	Fever, worsening cholestasis, cytolytic hepatitis	-	-	5 days	Rash resolved
<b>Urticaria / urticarial-like lesions</b>										
Study	# patients (%)	Age, sex	COVID-19 status	Cutaneous manifestation	Time of onset	Systemic Sx	Cutaneous treatment	COVID-19 treatment	Duration of cutaneous manifestation	Clinical outcome
Recalcati [2]*	18/88 (20.4%)	-	Positive	Erythematous rash (n=14), urticaria (n=3), chickenpox-like vesicles (n=1) on trunk, few with mild itching	With or after onset of Sx	-	-	-	Usually resolved within a couple of days	-
Fernandez-Nieto et al. [19]	1	32, F	Positive	Urticarial rash	6 days after onset of Sx	-	Oral antihistamine	HCQ, azithromycin	-	Clinical and symptomatic improvement 5 days later

Henry et al.[20]	1	27, F	Confirmed with PCR	Urticaria with face and acral involvement	Same time as onset of Sx (odynophagia, diffuse arthralgia)	Odynophagia, diffuse arthralgia, chills → chest pain, fever	Antihistamine	Paracetamol	-	Gradual improvement of symptoms
Hedou et al.[4]*	5/103 (4.9%)	-	Confirmed with PCR	Erythematous rash (n=2), urticaria (n=2), HSV-1 reactivation (n=1), pruritus (n=5)	Before (n=1 [urticaria]) or after (n=4) onset of Sx	-	-	-	Median: 2 days (range: 1-6 days)	Rash resolved
van Damme et al.[21]	2	71, M	Confirmed with PCR	Extensive, generalized acute urticaria	Same time as onset of Sx (weakness, pyrexia)	Weakness, pyrexia → hypoxemia, unilateral ankle pain, constipation, chest pain, atrial fibrillation, tachycardia	Bilastine	-	-	Improvement in rash, died from respiratory failure
		39, F	Not Confirmed, positive family member	Pruritic urticarial rash that started on arms and progressed to generalized	Same time as onset of Sx (pyrexia, chills, myalgia, headache)	Fever, chills, myalgia, headache, rhinorrhea, dry cough, dyspnea → anosmia, ageusia	Bilastine	-	-	Improvement in rash
Duong et al.[6]*	295	-	Not Confirmed	Chilblains or chilblain-like lesions (n=146), urticaria or rash or chickenpox-like lesions or pityriasis rosea (n=149)	-	-	-	-	-	-

Bouaziz et al. [9]*	14	-	Confirmed with PCR	Exanthema (n=4), chicken-pox like vesicles (n=2), cold urticaria (n=1), vascular lesions (n=7) including violaceous “porcelain-like” macules, livedo, non-necrotic purpura, necrotic purpura, chilblain-like with Raynaud, chilblain, eruptive cherry angioma	After onset of Sx	-	-	-	-	-
Galván Casas et al. [10]*	73 of 375 cases	Mean: 48.7, 64% F	Confirmed with PCR (n=49) or suspected positive (n=24)	Urticarial lesions: mostly on trunk or widespread, few cases on palms, associated with pruritus (92%)	Before (n=3), same time (n=43), or after (n=25) onset of Sx	Cough (n=48), dyspnea (n=30), fever (n=55), asthenia (n=47), headache (n=24), GI disturbance (n=18), anosmia/ageusia (n=21), pneumonia (n=38)	-	Paracetamol (n=33), NSAIDs (n=6), chloroquine/HCQ (n=23), lopinavir/ritonavir (n=13), tocilizumab (n=4), systemic steroids (n=7), azithromycin (n=13), ICU/ventilator (n=8)	Mean: 6.8 days	Associated with more severe COVID-19 disease; all patients survived
Quintana-Castanedo et al. [22]	1	61, M	Confirmed with PCR	Urticarial rash of mildly pruritic, confluent, edematous, and erythematous papules on thighs, arms, forearms	4 days before testing positive	Asymptomatic	Oral antihistamine	-	7 days	Rash resolved, remained afebrile



Paolino et al. [13]*	1	37, F	Clinical diagnosis, close contact with positive patient	Erythematous maculopapular lesions on trunk, neck, face; urticarial-like lesions on lower limbs, nonpruritic	3 days after onset of Sx and 10 days postpartum	Fever, dry cough, myalgia, arthralgia	-	Acetaminophen	-	Clear improvement in rash and general Sx after 8 days
Lu et al. [23]	1	-	Clinically diagnosed based on CT and close contact hx	Systemic erythema consistent with urticaria; rash on limbs	~Same time as onset of Sx (dry cough)	Dry cough	Anti-allergy	Ribavirin, interferon atomization	-	Rash resolved
Castelnovo et al. [26]*	1 of 2 cases	-	-	Widespread urticaria of thigh and perimalleolar area	-	Lung involvement	-	-	Few days	Rash resolved
de Masson et al. [15]*	277	Median age: 27 (range: 2-98); 50% F	Confirmed with PCR (n=25), suspected or close contact (n=115), negative (n=9)	Urticarial (n=26) on trunk, limbs, rarely face, vesicular (n=41), acral (n=142), morbilliform (n=25), petechial (n=7), livedo reticularis (n=4), other (n=41)	-	Fever (n=48), respiratory Sx (n=44), anosmia/ageusia (n=18), GI Sx (n=16)	-	-	-	-
Gunawan et al. [24]	1	51, M	Confirmed with PCR	Pruritic urticaria involving face	5 days after onset of Sx	Fever, cough, dyspnea, diarrhea	Loratadine	Azithromycin, HCQ, cefoperazone-sulbactam	-	Rash improved
Naziroğlu et al. [25]	1	53, M	Confirmed with PCR	Acute urticaria: pruritic, edematous plaques	-	Asymptomatic	-	"Treatment started for COVID-19 pneumonia"	6 days	Rash resolved and discharged after 5 days in the hospital

Morey-Olivé et al. [17]*	1 of 2 cases	2 mo., F	Confirmed with PCR	Acute, pruritic urticaria on face, upper extremities that progressed to trunk and lower extremities	Same time as onset of fever	Fever	-	Symptomatic treatment	5 days	Rash resolved
<b>Vesicles / vesicular-like lesions</b>										
Study	# patients (%)	Age, sex	COVID-19 status	Cutaneous manifestation	Time of onset	Systemic Sx	Cutaneous treatment	COVID-19 treatment	Duration of cutaneous manifestation	Clinical outcome
Recalcati [2]*	18/88 (20.4%)	-	Positive	Erythematous rash (n=14), urticaria (n=3), chickenpox-like vesicles (n=1) on trunk, few with mild itching	Same time or after	-	-	-	Usually resolved within a couple of days	-
Marzano et al. [27]	22	Median age: 60, 27.3% F	Not Confirmed	Varicella-like exanthem: scattered (n=16), diffuse (n=6), vesicles (n=12), mild pruritus (n=9), on trunk (n=22) and/or limbs (n=4)	Median: 3 days after onset of Sx (range: -2 – 12 days)	Fever (n=21), cough (n=16), headache (n=11), weakness (n=11), coryza (n=10), dyspnea (n=9), hyposmia (n=4), hypogeusia (n=4), pharyngodynia (n=1), diarrhea (n=1), myalgia (n=1)	-	-	Median: 8 days (range: 4–15 days)	Death (n=3)
Hedou et al. [4]*	5/103 (4.9%)	-	Confirmed with PCR	Erythematous rash (n=2), urticaria (n=2), HSV-1 reactivation	Before (n=1 [urticaria]) or after (n=4)	-	-	-	Median: 2 days (range: 1-6 days)	Resolved

				(n=1), pruritus (n=5)	onset of Sx					
Duong et al. [6]*	295	-	Not Confirmed	Chilblains or chilblain-like lesions (n=146), urticaria or rash or chickenpox-like lesions or pityriasis rosea (n=149)	-	-	-	-	-	-
Tammaro et al. [28]	2/130 (1.5%)	-	Positive	Isolated herpetiform lesions: mildly pruritic vesicles with erythematous halo, with or without crust on trunk	During inpatient stay	-	-	-	-	-
	1	-	Positive	Numerous vesicular lesions on back	8 days after diagnosis of COVID-19	-	-	-	-	-
Bouaziz et al. [9]*	14	-	Confirmed with PCR	Exanthema (n=4), chickenpox like vesicles (n=2), cold urticaria (n=1), vascular lesions (n=7) including violaceous "porcelain-like" macules, livedo, non-necrotic purpura, necrotic purpura, chilblain-like with Raynaud, chilblain,	After onset of Sx	-	-	-	-	-

				eruptive cherry angioma						
Galván Casas et al. [10]*	34 of 375 cases	Mean age: 45.6, 56% F	Confirmed with PCR (n=17) or suspected positive (n=17)	Vesicular eruptions: small, monomorphic vesicles on trunk, sometimes on limbs, hemorrhagic content, or large and diffuse, associated with pruritus (n=23), pain (n=3), burning (n=2)	Before (n=5), same time (n=19), or after (n=10) onset of Sx	Cough (n=25), dyspnea (n=12), fever (n=24), asthenia (n=21), headache (n=12), GI disturbance (n=8), anosmia/ageusia (n=10), pneumonia (n=10)	-	Paracetamol (n=21), NSAIDs (n=2), chloroquine/HCQ (n=7), lopinavir/ritonavir (n=2), tocilizumab (n=1), systemic steroids (n=3), azithromycin (n=7), ICU/ventilator (n=2)	Mean = 10.4 days	All patients survived
Martín Carreras-Presas et al. [29]*	3	56, M	Suspected	Ulcers resembling herpetic recurrent stomatitis, associated with pain and sore throat	2 days after onset of systemic Sx	Asthenia, fever, hyposmia, dysgeusia, lymphadenopathy	Valacyclovir, topical antiseptics with chlorhexidine and hyaluronic acid	-	10 days	Full recovery of oral lesions
		58, M	Suspected	Multiple small ulcers on palate with unilateral affection, associated with pain	-	-	Topical antiseptic mouthwash	-	1 week	Lesions resolved
		65, F	Clinically diagnosed	Rash under breasts, back, genital area → blisters on internal lip mucosa, desquamative gingivitis, compatible with erythema multiforme	Rash 23 days after onset of Sx; oral lesions 1 week after rash	High fever, diarrhea, pain on tongue → bilateral pneumonia	Hyaluronic acid, chlorhexidine mouthwash	Antibiotics, corticosteroids, lopinavir/ritonavir, HCQ	-	Oral lesions improved within 3 days

de Masson et al. [15]*	277	Median age: 27 (range: 2-98), 50% F	Confirmed with PCR (n=25), suspected or close contact (n=115), negative (n=9)	Urticarial (n=26), vesicular (n=41) consisting of varicella-like on trunk and limbs (n=21) and acral dyshidrosis-like (n=20), acral (n=142), morbilliform (n=25), petechial (n=7), livedo reticularis (n=4), other (n=41)	-	Fever (n=48), respiratory Sx (n=44), anosmia/ageusia (n=18), GI Sx (n=16)	-	-	-	-
<b>Chilblains / chilblains-like</b>										
Study	# patients (%)	Age, sex	COVID-19 status	Cutaneous manifestation	Time of onset	Systemic Sx	Cutaneous treatment	COVID-19 treatment	Duration of cutaneous manifestation	Clinical outcome
Estébanez et al. [30]	1	28, F	Positive	Confluent erythematous/ yellow papules, pruritic on bilateral heels	13 days after testing positive	Dry cough, nasal congestion, fatigue, myalgias, arthralgias, diarrhea, ageusia, anosmia	Topical corticosteroid	Paracetamol	-	Progressed to erythematous, pruritic, hardened plaques 3 days later
Hedou et al. [4]*	3	Age range: 14-22	Not Confirmed	Red to purple maculopapular rash with or without vesicular lesions on toes with pain and chill burns	-	Asymptomatic	-	-	-	-
Alramthan and	2	27, F	Confirmed with PCR	Chilblains-like: red to purple papules on	-	-	-	-	-	-

Aldaraji [31]				dorsal fingers bilaterally						
		35, F	Confirmed with PCR	Chilblains-like: red to purple papules with diffuse erythema on dorsal fingers bilaterally and subungual area of right thumb	-	-	-	-	-	-
Duong et al. [6]*	295	-	Not Confirmed	Chilblains or chilblain-like lesions (n=146), urticaria or rash or chickenpox-like lesions or pityriasis rosea (n=149)	-	-	-	-	-	-
Recalcati et al.[32]*	14	Mean age: 14.4 (n=11), 29 (n=3); 57.1% F	Not Confirmed	Acral eruption of erythematous and violaceous papules and macules, some with bullous evolution or digital swelling; erythematous papular targetoid lesions on hands and elbows (n=2), mild pruritus (n=3)	3 weeks after onset of Sx (n=3)	Cough, fever, often asymptomatic	-	-	2-4 weeks	Skin lesions resolved without treatment
Bouaziz et al. [9]*	14	-	Confirmed with PCR	Exanthema (n=4), chicken-pox like vesicles (n=2), cold urticaria (n=1), vascular lesions (n=7) including violaceous	After onset of Sx	-	-	-	-	-

				“porcelain-like” macules, livedo, non-necrotic purpura, necrotic purpura, chilblain-like with Raynaud, chilblain, eruptive cherry angioma						
Piccolo et al. [33]	63	Median age: 14, 57.4% F	Confirmed with PCR (n=2), not confirmed (n=61)	Chilblain-like lesions: erythematous-edematous lesions (n=31/54), blistering (n=23/54), pain (27%), pruritis (27%), pain+pruritus (20.6%), asymptomatic (25.4%), feet (85.7%), feet+hands (7%), hands (6%)	After onset of systemic Sx in most cases	GI Sx (11.1%), respiratory Sx (7.9%), fever (4.8%)	-	-	-	Resolved (6.3%), stable (79.4%), relapsing (14.3%)
Fernandez-Nieto et al. [34]*	132/346 (38.2%)	Mean: 19.9, 46.2% F	Confirmed with PCR (n=2/11), clinically diagnosis (n=19), close contact with positive patient (n=54), close	Acro-ischemic lesions: -chilblain-like (n=95) red to purple macules, plaques, or nodules on distal toes/fingers -erythema multiforme-like (n=37) round erythematous macules and	Same time as systemic Sx (n=3) or after Sx with mean latency time 9.2 days (n=16)	-	-	-	Mean: 8.7 days (range 2-24 days)	-

			contact with healthcare worker (n=28)	vesicles that could coalesce; lesions smaller than classic erythema multiforme, not typical targetoid, less widespread; presented on elbows, knees, ears (n=2)						
Galván Casas et al. [10]*	71 of 375 cases	Mean age: 32.5, 68% F (n=48)	Confirmed with PCR (n=29) or suspected positive (n=42)	Pseudo-chilblain: Acral areas of erythema-edema with vesicles/pustules, may have purpura on hands and feet, asymmetrical	Before (n=5), same time (n=24), or after (n=42) onset of Sx	Cough (n=37), dyspnea (n=18), fever (n=44), asthenia (n=37), headache (n=27), GI Sx (n=17), anosmia/ageusia (n=13), pneumonia (n=10)	-	Paracetamol (n=32), NSAIDs (n=11), chloroquine/HCQ (n=6), lopinavir/ritonavir (n=3), tocilizumab (n=2), systemic steroids (n=1), azithromycin (n=3)	Mean: 12.7 days	All patients survived
Tosti et al. [35]*	3 of 4 cases	26, M	Not Confirmed	Hardened, erythematous plaques on heels with burning sensation	-	Asymptomatic	-	-	-	-
		18, F	Not Confirmed	Erythematous plaques on extensor surface of toes; erythematous confluent plaques on bilateral heels; associated with pain and pruritus	-	Asymptomatic	Emollients	Paracetamol	-	-



		16, F	Not Confirmed	Erythematous plaques on bilateral heels associated with pain	2 weeks after onset of Sx	Pharyngodynia	Emollients	Paracetamol	-	-
Mazzotta, et al. [36]	1	13, M	Suspected positive	Erythematous and violaceous round lesions on plantar surface of R big toe and dorsal surface of bilateral 2 <sup>nd</sup> toes → L 2 <sup>nd</sup> toe developed tense bulla, lesions associated with pruritus and burning → purpuric with black crust	2 days before onset of Sx	Fever, muscle pain	Oral macrolide, topical therapy	-	~10 days	Lesions regressed
Colonna et al. [37]	4	11, F	Suspected but tested negative	Dusky, erythematous macules with blurred edges on lateral feet and dorsal surface of R 1 <sup>st</sup> , 2 <sup>nd</sup> , and 3 <sup>rd</sup> toes, erythematous-cyanotic, slightly atrophic lesions on plantar surface of L 1 <sup>st</sup> and 4 <sup>th</sup> toes, associated with edema, coldness and mild pain	Weeks after systemic Sx	Flu-like Sx, headache, rhinitis	-	-	5 days	Skin lesions resolved
		6, F	Suspected but tested negative	Erythematous, edematous macular lesions and central	10 days after systemic Sx	Fever, pain on soles	-	-	3 days	Skin lesions resolved

				erythematous-cyanotic lesions on bilateral plantar surfaces, associated with pruritis and moderate pain						
		5, M	Suspected but tested negative	Macular lesions on feet and R hand preceded by edema	4 days after systemic Sx	Fever, cough, edema, pain on R hand and feet	-	-	3 days	Skin lesions resolved
		11, F	Suspected but tested negative	Erythematous dusky plaques on lateral L foot and dorsal L 2 <sup>nd</sup> , 3 <sup>rd</sup> , and 5 <sup>th</sup> toes, associated with swelling	10 days before systemic Sx	Fever, localized pain	-	-	-	Lesions still present
Garcia-Lara et al. [38]	27	Mean age: 14.4, 34% F (n=9)	Negative from PCR (n=2), IgM (n=9), IgA (n=9), IgG (n=9)	Chilblain-like (n=25), erythema multiforme-like (n=2); associated pruritus (n=3), mild pain (n=6); located on hands (n=6), feet (n=20), hands + feet (n=1)	Same time as systemic Sx (n=1)	Diarrhea (n=1)	-	-	Mean duration: 14.6 days	-
López-Robles et al. [39]	41	Mean age: 16 (range 1-74), 47% F	Not Confirmed (n=22), close contact (n=6), negative (n=19)	Acral erythematous, violaceous papules and plaques; feet (80%), hands + feet (10%), hands (7%), ears (2%)	After systemic Sx (n=3)	Extracutaneous Sx (n=6)	Topical steroid for itch	-	Days	Rash resolved within days
Locatelli et al. [40]	1	16, M	Confirmed with PCR	Erythematous, partially eroded macules and plaques on	3 days after onset of Sx	Dysguesia, mild diarrhea	-	-	Several weeks	-

				dorsal fingers and 2 <sup>nd</sup> R toe consistent with chilblains						
Cordoro et al. [41]	6	Age range: 12-17, 16.7% F (n=1)	Negative	Chilblains: pruritic, red to violaceous macules, dusky plaques on mid and distal toes, some with tenderness, swelling, bullae, hemorrhagic crust; some with scattered petechiae and purpuric macules on feet; livedo reticularis on forearms, dorsal hands or feet (n=3)	1 week after onset of Sx	Asymptomatic (n=4), rhinorrhea, congestion, sore throat, fever (n=2)	-	-	-	-
Andina et al. [42]*	22	Median age: 12 (range 6-17), 41% F (n=9)	Confirmed with PCR (n=1), negative (n=18)	Chilblains: erythematoviolaceous or pruritic macules on toes and lateral aspects of feet and heels, some with swollen toes and dusky violaceous discoloration, some with dark ischemic areas with blisters; feet (n=22), hands (n=3); pruritus (n=9), mild pain (n=7);	After onset of Sx with median time of 14 days (range: 1-28 days)	Mild respiratory Sx (n=9), GI Sx (n=2), both respiratory & GI Sx (n=2)	Oral analgesics or antihistamines, topical steroids (n=1), oral steroids (n=1)	-	3-5 weeks	Lesions had marked improvement or resolution

				concomitant erythema multiforme (n=4)						
Abril-Pérez et al. [43]	1	13, M	Suspected positive	Perniosis: purpuric, acral macules and papules with vasculitic appearance on toes of both feet	-	Asymptomatic	-	-	-	-
de Masson et al. [15]*	277	Median age: 27 (range: 2-98), 50% F	Confirmed with PCR (n=25), suspected or close contact (n=115), negative (n=9)	Urticarial (n=26), vesicular (n=41), acral (n=142) consisting of Chilblains (n=106) or dyshidrosis-like (n=16), morbilliform (n=25), petechial (n=7), livedo reticularis (n=4), other (n=41)	-	Fever (n=48), respiratory Sx (n=44), anosmia/ageusia (n=18), GI Sx (n=16)	-	-	-	-
Suarez-Valle et al. [44]	3	-	Confirmed with swab	Round, red to purple well-demarcated plaques affecting toes (n=3) and soles (n=1)	17-28 days after onset of Sx	Atypical bilateral pneumonia	-	-	2 weeks	Elevated D-dimer (n=3) and fibrinogen (n=2), skin fully recovered, no fatalities
<b>Non-chilblains vasculopathy-related</b>										
<b>Study</b>	<b># patients (%)</b>	<b>Age, sex</b>	<b>COVID-19 status</b>	<b>Cutaneous manifestation</b>	<b>Time of onset</b>	<b>Systemic Sx</b>	<b>Cutaneous treatment</b>	<b>COVID-19 treatment</b>	<b>Duration of cutaneous manifestation</b>	<b>Clinical outcome</b>
Joob and Wiwantikit [45]	1/48 (2.1%)	-	Confirmed with PCR	Skin rash with petechiae	Before onset of Sx	Respiratory Sx	-	-	-	-

Jimenez-Cauhe et al. [46]	1	-	Confirmed COVID-19 pneumonia	Purpuric rash of coalescing macules on left and right peri-axillary regions	-	Bilateral pneumonia	-	HCQ, lopinavir-ritonavir	-	-
Magro et al. [47]	3	32, M	Confirmed with PCR	Retiform purpura on buttocks	After 4 days on ventilator support	1 week of fever, cough → dyspnea	-	HCQ, azithromycin, remdesivir	-	Respiratory failure requiring ventilator support
		66, F	Confirmed with PCR	Dusky purpuric patches on bilateral palms and soles	11 days after hospital admission	9 days of fever, cough, diarrhea, chest pain → confusion, hypoxemia	-	HCQ, enoxaparin	-	Increasing confusion requiring intubation
		40, F	Confirmed with PCR	Livedo racemosa on chest, bilateral arms and legs	After onset of Sx	2 weeks of dry cough, fever, myalgias, diarrhea, progressive dyspnea	-	-	-	Intubated for respiratory failure and shock
Recalcati et al. [32]*	3/107 (2.8%)	Mean age: 72.2 years, 45.8% F	Confirmed with PCR	Acrocyanosis (n=2); L foot thrombosis (n=1)	-	-	-	-	-	Acrocyanosis due to respiratory failure
Bouaziz et al. [9]*	14	-	Confirmed with PCR	Exanthema (n=4), chicken-pox like vesicles (n=2), cold urticaria (n=1), vascular lesions (n=7) including violaceous “porcelain-like” macules, livedo, non-necrotic purpura, necrotic purpura,	After onset of Sx	-	-	-	-	-

				chilblain-like with Raynaud, chilblain, eruptive cherry angioma						
Galván Casas et al. [10]*	21 of 375 cases	Mean age: 63.1, 48% F (n=10)	Confirmed with PCR (n=27) or suspected positive (n=4)	Livedo or necrosis: including truncal and acral ischemia	Before (n=1), same time (n=18), or after (n=2) onset of Sx	Cough (n=14), dyspnea (n=11), fever (n=17), asthenia (n=11), headache (n=9), GI Sx (n=6), anosmia/ageusia (n=6), pneumonia (n=15)	-	Paracetamol (n=8), NSAIDs (n=1), chloroquine/HCQ (n=11), lopinavir/ritonavir (n=6), tocilizumab (n=3), systemic steroids (n=6), azithromycin (n=2)	Mean: 9.4 days	Patient survival (n=19)
Tosti et al. [35]*	1 of 4 cases	48, M	Not Confirmed	Erythematous plaques on extensor surfaces of toes consistent with acrocyanosis	10 days after onset of Sx	Headache, asthenia, slight increase in body temp	-	Paracetamol	-	-
Diaz-Guimaraens et al. [48]	1	48, M	Confirmed with PCR	Confluent, erythematous macules, papules, and petechiae on buttocks, popliteal fossa, proximal anterior thighs, lower abdomen	3 days after onset of fever	Fever, pleuritic chest pain, SOB	Betamethasone 0.05%	HCQ, lopinavir-ritonavir, azithromycin	5 days	Rash resolved, discharged after 12 days
Manalo et al. [49]	2	67, M	Confirmed with PCR	Transient, blanching, non-pruritic livedoid patch on R anterior thigh resembling livedo reticularis	After onset of Sx	Fever, nasal congestion, post-nasal drip, cough → gross hematuria, weakness	-	-	19 hours	Rash resolved

		47, F	Confirmed with PCR	Livedo reticularis on R leg	-	Headache, sinus pressure, anosmia, fever	-	-	20 minutes	Rash resolved
Zhang et al. [50]	7	Median age: 59, 42.9% F	Confirmed with PCR	Limb ischemia: plantar plaques or vesicles, dry gangrene, purpuric fingers/toes	After onset of Sx with median latency of 19 days (range 3-17 days)	Fever (n=7), cough (n=6), dyspnea (n=4), diarrhea (n=4), hypoxia (n=7)	-	Human gamma globulin (n=7), vitamin C (n=7), glucocorticoids (n=5), LMWH (n=6)	-	Associated with worse COVID-19 disease; ICU (n=2); death (n=5)
Ma et al. [51]	1	69, M	Confirmed with IgM/IgG antibody and CT	Dry gangrene on R index finger	~1.5 months after onset of Sx	Fever, lethargy → cerebral infarcts	-	Antibiotics, ribavirin, gamma globulin, LMWH, aspirin	-	Required intubation and ventilation; positive antiphospholipid antibodies; weaned from ventilator and clinically stable
Zhang et al. [52]	1	69, M	Confirmed with PCR	Ischemia of bilateral lower limbs and index and middle finger of left hand	After onset of Sx	Fever, cough, dyspnea, diarrhea, headache → hypoxemia, cerebral infarcts	-	-	-	Required ventilation; positive antiphospholipid antibodies
Castelnovo et al. [26]*	1 of 2 cases	-	-	Vasculitic purpura on legs → fleeting erythematous rash; associated mild pruritus	-	Respiratory failure with ARDS	Topical steroid	-	Few days	Lesions healed
de Masson et al. [15]*	277	Median age: 27 (range: 2-98), 50% F	Confirmed with PCR (n=25), suspected or close	Urticarial (n=26), vesicular (n=41), acral (n=142), morbilliform (n=25), petechial	-	Fever (n=48), respiratory Sx (n=44), anosmia/ageu-	-	-	-	-

			contact (n=115), negative (n=9)	(n=7) on acral (n=2), limbs (n=2) or diffuse (n=3), livedo reticularis (n=4), other (n=41)		sia (n=18), GI Sx (n=16)				
<b>Pityriasis rosea-like</b>										
Study	# patients (%)	Age, sex	COVID-19 status	Cutaneous manifestation	Time of onset	Systemic Sx	Cutaneous treatment	COVID-19 treatment	Duration of cutaneous manifestation	Clinical outcome
Sanchez et al. [53]	1	-	Confirmed with PCR	Digitate papulosquamous eruption with squamous and erythematous periumbilical patch and rapid progression of digitate scaly thin plaques on lateral side of trunk and thighs reminiscent of pityriasis rosea, papular lesions on upper arms, shoulders, back	1 week after onset of symptoms	Fatigue, fever, dyspnea	-	Cefpodoxime	7 days	Rash resolved; died of COVID-19
Galván Casas et al. [10]*	176 of 375 cases	Mean age: 55.3, 56% F	Confirmed (n=122) or suspected (n=54)	Maculopapular lesions: perifollicular distribution, pityriasis rosea-like, purpura may be present, infiltrated papules on extremities, erythema elevatum	Before (n=8), same time (n=108), or after (n=60) as onset of Sx	Cough (n=135), dyspnea (n=100), fever (n=140), asthenia (n=110), headache (n=55), GI disturbance (n=58), anosmia/ageusia (n=40),	-	Paracetamol (n=82), NSAIDs (n=16), chloroquine/HCCQ (n=79), lopinavir/ritonavir (n=54), systemic steroids (n=21), tocilizumab (n=9), azithromycin (n=39),	Mean: 8.6 days	Associated with more severe COVID-19 disease; patient survival (n=172)



				diutinum or erythema multiforme		pneumonia (n=110)		ICU/ventilator (n=21)		
Duong et al. [6]*	295	-	Not Confirmed	Chilblains or chilblain-like lesions (n=146), urticaria or rash or chickenpox-like lesions or pityriasis rosea (n=149)	-	-	-	-	-	-
Ehsani et al. [54]	1	27, M	Chest CT consistent with COVID-19	Erythematous, scaly annular plaque on left forearm that became generalized papular and plaques over trunk and upper extremities consistent with pityriasis rosea; associated with pruritus	3 days after onset of Sx	Fever, fatigue, gastroenteritis, anorexia	Topical corticosteroid and anti-histamine (cetirizine)	Acetaminophen	-	-
<b>Erythema multiforme-like</b>										
Study	# patients (%)	Age, sex	COVID-19 status	Cutaneous manifestation	Time of onset	Systemic Sx	Cutaneous treatment	COVID-19 treatment	Duration of cutaneous manifestation	Clinical outcome
Recalcanti et al. [32]*	14	Mean age: 14.4 (n=11), 29 (n=3), 57.1% F	Not Confirmed	Acral eruption of erythematous and violaceous papules and macules, some with bullous evolution or digital swelling; erythematous papular targetoid	3 weeks after onset of Sx (n=3)	Cough, fever	-	-	2-4 weeks	Skin lesions resolved without treatment

				lesions on hands and elbows (n=2), mild pruritus (n=3)						
Galván Casas et al. [10]*	176 of 375 cases	Mean age: 55.3, 56% F	Confirmed (n=122) or suspected (n=54)	Maculopapular lesions: perifollicular distribution, pityriasis rosea-like, purpura may be present, infiltrated papules on extremities, erythema elevatum diutinum or erythema multiforme	Before (n=8), same time (n=108), or after (n=60) as onset of Sx	Cough (n=135), dyspnea (n=100), fever (n=140), asthenia (n=110), headache (n=55), GI disturbance (n=58), anosmia/ageusia (n=40), pneumonia (n=110)	-	Paracetamol (n=82), NSAIDs (n=16), chloroquine/HCQ (n=79), lopinavir/ritonavir (n=54), systemic steroids (n=21), tocilizumab (n=9), azithromycin (n=39), ICU/ventilator (n=21)	Mean: 8.6 days	Associated with more severe COVID-19 disease; patient survival (n=172)
Fernandez-Nieto et al. [34]*	132/346 (38.2%)	Mean: 19.9, 46.2% F	Confirmed with PCR (n=2/11), clinically diagnosis (n=19), close contact with positive patient (n=54), close contact with healthcare worker (n=28)	Acro-ischemic lesions: -chilblain-like (n=95) red to purple macules, plaques, or nodules on distal toes/fingers -erythema multiforme-like (n=37) round erythematous macules and vesicles that could coalesce; lesions smaller than classic erythema multiforme, not typical targetoid, less	Same time as systemic Sx (n=3) or after Sx with mean latency time 9.2 days (n=16)	-	-	-	Mean 8.7 days (range 2-24 days)	-

				widespread; presented on elbows, knees, ears (n=2)						
Martín Carreras-Presas et al. [29]*	1 of 3 cases	65, F	Clinically diagnosed	Rash under breasts, back, genital area → blisters on internal lip mucosa, desquamative gingivitis, compatible with erythema multiforme	Rash 23 days after onset of Sx; oral lesions 1 week after rash	High fever, diarrhea, pain on tongue → bilateral pneumonia	Hyaluronic acid, chlorhexidine mouthwash	Antibiotics, corticosteroids, lopinavir/ritonavir, HCQ	-	Oral lesions improved within 3 days
Jimenez-Cauhe et al. [55]	4	Mean age: 66.8 (range: 58-77), 100% F (n=4)	Positive	Erythema multiforme-like lesions: erythematous papules on upper trunk that evolved to erythematous and violaceous patches with dusky centers and pseudo-vesicles; spread to face and limbs in 1 week; classic targets (n=2); oral mucosa involvement (n=3)	16-24 days after onset of systemic Sx (mean latency: 19.5 days)	-	Systemic corticosteroids	-	2-3 weeks	Progressive resolution of lesions
Janah et al. [56]	2	17, M	Positive	Erythematous maculopapular atypical targetoid eruption on palms with mild pruritus	15 days after onset of Sx		-	Vitamin C	-	-
		29, M	Positive	Fixed erythematous urticarial	12 days after onset of Sx	-	-	HCQ, azithromycin	-	Eruption progressively disappeared

				targetoid lesions on palms						
Rodríguez-Jiménez et al. [57]	1	60, F	-	Urticarial eruption → biopsy consistent with erythema multiforme	~2 weeks after onset of Sx	Dry cough, pyrexia → bilateral pneumonia	-	-	-	Persistent lesions on follow-up
Andina et al. [42]*	22	Median age: 12 (range 6-17), 41% F (n=9)	Confirmed with PCR (n=1), negative (n=18)	Chilblains; concomitant erythema multiforme (n=4)	After onset of Sx with median time of 14 days (range: 1-28 days)	Mild respiratory Sx (n=9), GI Sx (n=2), both respiratory & GI Sx (n=2)	Oral analgesics or antihistamines, topical steroids (n=1), oral steroids (n=1)	-	3-5 weeks	Lesions had marked improvement or resolution
<b>Kawasaki/Kawasaki-like disease</b>										
<b>Study</b>	<b># patients (%)</b>	<b>Age, sex</b>	<b>COVID-19 status</b>	<b>Cutaneous manifestation</b>	<b>Time of onset</b>	<b>Systemic Sx</b>	<b>Cutaneous treatment</b>	<b>COVID-19 treatment</b>	<b>Duration of cutaneous manifestation</b>	<b>Clinical outcome</b>
Jones et al. [58]	1	6 mo., F	Confirmed with PCR	Erythematous, non-pruritic, blotchy rash → conjunctivitis, dry cracked lips → hand and lower extremity swelling, prominent tongue papilla	2 days after onset of fever	Fever, fussiness, refusal to eat → mild congestion, tachypnea, irritability	IVIG, acetylsalicylic acid	-	-	Diagnosed with Kawasaki disease, tested positive for COVID-19 on evening of discharge
Rivera-Figueroa et al. [59]	1	5, M	Positive	Rash, swelling of palms and soles, non-exudative conjunctivitis, dry cracked erythematous lips, cervical lymphadenopathy consistent	-	Fever, decreased appetite, diarrhea, dysuria, abdominal pain	IVIG, pre-mediated with diphenhydramine and methylprednisolone for first dose, aspirin	Fluids	-	Echocardiogram showed small global pericardial effusion, developed hypotension, required

				with incomplete Kawasaki disease						high flow nasal cannula, discharged after 6 days in hospital
Verdoni et al. [60]	10	Median age: 7.5 (range: 2.9-16), 30% F (n=3)	Positive IgG or IgM (n=8)	Classic Kawasaki (n=5) with conjunctivitis (n=5), hand/feet anomalies (n=5), polymorphic rash (n=5), lip/oral cavity changes (n=4); incomplete Kawasaki (n=5) with conjunctivitis (n=4), lip/oral cavity changes (n=3), polymorphic rash (n=4)	-	Pneumonia (n=5)	IVIG (n=10), aspirin (n=2), methylprednisolone (n=8)	-	-	All patients responded to treatment
<b>Other</b>										
Study	# patients (%)	Age, sex	COVID-19 status	Cutaneous manifestation	Time of onset	Systemic Sx	Cutaneous treatment	COVID-19 treatment	Duration of cutaneous manifestation	Clinical outcome
Mahé, et al. [62]	1	64, F	Confirmed with PCR	Erythematous rash on antecubital fossa that spread to trunk and axillary folds resembling Symmetrical Drug-Related Intertriginous and Flexural	4 days after onset of Sx	Fever, asthenia, cough	-	Paracetamol	5 days	Rash resolved; all symptoms resolved on day 18

				Exanthema (SDRIFE)						
Bouaziz et al. [9]*	1 of 14 cases	-	Confirmed with PCR	Eruptive cherry angioma	After onset of Sx	-	-	-	-	-
Wu et al. [61]	1	2, M	Confirmed with PCR	Conjunctivitis, eyelid dermatitis	7 days after positive swab	-	-	COVID-19 treatment per Chinese protocol	5 days	Rash resolved
de Masson et al. [15]*	277	Median age: 27 (range: 2-98), 50% F	Confirmed with PCR (n=25), suspected or close contact (n=115), negative (n=9)	Urticarial (n=26), vesicular (n=41), acral (n=142), morbilliform (n=25), petechial (n=7) livedo reticularis (n=4), other (n=41) including eczema-like, angiomatous, annular lesions	-	Fever (n=48), respiratory Sx (n=44), anosmia/ageusia (n=18), GI Sx (n=16)	-	-	-	-
Kalner and Vergilis [63]	2	43, F	Positive	Dusky red, non-blanching periorbital dyschromia, non-pruritic	2 days before onset of Sx	Fever, cough, sore throat, muscle weakness, myalgias, SOB	Alclometasone dipropionate	-	Few days	Rash and symptoms resolved → 10 days after onset of cutaneous Sx recurrence of cutaneous and systemic Sx → resolved
		50, M	Positive	Periorbital dyschromia	2 days before onset of Sx	Fever, SOB, myalgias, syncope	-	-	-	Resolved → recurrence of cutaneous and systemic Sx after initial resolution → resolved

Cutaneous manifestations of COVID-19 include viral exanthem, urticaria/urticaria-like, vesicular, chilblains/chilblains-like, non-chilblains vasculopathy-related, pityriasis rosea-like, erythema multiforme-like, Kawasaki/Kawasaki-like disease (multisystem inflammatory syndrome), and other.

*\*Study under multiple categories*

*Abbreviations: M, male; F, female; R, right; L, left; PCR, polymerase chain reaction; Sx, symptoms; HCQ, hydroxychloroquine; LMWH, low molecular weight heparin; SOB, shortness of breath; ICU, intensive care unit; IV, intravenous.*